

The Relationship Between Impact Investing Mechanism Design and Social Value Creation



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Thesis submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy

Trinity 2018

I.

Acknowledgements

I am extremely grateful to every person who has contributed to making this dissertation possible – both those who are aware of their contribution and those who are not, both those who directly provided support and those who indirectly contributed to my education that led to this point, both those who encouraged me professionally and those who helped me on a personal level, both those who supported me financially and those who supported me with their words.

First and foremost, I want to acknowledge those who have directly contributed to this dissertation research. I am especially grateful to my DPhil supervisor, Professor Douglas Gollin, for his advice, guidance, expertise, feedback, support and patience during the long and non-linear DPhil journey. I am also grateful to the academics who provided valuable feedback at each assessment stage during the DPhil process – especially Associate Professor Marc Ventresca, Professor Xiaolan Fu and Professor Chris Adam. This feedback helped to improve the quality and usefulness of the research undertaken. I also want to acknowledge my past academic supervisors, Daniel Clarke, Professor Stefan Dercon, and Professor Kunal Sengupta, for instilling in me a love of research, a thirst for discovery, a deep appreciation of academic rigour, and for making me realise that theoretical microeconomics is a valuable lens through which to view the world. I also want to thank all the individuals who gave up their time to provide primary data for this research, whether via partaking in semi-structured interviews or via survey completion.

This research was inspired by two individuals who, more than anyone else, fueled my interest in the fields of social finance and development economics. Unfortunately, they are no longer with us. As such, it is with sadness that I thank them. First, the late Dr. Richard Seymour, who taught me social entrepreneurship at an undergraduate level at The University of Sydney. Secondly, the late Dr. Pamela Hartigan, who encouraged me to undertake this DPhil research, who provided guidance on the research direction, who was generous with her personal connections, who I was fortunate to call a mentor, and whose last piece of advice remained with me to the very end of the research – that the best academic work takes place when you think and research at the intersection of the conceptual and practical.

I also want to thank others at Oxford who have supported me over the years. I am immensely grateful to everyone at Rhodes House for their continual and unfailing support, both financially and non-financially. I'm grateful to Don Markwell for convincing me to undertake a DPhil, to Charles Conn for seeing the value in bridging the fields of entrepreneurship, finance, microeconomics and international development, and to Mary Eaton for solving problems large and small with kindness, patience, understanding and humility. I also want to thank Magdalen College for providing a supportive MCR community, endless positive memories, and one the most beautiful place to live and work anywhere on the planet.

There are other places in the world where I have worked on this DPhil research too. I want to thank Princeton University for enabling me to conduct part of my DPhil research at Princeton on a William Alexander Fleet Visiting Fellowship. Thank you in particular to those at the Keller Center for Entrepreneurship and the Woodrow Wilson School of Public and International Affairs, for providing me with places to work and supportive communities. I also want to thank the University of British Columbia, for inviting me to work from the Centre for Interactive Research on Sustainability for several months.

There are others who have contributed to this research in less direct ways, by supporting me on a personal level. Thank you to Alan Atkinson, Lisa Mauritz, Brianne Kent, Erik Edstrom, Jake Muller, Daniel Tracey, Andrew Thomas, Edward Miller, Joseph Ware, Martha Campbell, Claudia Ware, Hannah Quadrio, and many others.

Last of all and most of all, I want to thank my parents, Jeffrey and Annette Ware, for thirty years of endless love, support and sacrifices to enable me to have the educational opportunities I have had. None of this would have been remotely possible without them. This dissertation is dedicated to them.

II.

Abstract

Impact investing is growing in acceptance and adoption within the Western, neoliberal framework. Investors are increasingly seeking a combination of social and financial returns from their investments, rather than just one or the other. Both a symptom and consequence of this trend is the design of new financing mechanisms which aim to better enable investors to generate blended social and financial value. Such mechanisms include social impact bonds, income-contingent loans, and combined credit and insurance. However, empirical evidence shows that these mechanisms have been beset by problems. Many have low take-up rates, and those that are adopted rarely generate social value to the degree intended. Why is this? Unfortunately, the existing academic literature provides limited guidance. For while individual investment mechanisms have been researched in isolation, they have not been researched collectively at a conceptual level. This is partly attributable to the underdeveloped nature of the social finance field, and partly due to the divergent treatment of investment mechanisms within the incumbent literature. Different impact investment mechanisms are situated in different pools of academic literature, with each discipline having distinctive terminology, research methodology, geographic focus, types of investors, and types of investees.

This dissertation begins to address this gap in the literature by researching the design of impact investing mechanisms collectively, at a conceptual level, and in an interdisciplinary manner. Specifically, the dissertation asks the question: *“How does the design of impact investing mechanisms affect the creation of social value?”* This overarching question is answered by focusing on a specific class of impact investments – investments that are in individuals, that aim to improve productivity, and that involve contingent repayments. Given the interdisciplinary nature of the research, a mixed-method approach is employed.

To better understand why the existing literature fails to explain the relationship between mechanism design and social value creation, bibliometrics research is undertaken of two corpora – one with 500 publications from social finance and one with 500 publications from development economics. Keyword co-occurrence, pairwise publication similarity, and citation analysis reveals there is a key missing link in the academic literature which stems from the differing approaches of the two fields and the negligible interaction between them. This missing link is between the aggregate *financial value* that arises from an investment and the *financial return* that accrues to a specific investor.

To understand the role this missing link plays in the relationship between mechanism design and social value creation, each of the five main existing contingent-repayment impact investing mechanisms are modelled using theoretical microeconomics. It is proven mathematically that none of these five mechanisms can sustain the first-best in equilibrium. There are two underlying reasons for this: first, a lack of social value creation for a given investment expenditure, due to suboptimal investment selection, quantity and/or effort; secondly, a lack of value capture for a given social value creation, due to suboptimal value attribution and/or an inability to appropriate attributed value. These reasons for why existing mechanisms fail to maintain the first-best correspond to the two main ways that mechanism design affects social value creation. Importantly, the latter of these two relationship pathways – value capture – corresponds to the missing link discovered in the bibliometrics research. In other words, the ability of investors to translate financial value into financial return is determined by the factors of attribution and

appropriation. Those are the prerequisites for the internalisation of positive pecuniary externalities from investments.

Given the above, a Unified Fundamental Model of Impact Investing is developed to complete the impact investing cycle. This theory construction brings together all the different impact investing mechanism designs, as well as related topics (such as social impact measurement, capital recycling, and social impact definitions), into a single, consistent framework. It conceptually unites numerous previously siloed concepts, resolving ambiguities in the process, and laying the foundation for further research.

This theory construction, together with economic modelling, points to three additional intermediate ways that mechanism design affects social value creation: via social impact measurement, via the alignment of social and financial returns, and via constraint adherence. These three intermediary relationship pathways are investigated in a nuanced way via qualitative methods, with primary data obtained from 141 detailed survey responses by impact investors and 19 semi-structured interviews with key stakeholders. This data reveals both impact investor practices and perceptions, thereby enabling us to identify where practices and perceptions diverge. It is discovered that there are seven properties which impact investors believe a measure of social impact should possess, four stakeholder constraints which restrict the ability of stakeholders to adopt mechanism designs, and two practical constraints which limit the extent to which a mechanism design can operate as intended. Combining these with the three components of social value creation (selection, quantity and effort) gives 16 first-best properties. It is discovered via logical deduction that for a mechanism design to satisfy all these sixteen properties simultaneously, it necessarily requires investment by a private investor, enforcement of repayments by the government, and appropriation of value in the form of taxation revenue. These precise characteristics needed for a first-best mechanism are the precise characteristics that correspond to a gap in the impact investing landscape, as shown via gap analysis. This result motivates research into this implied modified mechanism design as an extension.

The relationship between mechanism design and social value creation for the specific implied mechanism, termed Tradable Income-Based Securities (TIBS), is then researched. This is done by identifying and evaluating the concerns of key stakeholders regarding the mechanism design. Sixteen concerns were raised by at least three interviewees, with the concerns evaluated on the basis of validity and importance. As part of this, it is proved via microeconomic modelling that TIBS can maintain the first-best in equilibrium where existing mechanism designs do not. It is also shown that this implied mechanism enables a new method of measuring social impact, termed Discounted Expected Marginal Impact (DEMI), that satisfies the seven first-best measurement properties where existing approaches (such as SROI) only satisfy a subset.

Further contributions of this research include: determining the conditions under which capital recycling is socially optimal; discovering an advantage to aligning social and financial returns that has not been identified in the literature to date (namely that when there is alignment, financial tools can be used to obtain first-best social impact properties by obtaining the equivalent financial properties); proving that if investors maximize their own measured social impact, this does not necessarily maximize aggregate social impact; formally distinguishing between the oft-conflated concepts of 'social value' and 'social impact/return'; and discovering a way to objectively reveal

the expected effectiveness of potential investments *ex ante*, thereby enabling selection of the most effective investment, knowledge of the counterfactual, and measurement of marginal social impact.

III.

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I.

Introduction

1.1 A Defining Trend

Since the emergence of economics as an academic discipline, the literature has commonly viewed private sector financiers as falling into one of two distinct, mutually exclusive categories. On the one hand are profit-maximizing individuals and enterprises seeking maximum return on their investments; on the other are philanthropic individuals and organisations who do not seek financial returns and who forgo capital repayment (Anheier, 2005).¹ This binary conception of private financiers is widespread. Even in economic models where for-profit firms engage in corporate social responsibility (CSR), their actions are often modelled as merely a way to increase company profits, such as by increasing sales due to greater customer goodwill (Baron, 2007),² improving public relations (Andre, 2015; Podnar, Lah & Golob, 2009; Verčič & Grunig, 2000),³ or boosting employee morale (Schmitz & Schrader, 2015; Ferauge, 2012; Becchetti, Di Giacomo & Pinnacchio, 2008; Jenkins, 2004; Lee, Lee & Li, 2012; Burke & Logsdon, 1996; Lee et al., 2013).⁴ Improving the welfare of others is not traditionally viewed as an independent objective of for-profit firms. Typically, it is either not an objective at all, or simply a means to an end.

Until recently, this conceptualisation was reasonably accurate. In many jurisdictions throughout history, entities could only be legally classified as either for-profit, with board directors having a fiduciary duty to act in the best interests of equity stakeholders (Macey, 1991; Fairfax, 2005),⁵ or non-profit, with limitations on private benefits (Leifer & Glomb, 1997; Hopkins, 2009).⁶ Even when other legal classifications have been possible, in practice they have rarely been adopted (Pache & Santos, 2013; Rawhouser, Cummings & Crane, 2015).⁷

¹ The literature sometimes refers to this as the 'voluntary sector' or 'third sector'. See Anheier, H. K. (2005). *A dictionary of civil society, philanthropy and the third sector*. Routledge.

² Baron argues that a valid explanation for the existence of social entrepreneurs, which the author defines as entrepreneurs who allocate a portion of profits to social causes, is that it may increase the set of consumers who will buy from the firm because some consumers will reward the company for doing good. See Baron, D. P. (2007). Corporate social responsibility and social entrepreneurship. *Journal of Economics & Management Strategy*, 16(3), 683-717.

³ Andre, T. (2015). *Base of the Pyramid and Corporate Social responsibility: Why they interact and how* (Doctoral dissertation, Ecole Polytechnique). Podnar, K., Lah, M., & Golob, U. (2009). Economic perspectives on public relations. *Public Relations Review*, 35(4), 340-345. Verčič, D., & Grunig, J. E. (2000). The origins of public relations theory in economics and strategic management. *Perspectives on public relations research*, 9-58.

⁴ Schmitz, J., & Schrader, J. (2015). Corporate social responsibility: A microeconomic review of the literature. *Journal of Economic Surveys*, 29(1), 27-45. Ferauge, P. (2012). A conceptual framework of corporate social responsibility and innovation. Becchetti, L., Di Giacomo, S., & Pinnacchio, D. (2008). Corporate social responsibility and corporate performance: evidence from a panel of US listed companies. *Applied Economics*, 40(5), 541-567. Jenkins, H. (2004). A critique of conventional CSR theory: An SME perspective. *Journal of General Management*, 29(4), 37-57. Lee, Y. K., Lee, K. H., & Li, D. X. (2012). The impact of CSR on relationship quality and relationship outcomes: A perspective of service employees. *International Journal of Hospitality Management*, 31(3), 745-756. Burke, L., & Logsdon, J. M. (1996). How corporate social responsibility pays off. *Long range planning*, 29(4), 495-502. Lee, C. K., Song, H. J., Lee, H. M., Lee, S., & Bernhard, B. J. (2013). The impact of CSR on casino employees' organizational trust, job satisfaction, and customer orientation: An empirical examination of responsible gambling strategies. *International Journal of Hospitality Management*, 33, 406-415.

⁵ Macey, J. R. (1991). An economic analysis of the various rationales for making shareholders the exclusive beneficiaries of corporate fiduciary duties. *Stetson L. Rev.*, 21, 23. Fairfax, L. M. (2005). Spare the Rod, Spoil the Director-Revitalizing Directors' Fiduciary Duty through Legal Liability. *Hous. L. Rev.*, 42, 393.

⁶ Leifer, J. C., & Glomb, M. B. (1997). The legal obligations of nonprofit boards: A guidebook for board members. Natl Center for Nonprofit Boards. Hopkins, B. R. (2009). *Legal responsibilities of nonprofit boards* (Vol. 2). BoardSource, Inc.

⁷ Pache, A. C., & Santos, F. (2013). Inside the hybrid organization: Selective coupling as a response to competing institutional logics. *Academy of Management Journal*, 56(4), 972-1001. Rawhouser, H., Cummings, M., & Crane, A. (2015). Benefit corporation legislation and the emergence of a social hybrid category. *California Management Review*, 57(3), 13-35.

However, times have changed. The traditional neoliberal conceptualisation of the market is increasingly non-reflective of the types of behaviours and entities seen today (Santos, 2012).⁸ Over the past decade, an increasing proportion of private sector investors have been seeking a combination of financial and social returns, rather than just one or the other, from the investments they make (John, 2006; O'Donohoe et al., 2010; Saltuk et al., 2011; Saltuk, 2012).⁹ There is now a full spectrum of capital providers: those seeking no return of capital (philanthropic donors), those wanting partial return of capital (many venture philanthropists), those prepared to take below market returns, those wanting close to market returns (many social venture capitalists), and those demanding market or above market returns (traditional financial investors). As such, the previous binary system, with two distinct types of financiers, has given way to a spectrum with a myriad of types of financiers. There is now a plurality of preferences regarding what returns should be maximized. Investors are increasingly optimizing over a weighted average of *both* social and financial variables, rather than *either* social or financial variables.

This emerging middle-ground between capital providers who are purely profit-maximizing and purely philanthropic can be collectively referred to as 'impact investing' – a term first coined by Antony Bugg-Levine at the Rockefeller Foundation's Bellagio Centre in 2007 (Kania, KraMer & Russell, 2014).¹⁰ While there is a lack of consensus in the social finance literature regarding the precise definition of impact investing and related terms (Daggers & Nicholls, 2016),¹¹ this research uses the term 'impact investments' to refer to investments where the primary purpose is the creation of social value, and where future payments that are attributable to those investments are expected by investors.¹²

It is important to not conflate impact investing with related terms and classifications. In the academic literature, 'social finance' is commonly used as a broad term that encompasses various uses of private financial resources to create social impact, whether investments involve repayments and regardless of repayment size (Daggers & Nicholls, 2016).¹³ A subset of social finance is 'social impact investment', which refers to investments where some or all of the principal is repaid, therefore excluding grant capital *inter alia*. Social impact investment can be broken down further into two sub-categories. The first of these is impact investing, which approaches social impact investment from an investor perspective. The second sub-category is 'social investment', a term predating social finance that was historically used in reference to public and social policy. This sub-category approaches social impact investment from the perspective of investee organisations, with the literature focusing on the readiness of social

⁸ Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

⁹ John, R. (2006). Venture philanthropy: The evolution of high engagement philanthropy in Europe. Brandenburg, M., Bugg-Levine, A., Leijonhufvud, C., O'Donohoe, N., & Saltuk, Y. (2010). Impact Investments: An Emerging Asset Class. JP Morgan, Rockefeller Foundation, GIIN (November 29, 2010), 6. Saltuk, Y., Bouri, A., & Leung, G. (2011). Insight into the impact investment market. Insight. Saltuk, Y., & Idrissi, A. E. (2012). A Portfolio Approach to Impact Investment. Global Social Finance Research, JP Morgan.

¹⁰ Kania, J., KraMer, M., & Russell, P. (2014). Strategic philanthropy for a complex world. *Stanford Social Innovation Review*, 12(3), 26-33.

¹¹ Daggers, J., & Nicholls, A. (2016). The landscape of social impact investment research: Trends and opportunities. SBS, Oxford.

¹² The justification for being agnostic to the type of investor, and not restricting impact investing to private investors, is explained later in this chapter.

¹³ Daggers, J., & Nicholls, A. (2016). The landscape of social impact investment research: Trends and opportunities. SBS, Oxford.

enterprises for repayable financing. Daggers and Nicholls (2016) find that the terms ‘impact investment’ and ‘social investment’ are used inconsistently, often interchangeably, and in roughly equal proportion in the literature, which reflects the nascent nature of the academic field.

Importantly, despite the underdeveloped nature of the social finance field, the notion and practice of combining social and financial returns has historical and cultural origins. The seeking of blended value has long been a characteristic of Islamic financing (Warde, 2000),¹⁴ government financing, Community Development Financial Institutions (CDFIs),¹⁵ and investments by early American Methodists (Arjaliès, 2010).¹⁶ What is new is the application and adoption of impact investment within a Western, neoliberal framework. The significant change is that impact investing is being absorbed into institutional logics.¹⁷ It is being formally embraced by neoliberal institutions.

1.2 Evidence of Increasing Engagement with Impact Investing

Evidence of the growing acceptance and adoption of impact investing comes in many forms.

Politically, the importance of impact investing in the eyes of the British Government resulted in the establishment of a Social Impact Investment Taskforce under the UK’s Presidency of the G8 in 2013.¹⁸ Furthermore, governments have been supportive of the assumption of greater responsibility for public service delivery by the so-called ‘third sector’ (Sharir & Lerner, 2006; Gibbon & Dey, 2011).¹⁹

Financially, the broadening of investor types has resulted in impact investing being recognised as an asset class in several countries, including the UK and the US (Daggers & Nicholls, 2016).²⁰ Furthermore, socially responsible investing, which is sometimes distinguished from other forms of impact investing on the basis of the intentionality of impact creation, has progressed from a niche approach to an established part of asset management (Renneboog, Ter Horst & Zhang, 2008).²¹ This is evident in the widespread adoption of the United Nations Principles for Responsible Investment (PRI) - six principles aimed at helping investors take into account environmental, social and governance (ESG) factors when making investment decisions

¹⁴ Warde, I. (2000). *Islamic finance in the global economy*. Edinburgh University Press.

¹⁵ Community Development Financial Institutions (CDFIs) are private financial institutions that have as an objective meeting the needs of disadvantaged individuals in local communities.

¹⁶ Arjaliès, D. L. (2010). A social movement perspective on finance: How socially responsible investment mattered. *Journal of business ethics*, 92(1), 57-78.

¹⁷ The term ‘institutional logics’ refers to a “set of material practices and symbolic constructions – which constitutes its organizing principles and which is available to organizations and individuals to elaborate” (Friedland & Alford, 1991). See Friedland, R., & Alford, R. R. (1991). Bringing society back in: Symbols, practices and institutional contradictions.

¹⁸ Taskforce, S. I. I. (2014). *Impact investment: The invisible heart of markets-harnessing the power of entrepreneurship, innovation and capital for public good*. London: Social Impact Investment Taskforce.

¹⁹ Sharir, M., & Lerner, M. (2006). Gauging the success of social ventures initiated by individual social entrepreneurs. *Journal of world business*, 41(1), 6-20. Gibbon, J., & Dey, C. (2011). Developments in social impact measurement in the third sector: scaling up or dumbing down?. *Social and Environmental Accountability Journal*, 31(1), 63-72.

²⁰ Daggers, J., & Nicholls, A. (2016). *The landscape of social impact investment research: Trends and opportunities*. SBS, Oxford.

²¹ Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), 1723-1742.

(Sievänen et al., 2013).²² Over 2100 investment managers and asset owners worldwide, representing in excess of US\$80 trillion in assets under management, have now signed the PRI.²³

Legally, new types of entities have been created that enable both investors and entrepreneurs to more easily pursue a so-called 'double bottom-line' (Emerson & Twersky, 1996).²⁴ These new legal structures include Community Interest Companies (CICs) in the UK, and Low-Profit Limited Liability Companies (L3Cs), Benefit Corporations,²⁵ and Social/Flexible Purpose Corporations in the US.²⁶ Such legal entities possess characteristics of both traditional non-profits and traditional for-profits. From an investor's perspective, they may enable investments that have both social impact protections and financial upside. From an entrepreneur's perspective, they may enable financing to be obtained from a broader range of investor types than would otherwise be possible.

Institutionally, there has been an emergence of initiatives and intermediaries dedicated to supporting and growing the field of impact investing. The GIIN (Global Impact Investing Network) was created in 2009 to serve as a hub for tools and thought leadership on impact investing (Jackson, 2013).²⁷ To facilitate peer learning on impact investing, there is Mission Investors Exchange for foundations and Toniic for family offices (Mitchell, 2016).²⁸ The ImPact, founded in 2015 by Justin Rockefeller and Josh Cohen, is a similar initiative to the Giving Pledge (Kawachi & Subramanian, 2014),²⁹ but instead of high-net-worth individuals committing to give away their capital philanthropically, they commit to investing their capital to have a social impact. In the first two years alone, ImPact grew to have 125 members with an average wealth of US\$700 million (Scott, K., 2017).³⁰ A plethora of conferences and summits have also emerged to help build the impact investing ecosystem, including Social Capital Markets (SOCAP) in San Francisco, the Impact Investing World Forum (IIWF) in London, and the Global Impact Investment Steering Group (GSG) whose annual meetings attract over 500 leaders from around the world. As such, there is evidence of emergent communities and institutions focussed on building the impact investing ecosystem.

²² Note that the United Nations PRI are normally framed as a way to help investors fulfil their fiduciary duty, since ESG factors, such as climate change, may indirectly influence the financial return of an investment portfolio. As such, responsible investing is best viewed as part of a broad trend in the direction of impact investing. See Sievänen, R., Rita, H., & Scholtens, B. (2013). The drivers of responsible investment: The case of European pension funds. *Journal of Business Ethics*, 117(1), 137-151.

²³ On the 25th of September 2018, the UNPRI had 2126 signatories. See <https://unpri.org/signatories>.

²⁴ An early reference to the term 'double bottom-line' can be found in Emerson, J., & Twersky, F. (Eds.). (1996). *New social entrepreneurs: The success, challenge and lessons of non-profit enterprise creation*. The Homeless Economic Fund, the Roberts Foundation.

²⁵ For an excellent in-depth discussion of Benefit Corporations, see Kendall Park's doctoral thesis from Princeton. Park, K. C. (2018). *B the Change: Social Companies, B Corps, and Benefit Corporations* (Doctoral dissertation, Princeton University).

²⁶ CICs involve limitations on the dividends that can be paid to investors but provide taxation benefits to the enterprise. L3Cs are able to accept capital from some tax-exempt sources such as private foundations. Benefit Corporations, as distinct from 'B Corporations' which is a type of certification, are required to consider specified social impact objectives alongside financial objectives when making business decisions. Social/Flexible Purpose Corporations involve the firm and shareholders agreeing on objectives other than a financial bottom-line and pursuing those objectives in tandem.

²⁷ Jackson, E. T. (2013). Interrogating the theory of change: evaluating impact investing where it matters most. *Journal of Sustainable Finance & Investment*, 3(2), 95-110.

²⁸ Mitchell, T. (2016). Understanding the World of Impact Investing. *Trusts & Estates*, 2-7.

²⁹ Kawachi, I., & Subramanian, S. V. (2014). Income inequality. *Social epidemiology*, 126.

³⁰ Scott, K. (2017, August 23). These super-rich families are investing their fortunes to help others. Retrieved from <https://money.cnn.com>.

1.3 Explaining This Trend

This shift in the perceptions of, and engagement with, impact investing is representative of shifting institutional logics (Nicholls, 2010).³¹ It represents new perception patterns across a range of institutions.

Both financiers who were previously purely profit-maximizing, and financiers who were previously purely philanthropic, have driven the evolution of impact investing. In both cases, the trigger towards impact investing seems to have been less a change in their underlying objectives, and more a recognition that their objectives can sometimes be equally or better achieved through a form of impact investing.

Among the pool of previously purely profit-maximizing investors, there is growing acceptance that the traditional assumption of an inverse relationship between financial returns and social returns does not always hold true. The evidence of this non-inverse relationship includes case studies that demonstrate social and financial returns can be aligned and do not necessarily involve a trade-off (Emerson, 2003),³² as well as market data which suggests that investments that generate a social return do not necessarily require sacrificing financial returns. For example, the Canadian Social Investment Organization estimated that in 2012 the value of socially responsible investments grew by 16%, a significantly better performance than the S&P Toronto Stock Exchange Composite Index, which grew by 5.8% (Bragg & Smeh, 2013).³³ As such, investors are increasingly confident that positive financial returns can occur even with some focus on generating social impact.

Among the pool of previously purely philanthropic investors, there is growing consensus that in many cases impact is maximized by generating some financial return. This is for a variety of reasons. First, profit generated may be able to be reinvested, a phenomenon known as ‘capital recycling’. This ability to make multiple successive investments from the same initial pool of capital may lead to greater aggregate social impact than a one-time investment (Francis, 2016; Wong & Alto, 2014).³⁴ Secondly, where the investment is in a non-profit and some repayment of capital is required, it may incentivise the non-profit entity to become financially sustainable, which may reduce philanthropic dependency and be beneficial in the long-run (Helmsing, 2015).³⁵ Thirdly, it may facilitate recruitment and retention of better talent within the organisations making the investments, by enabling higher salaries to be paid and equity

³¹ Nicholls, A. (2010). The institutionalization of social investment: The interplay of investment logics and investor rationalities. *Journal of Social Entrepreneurship*, 1(1), 70-100.

³² Emerson, J. (2003). The blended value proposition: Integrating social and financial returns. *California management review*, 45(4), 35-51.

³³ Bragg, I., & Smeh, D. T. (2013). Canadian Socially Responsible Investment Review 2012. Social Investment Organization.

³⁴ Gavin Francis, the founder of Worthstone, a social impact investment resource and advisory organisation, writes that investors should “reinvest, generating further social impact and a return in a cycle that leverages the investor’s resources. This... is a highly effective way of making money go further.” Furthermore, Ming Wong and Philo Alto (co-founders of Asia Community Ventures) argue in a Stanford Social Innovation Review article that impact investing is “an important, additional tool” and that its merits include “capital recycling for future investments.” Francis, G. (2016, July 25). Why social impact investing can reap rewards for clients. Retrieved from <http://citywire.co.uk/new-model-adviser/>. Wong, M. & Alto, P. (2014, August 25). Adopting the London Principles. Retrieved from <https://ssir.org/>.

³⁵ Helmsing, A. B. (2015). Conditions for social entrepreneurship. *The International Journal of Social Quality*, 5(1), 51-66.

allocations to be used as a recruitment and performance incentive.³⁶ For these reasons, capital that moves from being philanthropic to repayable in nature does not necessarily result in a lower social impact.

In addition to the impact investing trend being driven by financiers on both ends of the spectrum, the trend has also been driven by a complementary, related trend: the rapidly increasing number of social enterprises and social businesses. Among entrepreneurial individuals whose primary goal is to maximize social impact, there are a growing proportion who are choosing to establish social enterprises - ventures seeking blended value of social and financial outcomes via business approaches, as opposed to traditional charities.³⁷ This has resulted in more investable opportunities for impact investors. Furthermore, many social entrepreneurs are actively looking for more innovative forms of growth capital because traditional sources of growth financing often do not match their needs. Philanthropic capital is often insufficient in size, debt financing often involves enterprises bearing significant financial risk, and equity financing runs the risk of mission-drift over time due to pressure from investors to prioritise profitability over impact and quick acquisition exits over long-term sustainable growth (Ebrahim, Battilana, & Mair 2014; Zhao & Grimes, 2016).³⁸ Instead, many social entrepreneurs want large quantities of capital to enable them to rapidly scale their impact, while having investors whose objectives align with their social mission.

Finally, there has been support for impact investing from entities other than investors and investees. This includes policy-makers, academics, thinktanks and international development practitioners. Many of these actors recognise that impact investing has a key role to play in alleviating poverty and combatting socio-economic disadvantage. One reason for this is that a significant proportion of the world's population are still unable to self-finance, or obtain finance for, basic investments such as education that would increase their productive capacity (Pooge, 2004; DaSilva, Baydoun & Badran, 2002; Abadzi, 2004).³⁹ This is particularly true for those on low incomes, including refugees who are being resettled in the millions (Roberts, Murphy & McKee, 2016),⁴⁰ girls across the Global South who struggle to access a sufficient quantity of high-

³⁶ Chambers, E. G., Foulon, M., Handfield-Jones, H., Hankin, S. M., & Michaels, E. G. (1998). The war for talent. *McKinsey Quarterly*, 44-57.

³⁷ One of the reasons for this trend is a recognition among entrepreneurial individuals that heavy reliance on donations may limit social impact scalability. Many traditional non-profits are effective but non-scalable because they rely predominantly on donations. For example, Darkinjung is an innovative non-profit indigenous school in Australia (Barker, 2016).³⁷ It has proven effective at bridging the significant educational gap between indigenous and non-indigenous populations;³⁷ however, it relies on over £540,000 per year in donations to educate just 28 students. To replicate Darkinjung for all 11,342 Australian indigenous students would require them to raise £219M annually in donations – an improbable task. However, if the organisation operated with a more sustainable business model (either as a non-profit or for-profit) then raising such large quantities of capital may be an easier and less daunting task.

³⁸ Ebrahim, A., Battilana, J., & Mair, J. (2014). The governance of social enterprises: Mission drift and accountability challenges in hybrid organizations. *Research in Organizational Behavior*, 34:81-100. Zhao, E.Y. & Grimes, M. (2016). Staying True to Purpose: How Commercial Pressures Affect Mission Drift among Social Enterprises. *Academy of Management Proceedings*, 1:13440.

³⁹ Pogge, T. (2004). Assisting the global poor. The ethics of assistance: Morality and the distant needy, 260-88. DaSilva, E. J., Baydoun, E., & Badran, A. (2002). Biotechnology and the developing world. *Electronic Journal of Biotechnology*, 5(1), 1-2. Berry, C., Forder, A., Sultan, S., & Moreno-Torres, M. (2004). Approaches to improving the delivery of social services in difficult environments. Poverty Reduction in Difficult Environments (PRDE) Working Paper, 3. Abadzi, H. (2004). Education for all or just the Smartest Poor?. *Prospects*, 34(3), 271-289.

⁴⁰ Roberts, B., Murphy, A., & McKee, M. (2016). Europe's collective failure to address the refugee crisis. *Public health reviews*, 37(1), 1.

quality schooling (Guinée, 2014),⁴¹ indigenous populations who continue to endure dramatically different living standards to those living around them (Adelson, 2005; Altman, Biddle & Hunter, 2008),⁴² and the millions of working-age people who are unemployed due to technological advances such as automation, robotics and artificial intelligence (Brynjolfsson & McAfee, 2012).⁴³ These individuals are often unable to finance investments in themselves due to limited credit history, cash flow constraints, lack of familial support, negligible or non-existent savings, and a rational aversion to risk (Collins, Morduch, Rutherford & Ruthven, 2010).⁴⁴ As such, there is a need for more available and effective financing mechanisms that can improve the productive capacity and well-being of disadvantaged individuals at the scale required.

Arguably, impact investing has the potential to do just that. The quantity of return-seeking capital significantly exceeds the quantity of philanthropic capital, so if more of the former can be channelled into socially beneficial investments then there may be a significant improvement in social outcomes (Carmody et al., 2011).⁴⁵ This is not only because the aggregate quantity of capital seeking social outcomes would increase, but also because of the nature of that capital. When financial upside from investments is possible, investors may be less risk averse and more willing to pursue investments with a high yet uncertain expected impact. They may also be more incentivised to be innovative and to ensure investments are as effective as possible.

As such, investors and entrepreneurs are driving the trend towards impact investing in a mutually reinforcing way. Capital is following entrepreneurs, and entrepreneurs are following capital. This is supported by many policy-makers and international development practitioners, who see the value and potential of impact investing to help address socio-economic disadvantage, especially in low-income countries.

1.4 The Advent of New Impact Investing Mechanism Designs

One of the key consequences of the growth of impact investing has been the search for and creation of new ways of doing impact investing. Drawing from the microeconomics literature, a way of doing impact investing can simply be referred to as an impact investing ‘mechanism’ (Hurwicz, 1973; Maskin, 2008; Hurwicz & Reiter, 2006).⁴⁶

⁴¹ Guinée, N. (2014). Empowering women through education: Experiences from Dalit women in Nepal. *International Journal of Educational Development*, 39, 173-180.

⁴² Adelson, N. (2005). The embodiment of inequity: Health disparities in Aboriginal Canada. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, S45-S61. Altman, J. C., Biddle, N., & Hunter, B. (2008). How realistic are the prospects for 'closing the gaps' in socioeconomic outcomes for Indigenous Australians?. Centre for Aboriginal Economic Policy Research.

⁴³ Brynjolfsson, E., & McAfee, A. (2012). *Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy*. Brynjolfsson and McAfee.

⁴⁴ Collins, D., Morduch, J., Rutherford, S., & Ruthven, O. (2010). *Portfolios of the poor: how the world's poor live on \$2 a day*. Princeton University Press.

⁴⁵ Carmody, L., McCarron, B., Blinch, J., Prevat, A., & Arosio, M. (2011). *Impact Investing in Emerging Markets*.

⁴⁶ A mechanism can be defined as an established process by which something takes place or is brought about. Mechanism design, which forms part of the field of economics, refers to the design of rules or processes to achieve specific outcomes. The Nobel Memorial Prize in Economic Sciences in 2007 was awarded to Maskin, Myerson and Hurwicz for their work on mechanism design theory. See Hurwicz, L. (1973). The design of mechanisms for resource allocation. *The American Economic Review*, 63(2), 1-30., Maskin, E. S. (2008). Mechanism design: How to implement social goals. *American Economic Review*, 98(3), 567-76., and Hurwicz, L., & Reiter, S. (2006). *Designing economic mechanisms*. Cambridge University Press.

While impact investing mechanisms all share the common design characteristic of enabling investments that seek financial and social benefits, the designs differ along several specific dimensions. These dimensions include: (a) how investments are selected; (b) who makes the investment; (c) who pays the investor; (d) whether payments are conditional; (e) the size of financial benefits to investors; (f) when investors can realise financial returns; (g) who facilitates the payments to investors; and (h) whether and how social impact is measured.

Traditional investment mechanisms, such as fixed-repayment debt contracts and equity investments, are still common in the impact investing space. However, alternative mechanism designs are receiving increasing attention in both theory and practice. Three of the more recent and innovative impact investing mechanism designs are social impact bonds (SIBs), income-contingent loans, and simultaneous credit and insurance provision.

Social impact bonds (or SIBs) are a relatively recent impact investing mechanism design. They involve an agreement between a government and an investor for the government to pay the investor a pre-determined amount at a pre-determined time if specific social outcomes are achieved, as typically determined by an independent entity (Liebman, 2011; Fox & Albertson, 2011).⁴⁷ The first SIB, launched in 2010 by Social Finance UK, focused on reducing recidivism among prisoners leaving Peterborough prison (Disley et al., 2011).⁴⁸

Income-contingent loans, which are also sometimes referred to as income share agreements (ISAs), microequity, human equity, or human capital contracts (HCCs), involve investments in individuals, with those individuals repaying investors a certain percentage of their after-tax income rather than repaying fixed instalments. This mechanism is commonly, though not exclusively, used to finance human capital investments. It has been argued that this arrangement transfers risk from low-income individuals to private investors, and that it aligns social and financial returns for investors since investor revenue is a positive function of the incomes of investment recipients (Palacios, 2004; Lleras, 2007; Johnstone, 2014; Chapman, 2006; Stiglitz, 2014; Simkovic, 2013).⁴⁹

A third recent mechanism design, which has been attempted in several low-income countries, involves the simultaneous provision of credit and insurance by investors to individuals (Giné & Yang, 2009).⁵⁰ It is reasoned that the inclusion of insurance may help to overcome some common

⁴⁷ Liebman, J. B. (2011). Social Impact Bonds: A promising new financing model to accelerate social innovation and improve government performance. Center for American Progress, 9. Fox, C., & Albertson, K. (2011). Payment by results and social impact bonds in the criminal justice sector: New challenges for the concept of evidence-based policy?. *Criminology & Criminal Justice*, 11(5), 395-413.

⁴⁸ Disley, E., Rubin, J., Scraggs, E., Burrowes, N., & Culley, D. (2011). Lessons learned from the planning and early implementation of the Social Impact Bond at HMP Peterborough. London: Ministry of Justice.

⁴⁹ Palacios, M. (2004). Investing in human capital: a capital markets approach to student funding. Cambridge Univ Pr. Lleras, M. P. (2007). Investing in human capital: A capital markets approach to student funding. Cambridge University Press. Johnstone, D. B. (2004). Cost-sharing and equity in higher education: Implications of income contingent loans. In *Markets in Higher Education* (pp. 37-59). Springer Netherlands. Chapman, B. (2006). Income contingent loans for higher education: International reforms. *Handbook of the Economics of Education*, 2, 1435-1503. Stiglitz, J. E. (2014). Remarks on Income Contingent Loans: How effective can they be at mitigating risk?. *Income Contingent Loans: Theory, Practice and Prospects*, Basingstoke, UK and New York: Palgrave Macmillan, 31-8. Simkovic, M. (2013). Risk-based student loans. *Wash. & Lee L. Rev.*, 70, 527.

⁵⁰ Giné, X., & Yang, D. (2009). Insurance, credit, and technology adoption: Field experimental evidence from Malawi. *Journal of Development Economics*, 89(1), 1-11.

problems with standalone debt financing, such as high default rates and low-income individuals bearing too much risk (Clarke & Dercon, 2009).⁵¹ At the same time, this approach may be easier than income-contingent loans from an enforcement, legal and operations perspective. This is because there is no need to know incomes, since credit repayments are fixed and insurance pay-outs can be based on an index rather than individual outcomes.⁵²

Importantly, these new impact investing mechanism designs are predominantly positioned in different fields of academic literature. Most research on SIBs takes place in the social finance literature, while most research on the latter two mechanisms takes place in the economics literature – especially, though not exclusively, the sub-field of development economics. It is worth noting that these mechanisms share the common design characteristic that the investment is often undertaken by the private sector.

1.5 An Overlooked Impact Investor

While the trend towards making investments with both expected welfare improvements and expected future revenue attributable to the investment is relatively new in the private sector, the same cannot be said for the public sector. As alluded to in Section 1.1, a large proportion of government expenditure can be classified in precisely that way – as investments that are expected to increase welfare and have an attributable financial return of greater than – 100% of capital. This is often overlooked as the financial benefit to the government takes a myriad of forms and accrues well into the future. It is commonly in the form of welfare savings or higher taxation revenue, as with poverty alleviation initiatives, education investments and health interventions. Sometimes it is in the form of repayments of publicly-provided income-contingent loans, as with the Higher Education Loan Program (HELP) in Australia (Chapman, 1997; Chapman & Ryan, 2002).⁵³ Occasionally it is in the form of a more recently designed mechanism known as ‘value capture’ that normally involves the government funding infrastructure projects, especially transportation projects, by capturing a portion of the increase in property values that arises from those investments (Rybeck, 2004; Mathur & Smith, 2013).⁵⁴ These are just three of the mechanisms the government uses to achieve simultaneous social and financial benefits from investments.

This is not to say that all government expenditure seeks both a financial return and a social impact. Some expenditure, such as foreign aid and initiatives to simply increase individual contentment, may produce negligible, if any, financial benefits. Other expenditure, such as exporting weapons to foreign countries, may produce a financial benefit but not directly improve citizen well-being. Nevertheless, a significant proportion of public sector investments fit the

⁵¹ Clarke, D., & Dercon, S. (2009). Insurance, credit and safety nets for the poor in a world of risk.

⁵² One index commonly used for agricultural insurance, particularly in India and East Africa, is a rainfall index. See Giné, X., Menand, L., Townsend, R., & Vickery, J. (2010). Microinsurance: a case study of the Indian rainfall index insurance market. The World Bank.

⁵³ This was previously referred to as the Higher Education Contribution Scheme (HECS). See Chapman, B. (1997). Conceptual issues and the Australian experience with income contingent charges for higher education. *The Economic Journal*, 107(442), 738-751., and Chapman, B., & Ryan, C. (2002). Income-contingent financing of student charges for higher education: Assessing the Australian innovation.

⁵⁴ Rybeck, R. (2004). Using value capture to finance infrastructure and encourage compact development. *Public Works Management & Policy*, 8(4), 249-260. Mathur, S., & Smith, A. (2013). Land value capture to fund public transportation infrastructure: Examination of joint development projects' revenue yield and stability. *Transport Policy*, 30, 327-335.

defining characteristic of impact investments – namely investments that seek both social and financial benefits.

1.6 The Research Question

It follows that within both the public sector and private sector there exists a broad range of differently-designed financial mechanisms that are all working towards the same objective – how to effectively enable investments that both improve human welfare and provide financial benefits to those undertaking the investments.

Given this, one may expect there to be a large pool of academic literature that researches the design of different mechanisms, determines the characteristics of these mechanisms, compares the different mechanisms across sectors, attempts to bring together disjointed theory into a consistent framework, and determines which mechanism traits lead to the greatest social value creation. However, this is not the case. As is empirically shown in Chapter 2, there is a severe lack of research on the design of impact investing mechanisms that is comparative, theoretical, or cross-sectoral in nature.

This motivates the following overarching question, which this research seeks to answer:

“How does the design of impact investing mechanisms affect the creation of social value?”

This research question is intentionally broad, short and simple. It does not presume any result and is answerable via academic research.

As noted earlier in this chapter, the term ‘impact investment’ here is broadly defined. Formally, this research defines impact investments as *“investments that are undertaken by either a private or public entity, with a primary objective being the creation of social value, and where future payments that are attributable to those investments are reasonably expected to be received.”* Importantly, unlike in some of the academic literature on this topic, the type of stakeholder making the investment is not restricted to a private investor.⁵⁵ Instead, this research takes the view that investments by governments that intentionally seek both social and financial benefits should be classified as impact investments, in addition to double bottom-line investments by the private sector. This is a similar view to that taken by Wood (2014),⁵⁶ who argues that the government is a type of impact investor. By defining impact investments in this way, the types of mechanism designs that can be researched are not unnecessarily restricted. Furthermore, as will become apparent, this definition enables the field of impact investing to bridge the social finance and public finance literatures. It enables cross-sectoral comparative research on different mechanisms and means public-private partnerships that facilitate impact investing can be

⁵⁵ See, for example, the definition provided by Daggers and Nicholls (2016). They define social finance as “the use of a range of private financial resources to support the creation of public, social and environmental value or impact” (p. 6). They further view impact investing as a subset of social finance, defined as “the use of capital to create specified social or environmental impact, whether it is through direct allocation capital, investment in funds, or contractual agreements such as SIBs” (p. 6).

⁵⁶ Wood, D. (2014, March 26). The Role of Government in Impact Investing. Retrieved from <https://shelterforce.org>.

researched more easily and comprehensively. As such, conceptualizing the government as an impact investor is both theoretically sound and beneficial for research purposes.

The term ‘social value’ refers to the amount of value created from an investment *ex ante* any investor appropriation of that value. It is the maximum potential social impact – the social impact that would arise if an investor did not appropriate any value created. As is discovered in Chapter 3, and explained in Section 3.9, this is similar to but different from ‘social impact’, which is the amount of value created from an investment *ex post* investor appropriation of financial value.

To answer this research question, the scope is narrowed to a specific class of impact investing mechanisms – namely investments that: (a) involve contingent-repayments of some sort; (b) can be in individuals rather than just enterprises; and (c) are expected to improve those individuals’ productivity. This case, and the justification for focussing on it, will be explained shortly. However, before that, it is important to ask two questions. First, why is this question so important to research? Secondly, why is this topic so under-researched at the moment? The answers to both of those questions justify the research focus and inform the research methodology.

1.7 The Research Imperative

There are three key reasons why this particular topic is important to research. This is in addition to a number of well-accepted reasons for researching impact investing, including the persistence of widespread socio-economic disadvantage (Brest & Born, 2013),⁵⁷ the limited capacity of individuals to self-finance investments (Clarkin, Bacq & Nordqvist, 2014),⁵⁸ and the high potential for impact investing to address those problems due to the quantity and nature of capital that could seek social outcomes (Rodin & Brandenburg, 2014).⁵⁹

i) The Potential of Impact Investing is Not Currently Being Fulfilled

First, despite the size of the problem and the intuitive potential of impact investing, empirical evidence suggests that existing impact investing mechanisms have significant shortcomings. Impact investing levels are still a very small proportion (approximately 0.29%) of total investments,⁶⁰ with limited take-up of some recent much-hyped mechanisms.

When it comes to public-private partnership mechanisms, enthusiasm was high when the first social impact bond was launched in 2010. However, that enthusiasm has since tapered. According

⁵⁷ Brest, P., & Born, K. (2013). When can impact investing create real impact. *Stanford Social Innovation Review*, 11(4), 22-31.

⁵⁸ Clarkin, J. E., Phan, P., Bacq, S., & Nordqvist, M. (2014). Crowdfunding, foundations, and impact investors as sources of financial capital for social entrepreneurs. *Theory and empirical research in social entrepreneurship*, 191.

⁵⁹ Rodin, J., & Brandenburg, M. (2014). *The power of impact investing: Putting markets to work for profit and global good*. Wharton Digital Press.

⁶⁰ The Global Impact Investing Network (GIIN) released a report on the 6th of June, 2018, which claims that the size of the impact investing market has a floor of US\$228 billion. This compares with the estimated US\$79.2 trillion in total assets under management in 2018, as estimated by Boston Consulting Group. Combining these two estimates, impact investing assets are approximately 0.29% of total assets under management. See Mudaliar, A., Bass, R., & Dithrich, H. (2018) Annual Impact Investor Survey 2018. Global Impact Investing Network. Fages, R., Beardsley, B., Brömstrup, I., Donnadiou, H., Macé, B., Pardasani, N., Schmitz, L., Sheridan, B., Taglioni, G., Xu, Q. (2018) Global Asset Management 2018: The Digital Metamorphosis. The Boston Consulting Group.

to Sir Ronald Cohen,⁶¹ who some regard as the ‘father of social finance’ (Humber, 2016),⁶² “in the past three years, no government has really pursued SIBs as a financing instrument.”⁶³

As for mechanisms involving investment by private investors, it has been difficult for private investors to make investing in low-income populations profitable. Upfront payments from low-income individuals are not always possible. Investments in the form of long-term fixed-repayment loans are problematic due to financial returns accruing beyond the time-horizon required, payment enforcement difficulties, high default rates, and the risk burden on individuals (Kono & Takahashi, 2010; Guillemette, 2006; Wulandari & Kassim, 2016).⁶⁴ Risk-averse low-income individuals are often unwilling to take out fixed repayment loans to invest in their own productive capacity, such as by furthering their education, because of the uncertain returns to those human capital investments (Williams, 1979).⁶⁵ If positive returns fail to materialize, then they may be left with a large debt that they are unable to repay.

Furthermore, privately provided income-contingent loans have not gained significant traction and have been beset by problems (Palacios, DeSorrento & Kelly, 2014; Kapadia, 2014; Marcus, 2016).⁶⁶ For example, between 1971 and 1978, Yale University provided income-contingent loans to approximately 3,900 students under two programs called ‘Contingent-repayment Option’ and ‘Tuition Postponement Option’ that were designed by economists James Tobin and Milton Friedman.⁶⁷ These programs involved students making repayments of 0.04 percent of their future income for every US\$1,000 borrowed for 35 years, unless the total amount owed by the graduating class was repaid first. Eventually, the scheme was abandoned and all income-contingent loans were forgiven. Yale attributed this failure to two main problems. First, there was enforcement difficulty. More than 750 students did not make the repayments required in the contract. Secondly, there were adverse selection problems. Those with higher expected incomes had either bought out their loans or opted into different programs to begin with, which made the scheme financially non-viable (Chapman, 2006; Yi, 2014).⁶⁸

⁶¹ Sir Ronald Cohen is the Co-Founder of Social Finance UK, Chairman of the Global Social Impact Investment Steering Group, and Chair of the Social Impact Investment Taskforce.

⁶² Humber, L. A. (2016). The impact of neoliberal market relations of the production of care on the quantity and quality of support for people with learning disabilities. *Critical and Radical Social Work*, 4(2), 149-167.

⁶³ This statement was made as part of a research interview with Sir Ronald Cohen on the 24th of July, 2017. The reasons given for low adoption of SIBs include the time and cost required to measure specific outcomes, the limited value proposition to governments and investors, and the fact that the adoption of the SIB mechanism design requires a mindset shift from policymakers that is difficult to bring about. These factors are discussed more in Chapters 3 and 6.

⁶⁴ Kono, H., & Takahashi, K. (2010). Microfinance revolution: Its effects, innovations, and challenges. *The Developing Economies*, 48(1), 15-73. Guillemette, Y. (2006). The Case for Income-contingent-repayment of Student Loans. CD Howe Institute. Wulandari, P., & Kassim, S. (2016). Issues and challenges in financing the poor: case of Baitul Maal Wa Tamwil in Indonesia. *International Journal of Bank Marketing*, 34(2), 216-234.

⁶⁵ Williams (1979) was the first to study education with a stochastic dynamic programming model, viewing education as a marketable investment and relating education to the finance literature. Williams, J. T. (1979). Uncertainty and the accumulation of human capital over the life cycle. *Journal of Business*, 521-548.

⁶⁶ Palacios, M., DeSorrento, T., & Kelly, A. P. (2014). Investing in value, sharing risk: Financing higher education through income share agreements. *AEI Series on Reinventing Financial Aid*. Kapadia, R. (2014). A Solution to the Student Loan Crisis: Human Capital Contracts. *Brook. J. Corp. Fin. & Com. L.*, 9, 591. Marcus, J. (2016). Students’ Futures as Investments: The Promise and Challenges of Income-Share Agreements. *AEI Series on Private Financing in Higher Education*. American Enterprise Institute for Public Policy Research.

⁶⁷ The Associated Press. (1999, April 13). Yale to Erase Alumni Debts in 2 Loan Plans. Retrieved from <https://www.nytimes.com/1999/04/13/nyregion/yale-to-erase-alumni-debts-in-2-loan-plans.html>

⁶⁸ Chapman, B. (2006). Income contingent loans for higher education: International reforms. *Handbook of the Economics of Education*, 2, 1435-1503. Yi, A. (2014). Reforming the Student Debt Market: Income-Related Repayment Plans or Risk-Based Loans. *Va. J. Soc. Pol’y & L.*, 21, 511.

More recent ventures that have attempted to use the mechanism of income-contingent loans to finance human capital have struggled to scale and have also been beset by enforcement, moral hazard and adverse selection problems. Three well-known examples - Upstart, Pave and Fantex (which is focused on investing in sporting talent) - have all pivoted away from income-contingent loans. Lumni, a South American company working with low-income individuals, and Vemo Education, a US based B2B firm that works in partnership with universities, have had marginally more success, but have still failed to scale and gain significant traction.

When credit and insurance are provided separately, rather than together in the form of a contingent loan, adoption rates are still low. It seems intuitive that credit and insurance are complementary financial products and would be demanded by rational risk-averse individuals at actuarially fair rates.⁶⁹ Yet, empirically, when insurance is offered with credit there is extremely low insurance uptake (Giné & Yang, 2009).⁷⁰ To date, the literature has not provided a compelling explanation for this puzzle.

When it comes to mechanisms where the government is the entity doing the investing, problems are equally widespread. Often a government's primary goal is being re-elected, which corresponds to maximizing the well-being of citizens within a short-term time-horizon (Alesina & Tabellini, 2004; Davis & Ferrantino, 1996; Alesina & Tabellini, 2008).⁷¹ Unfortunately, investments in education and preventative healthcare have long-term returns, so there is a lack of incentive to invest in these areas (Neumayer et al., 2014).⁷² Governments may also find it politically difficult to invest in disadvantaged groups, especially if this means generating a deficit, using large sums of taxpayer money on non-tax-paying individuals, or risking programmatic failure and the perception of waste. There is also the challenge of incentivizing government workers to exert high-effort in the provision of investments when firing is more difficult, and performance-contracts rarer, than in the private sector (Ritz, Neumann & Vandenabeele, 2016).⁷³

ii) Evidence Suggests Mechanism Design Plays a Key Role in Determining Impact Investing Adoption

Secondly, an in-depth analytical reading of the social finance, development economics, and public finance literature reveals an important point: that the *design* of impact investing mechanisms may play a key role in explaining the low levels of impact investment at present.

⁶⁹ An actuarially fair price of insurance, from the perspective of the consumer, occurs when the expected compensation received equals the premiums paid so that the expected payoff is zero (Hellmen, 1997). Hellman, D. S. (1997). Is Actuarially Fair Insurance Pricing Actually Fair-A Case Study in Insuring Battered Women. *Harv. CR-CLL Rev.*, 32, 355.

⁷⁰ Giné, X., & Yang, D. (2009). Insurance, credit, and technology adoption: Field experimental evidence from Malawi. *Journal of Development Economics*, 89(1), 1-11.

⁷¹ Alesina, A., & Tabellini, G. (2004). *Bureaucrats or politicians?*(No. w10241). National Bureau of Economic Research. Davis, M. L., & Ferrantino, M. (1996). Towards a positive theory of political rhetoric: Why do politicians lie?. *Public Choice*, 88(1-2), 1-13. Alesina, A., & Tabellini, G. (2008). Bureaucrats or politicians? Part II: Multiple policy tasks. *Journal of Public Economics*, 92(3-4), 426-447.

⁷² Neumayer et al. (2014) find that governments tend to prioritise policies that increase short-term political support and underinvest in investments, such as disaster prevention and mitigation, that have longer term and more uncertain returns. Neumayer, E., Plümper, T., & Barthel, F. (2014). The political economy of natural disaster damage. *Global Environmental Change*, 24, 8-19.

⁷³ Ritz, A., Neumann, O., & Vandenabeele, W. (2016). Motivation in the Public Sector.

At a simple conceptual level, there are two possible explanations for impact investments not being undertaken. Typically, investments involve the incursion of costs that are borne by a *single* investor, and the generation of benefits that accrue to *various* stakeholders. Through an economic cost-benefit analysis lens, an investment is generally considered *appropriate* if the present value of *aggregate* benefits exceeds the present value of costs (Mishan & Quah, 2007).⁷⁴ Through a finance lens, an investment generally *occurs* if the present value of *investor* benefits exceeds the present value of costs. It logically follows that investments that do occur can be conceptualised as falling into one of two categories. The first category is where the present value of aggregate costs exceeds the present value of aggregate benefits. In such instances, it is not theoretically possible for the investments to occur without a financial loss being incurred by one or more stakeholders. It is impossible for investor benefits to exceed costs unless financial value comes from elsewhere. The second case is where the present value of aggregate benefits exceeds the present value of costs, but the present value of costs exceeds the present value of *investor* benefits. In this latter category, it is theoretically possible for investments to occur. If they do not take place, the problem is not insufficient value creation from investments, but the dispersion of value. The investor needs to be able to appropriate more of the value created for the investment to take place.

It follows that mechanism design may help explain why potential investments that fall into the latter category, where investments are theoretically possible, do not take place. This then prompts the question, “Do many investments fall into this second category?”

The literature reveals that there are many types of investments in this category, especially human capital investments with positive externalities, such as investments in education and health. For example, there is a significant body of economics literature on the returns to education, which finds that the aggregate benefits of education investments typically exceed the costs of such education provision (Psacharopoulos, 2004; Blundell et al., 1999).⁷⁵ Despite this, levels of education financing are still suboptimal in many low-income countries (Patrinos, 2016; Hodal, 2018).⁷⁶ This suggests that the problem is not that the costs of education investments exceed the aggregate benefits, but that the costs exceed the realisable financial benefits for the investor.

The evidence that mechanism design is important for impact investing effectiveness also comes from primary data from leading authorities in both the development economics and social finance fields. Sir Ronald Cohen said in an interview as part of this research:

“The [social finance] trends are real. This thing is real. Capital flows are increasingly

⁷⁴ Mishan, E. J., & Quah, E. (2007). Cost-benefit analysis. Routledge.

⁷⁵ Psacharopoulos, G. (1994). Returns to investment in education: A global update. *World development*, 22(9), 1325-1343. Blundell, R., Dearden, L., Meghir, C., & Sianesi, B. (1999). Human capital investment: the returns from education and training to the individual, the firm and the economy. *Fiscal studies*, 20(1), 1-23.

⁷⁶ According to Harry Patrinos, a manager in the World Bank’s education sector, in 2016 there were 124 million children and adolescents not in school, and a further 250 million who cannot read despite at least several years of schooling. When youth are included in addition to children and adolescents, the number of individuals out of school for three consecutive years increases to 264 million. See Patrinos, H. (2016, May 17). Why education matters for economic development. Retrieved from <http://blogs.worldbank.org/education/why-education-matters-economic-development>; Hodal, K. (2018, February 2). Hundreds of millions of children in school but not learning. Retrieved from <https://www.theguardian.com/global-development/2018/feb/02/hundreds-of-millions-of-children-in-school-but-not-learning-world-bank> and <http://uis.unesco.org/sites/default/files/documents/reducing-global-poverty-through-universal-primary-secondary-education.pdf>.

changing because people are increasingly optimising over the three dimensions of risk, return and impact. That is going to be the direction very clearly. But investors need to be able to capture more of the value they create if the full potential of the field is to be realised. We need to align social and financial returns in new and better ways, so as to incentivise further social value creation.”

Meanwhile, Professor Jeffrey Sachs, regarded as one of the world's foremost development economists, said:

“The biggest challenge in international development is how to internalise the positive externalities from investments so that there is the right degree and type of investments. We need to make the market work for goods and services that are currently inadequately provided by the government as public goods.”

While Sir Ronald Cohen and Jeffrey Sachs express the problem differently, based on the terminology of their respective fields, they are emphasising the importance of the same fundamental issue of impact investing mechanism design. This is because mechanism design determines if, how, what proportion of, and when the value that is created from impact investments - which is often dispersed over time and stakeholders - is able to be captured by investors.

This insight is consistent with the research on the mechanism of income-contingent loans. The main reasons given in the literature for the low adoption of contingent loans relate to the inability of investors to capture the value they create, rather than the lack of value creation itself. These reasons include income misreporting by individuals, the difficulty that private investors have enforcing payments due to income information asymmetry, the incentive for recipients to migrate to other jurisdictions, and the fact that long-term benefits cannot be captured within short-term investor time-horizons (Chapman, 2006; Yi, 2014; Marcus, 2016).⁷⁷ Even the explanations focused on adverse selection and moral hazard are about how the mechanism reduces the value created from what it could potentially be. In other words, the financing mechanism, and not the inherent appropriateness of the investment, is often the problem.⁷⁸ These problems arise because the income-contingent loan mechanism involves investors attempting to appropriate financial value in the form of a percentage of after-tax income.

As such, there is strong initial evidence from logical reasoning, from primary data from leading authorities, and from the literature on specific impact investing mechanisms, that mechanism design plays an important role in determining whether impact investments take place and, if so, the social value they create.

⁷⁷ Chapman, B. (2006). Income related student loans: concepts, international reforms and administrative challenges. In *Cost-Sharing and Accessibility in Higher Education: A Fairer Deal?* (pp. 79-103). Springer, Dordrecht. Yi, A. (2014). Reforming the Student Debt Market: Income-Related Repayment Plans or Risk-Based Loans. *Va. J. Soc. Pol'y & L.*, 21, 511. Marcus, J. (2016). Students' Futures as Investments: The Promise and Challenges of Income-Share Agreements. AEI Series on Private Financing in Higher Education. American Enterprise Institute for Public Policy Research.

⁷⁸ A further explanation for the low prevalence of contingent loans, which has not been emphasised in the literature to date, is discussed Chapter 3 and proven in Appendix B.

iii) A More Rigorous, Nuanced and Comprehensive Understanding of the Relationship between Impact Investing Mechanism Design and Social Value Creation has the Potential to Increase Social Value

Thirdly, given the *prima facie* evidence that suggests there is an important role for mechanism design in determining impact investing adoption, it is at least arguable that objective research into the fundamental relationship between mechanism design and social value creation has a role to play in *proactively* refining existing impact investing mechanisms in addition to *reactively* understanding them.

Many existing impact investing mechanisms were designed and implemented in an ad hoc way, often in response to shortcomings with prior mechanisms, and often by specific stakeholders pursuing their own interest. Deep, rigorous, nuanced, and comprehensive research into impact investing mechanism design may help to improve social outcomes by laying the foundation for the design of modified and improved impact investing mechanisms. There may be alternative ways to materialize long-term value creation into resources to fund near-term impact investments that have not been considered in academia, or employed in practice, to date. If new mechanisms possess characteristics that make them preferable to incumbent mechanisms in certain circumstances, the set of possible impact investments that are also viable from an investor standpoint may increase. This, in turn, could contribute to achieving social and development outcomes.

In these ways, this research has the potential to make significant contributions to both the literature on, and practice of, impact investing.

1.8 The Research Challenge

Given that this is such an important research topic, it is pertinent to ask the question, “Why is it under-researched?” One straightforward explanation is that this is an incredibly challenging topic to research.

First, the field of social finance is underdeveloped. It has multiple entry points, blurred boundaries, and a lack of consensus on terminology (Daggers & Nicholls, 2016).⁷⁹ This absence of consensus can be found in topics ranging from how social impact should be measured to what is rightly classified as social finance itself. Without a solid core of theory, advanced analysis is more difficult because it first requires building that theoretical base.

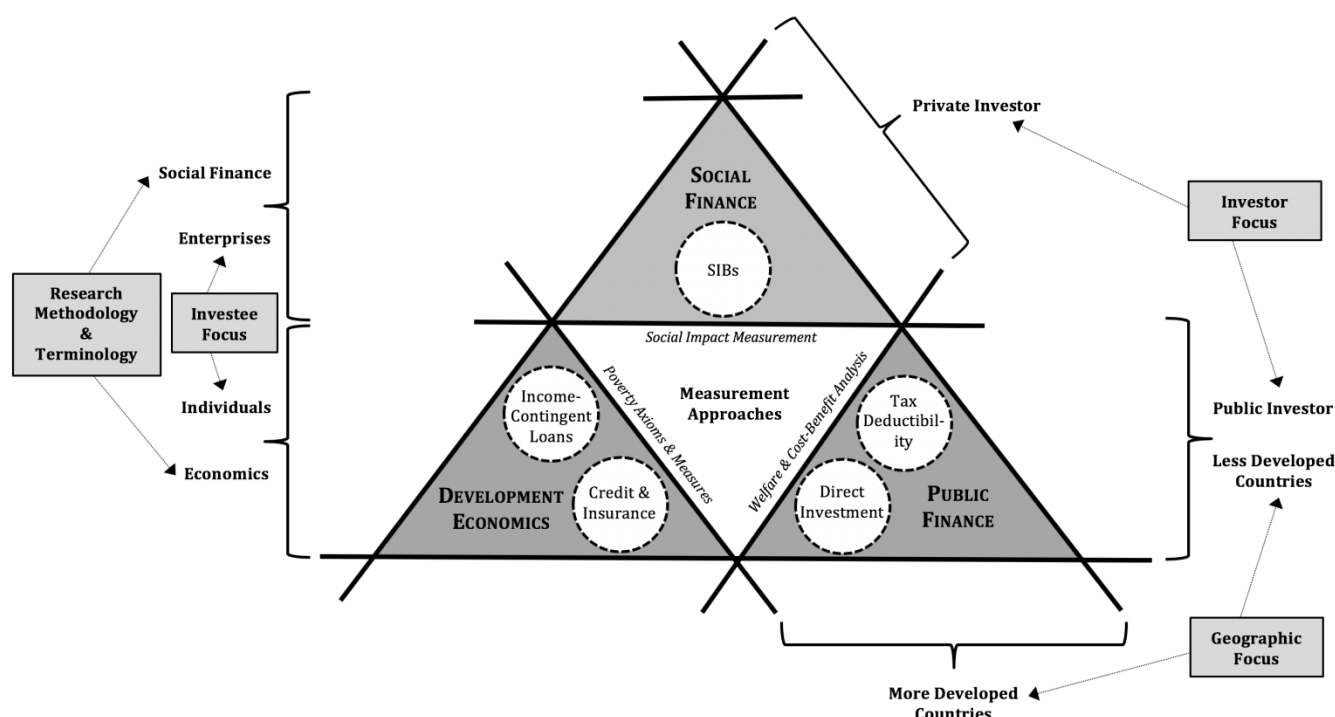
Secondly, and perhaps most importantly, existing impact investing mechanisms do not fall into any one neat pool of academic literature. Rather, existing mechanisms are positioned in a range of different fields of literature – predominantly social finance, development economics, and public finance. This is not a critical problem in and of itself. However, as is empirically shown in Chapter 2, it has resulted in different impact investing mechanisms being researched in vastly different ways. Despite content similarities between impact investing mechanisms, the academic literature uses differing terminology, research methodologies and degrees of mathematical rigour, and is

⁷⁹ Daggers, J., & Nicholls, A. (2016). The landscape of social impact investment research: Trends and opportunities. SBS, Oxford.

housed in different journals, from one impact investing mechanism to the next. Furthermore, different disciplines tend to approach impact investing from the perspective of specific types of investors and specific types of investment recipients. Whereas social finance typically focuses on *private* investors investing in *enterprises* and the ensuing *investor-specific* financial returns that accrue, the economics literature (especially the public finance literature) typically focuses on *public* investors investing in *individuals* and the ensuing *aggregate* financial value created from those investments. This divergent academic treatment of different impact investing mechanisms partly explains why they are typically studied in isolation rather than collectively or comparatively.

The following diagram maps impact investing mechanisms by the academic literature in which they are predominantly positioned. As the graph illustrates, mechanisms differ along a range of dimensions, including investor focus, investee focus, geographic focus, research methodology, and research terminology. For example, SIBs are researched extensively in the social finance literature, while credit and insurance are researched predominantly in the development economics literature. Note that some impact investing mechanisms, such as tax deductibility and income-contingent loans, are researched to a small extent in social finance, but are mostly researched in public finance and development economics respectively.

Figure 1.1: Predominant Positioning of Impact Investing Mechanisms in the Academic Literature



Not only is the literature on impact investing mechanisms disconnected, the literature on closely related topics is also siloed. For example, the literature on social impact measurement is largely viewed as a separate issue from impact investing mechanism design.⁸⁰ Furthermore, there is

⁸⁰ This is shown empirically in Chapter 2.

limited academic dialogue between those studying social impact measurement in social finance and those researching poverty measurement in development economics, despite their similarities in relation to content and objectives. A reason for this, as well as consequence of it, is that measurement approaches are vastly different methodologically between disciplines. The literature on poverty measurement focuses on precise poverty measurement axioms and mathematical analysis of which properties different measurement approaches satisfy (Sen, 1976; Zheng, 1993).⁸¹ In contrast, the literature on social impact measurement is less precise in its specification of desired measurement properties and its mathematical formulation. Other related topics are also approached in different ways depending on the discipline. For example, the process by which social outcomes come about is often approached from the theory of change and logic model perspective in social finance (Garud, Hardy, & Maguire, 2007),⁸² but often from the welfare and capabilities perspective in development economics (Kaldor, 1939; Sen, 1999).⁸³

This siloing of mechanism designs and related topics is problematic. As shown in Figure 1.1, there are commonalities between mechanisms, such as investor type and geographic focus, which may not be captured or explored through a siloed approach.

All of this means that, in order to research impact investing mechanism design in a comparative, fundamental and systematic way, it is necessary to be interdisciplinary in approach, drawing from multiple strands of literature.

This presents a methodological challenge.

One option is to approach the field of social finance using common microeconomics methodologies. However, the two most common research approaches in microeconomics – econometrics research and building theoretical microeconomics models – are each problematic if undertaken in isolation in this context. Econometrics research involving regression analysis is difficult due to the limited data available on different impact investing mechanisms. An alternative approach is building theoretical microeconomic models of different impact investing mechanisms and using mathematical proofs to determine the precise properties of different mechanisms. This approach has several advantages. It enables research into both existing mechanism designs and potential mechanism designs, thereby not restricting research to mechanisms that currently exist. It is also a useful method for discovering and understanding why mechanisms may be experiencing low take-up rates, and the conditions under which different mechanisms should be used. Furthermore, it is likely to make a significant contribution to the literature on impact investing mechanisms that tend to be positioned outside the field of economics, which have not been researched in this manner to date. However, there are downsides to this approach too. Accurate modelling requires changing commonly accepted microeconomic assumptions that the economics discipline strongly adheres to, such as the assumption that firms are purely profit-

⁸¹ Sen, A. (1976). Poverty: an ordinal approach to measurement. *Econometrica: Journal of the Econometric Society*, 219-231. Zheng, B. (1993). An axiomatic characterization of the Watts poverty index. *Economics Letters*, 42(1), 81-86.

⁸² Garud, R., Hardy, C., & Maguire, S. (2007). Institutional entrepreneurship as embedded agency: An introduction to the special issue.

⁸³ Kaldor, N. (1939). Welfare propositions of economics and interpersonal comparisons of utility. *The Economic Journal*, 549-552. Sen, A. (1999). *Commodities and capabilities*. OUP Catalogue.

maximizing.⁸⁴ There is likely to be push-back against changing such assumptions, especially given that the importance of impact investing is more widely accepted in business academic communities than economics academic communities. Also, research involving advanced microeconomic models and mathematical proofs may not be as accessible to social finance academics and practitioners who are more familiar with alternative methodologies.

A second option is to approach impact investing mechanisms typically positioned in the economics literature from the perspective of social finance. One possibility is extending social finance theory to the full range of impact investing mechanisms and obtaining primary data from surveys of, and interviews with, leading authorities. This is a novel approach given that many of the economics-situated mechanisms are not traditionally interpreted as being a form of impact investing, despite them generating both social benefits and financial value for the investor. As such, this method could make a significant contribution. However, there are limitations. Many of the unanswered questions in the literature are very complicated to research, due to impact investing mechanisms involving multiple stakeholders with differing constraints, characteristics, and objectives. Furthermore, the design of mechanisms often involves trade-offs between short-term and long-term benefits, between stakeholders, between social and financial returns, and between design properties. Because there are so many moving parts, some key unanswered questions in the literature necessitate mathematical precision. Without microeconomic approaches it is difficult to know conclusively for a specific mechanism design: (a) what the equilibrium outcome is; (b) whether there are multiple equilibria; (c) whether the equilibrium achieves the first-best; and (d) whether a first-best outcome is stable when considered dynamically over time rather than statically in a single time period. These are important questions to ask and answer. However, the social finance literature largely abstracts from them because the research methodologies commonly employed in social finance do not enable those questions to be answered.

As such, the research topic presents a research challenge because of the disjointed positioning and vastly differing treatments of impact investing mechanisms and related topics in the existing literature, the inherent complicated nature of impact investing mechanism designs, and the fact that methodologically no single approach is sufficient to answer the research question.

1.9 A Specific Class of Impact Investing Mechanisms

Given these challenges, the research strategy employed in this dissertation is centred on investigating a specific class of impact investing mechanisms through a mixed methods approach to address the research question, “How does the design of impact investing mechanisms affect the creation of social value?”

⁸⁴ Santos (2012) explains some of the ways that traditional economic assumptions are inconsistent with the field of social entrepreneurship: “While our economic theories are based on the assumption of self-interested economic actors, social entrepreneurs exhibit economic behaviours that seem inconsistent with this motivation. While our strategy theories suggest how organizations can develop sustainable competitive advantages, often social entrepreneurship does not seem to involve competitive behaviour.” (p.4). The premise of this argument, that economic assumptions are not reflective of the behaviours we see today, is equally valid for the field of social finance as the field of social entrepreneurship. Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

This research concerns a class of impact investing mechanisms that have the following three defining characteristics.

First, the mechanisms involve expected financial value to the investor that is contingent on some variable. In the past, mechanisms with non-contingent-repayments were common, such as loans with fixed repayment amounts (Rizzello, Migliazza, Carè & Trotta, 2016).⁸⁵ However, there has been a trend towards repayments being contingent on some variable as a means of reducing the financial risk to the investment recipient (Ragin & Palandjian, 2013).⁸⁶ To reflect this trend and to be consistent with the objective of reducing risk to low-income individuals, the focus of this research is on contingent-repayment mechanisms.

Secondly, the focus is on investments in individuals rather than enterprises. As previously mentioned, and as is shown empirically in Chapter 2, the literature focuses on different investees depending on the particular field of literature in which the relevant mechanism is situated. Development economics tends to have individuals as the investment recipient (Figures 2.18 & 2.40), while social finance typically treats enterprises as the investment recipient (Figures 2.5, 2.22 & 2.38). Given the necessity of consistency in order to accurately compare mechanisms, a consistent unit of analysis is needed. Why, then, is the focus of this research on individuals as the investee rather than enterprises? This is for two main reasons. First, causal relationships are arguably more consistent, and therefore more capable of generalisation, at an individual level than at an enterprise level. The consequences of investments in individuals, in terms of the social impact created, are also likely to be more predictable than investments in enterprises, where there is a high likelihood of venture failure. Furthermore, in the case of individuals there is likely to be a more consistent relationship between the social value created from impact investments and the subsequent financial value that arises. This is because the financial value created comes in more standard forms. For example, investments in individuals that lead to better development outcomes often result in higher expected incomes and therefore higher expected government taxation revenue. This contrasts with enterprises, where business models vary dramatically. The greater consistency at the individual level makes models of causal relationships more accurate. This may therefore make theoretical modelling more credible and theoretical research more valuable. A second reason for the focus on individuals is that a key objective of this research is to improve the living standards of low-income individuals in less developed countries. To consider whether there are impact investing mechanisms that enable investors to profit while not relying on payments from, or risk being borne by, low-income individuals, it is necessary to examine impact at an individual level. Thirdly, as argued by Santos (2012), organisations are not the most appropriate unit of analysis when the focus is on the creation of value.⁸⁷ One consequence of this

⁸⁵ Rizzello, A., Migliazza, M. C., Carè, R., & Trotta, A. (2016). A model and research agenda. *Routledge Handbook of Social and Sustainable Finance*, 102.

⁸⁶ Ragin, L., & Palandjian, T. (2013). Social impact bonds: Using impact investment to expand effective social programs. *Community Development Investment Review*, 9(1), 63-67.

⁸⁷ Santos (2012) writes, "*The theory of the firm suggests that the organization is the central unit of analysis because it is the locus of appropriation of rents through residual control rights over resources (Grossman & Hart, 1986). If we take seriously the fact that the motivation of social entrepreneurs is not value appropriation but rather value creation, then a corollary is that the organizations may not be the most important unit of analysis for social entrepreneurship. Sustainable advantages are defined at the level of the firm, which is the unit of accrual of appropriated value. In contrast, sustainable solutions are defined at the level of the system, which is the unit of accrual of the created value.*" (p. 35). Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

focus on individuals is that the research is concerned with *social* impacts and not directly on environmental impacts.⁸⁸

The third and final restriction is that this research focuses on investments that improve individuals' productivity in some way. This improvement in individual productive capacity may occur either directly by improving human capital or indirectly by improving the physical capital used by individuals to earn income. This restriction is in place because we are interested in the set of possible investments where the present value of aggregate benefits exceeds the present value of aggregate costs, so that theoretically the investments could occur. The focus is not on investments where there is no obvious potential financial benefit. This leaves open a wide range of possible impact investments, including investments to improve individuals' education, health and sanitation. From a social finance perspective, education, healthcare and sanitation are typically referred to as 'services' rather than 'goods'. From an economics perspective, these can be classified as predominantly (though not strictly) private goods, in the sense that they are mostly excludable and rivalrous, yet their effective provision creates positive pecuniary externalities that may benefit other stakeholders.

It is worth noting where restrictions are *not* placed. There is no restriction in this research on who invests or who repays. Both public and private investors are considered in tandem as potential investors. Also, no assumption is made that the investment recipient has to be the one making the contingent-repayments. In addition, no explicit restriction has been placed on the type of country the investment takes place in. That is because insights from impact investing mechanisms used in middle-income and high-income countries may help to improve impact investing in low-income countries, and vice versa. Nevertheless, because a key motivation for the research, and key application of it, pertains to improving living standards in low-income countries, special attention is paid to characteristics of low-income individuals in emerging markets. These characteristics include low levels of savings, a limited credit history, and a generally high degree of risk aversion (Collins, Morduch, Rutherford, & Ruthven, 2009).⁸⁹ This is because contingent-repayment financing mechanisms need to work within the constraints faced by those at the base of the pyramid if such mechanisms are to be widely adopted.

Accordingly, this research focuses on the case of contingent-repayment impact investments in individuals that are expected to improve those individuals' productivity. The literature points to five main existing types of mechanisms that fit this criterion, which this research therefore focuses on. These are: (1) contingent loans (repayment from individuals to investors, contingent on a variable such as personal income); (2) separate but simultaneous credit and insurance provision (repayment from individuals to investors, contingent on insurance pay-outs which themselves are contingent on variables such as the state of nature); (3) taxation deductibility (repayment from governments to investors, contingent on financial inputs and investor income levels);⁹⁰ (4) government investment and taxation (repayment from individuals to governments

⁸⁸ Note that the literature sometimes refers to environmental impacts as a subset of social impacts, and sometimes as distinct from it.

⁸⁹ Collins, D., Morduch, J., Rutherford, S., & Ruthven, O. (2009). *Portfolios of the poor: how the world's poor live on \$2 a day*. Princeton University Press.

⁹⁰ While taxation deductibility is not commonly conceived of as a form of impact investing, it fits within the definition of impact investing and so it is appropriate and desirable from a research perspective to view it as a form of impact investing. Recall from Section 1.6 that impact investing refers to "investments that are undertaken by either a private

in the form of taxation, contingent on personal income); and (5) social impact bonds (repayment from governments to investors, contingent on specified social outcomes). To the best of our knowledge, these various mechanisms have not previously been conceptualised or researched together.

1.10 The Research Methodology

To research this this class of impact investing mechanisms, a mixed methods approach is employed that is informed by a decade of active participant observation within the impact investing ecosystem. Through being a participant observer from 2007 to 2018, deep insider knowledge has been gained of how the culture and social dynamics within the ecosystem function. This background has informed the design of the research methodology, including how data is obtained from time poor and geographically disparate impact investors.

Specifically, the mixed methods approach used in this research consists of three steps. With each step, the research becomes narrower as previous findings are investigated in progressively more depth. Together, they answer the overarching research question.

The first key question this research asks is, “*Why* does the existing literature fail to explain the relationship between mechanism design and social value creation?” To answer this, in-depth quantitative bibliometric research is undertaken of two corpora – one with 500 journal articles related to social finance and one with 500 journal articles related to development economics. Analysis of these corpora enables a comprehensive and objective understanding of how the academic fields of social finance and development economics: (a) differ, overlap and relate in terms of content; and (b) interact with each other at various levels of aggregation. This, in turn, enables gaps in the literature to be precisely identified. The crucial discovery here is that there exists a major gap in the literature that is essential for explaining the relationship between mechanism design and social value creation.

This then brings us to the second key step, which asks, “*What* is the central relationship between mechanism design and social value creation?” To answer this question, two closely related methodological approaches are employed.

The first part of answering this question is understanding why existing impact investing mechanisms have low adoption rates. To discover this, each of the five impact investing mechanisms in the mechanism class being researched are formally modelled using theoretical microeconomic techniques. These microeconomic models enable findings that would not be possible with alternative methods – such as discovering for different mechanism designs their equilibrium outcome, whether the first-best is achieved, and if the first-best is not achieved then why not. These findings explain why existing mechanisms have the adoption rates, social impacts and financial returns that they do. In the process, the research provides nuanced insights into the

or public entity, with a primary objective being the creation of social value, and where future payments are reasonably expected to be received that are attributable to those investments.” In the case of taxation deductibility, a private investor allocates capital to create social value and receives a payment in the form of reduced taxation obligations that is directly due to the investment made. See Gergen, M. P. (1988). The Case for a Charitable Contributions Deduction. *Virginia Law Review*, 1393-1450., Bittker, B. I. (1972). Charitable contributions: Tax deductions or matching grants. *Tax. L. Rev.*, 28, 37.

relationship between mechanism design and social value creation. This research also provides plausible explanations for empirical puzzles that the incumbent literature highlights. While these theoretical mechanism models play a vital role in the research, the key contribution of this research is not the mathematical formalisation of mechanisms. As such, while the findings from the models are presented in Chapter 3, the mechanism models themselves and the accompanying mathematical proofs are presented as papers in the appendices.

The second part of answering this second question is taking the findings from the quantitative modelling, as well as the insights from an in-depth critical reading of the literature, and constructing theory based on it that explains the fundamental core relationship between mechanism design and social value creation. This is essential because, as Daggers and Nicholls (2016) emphasize,⁹¹ there is an urgent need for “a core set of ideas and theories” in impact investing since there is currently no established core theory in the field (p. 3).⁹² Importantly, this theory construction plugs the main gap in the literature identified in the bibliometric research and brings together existent but disparate strands of literature in a unified and consistent manner. By filling the gap in the literature, the theory is able to explain the relationship between mechanism design and social value creation where incumbent literature has not. The main finding here is that there are two main ways that mechanism design affects social value creation, with those two main relationship pathways each having identifiable components. Furthermore, the research points to three intermediary, or indirect, ways that mechanism design affects social value creation. Having this theoretical base then enables deeper qualitative research to be undertaken.

The third key question this research asks is, “How exactly do each of the three intermediary pathways contribute to the creation of social value?” To address this question, a significant degree of flexibility is necessary to be able to identify current realities including stakeholder practices, perspectives, objectives, constraints, and characteristics. As such, a qualitative method is employed. The question is answered primarily empirically by obtaining and analysing primary data from leading authorities by way of 19 interviews and 141 detailed survey responses. This research is contained in Chapters 4-6, with a different chapter focused on each intermediary pathway between mechanism design and social value creation. These intermediary pathways are social impact measurement (Chapter 4), the alignment of social and financial returns (Chapter 5), and constraint adherence (Chapter 6).

There is a further layer to the overall research and analysis. In the process of answering the three main research sub-questions “Why?” “What?” and “How?” the research also discovers the 16 characteristics that an ideal impact investing mechanism design would satisfy. This can be broken down into 10 first-best properties (consisting of three social impact creation properties and seven social impact measurement properties) and six mechanism constraints (consisting of four stakeholder constraints and two practical constraints). Having identified these 16 mechanism design characteristics, it is then possible to derive what a first-best mechanism design (that is, one that satisfies all 16 ideal characteristics) would look like. This implied modified mechanism

⁹¹ Daggers, J., & Nicholls, A. (2016). Academic research into social investment and impact investing: The status quo and future research. *Routledge handbook of social and sustainable finance* (pp. 68-82) doi:10.4324/9781315772578

⁹² This point is also made by Santos (2012), who argues that it is an effective approach to “start the theory development process in a new field with a well-defined, theoretical core” (p. 3). Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

design is derived through logical deduction and gap analysis applied to the theoretical model developed in Chapter 3.⁹³

Finally, Chapter 7 is an extension, which researches the effect of that specific implied mechanism design on social value creation. Whereas the main three research steps each involve different methodological approaches, the various methods come together in this extension chapter. Qualitative research is used to identify perceived problematic relationships between the implied mechanism's design and social value creation. These concerns are then critically evaluated via quantitative modelling of the modified mechanism and in-depth literature analysis.

As such, the research in this dissertation becomes progressively narrower with each chapter. It begins by focusing on the broad fields of literature, then focuses on the main ways mechanism design effects social value creation for a specific class of mechanisms, then focuses in on the indirect effects mechanism design has on social value creation, then narrows focus even more to investigate the relationship between a specific mechanism design and its creation of social value.

Throughout the research, methods are used that most appropriately address the research sub-question at hand. There are clear advantages to using this mixed methods approach. Each method complements and reinforces the findings of the other methods. For example, the theoretical microeconomic models in the appendices inform the assumptions underpinning theory construction in Chapter 3 and lend credence to empirical findings from primary data in Chapters 4-6. To the extent that different research methods result in consistent research findings, those findings carry greater weight and are more credible.

In this way, the research design overcomes the methodological challenges explained earlier. The approach utilizes the strengths and overcomes the limitations of individual research methods that are commonly employed in the fields social finance and economics. This multi-faceted approach is beneficial in this context because, as McWade (2012) explains,⁹⁴ each field can benefit from the insights and capabilities of the other field. Social finance offers economics conceptual and empirical challenges to traditional assumptions, while economics offers social finance rigorous and developed approaches to issues of principal-agent contracting, incentive alignment, mechanism design, auction theory, public-private partnerships, information asymmetry, and the causal relationship between human capital investments and the generation of economic benefits

It is worth noting that despite a cross-disciplinary and mixed methods approach, it is still appropriate to situate this research primarily in the field of social finance. This is because most of the (albeit limited) research on impact investing falls within social finance even though individual impact investing mechanisms are often positioned elsewhere. Indeed, this research contributes to seven of the areas of social finance identified by Daggers and Nicholls (2016),⁹⁵ as

⁹³ This highlights a further advantage of constructing fundamental theory in Chapter 3. A systematic theoretical approach means research is not restricted to consideration of contingent-repayment financing mechanisms that are currently employed. It enables consideration of possible modifications to mechanisms, which cannot be done empirically due to their present non-existence.

⁹⁴ McWade, W. (2012). The role for social enterprises and social investors in the development struggle. *Journal of social entrepreneurship*, 3(1), 96-112.

⁹⁵ Daggers, J., & Nicholls, A. (2016). Academic research into social investment and impact investing: The status quo and future research. *Routledge handbook of social and sustainable finance* (pp. 68-82) doi:10.4324/9781315772578

a result of interviews with 80 academics and practitioners, as most needing additional academic research. The areas of contribution are: the development of new financial tools to better suit the needs of impact investors; investigating the shortcomings of social impact bonds; clarification of terminology (especially as regards social impact measurement); methods and approaches to impact measurement; how development economics tools can be brought into social impact investing; issues regarding the effectiveness and desirability of taxation deductibility; and the optimal role of government in impact investing.

As such, this dissertation research is of utmost relevance. It is empirically motivated based on observable trends. It builds on the existing academic dialogue to fill a clear gap in the literature. It is broad in terms of the research question but narrow in terms of the case focus. It progresses in logical succession – beginning in Chapter 2 with research into why the existing literature fails to adequately explain the relationship between impact investing mechanism design and social value creation.

II.

Bibliometric Analysis and Literature Review

2.1 Introduction

The goal of this and the next chapter is the construction of theory that builds on and contributes to the social finance literature. When it comes to theory construction, Weick (1995) distinguishes between theorising and theory building.⁹⁶ Theorising can be broadly viewed as the exploratory, creative, cyclical, discursive phase, with theory building being a more methodologically linear process of model construction. Several books on the construction of theory, such as Dublin (1969),⁹⁷ Shoemaker, Tankard and Lasorsa (2003),⁹⁸ and Jaccard and Jacoby (2010),⁹⁹ focus solely on theory building, often from a highly technical perspective, and implicitly assume either a completed theorising phase or the non-necessity of a theorising phase. Such an approach emphasises methodological rigidity that is confined to traditional disciplinary boundaries (Lindblom, 1987).¹⁰⁰ The result is often overly formal and methodologically narrow papers with limited theoretical or practical usefulness (Rosemann, Recker, Indulska & Green, 2006).¹⁰¹ To avoid these problems, it is important to bring rigour to the theorising phase of theory construction (Weick, 1989).¹⁰²

Bibliometrics, first introduced by Pritchard (1969),¹⁰³ serves a crucial role in doing just that. It enables academic rigour to be applied to the theorising phase of theory construction. Aided by software tools, bibliometrics can enhance the quality of theorising by increasing the objectivity of assessments regarding what is important and what is not and by challenging prior assumptions. Objectivity is aided because bibliometric methods are predominantly quantitative, which improves the accuracy of qualitative judgements (Wallin, 2005).¹⁰⁴ Bibliometrics also enables a deep understanding of the conceptual and intellectual structure of disciplines (Cobo et al., 2011; Börner, Chen, & Boyack, 2003),¹⁰⁵ via the observation of relationships within those dynamic systems (Small, 1997).¹⁰⁶ This is achieved, *inter alia*, via visualisation of networks of literature so as to identify gaps, observe trends, understand the historical origins of fields, identify the key authors and publications, and detect where different disciplines intersect and are disjointed. For these reasons, visual mapping is an important tool in bibliometric studies (Morris

⁹⁶ Weick, K. E. (1995). What theory is not, theorizing is. *Administrative Science Quarterly*, 40(3), 385-390.

⁹⁷ Dublin, R. (1969). *Theory Building*. Free Press. New York, NY.

⁹⁸ Shoemaker, P. J., Tankard Jr, J. W., & Lasorsa, D. L. (2003). *How to build social science theories*. Sage publications.

⁹⁹ Jaccard, J., & Jacoby, J. (2010). *Theory construction and model-building skills: A practical guide for social scientists*. Guilford Press.

¹⁰⁰ Lindblom, C. E. (1987). Alternatives to validity: Some thoughts suggested by Campbell's guidelines. *Knowledge*, 8(3), 509-520.

¹⁰¹ Rosemann, M., Recker, J., Indulska, M., & Green, P. (2006). A study of the evolution of the representational capabilities of process modeling grammars. In *Advanced Information Systems Engineering* (pp. 447-461). Springer Berlin/Heidelberg.

¹⁰² Weick, K. E. (1989). Theory construction as disciplined imagination. *Academy of management review*, 14(4), 516-531.

¹⁰³ Pritchard, J. (1969). Statistical bibliography or bibliometrics?. *Journal of documentation*, 25(4), 348-349.

¹⁰⁴ Wallin, J. A. (2005). Bibliometric methods: pitfalls and possibilities. *Basic & clinical pharmacology & toxicology*, 97(5), 261-275.

¹⁰⁵ Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the Association for Information Science and Technology*, 62(7), 1382-1402. Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual review of information science and technology*, 37(1), 179-255.

¹⁰⁶ Small, H. (1997). Update on science mapping: Creating large document spaces. *Scientometrics*, 38(2), 275-293.

& Van Der Veer Martens, 2008; van Eck & Waltman, 2010).¹⁰⁷ Given this, this chapter uses bibliometrics to assist in the theorising stage of theory construction, while Chapter 3 proceeds to focus on theory building.

Specifically, this chapter addresses the question, *“Why do the fields of social finance and development economics fail to explain the relationship between mechanism design and social value creation?”* by asking a related, underlying question. This question is as follows: *“How do the fields of social finance and development economics (a) differ, overlap and relate in terms of content, and (b) interact with each other at various levels of aggregation?”* The two components of this latter question work together, because if there are areas where content relates but interaction lacks, there is a gap in the literature that may be pertinent to be researched so the gap can be filled.

While bibliometrics research has growth significantly in recent years (Willett, 2007),¹⁰⁸ there has only been one published bibliometric study directly on the field of social finance, and none on the relationship between the fields of social finance and development economics. To see this, a Scopus Boolean search for (bibliometrics OR linguistics) AND (“social finance” OR “social investment” OR “impact investing” OR “impact investments” OR “social entrepreneurship”) was conducted that yielded eight results. Of these, two were irrelevant, one publication was focused on social finance, and five publications were focused on entrepreneurship in general, social entrepreneurship, or social innovation.¹⁰⁹

The bibliometrics paper on social finance, Rizzello, Migliazza, Carè and Trotta (2016),¹¹⁰ identified 50 peer-reviewed articles related to social impact investing that were published prior to August 31, 2014. Following the methodology proposed by Furrer, Thomas and Goussevskaia (2008),¹¹¹ they developed 21 keywords to classify publications. They then conducted a “recoding process” to manually tag the 50 publications with the appropriate keywords. Multiple correspondence analysis (MCA) was then conducted, which involved first mapping the 21 terms onto a two-dimensional plane based on the two axes of social approach and investment approach, and then calculating based on the tag positioning where the publications should be positioned on the map. They found that a wide variety of terms are used in the literature, but they revolve around two fundamental concepts, namely a private/market perspective and a public/social intervention perspective. They also found that research can be classified into three domains: sustainable finance, impact entrepreneurship, and public policy in the social sector.

¹⁰⁷ Morris, S. A., & Van der Veer Martens, B. (2008). Mapping research specialties. *Annual review of information science and technology*, 42(1), 213-295. Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

¹⁰⁸ Willett, P. (2007). A bibliometric analysis of the *Journal of Molecular Graphics and Modelling*. *Journal of Molecular Graphics and Modelling*, 26(3), 602-606.

¹⁰⁹ The two irrelevant publications were: Homan, C. M., Schull, J. I., & Prabhu, A. (2017, May). On the Genesis of an Assistive Technology Crowdsourcing Community. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 1003-1011). ACM.; Smith-Carrier, T., & Lawlor, A. (2017). Realising our (neoliberal) potential? A critical discourse analysis of the Poverty Reduction Strategy in Ontario, Canada. *Critical Social Policy*, 37(1), 105-127.

¹¹⁰ Rizzello, A., Migliazza, M. C., Carè, R., & Trotta, A. (2016). A model and research agenda. *Routledge Handbook of Social and Sustainable Finance*, 102.

¹¹¹ Furrer, O., Thomas, H., & Goussevskaia, A. (2008). The structure and evolution of the strategic management field: A content analysis of 26 years of strategic management research. *International Journal of Management Reviews*, 10(1), 1-23.

Two of the main conclusions of Rizzello, Migliazza, Carè and Trotta (2016) strongly motivate the research undertaken in this thesis. One conclusion is that most research focuses on one aspect of the impact investing cycle, and fails to consider the full impact investing cycle. The authors observe the following:

“The multiplicity of studies found in the literature and more generally the different disciplinary domains involved in the debate about impact investment seem to focus alternatively on different and single aspects of the phenomenon while missing the whole picture.” (p. 120)

A second conclusion of the paper is that more research should be focused on the intersection of the three domains they identified. That is, more research should be undertaken on innovative financing mechanisms, especially those involving public-private partnerships, and especially in relation to optimal risk management. The authors explain:

“The foremost research questions in this context should cover the topic of financial innovation derived from the lack of financing instruments in public efforts to address social issues (Phillips & Hebb, 2010). Further studies on new financial instruments in this area, such as crowdfunding for social ventures, SIBs, and the connected research topic of evaluation, should be conducted, as suggested by Jackson (2013), Lehner and Nicholls (2014), and Warner (2013). However, further investigation should explore the emerging trend of public-private community partnerships between civil society, government, and financial institutions (Mendell & Nogales, 2009) from the perspective of risk mitigation.” (p. 120)

The research in this thesis addresses these two main shortcomings of the existing literature. Furthermore, the bibliometrics research in this chapter builds on the work of Rizzello et al. (2016). One of the main limitations of Rizzello et al. (2016) is that it only considers peer-reviewed publications prior to August 31, 2014. Given that social finance is a nascent field, it is important to consider the relatively large number of social finance publications between 2014 and 2017, and to include in the analysis publications that are not journal articles. Furthermore, Rizzello et al. (2016) do not undertake any form of citation analysis, pairwise document analysis, or analysis on how social finance intersects with other disciplines.

Of the five bibliometrics publications on topics related to social finance, the most general paper is Ferreira (2017),¹¹² which uses co-citation data to analyse how entrepreneurship scholarship is organised.¹¹³ Kraus et al. (2014) involves manual sorting of 129 social entrepreneurship papers into subject clusters,¹¹⁴ while van der Have and Rubalcaba (2016) follows a similar approach in

¹¹² Ferreira, J. J., Fernandes, C. I., & Kraus, S. Entrepreneurship research: Mapping intellectual structures and research trends. *Review of Managerial Science*, 1-25.

¹¹³ The paper uses data from the Science Citation Index Expanded, Social Science Citation Index, and Arts and Humanities Citation Index. It finds that entrepreneurship is based around six underlying theories: creation and networks theory, decision-making theory, knowledge spillover theory of entrepreneurship, specialisation of labour, entrepreneurship in the informal economy, and social entrepreneurship theory.

¹¹⁴ This paper examines 129 articles from a variety of databases that contain *social entrepreneur* or *social entrepreneurship* in the title. The 20 most cited articles are examined and manually sorted into five clusters: definitions and conceptual approaches, impetus, personality, impact and performance, and future research agenda. These five areas reflect a subjective evaluation of the field structure of social entrepreneurship. See Kraus, S., Filser, M., O'Dwyer,

relation to social innovation.¹¹⁵ The final two related publications use corpus linguistic analysis to analyse social entrepreneurship. These are Parkinson and Howarth (2008),¹¹⁶ and Chandra (2017).¹¹⁷

In relation to development economics, a Scopus Boolean search for (bibliometrics OR linguistics) AND (“economic development” OR “development economics” OR “international development”) yielded no relevant results. While there are bibliometric studies focused on other areas of economics, such as evolutionary economics (Silva & Teixeira, 2009),¹¹⁸ structural change (Silva & Teixeira, 2008),¹¹⁹ and economics research on China (Du & Teixeira, 2012),¹²⁰ to our knowledge no such studies have been undertaken on development economics. As such, bibliometric methods have not been employed widely in either the development economics or social finance fields.

2.2 Selection of Types of Analysis, Software and Bibliometric Sources

The general research approach in this chapter is to construct two corpora, one containing relevant social finance publications and the other containing relevant development economics publications, and then undertake bibliometric analysis on each corpus separately and the corpora together. In doing so, decisions need to be made regarding (a) the types of analysis to be undertaken, (b) the software to enable such analysis, and (c) the bibliometric data sources.

Types of Analysis

Three main types of analysis are undertaken on the corpora: pairwise publication similarity analysis, keyword co-occurrence analysis, and citation analysis.¹²¹

M., & Shaw, E. (2014). Social entrepreneurship: an exploratory citation analysis. *Review of Managerial Science*, 8(2), 275-292.

¹¹⁵ The authors examine 172 publications, and find the field can be divided into four academic communities: community psychology, creativity research, social and societal challenges, and local development. They also find little overlap between innovation research in general and social innovation research specifically. See van der Have, R. P., & Rubalcaba, L. (2016). Social innovation research: An emerging area of innovation studies?. *Research Policy*, 45(9), 1923-1935.

¹¹⁶ This paper focuses on how people conceive of social entrepreneurship. The paper finds that social enterprise practitioners in the UK have a modified construction of social entrepreneurship because they draw its legitimacy from local issues and experiences. See Parkinson, C., & Howarth, C. (2008). The language of social entrepreneurs. *Entrepreneurship and regional development*, 20(3), 285-309.

¹¹⁷ This paper applies corpus linguistics to a Chinese social enterprise that offers taxi services to the elderly and physically disabled. The paper finds that discourse centres on five areas: problematization, empowerment, marketization, resource mobilization, and publicness. Chandra, Y. (2017). Social entrepreneurship as institutional-change work: A corpus linguistics analysis. *Journal of Social Entrepreneurship*, 8(1), 14-46.

¹¹⁸ Silva, S. T., & Teixeira, A. A. (2009). On the divergence of evolutionary research paths in the past 50 years: a comprehensive bibliometric account. *Journal of Evolutionary Economics*, 19(5), 605.

¹¹⁹ Silva, E. G., & Teixeira, A. A. (2008). Surveying structural change: Seminal contributions and a bibliometric account. *Structural Change and Economic Dynamics*, 19(4), 273-300.

¹²⁰ Du, Y., & Teixeira, A. A. (2012). A bibliometric account of Chinese economics research through the lens of the China Economic Review. *China Economic Review*, 23(4), 743-762.

¹²¹ While co-author bibliometric networks are also possible (see, for example, Börner et al., 2003), this approach is less useful in the social sciences relative to the physical sciences as co-authorship is less common. It is also less useful in nascent fields like social finance where there is a limited number of peer-reviewed publications. See Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual review of information science and technology*, 37(1), 179-255.

Pairwise Publication Similarity

One type of analysis undertaken involves using cosine similarity with tf-idf (term frequency-inverse document frequency) to identify the pairs of documents across corpora that are the most similar (Glänzel, 2012; Goma & Fahmy, 2013; Mihalcea et al., 2006).¹²² The first step in this process is to generate a tf-idf representation for each document. In essence, the frequency of terms in each publication is calculated, with those figures normalised by the logarithmic of the quotient of total publications divided by publications containing that term. Normalization is necessary to ensure correct interpretation (Narin & Hamilton, 1996).¹²³ Terms that are common in a publication relative to the corpus are given high tf-idf scores. For each pair of documents across corpora (that is, document *x* from the social finance corpus and document *y* from the development economics corpus), cosine similarity is then used to compute the similarity between both vectors. Finally, pairs of publications that are most similar, as indicated by values close to one, are examined in-depth to identify the terms and themes that cause them to be similar.

Keyword Co-Occurrence

Another method for extracting insights from corpus texts is terminology co-occurrence analysis (Leopold et al., 2004). This involves calculating the number of documents where two keywords both occur in the title, abstract, or keyword list. These co-occurrence keyword frequencies are then subject to natural language processing techniques to remove irrelevant terms and phrases. This process enables revelation of the conceptual structure and key concepts of a research field (Callon et al., 1983).¹²⁴ Aside from Callon et al. (1983), other early work with this approach includes Callon et al. (1986) and Peters and Van Raan (1993).¹²⁵

Citation Analysis

The third type of analysis used in this chapter, and the most common bibliometric methodology, is the identification of relationships, patterns, and frequencies in citation records. Three types of citation-based bibliometric networks are analysed: direct citation relations, co-citation networks (Small, 1973),¹²⁶ and bibliographic coupling networks (Kessler, 1963).¹²⁷ These are carried out at different levels of aggregation, with publications, authors and journals as units of analysis. These techniques enable analysis of the intellectual structure of the disciplines.

¹²² Glänzel, W. (2012). Bibliometric methods for detecting and analysing emerging research topics. *El profesional de la información*, 21(1), 194-201. Goma, W. H., & Fahmy, A. A. (2013). A survey of text similarity approaches. *International Journal of Computer Applications*, 68(13). Mihalcea, R., Corley, C., & Strapparava, C. (2006, July). Corpus-based and knowledge-based measures of text semantic similarity. In *AAAI* (Vol. 6, pp. 775-780).

¹²³ Narin, F., & Hamilton, K. (1996). Bibliometric performance measures. *Scientometrics*, 36(3), 293-310.

¹²⁴ Callon, M., Courtial, J. P., Turner, W. A., & Bauin, S. (1983). From translations to problematic networks: An introduction to co-word analysis. *Information* (International Social Science Council), 22(2), 191-235.

¹²⁵ Callon, M., Rip, A., & Law, J. (Eds.). (1986). Mapping the dynamics of science and technology: Sociology of science in the real world. Springer. Peters, H. P. F., & van Raan, A. F. (1993). Co-word-based science maps of chemical engineering. Part I: Representations by direct multidimensional scaling. *Research Policy*, 22(1), 23-45.

¹²⁶ Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the Association for Information Science and Technology*, 24(4), 265-269.

¹²⁷ Kessler, M. M. (1963). Bibliographic coupling between scientific papers. *Journal of the Association for Information Science and Technology*, 14(1), 10-25.

Direct citation analysis gives a clear indication of the relatedness of publications. It is especially useful for seeing the historical origins of a field, and how a field has developed over time. One downside to this approach is that it often results in sparse networks (van Eck and Waltman, 2014).¹²⁸ Notwithstanding this, the approach has been increasingly adopted (Boyack & Klavans, 2010; Persson, 2010; Waltman & van Eck, 2012).¹²⁹

Co-citation analysis involves studying the patterns and frequency of where two publications are cited simultaneously by a third publication (Marshakova, 1973; Small, 1973).¹³⁰ The logic is that the more often two publications are cited together, the less likely that is a function of chance and the higher the likelihood of an intellectual relationship between those publications. Co-citation was first studied at a publication level (Griffith, Small, Stonehill, & Dey, 1974; Small & Griffith, 1974).¹³¹ This was followed by author co-citation, introduced by White and Griffith (1981),¹³² and then journal co-citation, introduced by McCain (1991).¹³³ As such, it is possible to research publications, authors and journals that are co-cited frequently. Over time, co-citation analysis has become the primary method of conducting citation analysis (Gmur, 2003).¹³⁴ Notwithstanding this, the approach is problematic for nascent academic fields that may lack a sufficient number of highly-cited publications (Hicks, 1987).¹³⁵ Given that social finance is one such emerging field, co-citation analysis is supported by its counterpart, bibliographic coupling.

Bibliographic coupling was first formulated by Fano (1956),¹³⁶ studied by Kessler (1963),¹³⁷ and mathematically formalised by Sen and Gan (1983).¹³⁸ In this approach, the commonality between publications is determined by the number of shared references. Whereas co-citation studies the *cited* publications and therefore the relationship between two publications varies over time, bibliographic coupling studies the *citing* publications and therefore the relationship between two

¹²⁸ Van Eck, N. J., & Waltman, L. (2014). CitNetExplorer: A new software tool for analyzing and visualizing citation networks. *Journal of Informetrics*, 8(4), 802-823.

¹²⁹ Boyack, K. W., & Klavans, R. (2010). Co-citation analysis, bibliographic coupling, and direct citation: Which citation approach represents the research front most accurately?. *Journal of the Association for Information Science and Technology*, 61(12), 2389-2404. Persson, O. (2010). Identifying research themes with weighted direct citation links. *Journal of Informetrics*, 4(3), 415-422. Waltman, L., & van Eck, N. J. (2013). Source normalised indicators of citation impact: an overview of different approaches and an empirical comparison. *Scientometrics*, 96(3), 699-716.

¹³⁰ Marshakova, I. V. (1973). Document coupling system based on references taken from Science Citation Index. *Russia, Nauchno-Tekhnicheskaya Informatsiya, Ser. 2*. Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the Association for Information Science and Technology*, 24(4), 265-269.

¹³¹ Griffith, B. C., Small, H. G., Stonehill, J. A., & Dey, S. (1974). The structure of scientific literatures II: Toward a macro- and microstructure for science. *Science studies*, 4(4), 339-365. Small, H., & Griffith, B. C. (1974). The structure of scientific literatures I: Identifying and graphing specialties. *Science studies*, 4(1), 17-40.

¹³² White, H. D., & Griffith, B. C. (1981). Author cocitation: A literature measure of intellectual structure. *Journal of the Association for Information Science and Technology*, 32(3), 163-171.

¹³³ McCain, K. W. (1991). Mapping economics through the journal literature: An experiment in journal cocitation analysis. *Journal of the American Society for Information Science*, 42(4), 290.

¹³⁴ Gmur, M. (2003). Co-citation analysis and the search for invisible colleges: A methodological evaluation. *Scientometrics*, 57(1), 27-57.

¹³⁵ Hicks, D. (1987). Limitations of co-citation analysis as a tool for science policy. *Social Studies of Science*, 17(2), 295-316.

¹³⁶ Fano, R. M. (1956). *Bibliographic Coupling. Documentation in Action*. New York: Reenhold.

¹³⁷ Kessler, M. M. (1963). Bibliographic coupling between scientific papers. *Journal of the Association for Information Science and Technology*, 14(1), 10-25.

¹³⁸ Sen, S. K., & Gan, S. K. (1983). A mathematical extension of the idea of bibliographic coupling and its applications.

publications is permanent (Jarneving, 2005).¹³⁹ Like co-citation, bibliographic coupling can be applied to journals and authors. Author bibliographic coupling identifies authors that cite the same references (Zhao & Strotmann, 2008),¹⁴⁰ while journal bibliographic coupling identifies journals that cite the same references (Gao & Guan, 2009; Small & Koenig, 1977).¹⁴¹ The popularity of bibliographic coupling has increased in recent years (van Eck et al., 2014; Jarneving, 2007; Boyack & Klavans, 2010).¹⁴²

Software Selection

In selecting software for keyword co-occurrence, co-citation, and bibliographic coupling analysis, it is important that the software can map large quantities of data, generate high-quality visualisations of network maps, and enable various forms of analysis such as cluster analysis, density analysis, and temporal analysis. VOSviewer, standing for visualisation of similarities and developed by Nees Jan van Eck and Ludo Waltman (van Eck & Waltman, 2006),¹⁴³ satisfies that criteria and so is used for that purpose.

Upon uploading corpus data and prior to mapping, VOSviewer provides various functionality. For citation-based analysis, fractional counting can be specified, which is often preferable to full counting as it ensures that publications that heavily cite or are heavily cited are not disproportionately weighted. In the case of keyword co-occurrence, natural language processing can be used in text mining to remove a specified percentage of general noun phrases that are likely to be irrelevant. Binary counting can also be selected so each term is only counted once per publication. Furthermore, a thesaurus can be uploaded to resolve common database errors. This includes misspelled items and author duplication from minor variations in citations. Concepts that are both referred to in full and by their acronym can and should be combined via a thesaurus in the case of keyword co-occurrence analysis to ensure accuracy.¹⁴⁴ This data pre-processing is essential to ensure research accuracy (Cobo et al., 2011).¹⁴⁵

When it comes to mapping, VOSviewer uses distance-based visualisations based around nodes (which could be terms, publications, authors or journals). To adjust for substantial differences in the degree of connections between nodes, these differences are normalised via the construction

¹³⁹ Jarneving, B. (2005). The combined application of bibliographic coupling and the complete link cluster method in bibliometric science mapping (Doctoral dissertation, Borås: Valfrid).

¹⁴⁰ Zhao, D., & Strotmann, A. (2008). Evolution of research activities and intellectual influences in information science 1996–2005: Introducing author bibliographic-coupling analysis. *Journal of the Association for Information Science and Technology*, 59(13), 2070–2086.

¹⁴¹ Gao, X., & Guan, J. (2009). Networks of scientific journals: An exploration of Chinese patent data. *Scientometrics*, 80(1), 283–302. Small, H. G., & Koenig, M. E. (1977). Journal clustering using a bibliographic coupling method. *Information Processing & Management*, 13(5), 277–288.

¹⁴² van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In *Measuring scholarly impact* (pp. 285–320). Springer International Publishing. Jarneving, B. (2007). Bibliographic coupling and its application to research-front and other core documents. *Journal of Informetrics*, 1(4), 287–307. Boyack, K. W., & Klavans, R. (2010). Co-citation analysis, bibliographic coupling, and direct citation: Which citation approach represents the research front most accurately?. *Journal of the Association for Information Science and Technology*, 61(12), 2389–2404.

¹⁴³ Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538.

¹⁴⁴ One example of this is corporate social responsibility (CSR).

¹⁴⁵ Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the Association for Information Science and Technology*, 62(7), 1382–1402.

of a similarity matrix using an association strength measure (van Eck & Waltman, 2010).¹⁴⁶ Nodes are then positioned in a two-dimensional space, with the proximity between nodes closely approximately their relatedness (Polanco, François, & Lamirel, 2001; van Eck & Waltman, 2010).¹⁴⁷ The closer the nodes, the stronger the relationship.

Three forms of visual displays are possible: network, temporal and density. The network and temporal displays shows the importance of nodes by the size of their corresponding circles. However, the colour of those circles varies. In the network display, nodal colour indicates the nodal cluster. These clusters are determined based on the smart local moving algorithm introduced in Waltman and Van Eck (2013),¹⁴⁸ which solves an optimisation problem, as well as a specified minimum cluster size and resolution parameter. In contrast, the colours in the temporal display indicate the date corresponding to the node. This type of display enables temporal analysis to assist in identifying trends, detecting outliers, and understanding the evolution of research fields (Price & Gürsey, 1975; Garfield, 1994).¹⁴⁹ However, it is only available for analysis of terms and publications, rather than authors or journals. The third type of display is a density view, which reveals where nodes are concentrated under the two-dimensional visual. This is useful since not all nodes and labels can be visualised simultaneously in large networks.

A different software package, CitNetExplorer, is used for visualising and analysing direct citation networks, as it is considered superior to VOSViewer for investigating the evolution of fields over time (van Eck & Waltman, 2014).¹⁵⁰ CitNetExplorer presents citation networks on a two-dimensional plane, with the vertical axis representing time (with more recent years below prior years), the horizontal axis representing the relatedness of publications, and curved lines representing citation relations. The closer the publications are together horizontally, the stronger the relationship. This horizontal positioning is calculated via both direct and indirect citation relationships, including co-citation and bibliographic coupling. This software enables two primary types of analysis. First, publications can be clustered using the methodology developed by Waltman and van Eck (2012),¹⁵¹ which involves the optimization of a modified algorithm from Newman (2004) and Newman and Girvan (2004).¹⁵² Secondly, core publications can be identified. Core publications are defined as those with a minimum number of ingoing and outgoing citation relations with other core publications. This concept is based on *k*-cores by Seidman (1983),¹⁵³ and is a way of identifying the most important publications in a network. One

¹⁴⁶ Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

¹⁴⁷ Polanco, X., François, C., & Lamirel, J. C. (2001). Using artificial neural networks for mapping of science and technology: A multi-self-organizing-maps approach. *Scientometrics*, 51(1), 267-292. Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

¹⁴⁸ Waltman, L., & van Eck, N. J. (2013). A smart local moving algorithm for large-scale modularity-based community detection. *The European Physical Journal B*, 86(11), 471.

¹⁴⁹ de Solla Price, D., & Gürsey, S. (1975). *Studies in Scientometrics I Transience and Continuance in Scientific Authorship*. *Ciência da Informação*, 4(1). Garfield, E. (1994). *Scientography: Mapping the tracks of science*. *Current Contents: Social & Behavioural Sciences*, 7(45), 5-10.

¹⁵⁰ van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In *Measuring scholarly impact* (pp. 285-320). Springer International Publishing.

¹⁵¹ Waltman, L., & van Eck, N. J. (2012). A new methodology for constructing a publication-level classification system of science. *Journal of the Association for Information Science and Technology*, 63(12), 2378-2392.

¹⁵² Newman, M. E. (2004). Fast algorithm for detecting community structure in networks. *Physical review E*, 69(6), 066133. Newman, M. E., & Girvan, M. (2004). Finding and evaluating community structure in networks. *Physical review E*, 69(2), 026113.

¹⁵³ Seidman, S. B. (1983). Network structure and minimum degree. *Social networks*, 5(3), 269-287.

limitation of CitNetExplorer is that it currently only works with Web of Science databases and does not support data extracts from Scopus. However, one can work around this by using the tool CRExplorer, available at www.crexplorer.net, to convert Scopus files into Web of Science files. Such a workaround has been used in this research. CitNetExplorer was selected over another publication citation network software, HistCite by Eugene Garfield (Garfield, 2003),¹⁵⁴ due to superior ability to drill down into the publication network.

These two main techniques are supported by three other software tools. Google Ngram, which searches terms in millions of books, is used to assist in diachronic analysis, although a limitation is that it only goes up to 2008 (Hai-Jew, 2015).¹⁵⁵ The tf-idf vectorizer software in the scikit-learn software machine learning library is used to convert the corpora of publications into a matrix of tf-idf features (Pedregosa et al., 2011).¹⁵⁶ This is equivalent to undertaking a count vectorization and then a tf-idf transformation. Sketch Engine is used to resolve ambiguities in keyword co-occurrence networks by analysing how terms are used in the full texts of corpus publications (Kilgarrieff et al., 2014).¹⁵⁷ It also enables the context of terminology usage to be compared across corpora and therefore disciplines.

Several other software tools were considered but not selected. These include the general network analysis tools of Pajek (De Nooy, Mrvar & Batagelj, 2005) and Gephi (Bastian, Heymann & Jacomy, 2009),¹⁵⁸ which both require additional software to process bibliographic data. Alternative visualisation tools that were considered include Sci² and CiteSpace (Chen, 2004),¹⁵⁹ which are time-line-based and graph-based rather than distance-based visualisations. Also considered were NVivo (Bazeley & Jackson, 2013),¹⁶⁰ ArXiv's Bookworm (King, Simboli & Rom, 2012),¹⁶¹ IBM Word Cloud Generator (Huang & Yuan, 2012),¹⁶² SciMAT (Cobo, López-Herrera, Herrera-Viedma & Herrera, 2012),¹⁶³ and AntConc (Arik, 2013).¹⁶⁴

¹⁵⁴ Garfield, E. (2003). Using HistCite to Map the Output of Small World, Watson-Crick 1953. In Cell Death and Differentiation, P. Nicotera, and Gene Flow. Presented at MRC Toxicology Unit Seminar at the University of Leicester, and available at: <http://garfield.library.upenn.edu/papers/leicester071103.pdf>.

¹⁵⁵ Hai-Jew, S. (2015). Querying Google Books Ngram Viewer's Big Data Text Corpora to Complement Research. In *Enhancing Qualitative and Mixed Methods Research with Technology* (pp. 514-555). IGI Global.

¹⁵⁶ Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., ... & Vanderplas, J. (2011). Scikit-learn: Machine learning in Python. *Journal of Machine Learning Research*, 12(Oct), 2825-2830.

¹⁵⁷ Kilgarrieff, A., Baisa, V., Bušta, J., Jakubíček, M., Kovář, V., Michelfeit, J., ... & Suchomel, V. (2014). The Sketch Engine: ten years on. *Lexicography*, 1(1), 7-36.

¹⁵⁸ de Nooy, W., Mrvar, A., & Batagelj, V. (2005). *Exploratory Social Network Analysis with Pajek* (Structural Analysis in the Social Sciences), illustrated edition ed. Bastian, M., Heymann, S., & Jacomy, M. (2009). *Gephi: an open source software for exploring and manipulating networks*. *Icwsn*, 8, 361-362.

¹⁵⁹ Chen, C. (2004). Searching for intellectual turning points: Progressive knowledge domain visualization. *Proceedings of the National Academy of Sciences*, 101(suppl 1), 5303-5310.

¹⁶⁰ Bazeley, P., & Jackson, K. (Eds.). (2013). *Qualitative data analysis with NVivo*. Sage Publications Limited.

¹⁶¹ King, A., Simboli, B., & Rom, K. (2012). Jstor's "data for research": A bibliometric analysis of mathematics in economics. *Issues in Science and Technology Librarianship*.

¹⁶² Huang, Z., & Yuan, B. (2012, July). Mining Google Scholar Citations: An Exploratory Study. In *International Conference on Intelligent Computing* (pp. 182-189). Springer, Berlin, Heidelberg.

¹⁶³ Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2012). SciMAT: A new science mapping analysis software tool. *Journal of the Association for Information Science and Technology*, 63(8), 1609-1630.

¹⁶⁴ Arik, E. (2013). A bibliometric analysis of a national Journal: The case of the Turkish Journal of Psychology. *Journal of Scientometric Research*, 2(3), 173.

Bibliometric Source Selection

Three of the main sources of bibliometric data are Web of Science (WoS) by Thomson Reuters, Scopus by Elsevier, and Google Scholar. These databases are primarily designed for information retrieval, with bibliometric studies a secondary purpose (Hood & Wilson, 2003).¹⁶⁵ Selecting the appropriate data source is important because databases do not cover all academic disciplines in the same way, and citation frequencies can differ significantly between sources, as various studies show (Bar-Ilan, 2010; Falagas, Pitsouni, Malietzis, & Pappas, 2008; Mikki, 2010).¹⁶⁶

Google Scholar is not used for the research in this chapter. While it has the widest variety of document types (Meho et al., 2007) and a comprehensive collective of conference papers (Huand & Yuan, 2012),¹⁶⁷ which is advantageous given the emerging field of social finance has a significant number of informal scholarly communications, Google Scholar has more limited bibliometric data and is less reliable than both WoS and Scopus.

Both WoS, which was founded by Eugene Garfield in 1960, and Scopus, which was founded in 2004, are more accurate and contain fewer errors than Google Scholar. One key difference is that WoS is more historical, starting at 1956 for the social sciences. In contrast, Scopus commences at 1966 for some journals and 1996 for others. A second important difference is that Scopus is more comprehensive, containing over 7.3 million conference papers and over 21,000 peer-reviewed journals, compared to WoS with over 12,000 journals. Given these two differences, WoS is used for diachronic analysis of historical trends, while Scopus is used for all other types of analysis. As will be seen, the more comprehensive coverage offered by Scopus is especially important in emerging fields like social finance, where there are few established discipline-specific journals and a limited number of academic publications.

2.3 Methodology

The types of analysis, software, and bibliometric sources that have been selected are combined in a logical six-stage methodology.

First, diachronic analysis is undertaken using WoS data and Google Ngram to see how the field of social finance has evolved by identifying terminology trends and publishing trends. By finding what terms are specific to social finance, more accurate corpora are able to be constructed in the next stage.

The second stage is construction of two representative corpora – one for the field of social finance, and one for the field of development economics. For comparability purposes, and to account for

¹⁶⁵ Hood, W. W., & Wilson, C. S. (2003). Informetric studies using databases: Opportunities and challenges. *Scientometrics*, 58(3), 587-608.

¹⁶⁶ Bar-Ilan, J. (2010). Citations to the "Introduction to informetrics" indexed by WOS, Scopus and Google Scholar. *Scientometrics*, 82(3), 495-506. Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. *The FASEB journal*, 22(2), 338-342. Mikki, S. (2010). Comparing Google Scholar and ISI Web of Science for earth sciences. *Scientometrics*, 82(2), 321-331.

¹⁶⁷ Meho, L. I., & Yang, K. (2007). Impact of data sources on citation counts and rankings of LIS faculty: Web of Science versus Scopus and Google Scholar. *Journal of the Association for Information Science and Technology*, 58(13), 2105-2125. Huang, Z., & Yuan, B. (2012, July). Mining Google Scholar Citations: An Exploratory Study. In *International Conference on Intelligent Computing* (pp. 182-189). Springer, Berlin, Heidelberg.

the differing sizes of the fields, both corpora consist of 500 publications. Given that social finance is an emerging discipline with few discipline specific journals, and given that development economics is quite multi-disciplinary, it is not possible to select corpora publications based on journals alone. Instead, a search strategy is employed that consists of running searches in Scopus for disciplinary specific terms, based on the first stage analysis. This is coupled with broader searches of related terms followed by manually eliminating irrelevant publications based on a close reading of abstracts. Following construction of these two corpora, the composition of each corpus is analysed by publication type, time, subject area, and journals.

The two corpora are then explored and analysed with software tools, first separately and then together.

The third stage focuses on just the social finance corpus. Direct citation relations in the corpus are analysed in-depth with CitNetExplorer, using clustering and core analysis techniques. Analysis is also undertaken on an expended social finance corpus, which includes publications cited by the corpus, so as to identify any publications missing from the main corpus and to discover the historical origins of the field. Keyword co-occurrence is analysed with VOSviewer.

Stage four examines the development economics corpus, using keyword co-occurrence analysis with VOSviewer to identify main research clusters.

The fifth stage is the most important, focussing on how the two fields currently, and how they should, intersect with each other. Pairwise publication similarity analysis is conducted to find the documents across corpora that are most similar. The themes of these pairwise documents are then identified, with the themes indicating where the two fields should interact even if they do not currently interact via citations. Keyword co-occurrence analysis with VOSviewer similarly finds where the fields intersect based on terminology, but in a more general sense. Research is also conducted via co-citation and bibliographic coupling analysis to identify the specific publications, authors and journals that bridge the two fields.

Finally, we research how the two disciplines differ in their treatment of the same topic. Given one of the areas of field overlap that is identified is microfinance, this is the focus. The two corpora are narrowed down to only those publications with microfinance in the title, abstract or lists of keywords. Keyword co-occurrence analysis is then run on each sub-corpus separately to see how the fields approach the topic of microfinance and what causal relationships they focus on.

Methodological Limitations

One limitation of this methodology, as with most forms of citation analysis, is the weak relationship between citation frequency and publication quality (Wallin, 2005).¹⁶⁸ This relationship is weak because of various factors, including: that very poor research tends to be cited more than mediocre research (Bornstein, 1991);¹⁶⁹ that citation patterns depend on the

¹⁶⁸ Wallin, J. A. (2005). Bibliometric methods: pitfalls and possibilities. *Basic & clinical pharmacology & toxicology*, 97(5), 261-275.

¹⁶⁹ Bornstein, R. F. (1991). The predictive validity of peer review: A neglected issue. *Behavioral and Brain Sciences*, 14(1), 138-139.

research methodology; that citations sometimes arise from a stochastic reinforcing process rather than independent academic assessments (Simkin & Roychowdhury, 2005);¹⁷⁰ that there is sometimes a large discrepancy in citation norms between disciplines (Kostoff, 2002);¹⁷¹ that each researcher, even within a discipline, has their own citation style (Cronin & Shaw, 2002; White, 2001);¹⁷² and that low citation rates may reflect a narrow field or new sub-discipline (Chew & Relyea-Chew, 1988).¹⁷³ There are also limitations when it comes to the visualization of bibliometric networks, including: that network visualization often involves a loss of information; that the distance between nodes only approximates relatedness; and that VOSViewer calculates keyword co-occurrence based on abstracts rather than full articles. Furthermore, while every effort has been made to detect and correct for database errors, any undetected errors may impact the analyses undertaken (Moed & Vriens, 1989; Hood & Wilson, 2003).¹⁷⁴

2.4 Diachronic Analysis

Figure 2.1 reveals the evolution of terminology usage in the Web of Science Core Collection database between 1950 and July 2017, as given by topic searches.

As is evident, the term *social finance* is used far less frequently (24 times) than *development finance* (274 times), which in turn is used far less frequently than *public finance* (2387 times). However, the frequency of these terms is inversely correlated with their growth rate. The use of the term *social finance* grew sharply, the use of the term *development economics* grew moderately, and the use of the term *public finance* grew slowly from 2014-2016.

Figure 2.1 also shows that the terms *impact investing*, *impact investment*, and *green investment* are far more recent than the terms *ethical investment*, *socially responsible investing*, *responsible investing* and *social investment*. This is an important insight because Daggers and Nicholls (2016) argue that the terms *impact investment* and *social investment* are used approximately equally in the social finance field.¹⁷⁵ If this is true, then given the term *social investment* was widely used prior to the emergence of the social finance field, it logically follows that *social investment* is used in ways not specific to social finance. Care must therefore be taken when using the term *social investment* for corpus construction and other analysis.

Another insight from Figure 2.1 is that there is more literature in this field studying enterprises and their actions than investors and their actions, as evidenced by the high frequency of the terms

¹⁷⁰ Simkin, M. V., & Roychowdhury, V. P. (2005). Stochastic modeling of citation slips. *Scientometrics*, 62(3), 367-384.

¹⁷¹ Note that while interdisciplinary normalization is possible, such as normalizing a publication's citation count by the average citation count of a journal (Wallin, 2005), all methods have disadvantages (Schubert & Braun, 1996). See Kostoff, R. (2002). Citation analysis of research performer quality. *Scientometrics*, 53(1), 49-71.

¹⁷² Cronin, B., & Shaw, D. (2002). Identity-creators and image-makers: Using citation analysis and thick description to put authors in their place. *Scientometrics*, 54(1), 31-49. White, H. D. (2001). Authors as citers over time. *Journal of the Association for Information Science and Technology*, 52(2), 87-108.

¹⁷³ Chew, F. S., & Relyea-Chew, A. (1988). How research becomes knowledge in radiology: an analysis of citations to published papers. *American Journal of Roentgenology*, 150(1), 31-37.

¹⁷⁴ Moed, H. F., & Vriens, M. (1989). Possible inaccuracies occurring in citation analysis. *Journal of Information Science*, 15(2), 95-107. Hood, W., & Wilson, C. (2003). Informetric studies using databases: Opportunities and challenges. *Scientometrics*, 58(3), 587-608.

¹⁷⁵ Daggers, J., & Nicholls, A. (2016). The landscape of social impact investment research: Trends and opportunities. SBS, Oxford.

Figure 2.1: Diachronic Analysis of Publications by Social Finance Related Terminology using the Web of Science Database

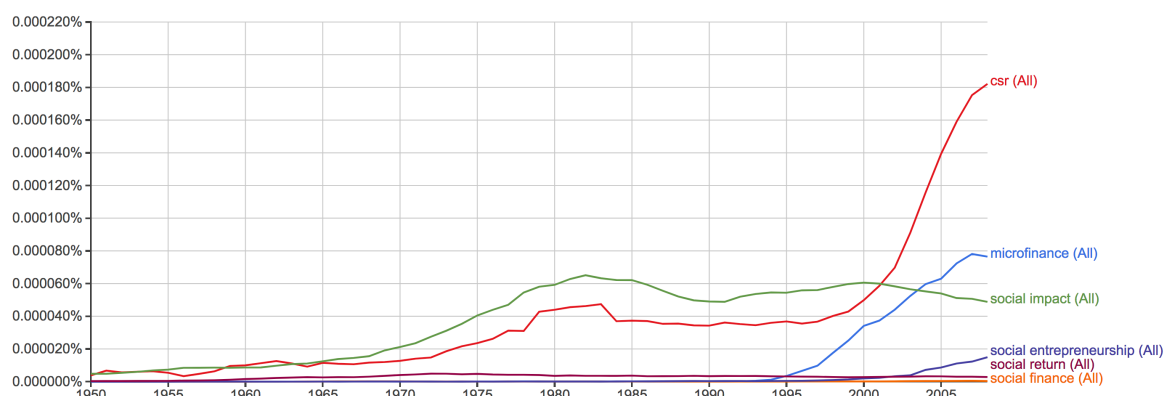
53

The various contingent-repayment financing mechanisms different significantly in their time and frequency of usage. *Tax deductibility* and *income-contingent loans* are very historical with negligible growth in usage, while *social impact bonds* and *development impact bonds* have only emerged in the literature since 2011.

Unsurprisingly, there is substantially more literature on economic methods of evaluating initiatives and measuring impact, such as *cost-benefit analysis* (11,088 times), than social finance methods of evaluating initiatives and measuring impact, such as *social return on investment* (89 times). What is counterintuitive is that *triple bottom line* (which refers to financial, social and environmental returns) is a more frequent and more historical term than *double bottom line* (which refers to just financial and social returns). Similar concepts to *double bottom line*, such as *blended value* and *inclusive capitalism* are also infrequent and recent.

Figure 2.1 further reveals that *social impact* and *social value* were used widely prior to 2000. As such, it should not be assumed that papers referring *social impact* or *social value* are within the broad field of social finance. This result can also be seen in Figure 2.2, which shows that *social impact* appears with moderate frequency in Google Books publications as far back as 1970, and until 2001 *social impact* was more frequently used than *CSR*. On the other hand, *microfinance* has grown steadily since 1995, and *social entrepreneurship* since 2003.

Figure 2.2: Google Books Ngram Term Frequencies (1950-2008)



Importantly, when the term frequency results from the Web of Science database in Figure 2.1 are compared with the equivalent results from the Scopus dataset, difference emerge. Web of Science returns significantly fewer results than the Scopus database on terms that are specific to the field of social finance, including *impact investment* (42 compared to 107 for Scopus), *impact investing* (47 compared to 67), *social finance* (27 compared to 60), *social impact measurement* (8 compared to 12), and *social entrepreneurship* (1125 compared with 1460). Closer examination reveals that one reason for this discrepancy is that Web of Science does not currently include the Journal of Social Entrepreneurship in its database, whereas Scopus does. Given that social finance is a relatively nascent field, with a small number of publications relative to most disciplines, it is preferable for further analysis to have as many publications as possible. As such, Scopus is the database used for corpora construction, rather than Web of Science.

2.5 Corpora Composition Analysis

An analysis of the corpora reveals differences in their composition, which is largely a function of the more recent and underdevelopment nature of the field of social finance. As illustrated in Figure 2.3 and Figure 2.4, publications in the social finance corpus are more recent, with 370 (74%) of the 500 publications occurring between 2012 and July 2017. In contrast, publications in the development economics corpus are more evenly spread out time-wise, with only 144 (28.8%) out of 500 publications in the same period. The nature of the publications also varies, with the social finance corpus having fewer journal articles (328 to 389), reviews (20 to 47), and complete books (11 to 25), but more conference papers (57 to 18), book chapters (52 to 18), notes (10 to 1), editorials (5 to 0), and articles in press (15 to 2).

Figure 2.3: Publications by Year in the Social Finance Corpus (Over Past 25 Years)

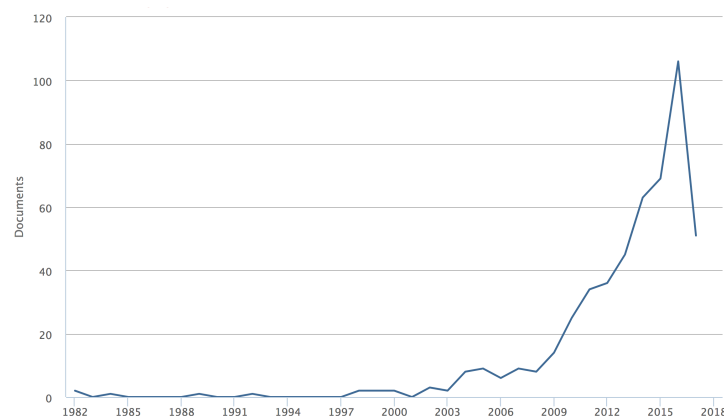
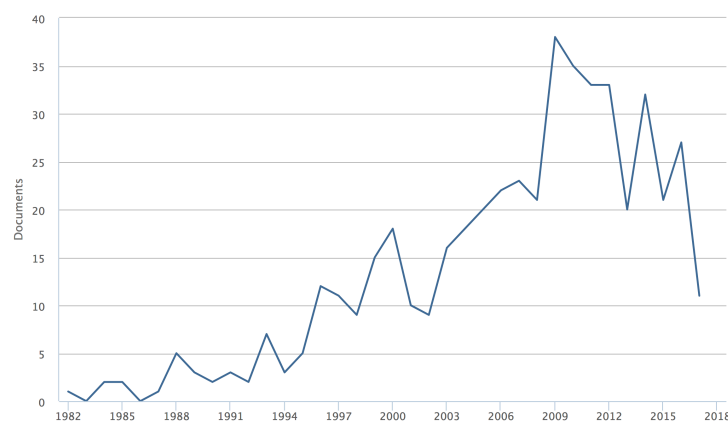


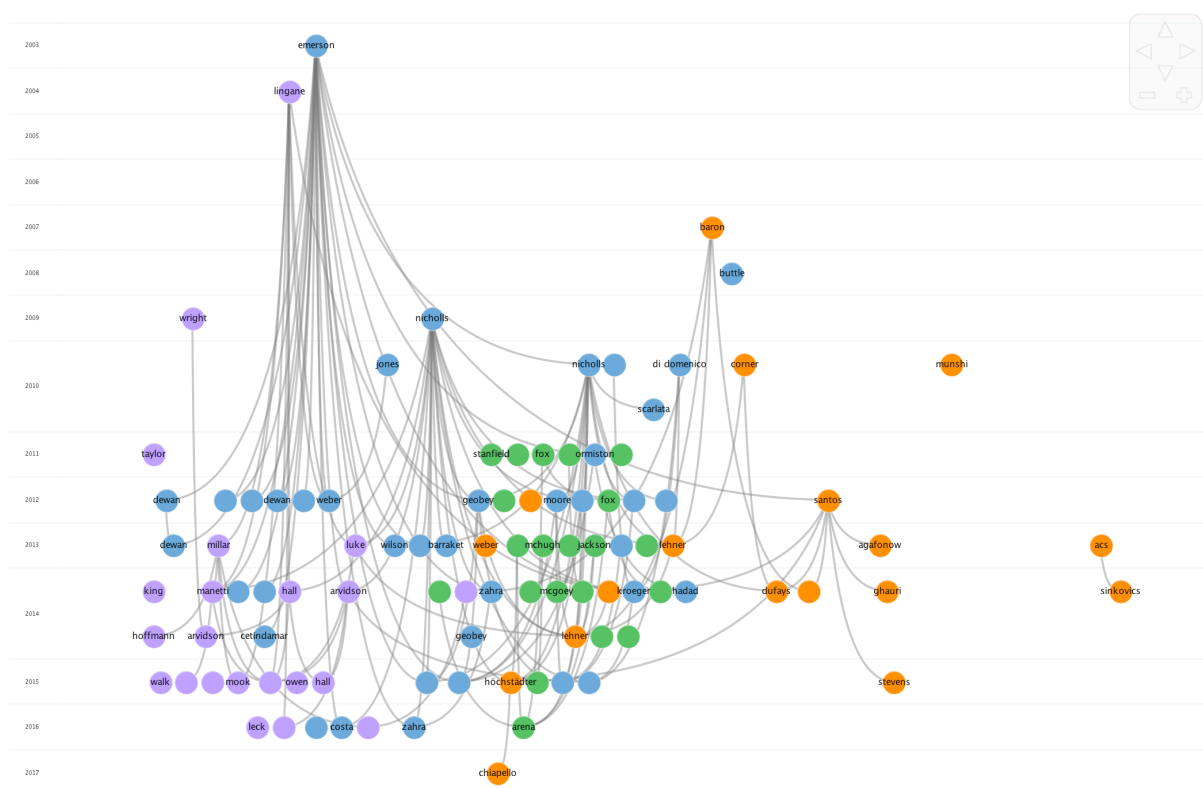
Figure 2.4: Publications by Year in the Development Economics Corpus (Over Past 25 Years)



In the social finance corpus, the journals with the greatest number of publications are the Journal of Social Entrepreneurship (15), Journal of Business Ethics (9), Voluntas (9), Nonprofit Management and Leadership (8), Evaluation and Program Planning (7), Enterprise Development and Microfinance (5), Corporate Ownership and Control (4), Critical Studies on Corporate Responsibility (4), and the Entrepreneurship Research Journal (4). In the development economics corpus, the most common journals are World Development (20), Journal of Economic

Turning to citation analysis results, Figure 2.7 reveals that the three oldest commonly cited publications in the network are the Emerson (2003),¹⁷⁶ Lingane et al. (2004),¹⁷⁷ and Baron (2007).¹⁷⁸ Emerson (2003) argues that social, environmental and financial returns should not be distinguished but should be considered as one ‘blended value’. Lingane (2004) was the first academic paper to propose guidelines for calculating social return on investment by giving a monetary figure to the social and environmental outcomes of businesses. This was a first attempt at being able to compare the social impacts of different firms. As such, while Lingane distinguishes between social and financial returns in a way contrary to Emerson’s argument, the result is the similar because in both cases total value can be represented as a single monetary figure and therefore compared.

Figure 2.7: Social Finance Main Publication Clusters Based on Citation Network



Baron (2007) presents an economic model of corporate social responsibility, where social outcomes are only achieved by firms or entrepreneurs allocating a portion of profits to social causes. Baron considers a firm that allocates profit a CSR firm, while social entrepreneurs are considered entrepreneurs who invest in or start a CSR firm. The author shows that the same or better outcomes as a CSR firm can be achieved via a combination of personal giving and investing

¹⁷⁶ Emerson, J. (2003). The blended value proposition: Integrating social and financial returns. California management review, 45(4), 35-51.

¹⁷⁷ Lingane, A., & Olsen, S. (2004). Guidelines for social return on investment. California management review, 46(3), 116-135.

¹⁷⁸ Baron, D. P. (2007). Corporate social responsibility and social entrepreneurship. Journal of Economics & Management Strategy, 16(3), 683-717.

in a non-CSR firm.¹⁷⁹ Baron argues that notwithstanding this, there are two valid explanations for the existence of social entrepreneurs. First, that sometimes allocating a portion of profit to social causes will increase the set of consumers who will invest in the firm or consume its products because some consumers want to reward the company for doing good. Secondly, entrepreneurs may receive a 'warm glow' that offsets any financial loss.

Importantly, this conception of social entrepreneurship, and the assumptions inherent in that conceptualisation, are counter to the later social finance and social entrepreneurship literature. Both of Baron's explanations for social entrepreneurs assume a trade-off between social and financial returns. Baron's first argument may seem like an argument that social and financial returns are aligned, but there is still a trade-off assumption. This is for two reasons. First, the argument implicitly concedes that a trade-off exists between social and financial returns for a given number of consumers and investment levels. Secondly, even if the number of consumers increases, there is still a trade-off from the perspective of those consumers. Indeed, the reason they are consuming is to compensate the firm for the trade-off. Just because that compensation may offset the trade-off does not negate the assumption of a trade-off. Another, and related, assumption Baron makes is that social impacts are a means to an end, rather than an end in themselves. Social entrepreneurs in Baron's model maximize personal utility, rather than maximizing the utility of others. As such, while the paper does not assume profit-maximizing firms, it assumes the economic basis for that assumption, namely individual utility maximisation.

The later social finance literature views social entrepreneurs not as those that run CSR firms, where social and financial returns arise from different activities that are in conflict with each other, but as those that run entities where social and financial outcomes arise from the same activities where there need not be a trade-off between the two. For example, Grabenwarter and Liechtenstein (2011) argue, based on interviews with sixty dedicated impact investors, that one of five defining features of impact investing is the lack of a trade-off between social and financial returns.¹⁸⁰ The other defining properties are a profit objective, and a social impact that is intentional, measureable and positive. Hence, what Baron considers social entrepreneurship is, in the eyes of the broader literature, a mischaracterization. Also, while neither this paper nor later literature assume profit-maximizing firms, the reasons differ. Later literature assumes that investors will maximize a weighted average of individual utility derived from financial returns and others' utility derived from social returns.

More generally, social finance relies on the two assumptions (a) that organisations are not binary in the sense of being solely profit-seeking or solely altruistic, but fall along a continuum, and (b) that there need not be a trade-off between social and financial returns because they can be achieved via the same investment and undertakings. These two assumptions may, *ceteris paribus*, seem in conflict, because an entity continuum is unnecessary if no trade-off exists. However, they are consistent assumptions because the second assumption is that there is not *necessarily* a trade-off, rather than there is *never* a trade-off.

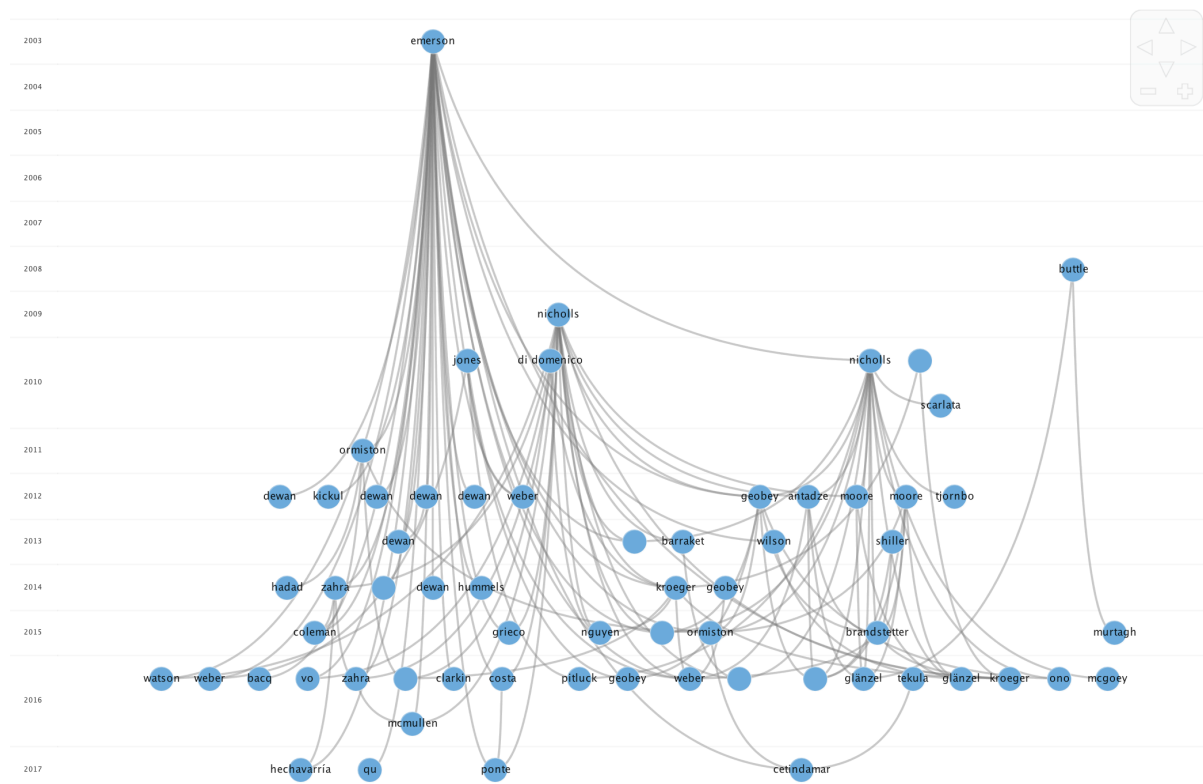
¹⁷⁹ Specifically, Baron (2007) argues that CSR outcomes are the same as a mix of personal giving and non-CSR outcomes if personal giving is a perfect substitute for corporate giving, while CSR outcomes are worse if they are imperfect substitutes.

¹⁸⁰ Grabenwarter, U., & Liechtenstein, H. (2011). In search of gamma-an unconventional perspective on impact investing.

As such, Baron (2007) is useful for several reasons. It highlights how the assumptions underlying the field have progressed, and acts as a bridge between mainstream economics with traditional assumptions and social finance with alternative assumptions. It also achieves its stated aim of explaining the existence of social finance, but not for the reasons the paper articulates. The paper's arguments for the existence of social entrepreneurs are really arguments for the existence of corporate social responsibility. However, because of the shortcomings of the arguments, owing to questionable assumptions, it acts as an argument for social entrepreneurship and social finance.

In addition to these three papers that helped launch the academic field of social finance, the citation analysis identifies four publication clusters based on citation links. These clusters reveal the main areas that the social finance literature addresses. They are mutually exclusive but not collectively exhaustive, as some publications do not belong to a cluster of at least five publications - the minimum specified cluster size.

Figure 2.8: Impact Investing Conceptual Publication Cluster Based on Social Finance Citation Network

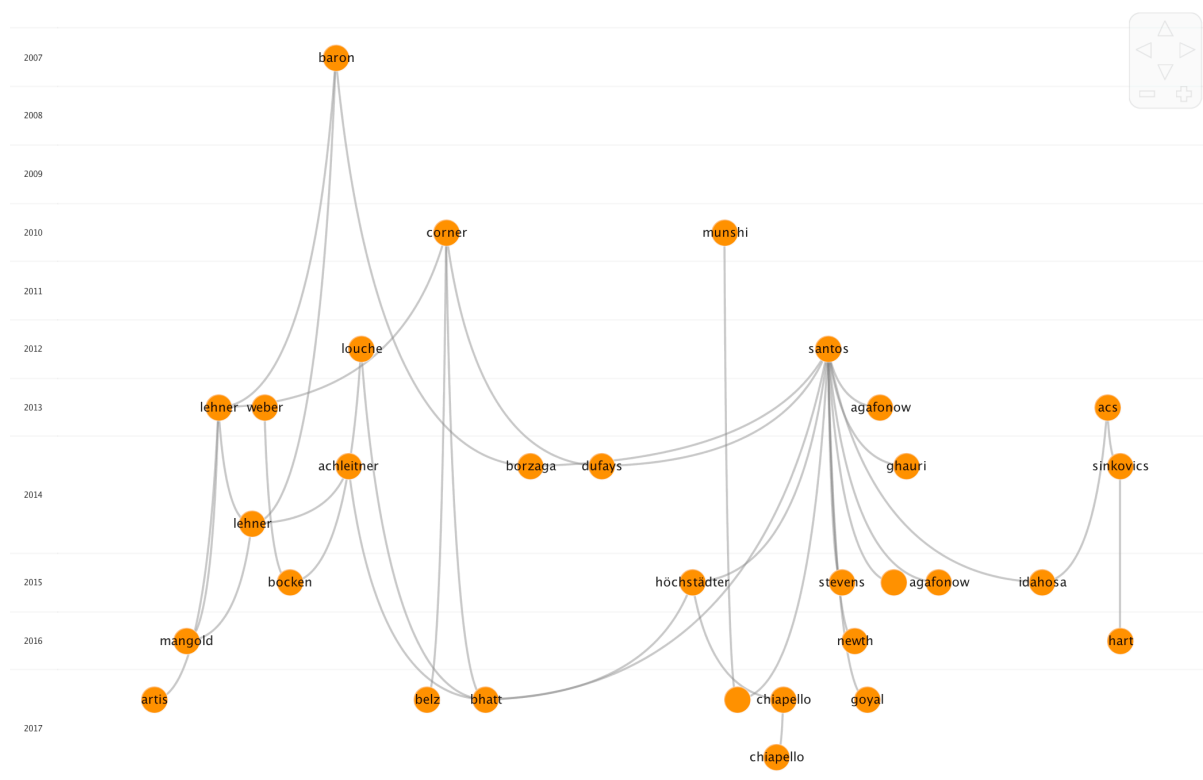


The blue cluster consists of 63 publications and focuses on social finance and impact investing at a conceptual level. A close examination of these publications shows they tend to approach the subject from the perspective of investors. The key publications in the cluster are shown in Figure 2.7, while the full cluster is shown in Figure 2.8. One of the key publications in the cluster is Di

Domenico et al. (2010),¹⁸¹ which researches eight U.K. social enterprises and identifies several social entrepreneurship constructs, namely social value creation, stakeholder participation, and persuasion, that are then used to develop an extended theory of ‘social bricolage’.

The orange cluster, with 31 publications, is concentrated on social enterprises and how social impact is created. These publications approach the field from the perspective of investment recipients, namely enterprises and individuals. This is shown in Figure 2.9. Aside from Baron (2007), two of the key publications in the cluster are Corner et al. (2010),¹⁸² and Santos (2012).¹⁸³ Corner et al. (2010) researches the process of identifying opportunities for social value creation. The paper finds, via analysing patterns across multiple case studies, that entrepreneurs typically see a need and potential ways to address it, and that multiple actors enable the opportunity to manifest. Santos (2012) explains social entrepreneurship as arising from situations of simultaneous market failures by the government and private sector, which typically occurs due to positive externalities and a trade-off between value creation and value capture.

Figure 2.9: Social Enterprise and Social Impact Publication Cluster Based on Social Finance Citation Network



The green cluster addresses financing mechanisms, especially the instruments of social impact bonds and microfinance. The 36 publications in the cluster are represented in Figure 2.10. The

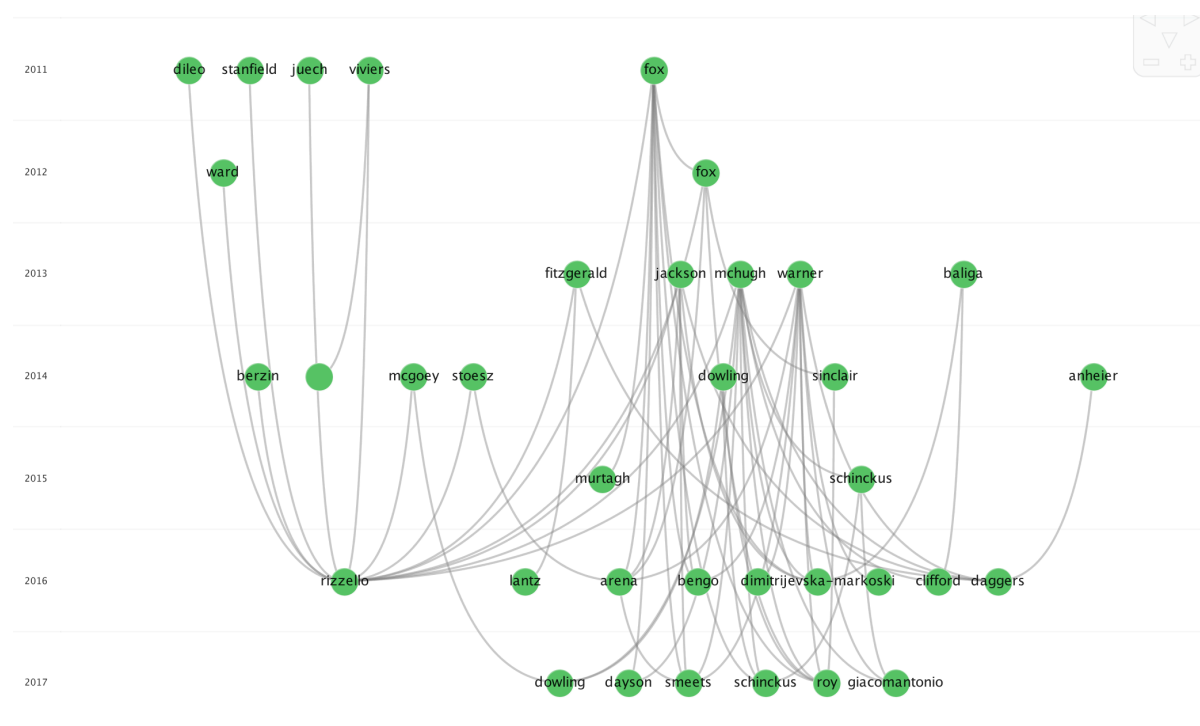
¹⁸¹ Di Domenico, M., Haugh, H., & Tracey, P. (2010). Social bricolage: Theorizing social value creation in social enterprises. *Entrepreneurship theory and practice*, 34(4), 681-703.

¹⁸² Corner, P. D., & Ho, M. (2010). How opportunities develop in social entrepreneurship. *Entrepreneurship theory and practice*, 34(4), 635-659.

¹⁸³ Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

three most cited publications in this cluster are Fox et al. (2011),¹⁸⁴ McHugh (2013),¹⁸⁵ and Warner (2013),¹⁸⁶ which all focus on social impact bonds. Fox et al. (2011) makes the strongest argument of the three for SIBs, arguing that they “drive greater efficiency, innovation and impact” while “reducing risk for government.” A key concern highlighted is the difficulty in attributing changes in outcomes to investors, particularly in the criminal justice sector. This concern is also one of the three main reservations about SIBs in McHugh (2013), which argues that it is difficult to attribute changes in outcomes to specific policies, due in part to the complexity and interdependency of social outcomes. Another concern raised is that by the government outsourcing the selection of the service provider as well as the service, there is “the build-up of asymmetric information in favour of the provider” and it “erodes the trail of public and democratic accountability.” Furthermore, there may be perverse incentives for the third sector to divert resources from where they are most needed to where outcomes are most measurable, and to focus on helping less problematic clients. Warner (2013) undertakes a comparative, exploratory study of two types of SIBs – one from the UK on reducing recidivism and one from the US on early childhood education. Warner’s main concerns are that SIBs are incredibly complex to design, that is difficult to align the incentives of the different stakeholders, that SIBs do not involve competition at the outset, and that private investors seem unwilling to invest in them unless risk is guaranteed by a subordinated investor.

Figure 2.10: Financing Mechanisms Publication Cluster Based on Social Finance Citation Network



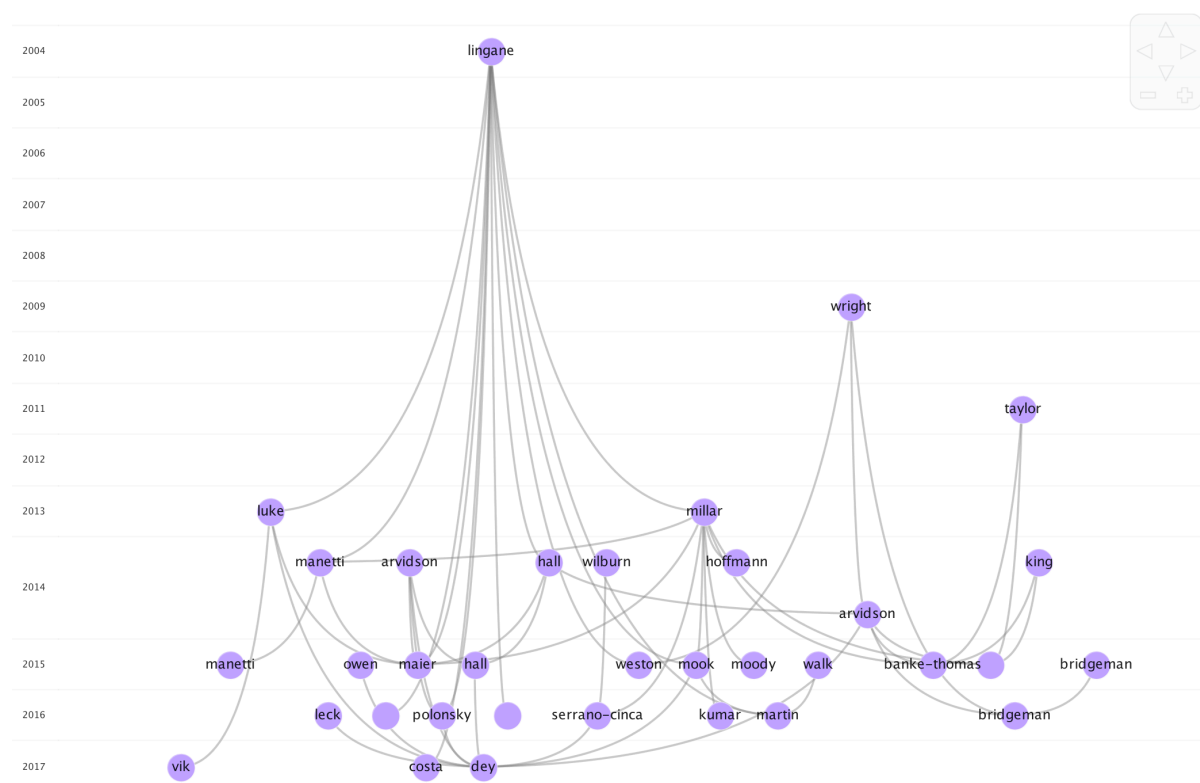
¹⁸⁴ Fox, C., & Albertson, K. (2011). Payment by results and social impact bonds in the criminal justice sector: New challenges for the concept of evidence-based policy?. *Criminology & Criminal Justice*, 11(5), 395-413.

¹⁸⁵ McHugh, N., Sinclair, S., Roy, M., Huckfield, L., & Donaldson, C. (2013). Social impact bonds: a wolf in sheep's clothing?. *Journal of Poverty and Social Justice*, 21(3), 247-257.

¹⁸⁶ Warner, M. E. (2013). Private finance for public goods: social impact bonds. *Journal of Economic Policy Reform*, 16(4), 303-319.

The fourth purple cluster is focused on social impact measurement broadly, and the method of social return on investment specifically. Figure 2.11 maps the 34 publications in the cluster. Aside from Lingane (2004), the most cited publication in the cluster is Miller et al. (2013),¹⁸⁷ which finds via survey and interview data that SROI is underused and undervalued in the field of healthcare because of various barriers, both practical and ideological.

Figure 2.11: Impact Measurement Publication Cluster Based on Social Finance Citation Network



Another way to analyse the citation network is to examine the core publications, which are publications with a specific minimum number of (incoming or outgoing) citations links with other core publications.

Figure 2.12 shows the 78 core publications where the minimum number of citations links is three.¹⁸⁸ This approach enables one to easily identify individual publications that connect the different clusters within the social finance field. For example, Figure 2.13 shows how Lehner and Nicholls (2014) connects with other publications.¹⁸⁹

¹⁸⁷ Millar, R., & Hall, K. (2013). Social return on investment (SROI) and performance measurement: The opportunities and barriers for social enterprises in health and social care. *Public Management Review*, 15(6), 923-941.

¹⁸⁸ If the minimum citation links were instead two, there would be 105 publications in the core, and if the minimum citation links were four, there would only be 46 core publications.

¹⁸⁹ Lehner, O. M., & Nicholls, A. (2014). Social finance and crowdfunding for social enterprises: A public-private case study providing legitimacy and leverage. *Venture Capital*, 16(3), 271-286.

Figure 2.12: Core Publications in the Social Finance Citation Network

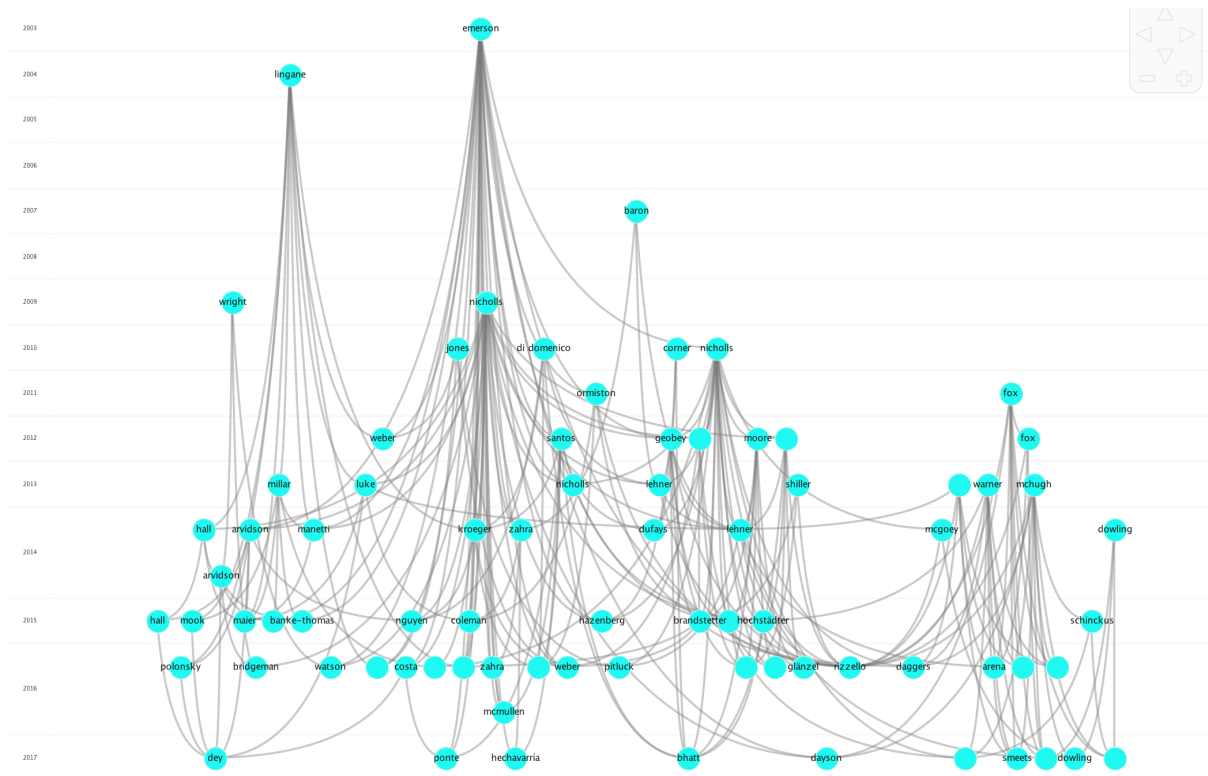
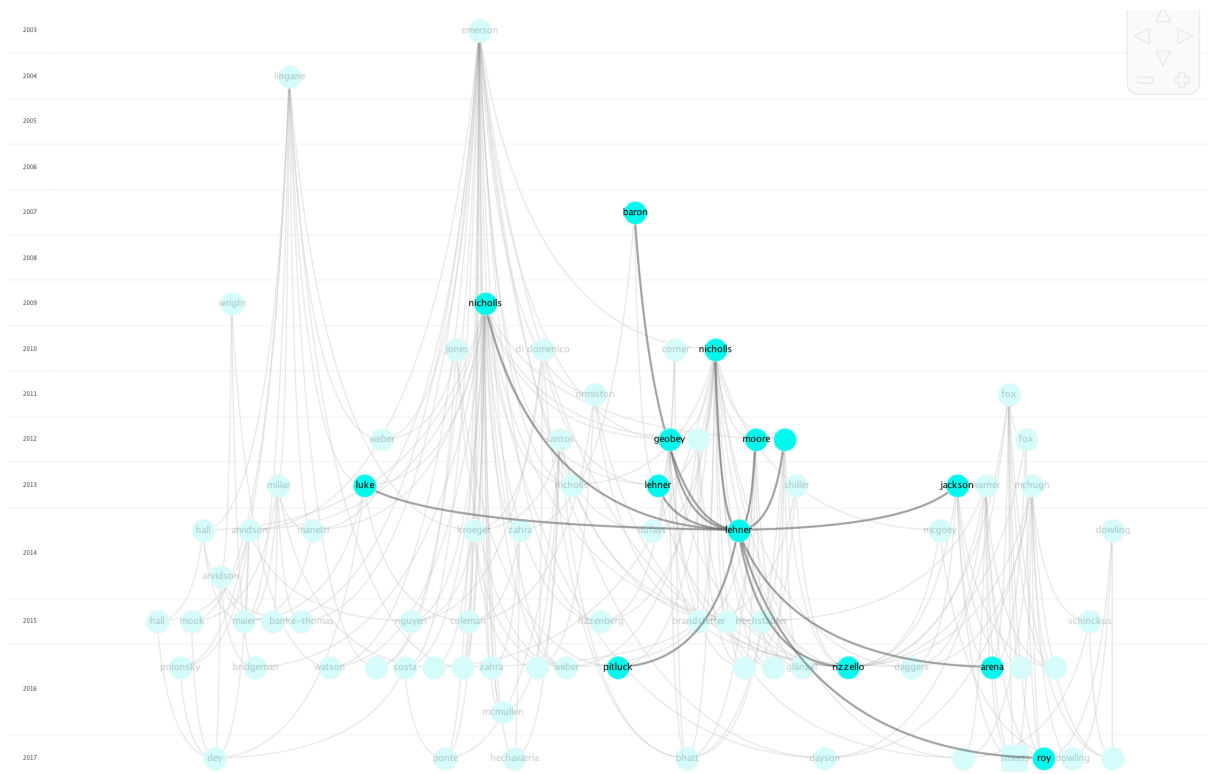


Figure 2.13: Identification of a Core Publication that Bridges Clusters in the Social Finance Citation Network



The paper represented in Figure 2.13, Lehner and Nicholls (2014), focuses on the UK social finance market, and examines how funds from the public, private and third sector may be able to work together to reduce risks and improve funding for social enterprises. The focus is on how crowdfunding may increase legitimacy for social enterprises and reduce investor risk by proving demand, and how governmental tax-relief and venture-philanthropic fund guarantees may enable debt financing and incentivise greater investment. A key insight is that by combining philanthropic funding that accepts a negative hundred percent return (that is, a complete loss of initial capital), with for-profit investor financing that demands a market return, a larger range of social enterprises can be financed, including those that generate below market rates of return and negative rates of return. Lenher et al. (2014) connects with four core publications in the green financing mechanisms cluster (Jackson, 2013; Rizzello et al., 2016; Arena et al., 2016; Roy et al., 2017),¹⁹⁰ two core publications in the orange social enterprise cluster (Baron, 2007; Lehner, 2013), one core publication in the purple measurement cluster (Luke et al., 2013),¹⁹¹ and six core publications in the blue conceptual cluster (Nicholls, 2009; Nicholls, 2010; Geobey & Harji, 2012; Moore et al. 2012a; Moore et al. 2012b; Pitluck, 2016).¹⁹²

Let us now extend the citation network to include publications that are cited by the social finance corpus but are not in the corpus itself. Figure 2.14 shows the 100 publications that are most cited by the extended citation network, provided there are at least four citations from corpus publications.

This extended citation network reveals the historical origins of the social finance field. It suggests that the field of social finance has roots in economic sociology (Granovetter, 1973; Granovetter, 1985),¹⁹³ the theory of the firm (Jensen et al., 1976),¹⁹⁴ non-profit enterprise (Hansmann,

¹⁹⁰ Jackson, E. T. (2013). Evaluating social impact bonds: Questions, challenges, innovations, and possibilities in measuring outcomes in impact investing. *Community Development*, 44(5), 608-616. Rizzello, A., Migliazza, M. C., Carè, R., & Trotta, A. (2016). Social impact investing: A model and research agenda. *Routledge handbook of social and sustainable finance* (pp. 102-124). Arena, M., Bengo, I., Calderini, M., & Chiodo, V. (2016). Social impact bonds: Blockbuster or flash in a pan? *International Journal of Public Administration*, 39(12), 927-939. Roy, M. J., McHugh, N., & Sinclair, S. (2017). Social impact bonds - evidence-based policy or ideology? *Handbook of social policy evaluation* (pp. 263-275).

¹⁹¹ Luke, B., Barraket, J., & Eversole, R. (2013). Measurement as legitimacy versus legitimacy of measures: Performance evaluation of social enterprise. *Qualitative Research in Accounting and Management*, 10(3-4), 234-258.

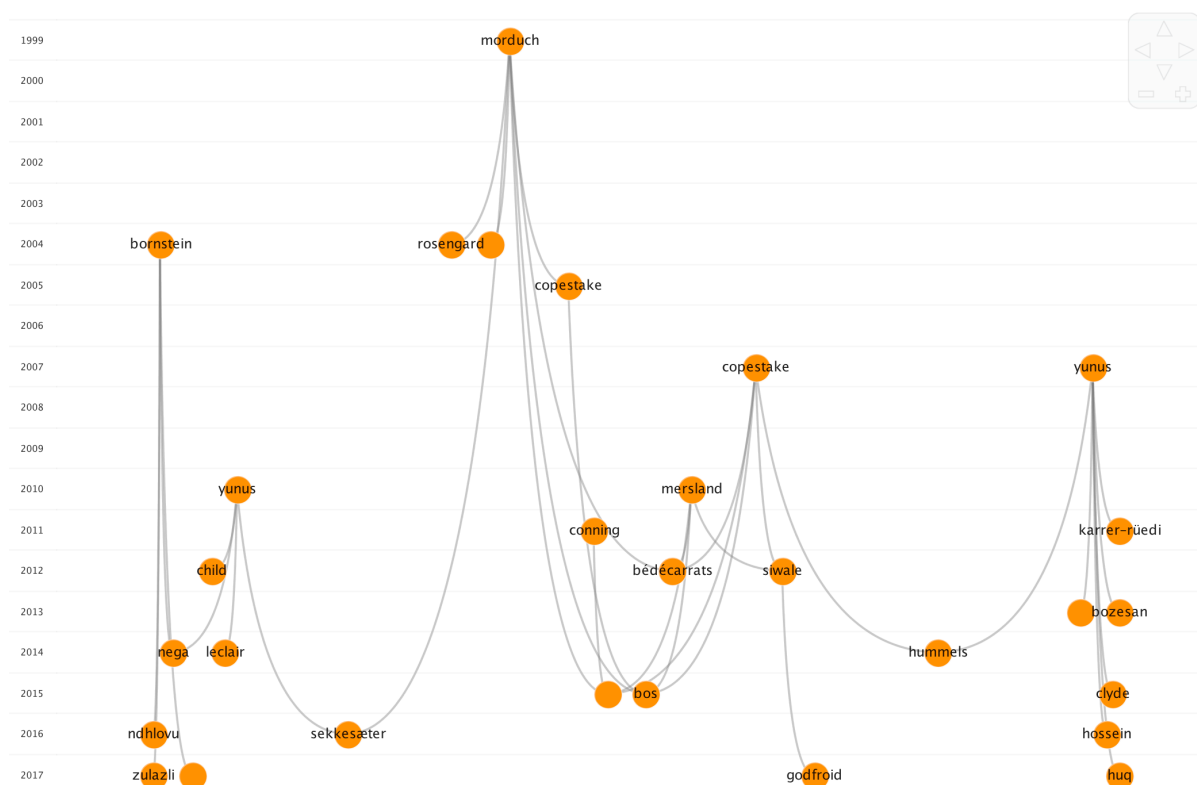
¹⁹² Nicholls, A. (2009). 'We do good things, don't we?': 'blended value accounting' in social entrepreneurship. *Accounting, Organizations and Society*, 34(6-7), 755-769. Nicholls, A. (2010). The institutionalization of social investment: The interplay of investment logics and investor rationalities. *Journal of Social Entrepreneurship*, 1(1), 70-100. Geobey, S., & Harji, K. (2014). Social finance in north america. *Global Social Policy*, 14(2), 274-277. Moore, M., Westley, F. R., & Brodhead, T. (2012a). Social finance intermediaries and social innovation. *Journal of Social Entrepreneurship*, 3(2), 184-205. Moore, M., Westley, F. R., & Nicholls, A. (2012b). The social finance and social innovation nexus 1. *Journal of Social Entrepreneurship*, 3(2), 115-132. Pitluck, A. Z. (2016). The convergence paradox of islamic finance: A sociological reinterpretation, with insights for proponents of social finance. *Routledge handbook of social and sustainable finance* (pp. 364-380).

¹⁹³ Granovetter, M. S. (1973). The strength of weak ties. *American journal of sociology*, 78(6), 1360-1380. Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American journal of sociology*, 91(3), 481-510.

¹⁹⁴ Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4), 305-360.

Drilling down into the orange cluster in Figure 2.15 reveals the publications in development economics that are most cited by the field of social finance. The middle grouping of Morduch (1999),²⁰¹ Rosengard (2004),²⁰² Mosley et al. (2004),²⁰³ and Copestake et al. (2005),²⁰⁴ are all focused on microfinance. The left-hand side emphasises social entrepreneurship and social innovation (Bornstein, 2004; Nega et al., 2014; Yunus et al., 2010).²⁰⁵ The right-hand side focuses on the emergence of impact investing as an asset class that traditional investors are becoming more willing to accept (Bozesan, 2013; Hummels et al., 2014; Karrer-Ruedi, 2011).²⁰⁶

Figure 2.15: Extended Citation Network Development Economics Cluster



²⁰¹ Morduch, J. (1999). The microfinance promise. *Journal of economic literature*, 37(4), 1569-1614.

²⁰² Rosengard, J. K. (2004). Banking on social entrepreneurship: the commercialization of microfinance. *Mondes en développement*, (2), 25-36.

²⁰³ Mosley, P., & Rock, J. (2004). Microfinance, labour markets and poverty in Africa: a study of six institutions. *Journal of International Development*, 16(3), 467-500.

²⁰⁴ Copestake, J., Dawson, P., Fanning, J. P., McKay, A., & Wright-Revollo, K. (2005). Monitoring the diversity of the poverty outreach and impact of microfinance: A comparison of methods using data from Peru. *Development Policy Review*, 23(6), 703-723.

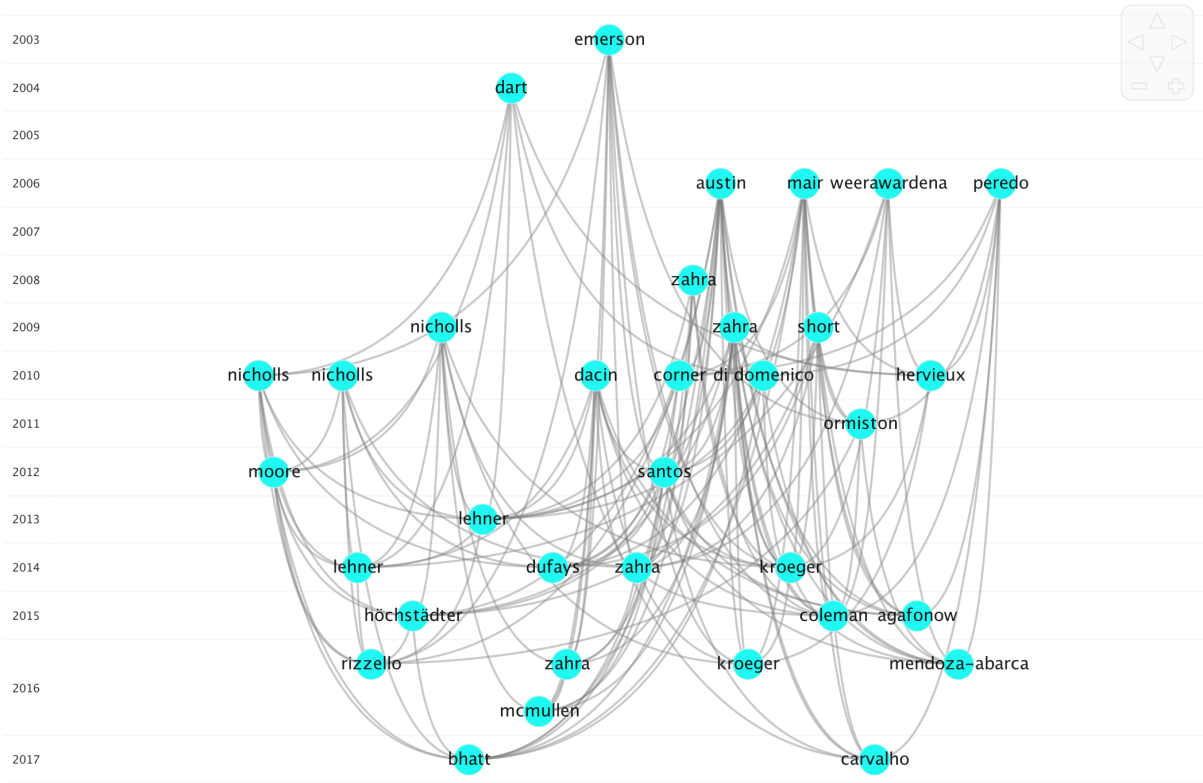
²⁰⁵ Bornstein, D. (2004). How to change the world: Social entrepreneurship and the power of ideas. Nega, B., & Schneider, G. (2014). Social entrepreneurship, microfinance, and economic development in Africa. *Journal of Economic Issues*, 48(2), 367-376. Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010). Building social business models: Lessons from the Grameen experience. *Long range planning*, 43(2), 308-325.

²⁰⁶ Bozesan, M. (2013). Demystifying the Future of Investing: Part 1: An Investor's Perspective. *Journal of Integral Theory and Practice*, 8(1/2), 19. Hummels, H., & de Leede, M. (2014). The emergence of impact investments: The case of microfinance. In *Socially Responsible Investment in the 21st Century: Does it Make a Difference for Society?* (pp. 91-115). Emerald Group Publishing Limited. Karrer-Ruedi, E. (2011). The importance of the link between socially responsible investors and microfinance institutions. *The handbook of microfinance*, 323-340.

It is also helpful to identify the most crucial publications in the extended citation network, as these publications warrant further examination. Two approaches are adopted here.

As shown in Figure 2.16, there are 34 publications in the core of extended citation network, when that core is specified to contain publications with seven or more citation links to others in the core.

Figure 2.16: Publications in the Core of the Extended Citation Network



Separately, there are 37 publications with 10 or more citations in the extended citation network (though not necessarily in the core).

Comparing these two lists of highly-cited publications reveals that 13 publications are in both categories. These 13 publications are listed in the table in Figure 2.17. These results show that there is a disproportionate focus in the literature on social entrepreneurship relative to social finance. The majority of the 13 publications in the table approach the field from the perspective of enterprises, rather than from the perspective of investors looking to create an impact or individuals needing assistance.

Figure 2.17: Publications Both Highly-Cited by Core Publications and Highly-Cited by Non-Core Publications in the Extended Citation Network

Author	Title	Source	Year
Emerson, J	The blended value proposition: Integrating social and financial returns	California Management Review	2003
Dart, R	The legitimacy of social enterprise	Nonprofit Management and Leadership	2004
Mair, J., Marti, I	Social entrepreneurship research: A source of explanation, prediction, and delight	Journal of World Business	2006
Austin, J., Stevenson, H., & Wei-Skillern, J.	Social and commercial entrepreneurship: same, different, or both?	Entrepreneurship Theory and Practice	2006
Peredo, A. M., & McLean, M.	Social entrepreneurship: A critical review of the concept	Journal of World Business	2006
Weerawardena, J., & Mort, G. S.	Investigating social entrepreneurship: A multidimensional model	Journal of World Business	2006
Nicholls, A.	'We do good things, don't we?': 'Blended Value Accounting' in social entrepreneurship.	Accounting, Organisations and Society	2009
Zahra, S. A., Gedajlovic, E., Neubaum, D. O., & Shulman, J. M.	A typology of social entrepreneurs: Motives, search processes and ethical challenges	Journal of Business Venturing	2009
Short, J. C., Moss, T. W., & Lumpkin, G. T.	Research in social entrepreneurship: Past contributions and future opportunities	Strategic Entrepreneurship Journal	2009
Nicholls, A.	The institutionalization of social investment: The interplay of investment logics and investor rationalities.	Journal of Social Entrepreneurship	2010
Dacin, P. A., Dacin, M. T., & Matear, M. (2010).	Social entrepreneurship: Why we don't need a new theory and how we move forward from here	Academy of Management Perspectives	2010
Nicholls, A.	The legitimacy of social entrepreneurship: reflexive isomorphism in a pre-paradigmatic field.	Entrepreneurship Theory and Practice	2010
Santos, F. M.	A positive theory of social entrepreneurship	Journal of Business Ethics	2012

Now that we have analysed the intellectual structure of the social finance field in detail, let us shift focus to development economics.

2.7 Field of Development Economics

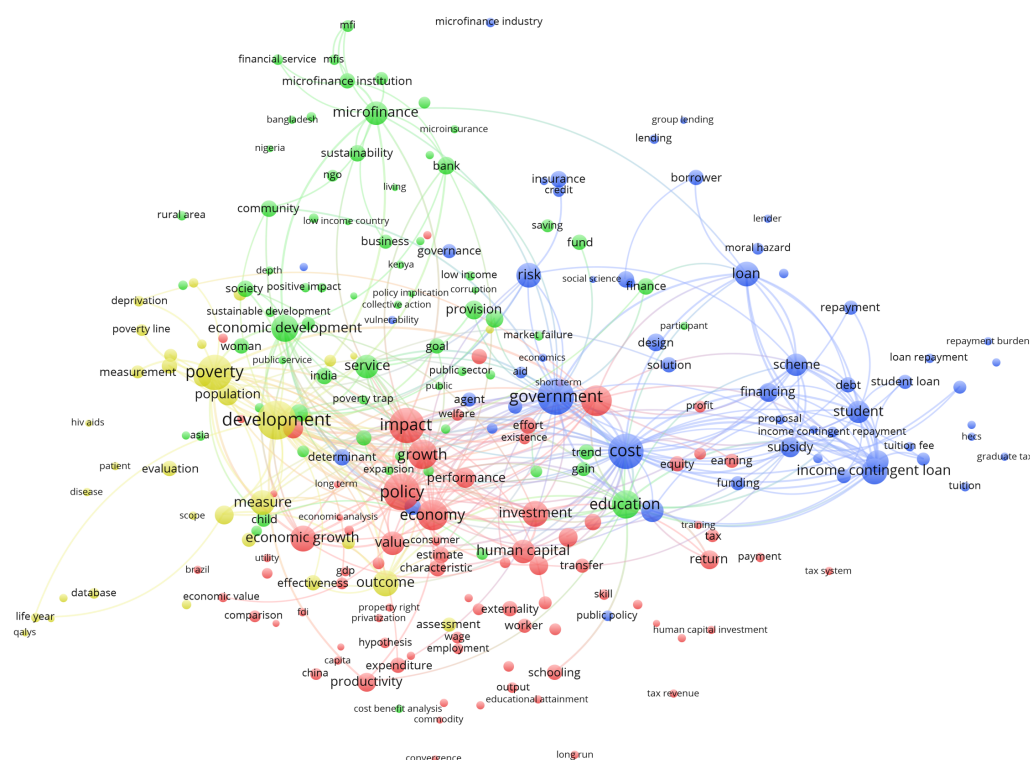
Co-occurrence term analysis on the development economics corpus indicates that the field, as pertains to the financing and provision of investments, can be divided into four clusters. These clusters are shown in Figure 2.18.

The yellow cluster represents development outcomes that affect poverty levels, and the measurement of those outcomes. As shown in network map (Figure 2.18), and reinforced in the density map (Figure 2.20), a close relationship exists between the terms *poverty* and *development*, indicating that they are commonly used together. On the other hand, measurement terminology such as *evaluation*, *measurement*, and *effectiveness*, are used less frequently (as indicated by smaller dot sizes) and with inconsistent associations (as indicated by disparate positioning). One method of evaluating the effectiveness of investments, namely changes in quality-adjusted-life-years (*QALYs*), appears on the field periphery in the bottom left corner of the figure.

The most obvious characteristic of the red cluster is the close association between *impact*, *growth*, *policy* and *economy*. This suggests that the study of the relationships between these factors is a key focus of the literature, and that *impact* and *growth* are inextricably linked. The right-hand side

of the red cluster reveals the role of human capital as a bridge in the literature between education financing (the blue cluster) and desired outcomes (the red and yellow clusters).

Figure 2.18: Term Co-Occurrence Network Map of the Development Economics Corpus



The blue and green clusters focus primarily on investment mechanisms. The blue cluster focuses on ways that a government may finance investments in individuals, including *aid*, direct provision that incurs *cost*, *subsidies*, non-contingent *loans*, and *income-contingent loans*. Importantly, there is a focus on economic issues around the *design* of investment mechanisms, including *moral hazard*, the *repayment burden* faced by individuals, and what *risk* is borne by whom. In contrast, the green cluster focuses on microfinance and financing for businesses. *Economic development* is the link between *microfinance* and the terms *poverty* and *development*, which indicates a focus in the literature on the relationship between those variables. Importantly, these clusters are distant from each other, indicating that different investment mechanisms are rarely analysed together or comparatively. Figure 2.19 suggests that this may be partly due to the sequential development of the field, with studies of human-capital financing predating microfinance.

The mapping analysis highlights four further characteristics of the field. First, the central role of the government relative to the private sector in financing investments and otherwise working towards development outcomes. Secondly, the focus on financial inputs (*costs*) and aggregate financial outcomes (*economic development* and *economic growth*) over financial returns. Thirdly, that while *development* and *impact* are common terms, development typically refers to poverty alleviation, while impact has broader associations with *policy*, *growth* and the *economy*. Finally, *risk* is a key link between the different investment mechanisms and development outcomes. This makes intuitive sense, given that a lack of capacity for low-income individuals to bear risk is likely to inform the design of investment mechanisms.

Figure 2.19: Term Co-Occurrence Temporal Map of the Development Economics Corpus

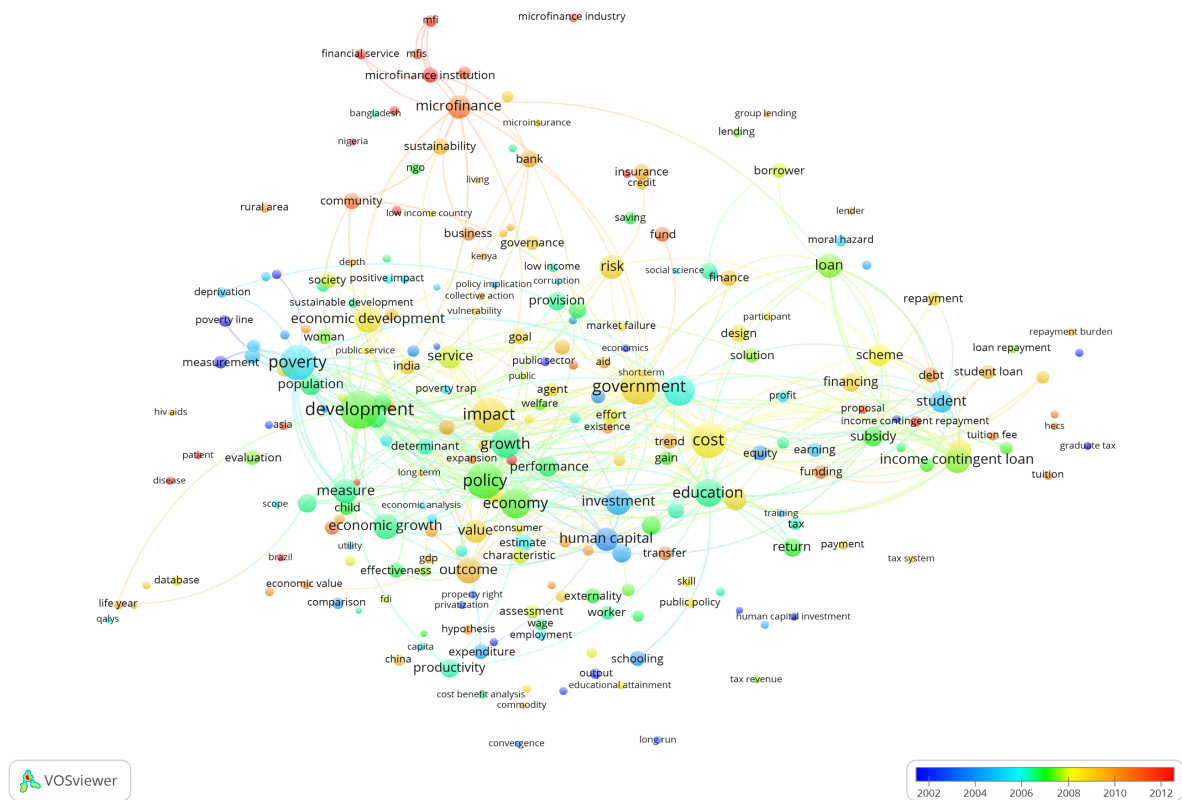
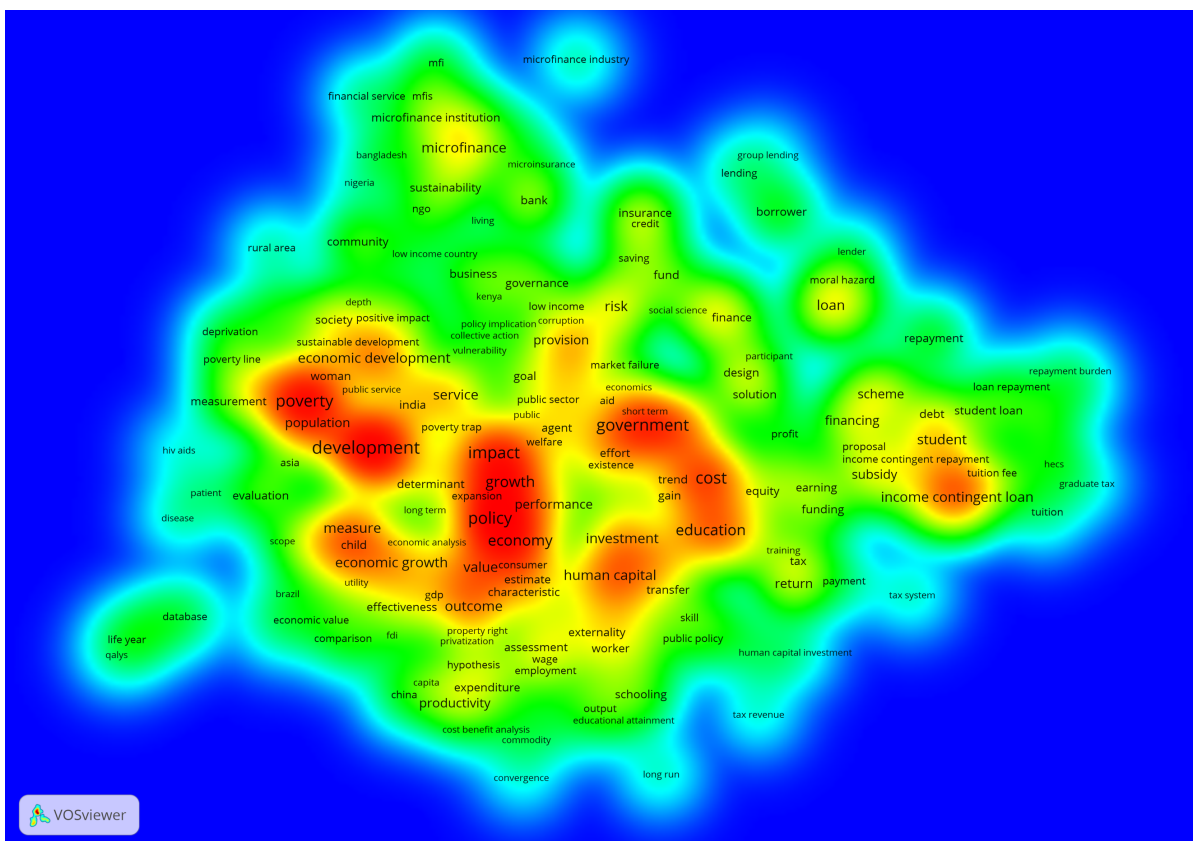


Figure 2.20: Term Co-Occurrence Density Map of the Development Economics Corpus



2.8 Intersection of Fields

Now let us examine how the two fields of social finance and development economics interact at various levels of aggregation. Results from various forms of analysis indicate consistent areas of overlap and diversion between the fields.

Terminology Analysis

In terms of pairwise document similarity, Figure 2.21 shows the seven document pairings with a cosine similarity of the tf-idf (term frequency-inverse document frequency) vectors closest to one. An analysis of the content of each article pairing reveals a pairing focus, as shown in the right column.

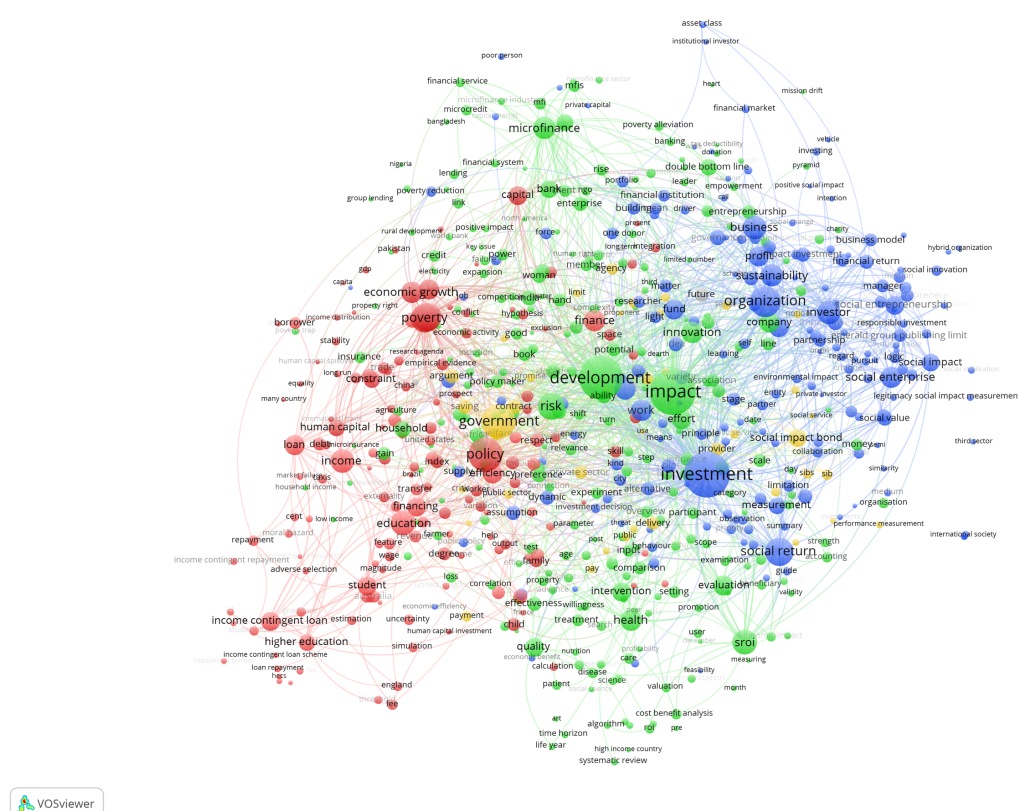
Figure 2.21: Cross-Corpus Publication Pairings with Highest Cosine Similarity of tf-idf Vectors

Pairing Number	Publication		Pairing Focus
	Social Finance Corpus	Development Economics Corpus	
1	Emerson, J. (2003). The blended value proposition: Integrating social and financial returns. <i>California management review</i> , 45(4), 35-51.	Woolcock, M. (1998). Social capital and economic development: Toward a theoretical synthesis and policy framework. <i>Theory and society</i> , 27(2), 151-208.	Conceptual relationship between social value creation and financial outcomes
2	Warner, M. E. (2013). Private finance for public goods: social impact bonds. <i>Journal of Economic Policy Reform</i> , 16(4), 303-319.	Donnelly, C. M. (2004). <i>Delegation of governmental power to private parties: a comparative perspective</i> (Doctoral dissertation, University of Oxford).	Public-private partnerships
3	McMullen, J. S., & Warnick, B. J. (2016). Should we require every new venture to be a hybrid organization?. <i>Journal of Management Studies</i> , 53(4), 630-662.	Boulouta, I., & Pitelis, C. N. (2014). Who needs CSR? The impact of corporate social responsibility on national competitiveness. <i>Journal of Business Ethics</i> , 119(3), 349-364.	Impact of an enterprise-level social impact focus on financial outcomes
4	Matthäus-Maier, I., & Von Pischke, J. D. (Eds.). (2006). <i>Microfinance investment funds: leveraging private capital for economic growth and poverty reduction</i> . Springer Science & Business Media.	Lopatta, K., & Tchikov, M. (2016). Do microfinance institutions fulfil their promise? Evidence from cross-country data. <i>Applied Economics</i> , 48(18), 1655-1677.	Use of microfinance to reduce poverty levels
5	Walk, M., Greenspan, I., Crossley, H., & Handy, F. (2015). Social Return on Investment Analysis: A Case Study of a Job and Skills Training Program Offered by a Social Enterprise. <i>Nonprofit Management and Leadership</i> , 26(2), 129-144.	Dustmann, C., & Glitz, A. (2011). Migration and education. <i>Handbook of the Economics of Education</i> , 4, 327-439.	The value of human capital acquisition by immigrant populations
6	LeClair, M. (2014). <i>Philanthropy in Transition</i> . Springer.	Pelozo, J., & Steel, P. (2005). The price elasticities of charitable contributions: a meta-analysis. <i>Journal of Public Policy & Marketing</i> , 24(2), 260-272.	Tax deductibility for philanthropic investments
7	Banke-Thomas, A. O., Madaj, B., Charles, A., & van den Broek, N. (2015). Social Return on Investment (SROI) methodology to account for value for money of public health interventions: a systematic review. <i>BMC Public Health</i> , 15(1), 582.	Jeuland, M., Lucas, M., Clemens, J., & Whittington, D. (2009). A cost-benefit analysis of cholera vaccination programs in Beira, Mozambique. <i>The World Bank Economic Review</i> , 23(2), 235-267.	Performance measurement applied to health

The areas of overlap indicated by terminology analysis of pairwise documents across corpora are mirrored at an aggregate level. Figure 2.22 shows the terminology network map when the two separate corpora are combined into one. The right-hand side blue cluster shows terms more

specific to the field of social finance (including *business*, *profit*, *financial return*, *social return*, *organisation*, *investor*, *social impact bonds*, and *SROI*). The left-hand side red cluster shows terms more specific to development economics (including *poverty*, *economic growth*, *policy*, *income-contingent loan*, *borrower*, and *human capital*). The middle vertical green cluster reveals the places where the fields intersect. The middle top is focused on *microfinance*, the middle centre on *development* and *impact*, and the middle bottom on performance measurement with terms such as *quality*, *valuation*, *life year*, *effectiveness*, *cost-benefit analysis*, and *SROI* (which is linked to both *cost-benefit analysis* and to several terms specific to social finance). The disparate yellow cluster focuses on the government and its role in public-private partnerships.

Figure 2.22: Term Co-Occurrence Network Map of Both Corpora



One insight from this mapping is that the three financing mechanisms of microfinance, social impact bonds, and income-contingent loans, are positioned almost as far apart as possible. This suggests they are rarely analysed comparatively or systematically, but are rather researched in isolation in the literature. The term mapping also reveals differing areas of focus between fields. Development economics seems focused on financing via *government policy* to individuals (that is, *borrowers*, *children*, *women*, and *students*) with a focus on aggregate financial outcomes (such as *economic growth*, *income* and *GDP*). In contrast, social finance appears focused on financing by private investors to *businesses* and *social enterprises* with a focus on firm-specific financial outcomes (such as *financial return*). This insight is reinforced in Figure 2.23, with high density areas around *economic growth* and *poverty* on one hand, and *business* and *profit* on the other hand. Figure 2.24 adds further insight by showing the sequential development of the fields, with terms on the right-hand side of the map appearing more recently than terms on the left-hand side.

Figure 2.23: Term Co-Occurrence Density Map of Both Corpora

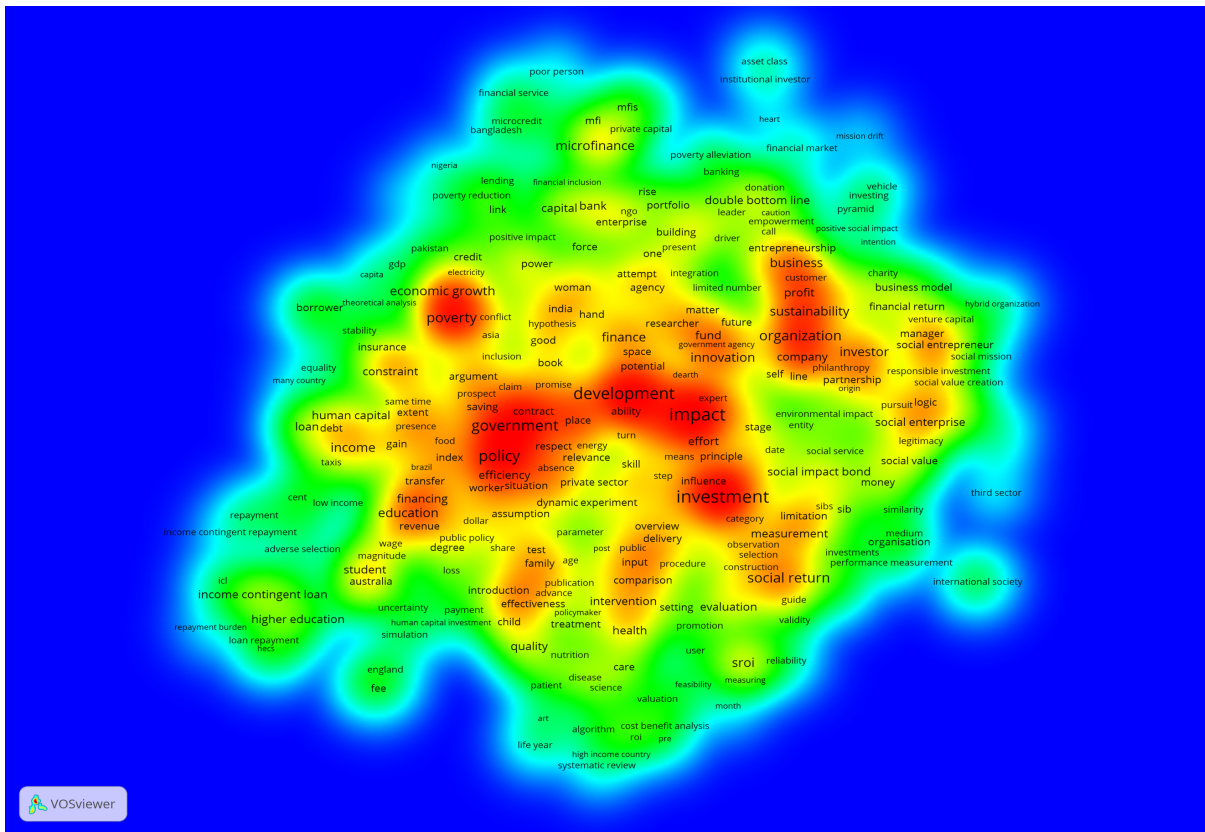
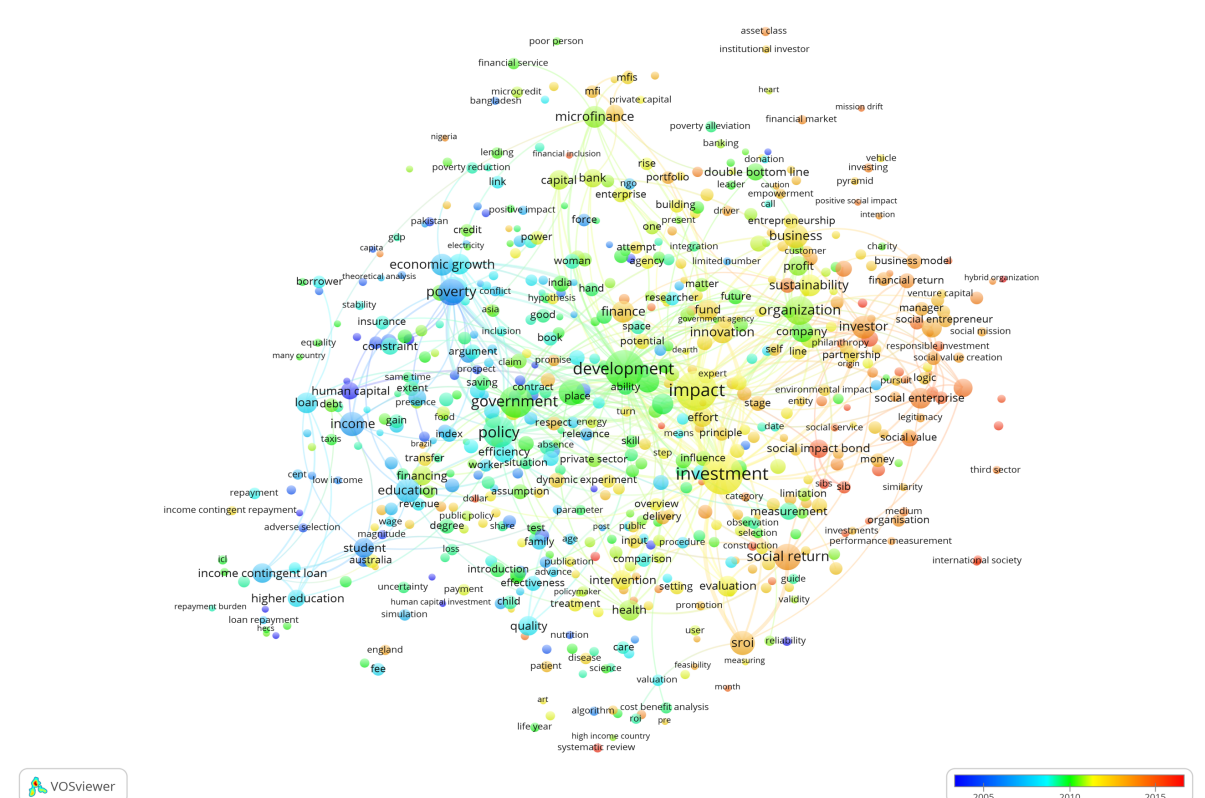


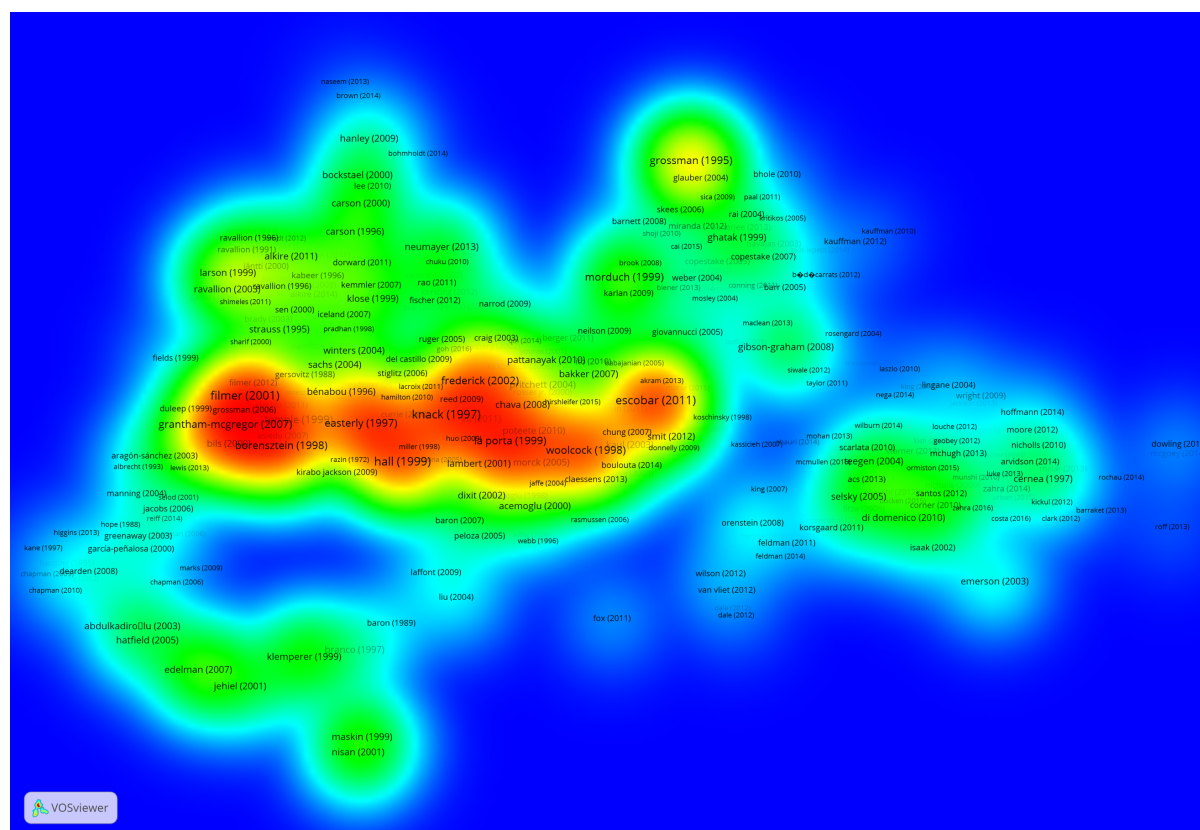
Figure 2.24: Term Co-Occurrence Temporal Map of Both Corpora



Publications at the Intersection of Fields

Bibliographic coupling analysis, visually represented in Figure 2.25, reveals the siloed nature of the two fields, with the field of social finance as a density island on the right of the diagram. The greater density in the development economics field reflects the more development nature of the discipline, and the fact that the corpus consists of a relatively greater proportion of journal articles.

Figure 2.25: Publication Bibliographic Coupling Density Map of Both Corpora



Closer examination reveals that the two fields can be broken down into twelve clusters, as shown in Figure 2.26. The yellow cluster (top left) focuses on the various economics methodologies to value future impacts and evaluate past impacts, including cost-benefit analysis (Hanley, 2009; Jeuland et al., 2009),²⁰⁷ revealed preference (Carson et al., 1996),²⁰⁸ and contingent valuation (Klose, 1999; Carson, 2000).²⁰⁹ The turquoise cluster (also top left) focuses on poverty alleviation, including a substantial focus on poverty measurement (Alkire et al., 2011; Deutsch et al., 2005; Ravallion, 1996).²¹⁰ Strikingly, these two measurement-focused clusters are completely isolated

²⁰⁷ Hanley, N., Barbier, E. B., & Barbier, E. (2009). *Pricing nature: cost-benefit analysis and environmental policy*. Edward Elgar Publishing. Jeuland, M., Lucas, M., Clemens, J., & Whittington, D. (2009). A cost-benefit analysis of cholera vaccination programs in Beira, Mozambique. *World Bank Economic Review*, 23(2), 235-267.

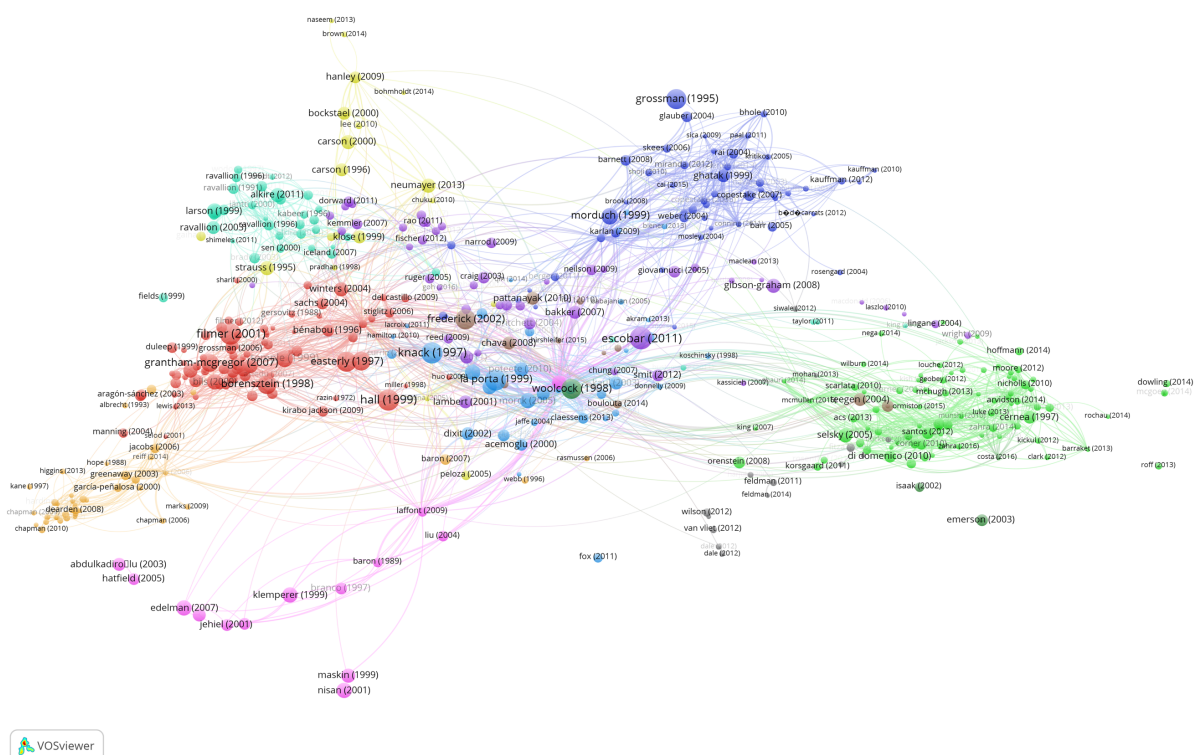
²⁰⁸ Carson, R. T., Flores, N. E., Martin, K. M., & Wright, J. L. (1996). Contingent valuation and revealed preference methodologies: Comparing the estimates for quasi-public goods. *Land Economics*, 72(1), 80-99.

²⁰⁹ Klose, T. (1999). The contingent valuation method in health care. *Health Policy*, 47(2), 97-123. Carson, R. T. (2000). Contingent valuation: A user's guide. *Environmental Science and Technology*, 34(8), 1413-1418.

²¹⁰ Alkire, S., & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7), 476-487. Deutsch, J., & Silber, J. (2005). Measuring multidimensional poverty: An empirical

from the social finance literature on valuing future impacts and evaluating past impacts, which is situated at the far right of the social finance green cluster. Hence, even though term co-occurrence mapping suggests that measurement related publication clusters could span both fields due to terminology similarities, this bibliographic coupling analysis reveals that this does not happen at present. There is little interaction between disciplines when it comes to measurement.

Figure 2.26: Publication Bibliographic Coupling Network Map of Both Corpora



This lack of overlap is not unique to measurement. The social finance literature is completely isolated from the economics literature on financing education, represented by the orange cluster (bottom left). This literature includes the use of income-contingent loans (Higgins, 2013; Harding, 1995; Johnstone, 2009; Chapman, 2006),²¹¹ and tax deductibility (Kane, 1997).²¹²

This orange cluster connects to the red cluster, which is focused on the determinants of economic growth, via literature on the economic benefits of education. This includes literature on the

comparison of various approaches. *Review of Income and Wealth*, 51(1), 145-174. Ravallion, M. (1996). Issues in measuring and modeling poverty. *Economic Journal*, 106(438), 1328-1343

²¹¹ Higgins, T., & Sinning, M. (2013). Modeling income dynamics for public policy design: An application to income contingent student loans. *Economics of Education Review*, 37, 273-285. Harding, A. (1995). Financing higher education: An assessment of income-contingent loan options and repayment patterns over the life cycle. *Education Economics*, 3(2), 173-203. Johnstone, D. B. (2009). Conventional fixed-schedule versus income contingent-repayment obligations: Is there a best loan scheme? *Higher Education in Europe*, 34(2), 189-199. Chapman, B. (2006). Income contingent loans for higher education: International reforms. *Handbook of the Economics of Education*, 2, 1435-1503.

²¹² Kane, T. J. (1997). Beyond tax relief: Long-term challenges in financing higher education. *National Tax Journal*, 335-349.

economic value of having well-trained education instructors (Hanushek, 2011),²¹³ whether schooling increases individual incomes (Bils et al., 2000),²¹⁴ and whether education causes economic growth and other positive externalities (Saito et al., 2011; Acemoglu et al., 2000).²¹⁵ The latter issue of human capital externalities is often studied at a country level, including South Africa (Michaud et al., 2003) and Chile (Saito et al., 2011).²¹⁶

The education literature is also largely isolated from the theoretical literature on mechanism design, which is the pink cluster (bottom centre-left). This cluster includes research on auction design (Dasgupta et al., 2000; Klemperer, 1999; Edelman et al., 2007),²¹⁷ first-best equilibria and welfare optimality (Maskin, 1999; Gul et al., 1999),²¹⁸ optimal principal-agent contracting, matching (Hatfield et al., 2005),²¹⁹ game theoretical approaches (Nisan & Ronen, 2001),²²⁰ and stakeholder incentive alignment more generally (Laffont et al., 2009).²²¹ The isolated nature of this cluster suggests negligible research has sought to apply mechanism design approaches to social finance problems – which provides a further justification for this dissertation’s overarching research question.

The remaining clusters are more closely connected to the social finance green cluster. This includes the dark blue cluster on microfinance, the light blue cluster on governance at both a corporate and government level, the grey cluster on health and environmental economics, and the purple cluster that is focused on qualitative research into international development issues.

In deciphering publications at the disciplinary intersection, it is useful to examine the map from both a spatial and temporal perspective. The temporal map (Figure 2.27) shows the eight publications in the social finance cluster that pre-date the majority of social finance publications. Cernea (1997) is the earliest of the eight publications, and develops a ‘risks and reconstruction model’ for refugee resettlement.²²² The fact that it is situated in the social finance cluster indicates the relevance of refugee resettlement to the fields of social finance and social entrepreneurship – a point explored in the extension in Chapter 7. The other seven publications are ‘The Making of

²¹³ Hanushek, E. A. (2011). The economic value of higher teacher quality. *Economics of Education Review*, 30(3), 466-479.

²¹⁴ Bils, M., & Klenow, P. J. (2000). Does schooling cause growth? *American Economic Review*, 90(5), 1160-1183.

²¹⁵ Saito, H., & Gopinath, M. (2011). Knowledge spillovers, absorptive capacity, and skill intensity of Chilean manufacturing plants. *Journal of Regional Science*, 51(1), 83-101. Acemoglu, D., & Angrist, J. (2000). How large are human-capital externalities? Evidence from compulsory schooling laws. *NBER macroeconomics annual*, 15, 9-59.

²¹⁶ Michaud, P. C., & Vencatachellum, D. (2003). Human capital externalities in South Africa. *Economic Development and Cultural Change*, 51(3), 603-628. Saito, H., & Gopinath, M. (2011). Knowledge spillovers, absorptive capacity, and skill intensity of Chilean manufacturing plants. *Journal of Regional Science*, 51(1), 83-101.

²¹⁷ Dasgupta, P., & Maskin, E. (2000). Efficient auctions. *Quarterly Journal of Economics*, 115(2), 341-388. Klemperer, P. (1999). Auction theory: A guide to the literature. *Journal of Economic Surveys*, 13(3), 277-286. Edelman, B., Ostrovsky, M., & Schwarz, M. (2007). Internet advertising and the generalized second-price auction: Selling billions of dollars worth of keywords. *American Economic Review*, 97(1), 242-259.

²¹⁸ Maskin, E. (1999). Nash equilibrium and welfare optimality. *Review of Economic Studies*, 66(1), 23-38. Gul, F., & Stacchetti, E. (1999). Walrasian equilibrium with gross substitutes. *Journal of Economic Theory*, 87(1), 95-124.

²¹⁹ Hatfield, J. W., & Milgrom, P. R. (2005). Matching with contracts. *American Economic Review*, 95(4), 913-935.

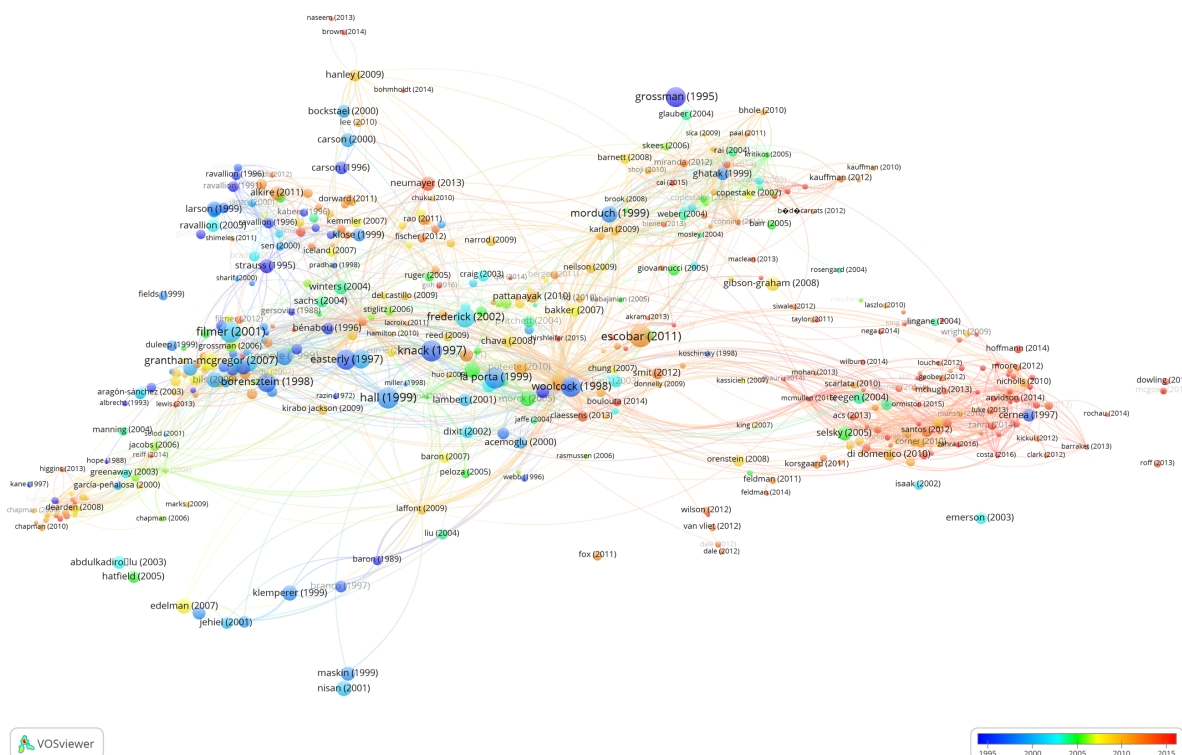
²²⁰ Nisan, N., & Ronen, A. (2001). Algorithmic mechanism design. *Games and Economic Behavior*, 35(1-2), 166-196.

²²¹ Laffont, J. J., & Martimort, D. (2009). *The theory of incentives: The principal-agent model*. Princeton university press.

²²² Cernea, M. (1997). The risks and reconstruction model for resettling displaced populations. *World Development*, 25(10), 1569-1587.

the Ecopreneur' (Isaak, 2002),²²³ 'The Blended Value Proposition' (Emerson, 2003),²²⁴ 'The Importance of Non-Governmental Organizations in Global Governance and Value Creation' (Teegen, 2004),²²⁵ 'Developing Countries and MNEs' (Ramamurti, 2004),²²⁶ and 'Cross-Sector Partnerships to Address Social Issues' (Selsky et al., 2005).²²⁷

Figure 2.27: Publication Bibliographic Coupling Temporal Map of Both Corpora



From a spatial perspective, there are several publications situated between the field clusters, as shown in the enlarged network map in Figure 2.28. These publications cover a range of research topics, from privatisation (Donnelly, 2009; Orenstein, 2008),²²⁸ to social enterprise approaches to microfinance (Mohan et al., 2013; Nega et al., 2014; Rosengard, 2004),²²⁹ to the merits of

²²³ Isaak, R. (2002). The making of the ecopreneur. *Greener Management International*, (38), 81-91.

²²⁴ Emerson, J. (2003). The blended value proposition: Integrating social and financial returns. *California Management Review*, 45(4), 35-51.

²²⁵ Teegen, H., Doh, J. P., & Vachani, S. (2004). The importance of nongovernmental organizations (NGOs) in global governance and value creation: An international business research agenda. *Journal of International Business Studies*, 35(6), 463-483.

²²⁶ Ramamurti, R. (2004). Developing countries and MNEs: Extending and enriching the research agenda. *Journal of International Business Studies*, 35(4), 277-283.

²²⁷ Selsky, J. W., & Parker, B. (2005). Cross-sector partnerships to address social issues: Challenges to theory and practice. *Journal of Management*, 31(6), 849-873.

²²⁸ Donnelly, C. M. (2009). Delegation of governmental power to private parties: A comparative perspective. Delegation of governmental power to private parties: A comparative perspective (pp. 1-528). Orenstein, A. M. (2008). Privatizing pensions: The transnational campaign for social security reform. Privatizing pensions: The transnational campaign for social security reform.

²²⁹ Mohan, L., Potnis, D., & Alter, S. (2013). Information systems to support "door-step banking": Enabling scalability of microfinance to serve more of the poor at the bottom of the pyramid. *Communications of the Association for*

Journals at the Intersection of Fields

When it comes to journals, bibliographic coupling analysis reveals that journals and other publications tend to fall into either the field of social finance or the field of development economics. In Figure 2.29 there are two high-density concentrations, which indicates that the fields are largely distinct, with few publications situated between fields.

Figure 2.29: Journal Bibliographic Coupling Density Map of Both Corpora

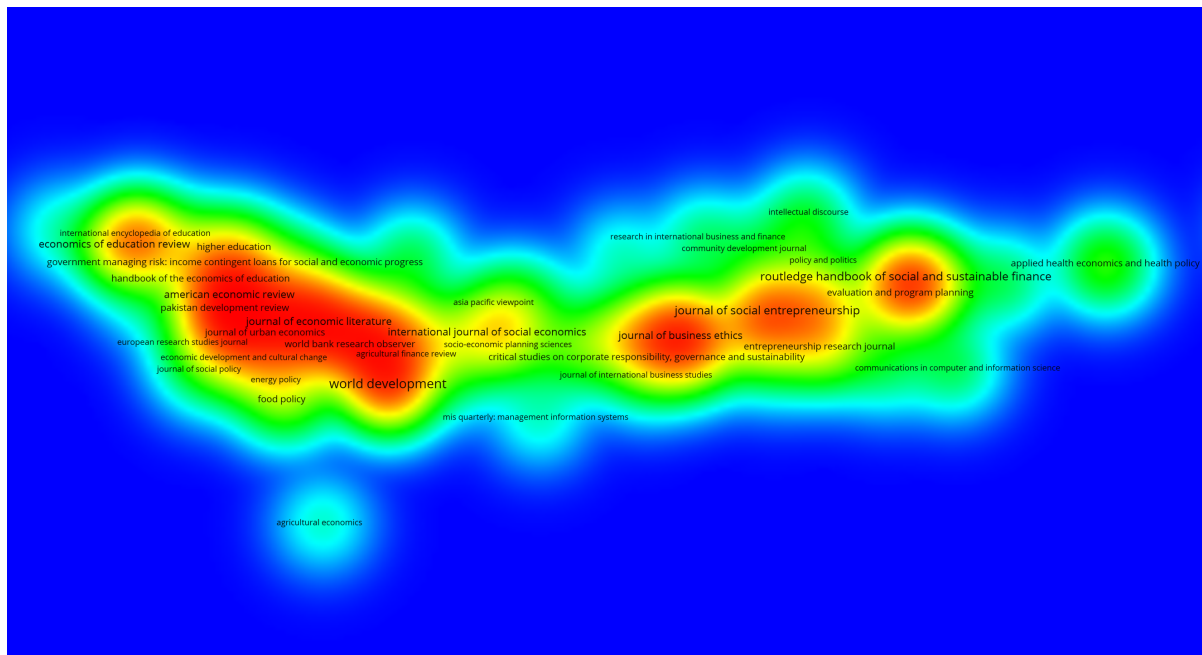
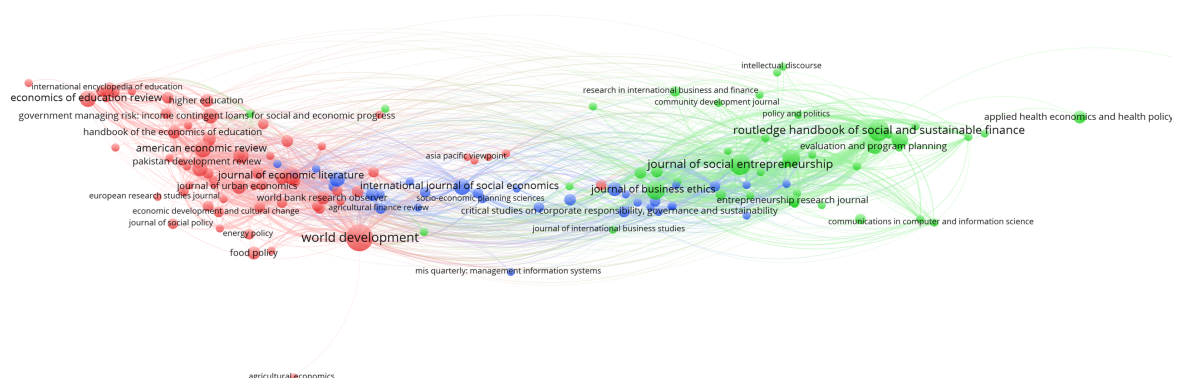


Figure 2.30: Journal Bibliographic Coupling Network Map of Both Corpora



A more three-dimensional mapping of journals and other publication sources is provided via co-citation research in Figure 2.32. The field of social finance is represented by the high-density blue cluster towards the bottom-left, while development economics is represented by the red cluster, and traditional economics and finance by the green cluster.

Figure 2.32: Journal Co-Citation Network Map of Both Corpora

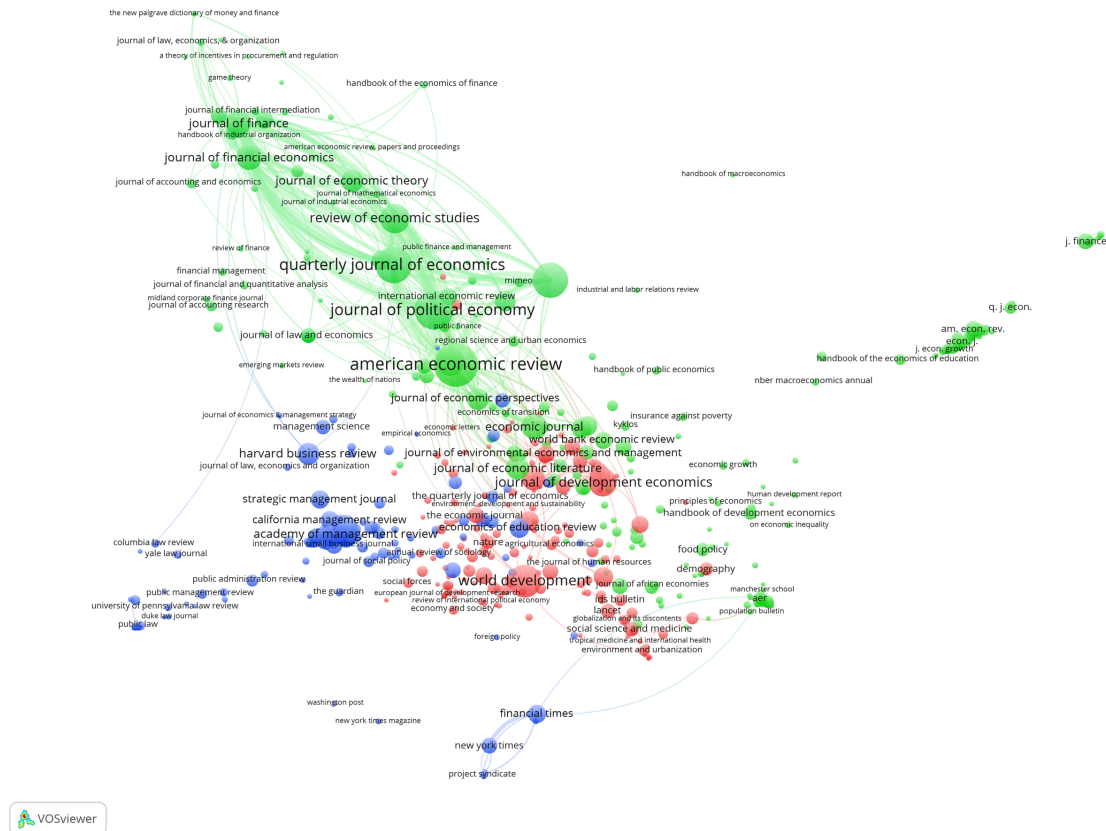


Figure 2.33: Journal Co-Citation Enlarged Network Map of Both Corpora

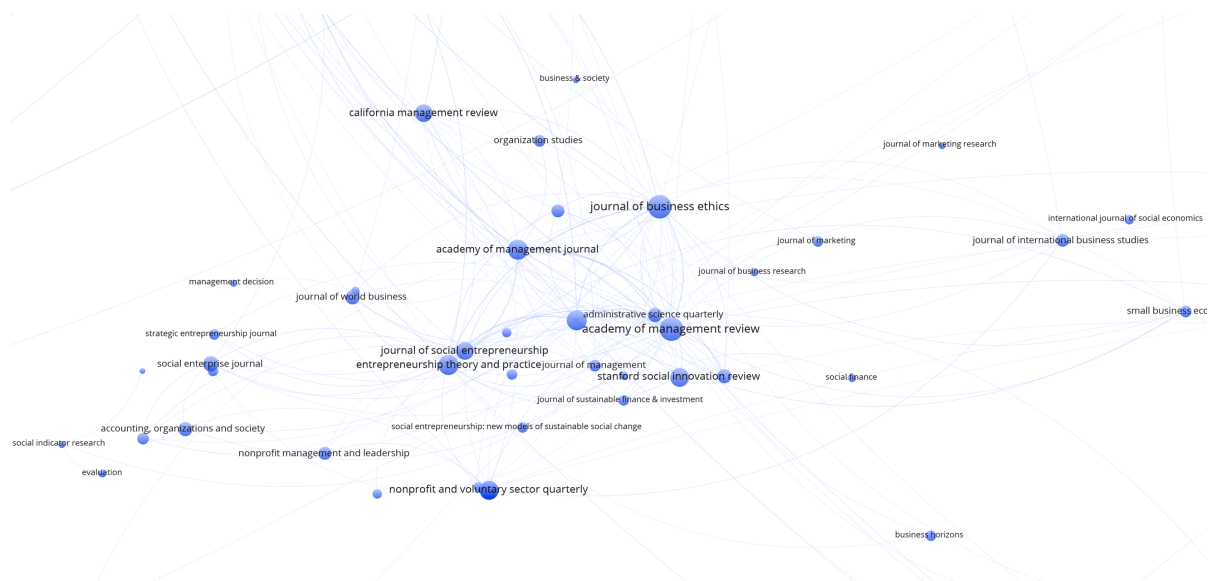
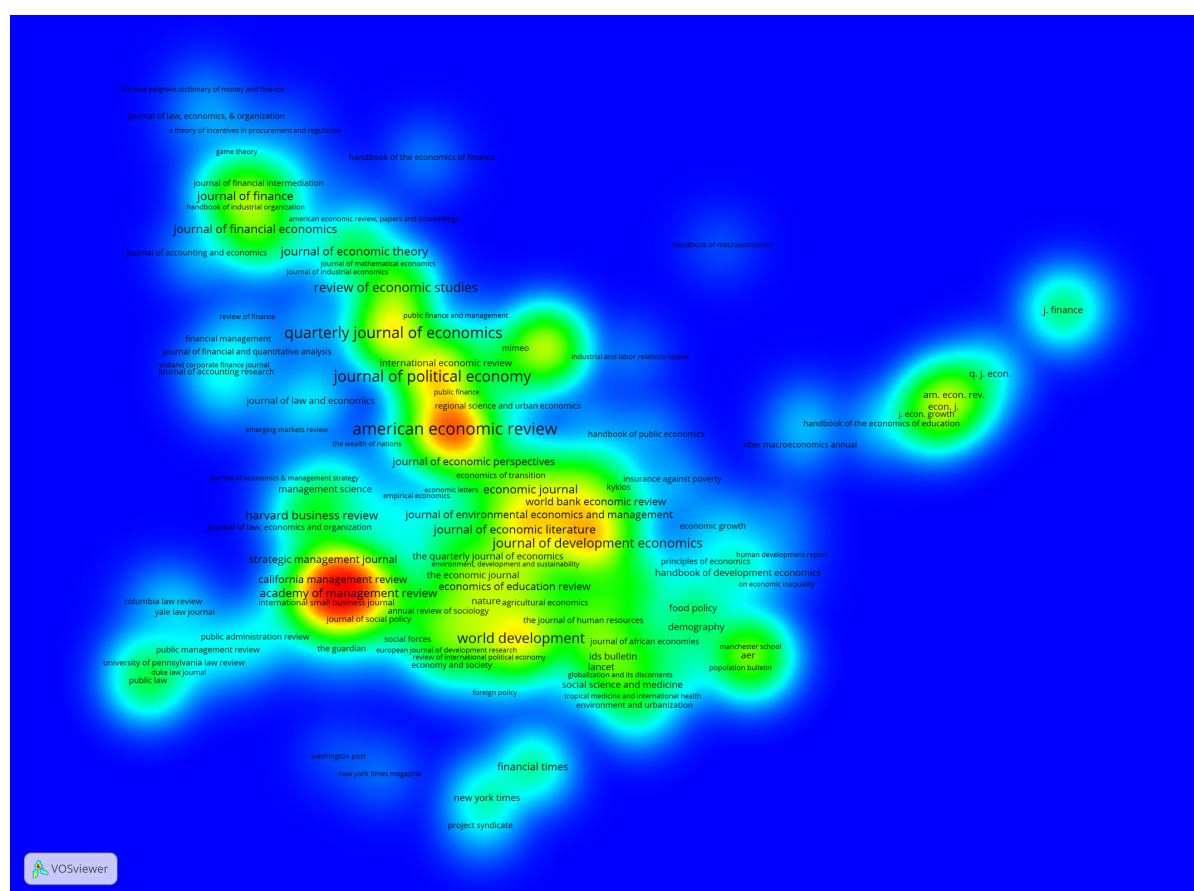


Figure 2.33 shows an enlarged visual of the social finance cluster. This suggests that the most influential journals in the field of social finance are the Journal of Business Ethics, Academy of Management Journal, Journal of Social Entrepreneurship, Journal of Sustainable Finance and Investment, and the Non-Profit and Voluntary Sector Quarterly. It also indicates that the Stanford Social Innovation Review, California Management Review, and Harvard Business Review are key contributors to the social finance field. The main journals that are positioned mid-way between the social finance and development economics clusters are the International Journal of Social Economics, Small Business Economics, Journal of International Business. The mapping further implies that World Development and the Journal of Development Economics are the most influential journals in development economics, while in traditional economics and finance the most influential journals are the American Economic Review, the Journal of Political Economy, and the Quarterly Journal of Economics.

The main result when these two research approaches are considered together is that the International Journal of Social Economics is the publication that most sits at the intersection of social finance and development economics. Also situated between these disciplines are the Journal of International Business, Small Business Economics, Worlds in Development, and Socio-Economic Planning Sciences.

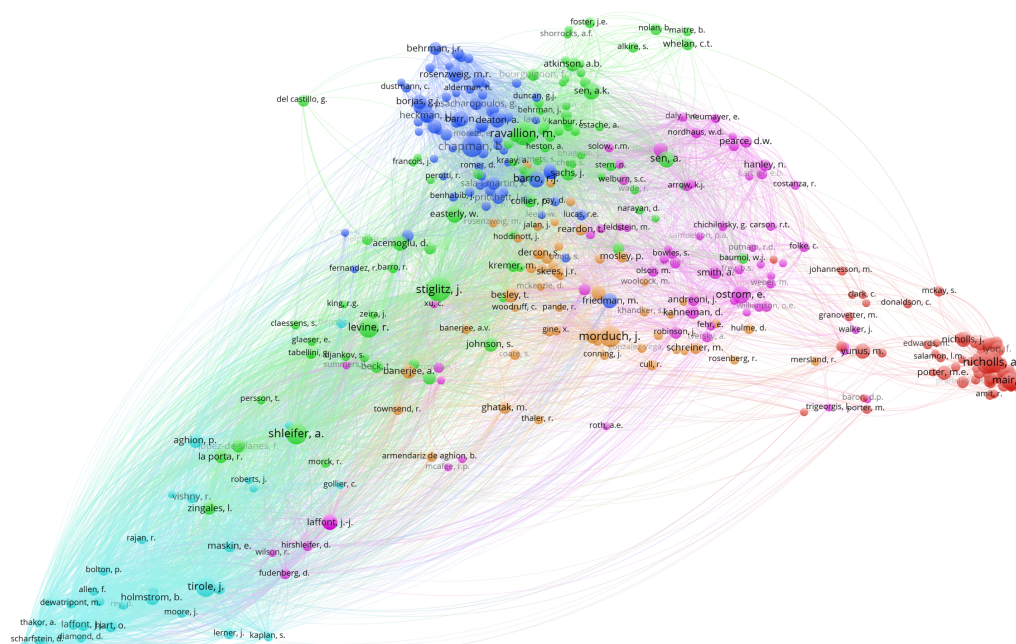
Figure 2.34: Journal Co-Citation Density Map of Both Corpora



Authors at the Intersection of Fields

Drilling down to the author level, Figure 2.35 reveals the academics whose work is situated between disciplines, as indicated by co-citation analysis. There are 26 authors that are situated on the map between the disciplines of social finance (red cluster) and development economics (other clusters). A close reading of the literature by these 26 authors reveals six main groupings of research, which correspond to areas of existing disciplinary overlap.

Figure 2.35: Author Co-Citation Network Map of Both Corpora



The first grouping comprises of six authors that use economics methodology to investigate issues related to non-profits, entrepreneurship, privatization, public goods, and corporate social responsibility.²³⁵ However, while these six authors addresses issues related to social finance, they do not research social finance directly. Common economics assumptions, such as organisations being either purely profit-maximizing or purely altruistic, are seen throughout their work. A second small group of authors are those that approach corporate social responsibility from a

²³⁵ The six authors are: Henry Hansmann (Professor of Law at Yale, whose research is focused on the law and economics of non-profit enterprise, including the issue of taxation deductibility); Joseph Schumpeter (who pioneered an economics approach to innovation and entrepreneurship, and who viewed capitalism as a continuous process of innovation and 'creative destruction'); Steve McKay (Distinguished Professor in Social Research at the University of Lincoln, who researches the economic impact of the third sector, including the marketization of charities and the economic relationship between volunteering and employability); David Baron (Professor of Political Economy and Strategy at Stanford Graduate School of Business, whose work includes the study of mechanism design and the economics of corporate social responsibility, including a paper examining the relationship between corporate financial performance and corporate social performance); Oliver Williamson (an American economist, whose economics work on transaction costs, contracting, the limits of the firm, and service provision, have influenced academic debate on the boundaries between the public and private sectors); and James Walker (Professor at Indiana University, whose research focuses on public economics, especially the incentives surrounding the provision of public goods and the appropriation of common pool resources).

business perspective, and do not employ standard economics methodologies in the process.²³⁶ The third grouping consists of four authors focused on microfinance,²³⁷ with a wide range of publications. Then there are two groups of authors that are more issue-specific. The first of these issues is health, with three academics focused on the *ex ante* evaluation of health policy and the *ex post* measurement of health outcomes.²³⁸ The other focus issue is the environment, with four authors in the group,²³⁹ who research the issue primarily from a public policy and governance perspective. The sixth category is economic sociology, and includes four academics.²⁴⁰ There are also three authors that do not fit into the six main categories described.²⁴¹

²³⁶ This group includes Michael Edwards (Former Senior Civil Society Specialist at the World Bank, and Former Director of Research at Save the Children, who writes on philanthropy, non-profits, official development assistance, philanthrocapitalism, civil society, and the role of business in society), and Michael Porter (Professor at Harvard Business School, whose recent work has included developing a Social Progress Index, and publishing articles on the creation of shared value and the link between competitive advantaged and corporate social responsibility).

²³⁷ These are: Roy Mersland (Professor at the University of Agder, who researches the social impact and governance of microfinance institutions); David Hulme (Professor of Development Studies at The University of Manchester, whose work focuses on poverty reduction, institutional governance, and microfinance); Muhammad Yunus (microfinance pioneer and founder of the Grameen Bank, whose writings focus on social businesses and microfinance); and Richard Rosenberg (Former Senior Advisor on Policy Issues and Research at the Consultative Group to Assist the Poor (CGAP), whose expertise spans microfinance, over-indebtedness, privatisation, and development finance).

²³⁸ These academics are: Cam Donaldson (Yunus Chair in Social Business in Health at Glasgow Caledonian University, whose work focuses on economic analysis of health-related social enterprises, microcredit institutions, and government financing); Peter Craig (Senior Research Fellow at the University of Glasgow, who specialises in the evaluation of public health policies and programs); and Magnus Johannesson (Economics Professor at Stockholm School of Economics, whose research focuses on the economic evaluation of health care interventions, and who has conducted a study on the psychology of entrepreneurs).

²³⁹ These are: Carl Folke (a multi-disciplinary environmental economist and scientist who is the Director of the Beijer Institute of Ecological Economics and Director of the Stockholm Resilience Centre, who focuses on the resilience of social-ecological systems); Elinor Ostrom (whose work focuses on economic governance of common resources and who has contributed to a comprehensive Social-Ecological Systems (SES) framework); Michele-Lee Moore (Assistant Professor at the University of Victoria, whose research applies resilience theory to social finance and public policy, especially as pertains to water management); and Ricardo Katz (researcher at the Center for Public Studies, an academic foundation in Chile dedicated to public issues, who has researched how market-based environmental mechanisms can alter firm behaviour). Note that it is possible that Ricardo Katz's positioning on the map is influenced, and pushed towards the social finance cluster, by another academic who shares the same surname and initial, and therefore citation reference. This academic is Ralph Katz, who is a Professor of Innovation and Entrepreneurship Management at Northeastern University, and whose research focuses on entrepreneurship and the management of technical innovation. The inability of VosViewer to distinguish between authors with identical names and initials, due to the way the World of Science and Scopus databases are constructed, is a limitation of this methodology.

²⁴⁰ These are: Mark Granovetter (Professor at Stanford University, whose 1985 article 'Economic Action and Social Structure: The Problem of Embeddedness' launched economic sociology, which is the social cause and effect of economic phenomena, and who more recently applied economic sociology to the field of entrepreneurship); Robert Putnam (American social theorist whose work focuses on social capital – a form of economic capital in which social networks are crucial and market players produce goods primarily for common, rather than individual, well-being improvements); Max Weber (a German sociologist who is regarded as one of the three founders of sociology alongside Émile Durkheim and Karl Marx, but who considered himself a political economist and who argued strongly for the marginal theory of value, or marginalism, which views the value of goods as dependent on their marginal rather than total value); and Luis Eugenio Di Marco (Professor of Economics at the University of Cordoba, whose 1972 book *International Economics and Development* includes a section on socio-economic approaches to international development, and who has published on economic humanism – the notion that sociology and moral philosophy should be incorporated into traditional economic thought, and that socio-economic institutions, such as corporate power and global financial institutions, should be critically analysed).

²⁴¹ These are Cathy Clark (Faculty Director of CASE at Duke's Fuqua School of Business and co-author of *The Impact Investor: Lessons in Leadership and Strategy for Collaborative Capitalism*, whose writing spans philanthropy, social innovation, impact investing and civic engagement), Lenos Trigeorgis (Professor of Finance at the University of Cyprus, whose work pioneered the valuation of investments with real options), and David Teece (an organisational theorist and Professor in Global Business at University of California, Berkeley, who published a 1986 paper in *Research Policy* entitled 'Profiting from Technological Innovation' in which he argued that firms often fail to capture the value of their innovations due to high imitability of those innovations and a lack of complementary assets, and who has also published an economics paper that seeks to explain the existence of multiproduct firms).

Figure 2.36: Author Co-Citation Enlarged Network Map of Both Corpora

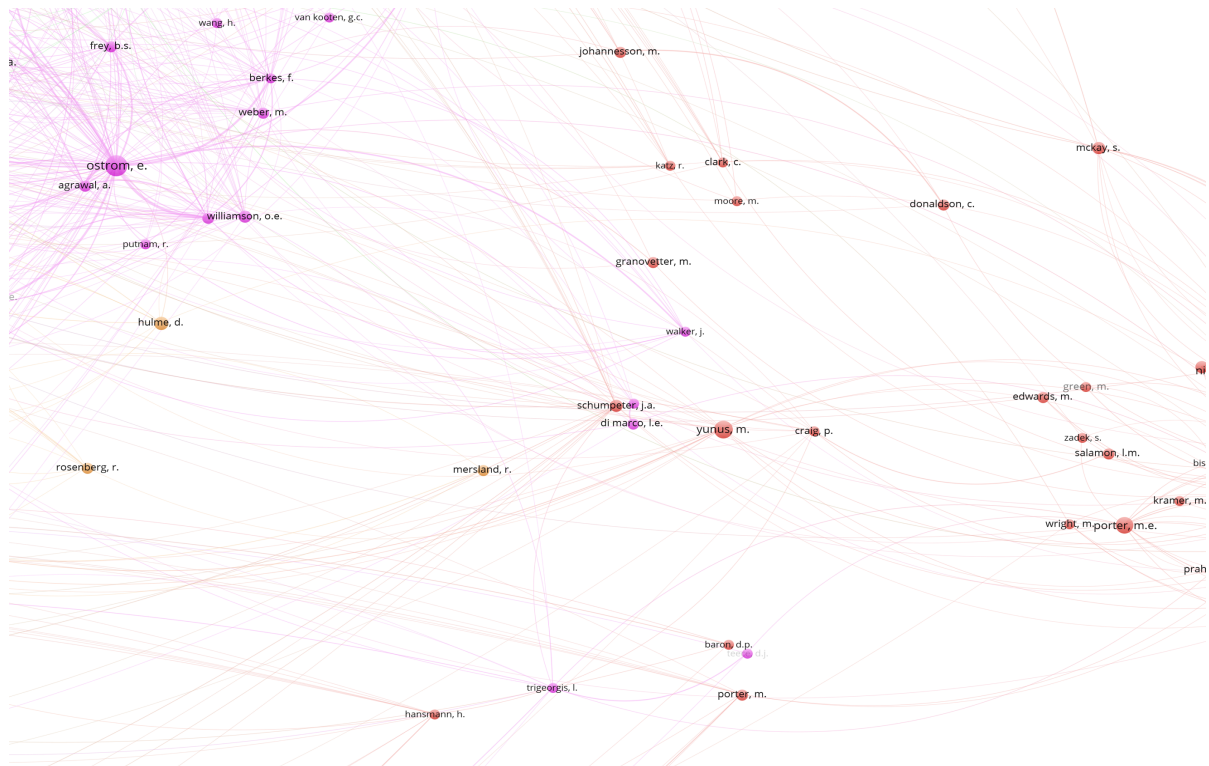
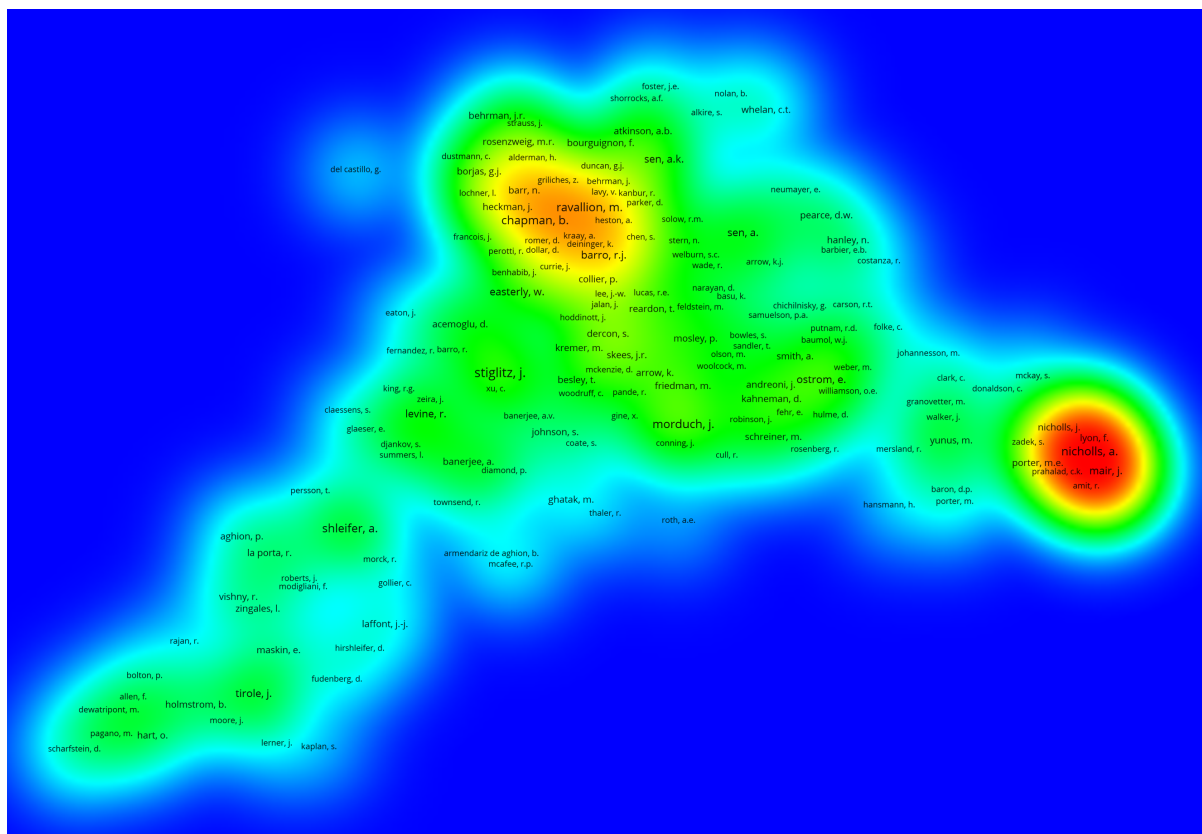
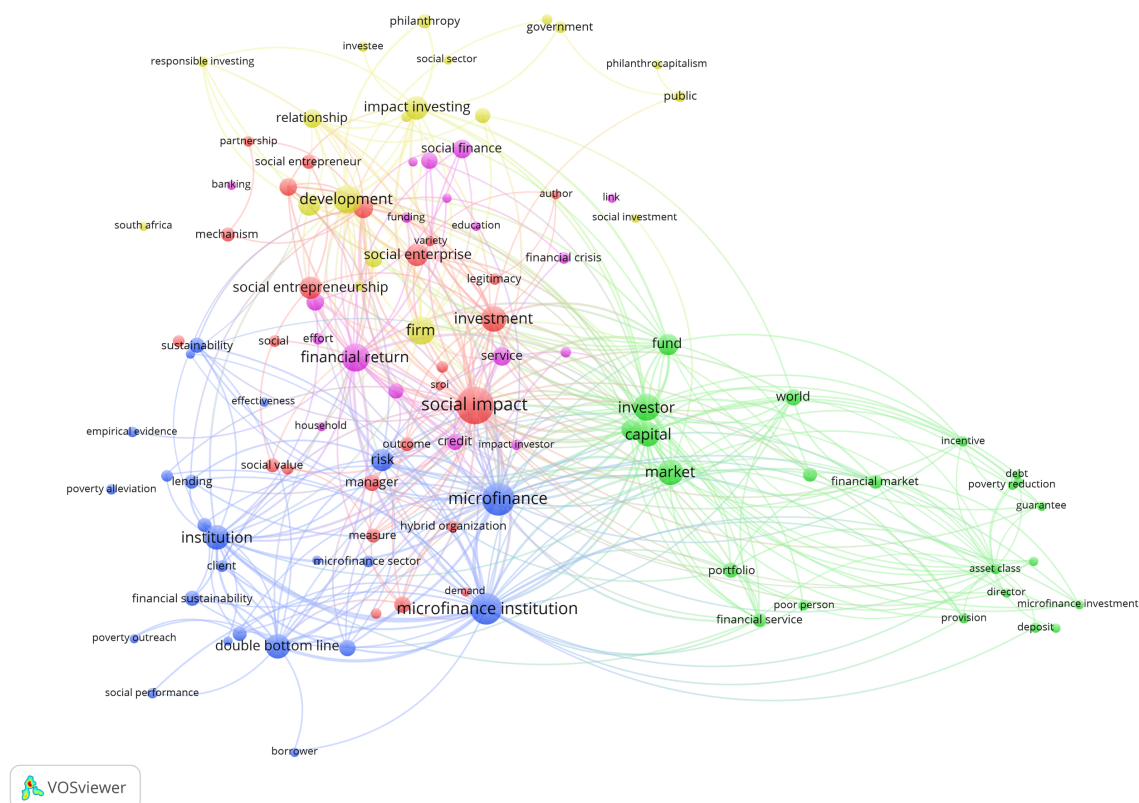


Figure 2.37: Author Co-Citation Density Map of Both Corpora



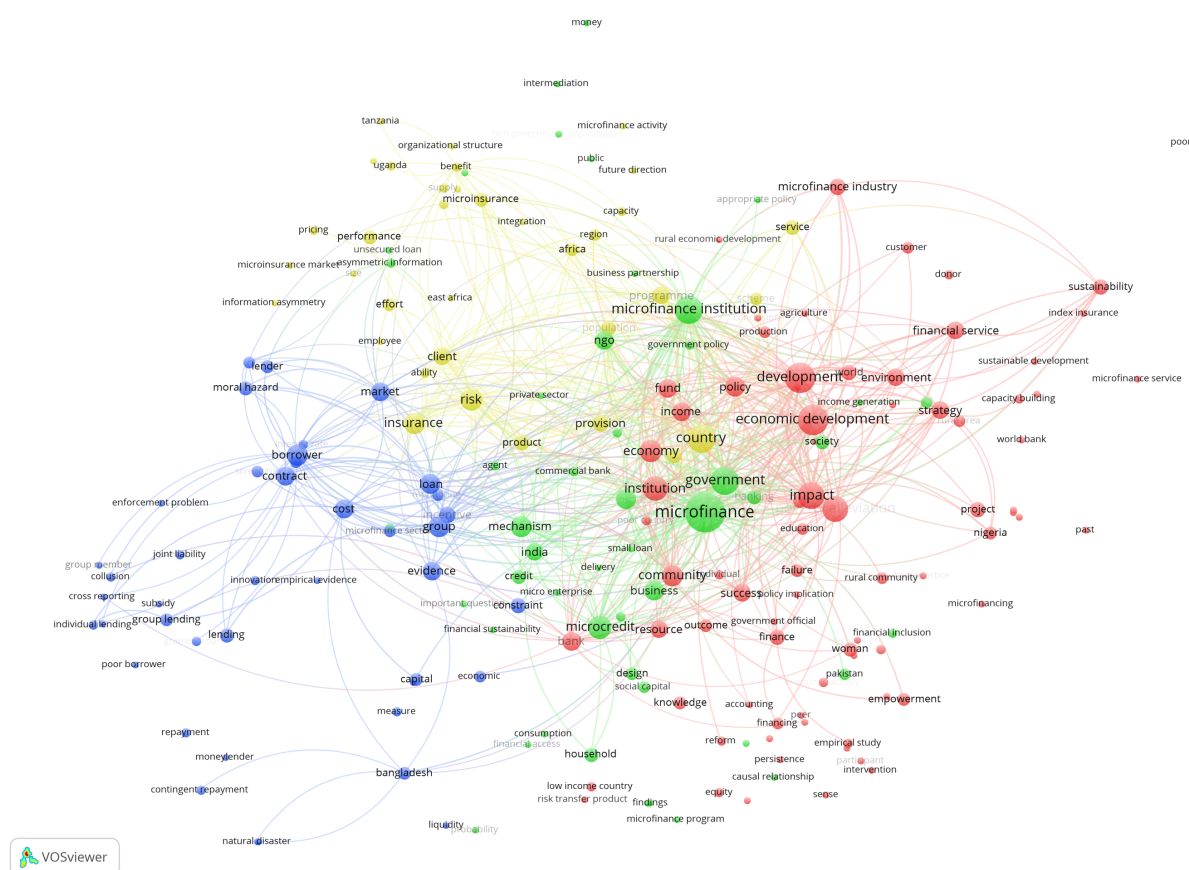
As is evident, while the co-citation mapping research suggests that 26 authors are situated between disciplines, none of these 26 authors bridge or integrate the disciplines from a conceptual perspective. The overlap that pertains to impact measurement is largely empirical and issue-specific rather than theoretical and issue-independent. Furthermore, the financing mechanisms of social impact bonds and contingent loans remain in research siloes, as shown by the high-density clusters in Figure 2.37.

Another way to see the differences between the two fields is to focus on how the fields approach a common topic. Based on the analysis in the previous section, one key area of intersection is microfinance. It is evident that the two fields approach this common financing mechanism in very different ways.



while the terms *private sector*, *investor* and *impact investors* are used infrequently. This suggests that the literature focuses on public policy and public investors, rather than private investors. Furthermore, terms such as *rural community*, *woman*, *borrower*, *empowerment*, *individual lending*, *group lending*, and *poor borrower* are scattered over the map. This suggests that the literature examines the impact of investments at an individual, rather than enterprise, level.

Figure 2.40: Term Co-Occurrence Network Map for Microfinance Subset of Development Economics Corpus

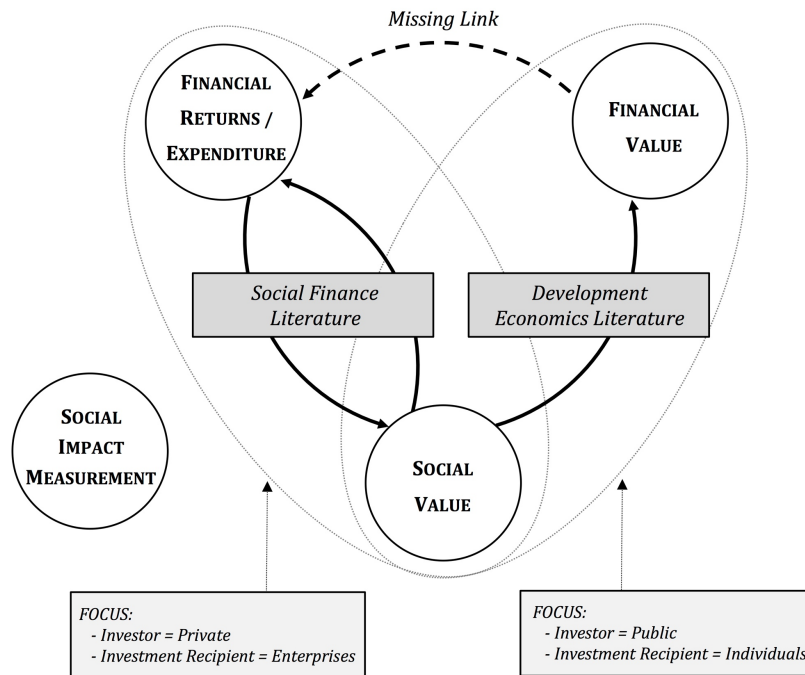


As such, the two fields approach this common financing mechanism in very different ways. The social finance literature predominantly studies microfinance at the enterprise level, with private investors, and with investor-specific financial impacts. In contrast, the development economics literature predominantly studies microfinance at the individual level, with public investors, and with aggregate financial impacts. The difference is stark.

2.10 Bringing It All Together

Taking a step back, and analysing the bibliometrics research in this chapter holistically, reveals a crucial gap in the literature. This gap is between *financial value*, which arises from social value creation, and *financial returns*, which accrue to investors. This is represented visually in Figure 2.41. This is the overarching and key finding of the research in this chapter.

Figure 2.41: Visual Representation of the Key Bibliometrics Research Finding



To fully understand this gap in the literature, and to see how the bibliometrics research reveals this gap, it is important to first understand some terminology nuances.

The two concepts *financial value* and *financial returns* are often conflated but are different. When a public or private investor makes an investment, financial value refers to the financial benefits that accrue to *all* stakeholders. This includes the financial benefits to the investor, the investment recipient, and other individuals or entities. In contrast, financial return refers only to the financial benefits that accrue to the investor. In other words, financial return is a weak subset of the financial value created, with the two equating when no stakeholder apart from the investor obtains a financial benefit. Another way to conceptualise this is that financial value less financial return represents the positive pecuniary externalities that arise from an investment.

Whereas financial value and financial return are different concepts that rarely equate, the same is not true of social value and social return, which do equate. The reason is that *return* refers to the value of whatever an investor is maximizing. To the extent that impact investors place weight on financial value, their objective is typically to maximize *their* financial value. To the extent that impact investors place weight on social value, their objective is typically to maximize *aggregate* social value. As such, the financial metric in investors' objective functions differs from aggregate financial value, while the social metric in investors' objective functions aligns with aggregate social value.

With this distinction in mind, our attention can turn to what we have discovered in this chapter about how the literature treats the relationship between financial returns, social value, and financial value. As is evident from the research in this chapter, it is inaccurate to claim that the

three notions of financial returns, social value and financial value are each viewed in isolation in the literature. While that is true in some cases, there are significant pools of literature that, either implicitly or explicitly, research the relationship between these concepts.

Social Finance: Relationship between Financial Returns/Expenditure and Social Value Creation

As discovered and explained in Sections 2.6, 2.8 and 2.9 (specifically, Figures 2.5, 2.22, 2.23 and 2.28), the social finance literature focuses almost exclusively on the relationship between social value creation and changes in financial value to *an* investor, rather than to *all* stakeholders.²⁴² These changes in financial value to *an* investor include both expenditure on investments, and the returns from investments. This is evident in Figure 2.7, where the literature in the blue and orange clusters focuses on the relationship between financial expenditure and social value creation, while the literature in the green cluster focuses on the relationship between social value creation and financial returns.

Financial Expenditure to Social Value Creation

There are two important points to note about how the social finance literature approaches the relationship between financial expenditure and social value creation.

First, in most cases the literature simply recognises the existence of social impact as an additional variable in investors' objective functions. Social value is rarely disaggregated into its components. For example, Dunn (2006) adds a third dimension of 'impact' to the conventional efficient frontier model to create a 'new efficient frontier' model.²⁴³ Brandstetter and Lehner (2015) follow a similar approach, integrating social risk and social return into the traditional portfolio optimisation model.²⁴⁴

Secondly, even when social value is disaggregated, the causal logic stops at social value. There is no explicit consideration of the financial value that may arise from social value creation. For example, Hatry (2006) develops a logic model, which conceptualises social value creation as being a product of five basic steps.²⁴⁵ It views *inputs* as being used to undertake *activities* that create quantifiable *outputs* that generate short-term social *outcomes* and long-term social *impacts* (El Ebrashi, 2013; Antadze & Westley, 2012; Nicholls, 2008).²⁴⁶ More generally, the absence of financial value from social finance research reflects the common implicit assumption in social finance that social and financial returns occur simultaneously.²⁴⁷

²⁴² This focus on financial returns over financial value is understandable given that the social finance literature focuses significantly more on private investors than public investors.

²⁴³ The efficient frontier model shows the maximum expected financial return for a given degree of financial risk. Dunn, B. (2006). *Modern Portfolio Theory-with a Twist: The New Efficient Frontier*. Aquillian Investments, Inc., August.

²⁴⁴ Brandstetter, L., & Lehner, O. M. (2015). Opening the market for impact investments: The need for adapted portfolio tools. *Entrepreneurship Research Journal*, 5(2), 87-107.

²⁴⁵ Hatry, H. P. (2006). *Performance measurement: Getting results*. The Urban Insitute.

²⁴⁶ El Ebrashi, R. (2013). Social entrepreneurship theory and sustainable social impact. *Social Responsibility Journal*, 9(2), 188-209. Antadze, N., & Westley, F. R. (2012). Impact metrics for social innovation: barriers or bridges to radical change?. *Journal of Social Entrepreneurship*, 3(2), 133-150. Nicholls, A. (Ed.). (2008). *Social entrepreneurship: New models of sustainable social change*. OUP Oxford.

²⁴⁷ This assumption, *ceteris paribus*, appears inconsistent with the common implicit assumption in development economics that financial value accrues subsequent to social value creation. However, as will be explained in Chapters

Social Value Creation to Financial Returns

When it comes to the reverse relationship, namely the relationship between social value creation and financial returns, it is worth noting that the social finance literature rarely involves in-depth causal analysis. Often the research simply shows a correlation between social and financial returns, with the results used to argue that firms can generate social value while still having above-average financial performance.²⁴⁸ This lack of causal analysis limits the usefulness of the research. One reason for this absence of causal findings is that the investment recipients in the social finance literature, and therefore the units of analysis, tend to be enterprises rather than individuals (as shown in Figures 2.5, 2.22, & 2.38). As mentioned in Chapter 1, it is more difficult to generalise a causal relationship at an enterprise level than an individual level given the myriad of different business models that might enable financial returns to be generated. Even if social value leads to a consistent quantity of financial value, the amount of that financial value captured as financial return need not be consistent. It is likely to be highly dependent on investor-specific factors such as (a) its capacity to appropriate the financial value it creates, and (b) its willingness to appropriate the value it creates, which is likely to be determined by where on the mission-driven to profit-driven spectrum the investor lies.

Development Economics: Relationship between Social Value Creation and Financial Value Creation

In contrast to the social finance literature that focuses on investments by *private* investors into *enterprises* and the creation of *financial returns*, the bibliometrics research in this chapter reveals that the development economics literature tends to focus on investments by *public* investors into *individuals* and the creation of *financial value*. This is shown in Figures 2.18, 2.20 and 2.40.

As is evident, in development economics, possible investments are often analysed from the perspective of a benevolent social planner, which means that all financial value is relevant and not only that which accrues to the entity making the investment. As shown by the orange cluster in Figure 2.26, there is a significant pool of literature that attempts to estimate the increase in lifetime income and taxation revenue from investments in education (Psacharopoulos & Patrinos, 2004; Schultz, 1988).²⁴⁹ More generally, the approach of cost-benefit analysis in economics considers the financial benefits to all stakeholders, not just those making the investment (Dasgupta, 1974; Boardman & Boardman, 2008; Mishan, & Quah, 2007).²⁵⁰

5 and 7, the two assumptions can be consistent. Due to securitization, it is possible to have simultaneous financial and social returns even when financial value accrues subsequent to social value creation.

²⁴⁸ For example, as mentioned in Chapter 1, research by the Canadian Social Investment Organization found that in 2012 the value of socially responsible investments grew by 16%, a significantly better performance than the S&P Toronto Stock Exchange Composite Index, which grew by 5.8% (Bragg & Smeh, 2013). See Bragg, I., & Smeh, D. T. (2013). Canadian Socially Responsible Investment Review 2012. Social Investment Organization.

²⁴⁹ Psacharopoulos, G., & Patrinos, H. A. (2004). Returns to investment in education: a further update. *Education economics*, 12(2), 111-134. Schultz, T. P. (1988). Education investments and returns. *Handbook of development economics*, 1, 543-630.

²⁵⁰ Dasgupta, A. K. (1974). Cost-benefit analysis. In *Economic Theory and the Developing Countries* (pp. 87-97). Macmillan Education UK. Boardman, A. E., & Boardman, A. E. (2008). *Cost-benefit analysis*. Pearson. Mishan, E. J., & Quah, E. (2007). *Cost-benefit analysis*. Routledge.

The bibliometrics research also shows that there is limited focus in development economics on how investments by *private* investors generate social value. An important reason for this is that a common and widely accepted assumption in economics is that private investors are profit-maximizing and do not care about social impact. In other words, economics typically takes a binary approach to investor motivations. Investors are either purely profit-driven, as in the case of firms, or purely altruistic, as in the case of governments. As discussed in Chapter 1, this binary approach is in discord with empirical evidence that an increasing proportion of investors are seeking a double bottom line (Wilburn & Wilburn, 2014),²⁵¹ and that governments do not make decisions with an infinite time horizon but are motivated by political and economic electoral constraints (Tufte, 1978; Nordhaus, 1975; MacRae, 1977; Neumayer, Plümper & Barthel, 2014; Finkelstein, 2009).²⁵² It is arguable that the rigorous adherence to this binary approach limits the scope and validity of some economics research. This is particularly the case for research where findings are dependent on the assumption of purely profit-maximizing firms or purely benevolent governments. This limitation offsets some of the advantages of the approach of development economics, including that the focus on individuals enables causal relationships to be more easily drawn, and the focus on financial value enables potential financial return to be researched, not just actual financial return.²⁵³

The Missing Link: Financial Value to Financial Return

As such, what this comprehensive and multi-faceted bibliometrics research reveals is that the social finance literature focuses on the two-way relationship between financial returns and social value creation, and the development economics literature focuses on the relationship between social value creation and financial value creation. It follows that a key gap in the literature is the relationship between financial value and financial returns, as shown in Figure 2.41. This is the missing link in the impact investing cycle.

Intuitively, it seems that a link between financial value and financial returns should exist. This is because the total financial value created would appear to be a constraint on the financial returns that can be generated. In the other direction, financial value may be influenced by financial returns because financial returns may increase capacity for reinvestment and therefore the generation of further financial value via social value creation.

²⁵¹ Wilburn, K., & Wilburn, R. (2014). The double bottom line: Profit and social benefit. *Business Horizons*, 57(1), 11-20.

²⁵² For example, Tufte (1978) finds that transfer payments to individuals are typically greater during election years, while Nordhaus (1975) and MacRae (1977) find macroeconomic variables such as unemployment and inflation are partly determined by electoral cycles. Neumayer et al. (2014) find that governments tend to prioritise policies that increase short-term political support and underinvest in investments, such as disaster prevention and mitigation, that have longer term and more uncertain returns. Furthermore, research by Finkelstein (2009) finds that the electronic road tolls are less likely to be raised in election years, and are raised at a faster rate when those tolls are electronic and consumers are less aware of the toll amount. Tufte, E. R. (1978). *Political Control of the Economy*. Princeton, NJ: Princeton University Press. Nordhaus, W. D. (1975). The political business cycle. *The review of economic studies*, 42(2), 169-190. MacRae, C. D. (1977). A political model of the business cycle. *Journal of political economy*, 85(2), 239-263. Neumayer, E., Plümper, T., & Barthel, F. (2014). The political economy of natural disaster damage. *Global Environmental Change*, 24, 8-19. Finkelstein, A. (2009). E-ztax: Tax salience and tax rates. *The Quarterly Journal of Economics*, 124(3), 969-1010.

²⁵³ An important implication of this insight regarding the relationship between social value and financial value, as will be discussed in Chapter 3, is that the positive pecuniary externalities that arise from impact investments are appropriately classified as social impacts. This insight acts as a bridge between the public economics literature on externalities and the social finance literature on social impact.

The existence of a key gap in the literature on impact investing may help to explain why the existing literature has, to date, failed to adequately explain the relationship between impact investing mechanism design and social value creation. Given this, it is pertinent to discover what fills the gap in the literature, and to research the role that this gap plays in explaining the strengths and shortcomings of different impact investing mechanism designs. This is the focus of Chapter 3.

In the process of constructing theory in Chapter 3, other shortcomings of the existing literature that the bibliometrics research highlights are addressed. Social value is disaggregated into its components. Casual links between social value and financial value are established. The siloed topics of mechanism design and social impact measurement are integrated. Most importantly, the distinct fields of social finance and development economics are brought together in a theoretically consistent manner so that the various impact investing mechanism designs can be researched conceptually and comparatively.

III.

Identification of the Two Main Ways That Mechanism Design Affects Social Value Creation

3.1 Approach

The primary objective of this chapter is to identify the main ways that mechanism design affects social value creation. This is done by researching the five existing contingent-repayment impact investing mechanisms in-depth. As identified in the introductory chapter, these mechanisms are (i) contingent loans, (ii) debt financing with separate insurance, (iii) social impact bonds, (iv) direct government provision with subsequent taxation revenue, and (v) taxation deductibility for socially-beneficial investments.

Methodologically, these mechanisms are researched by building formal theoretical microeconomic models of each mechanism, and then deriving, proving and analysing the precise properties of each mechanism design. Due to length and flow considerations, these microeconomic models and the accompanying mathematical proofs are contained in the three appendices. However, the key findings from these models are presented and discussed in this chapter. These findings provide insights into what mechanism design features contribute to and undermine the creation of social value. In the process, the models provide compelling explanations for the low adoption rates of some mechanism designs.

The primary finding of this research is that there are two main ways that mechanism design affects social value creation: value creation and value capture. First, mechanism design affects the social value that is created for a given quantity of aggregate investment. This is a function of three variables: the inherent quality of the investment that is selected, the quantity of investment per recipient, and how much effort is exerted in the provision of the investment. This can be viewed as the direct impact of mechanism design on social value creation. Secondly, mechanism design affects the extent to which the financial value that arises from social value creation is captured by the investor as financial return. This can be viewed as the indirect impact of mechanism design on social value creation, given that financial returns in turn affect the aggregate level of investment that is made. This value capture is a function of three variables: the attribution of value, the means of appropriation, and the quantity that is appropriated.

These findings, which are consistent with Santos (2012),²⁵⁴ reveal that the gap in the literature identified in Chapter 2 has a crucial role to play in explaining the shortcomings of contingent-repayment investment mechanisms. This motivates the development of theory to fill the gap in the impact investing literature and to provide an analytical framework for further research in Chapters 4-7.

Given this, the chapter proceeds to develop a Unified Fundamental Model of impact investing in individuals. This conceptual framework ties together in a consistent, cyclical, precise and fundamental manner various currently disparate strands of literature by extending and reinterpreting existing frameworks. The model conceptualizes the relationship between financial value and financial returns in the way suggested by the microeconomic models – as being determined by value attribution and value appropriation, which are themselves related via the measurement of social impact – an important insight. Further theoretical contributions of this model include recognizing and integrating the sequencing of social value creation and financial

²⁵⁴ Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

value creation, identifying the three main types of financial value that arise from impact investments in individuals, separating in the analysis the oft-merged investor functions of investment financing and the enforcement of investee payments, and identifying six possible value appropriation pathways.

The research in this chapter also points to three intermediary ways that mechanism design affects social value creation. Social value creation is affected via social impact measurement, via the alignment of social and financial returns, and via constraint adherence. These intermediary pathways are researched in-depth in Chapters 4-6.

3.2 Contingent Loans

The first appendix (Appendix A) is focused on two mechanisms: contingent loans, and standard debt financing with insurance. These mechanisms are closely related to one another and both aim to transfer risk from low-income individuals receiving investment to investors who have a greater risk tolerance. The model developed in Appendix A recognises that both exogenous and endogenous factors affect the probability of investment success. In the model, the choice of high effort by an individual increases the likelihood of investment success but carries with it either a pecuniary or non-pecuniary cost.

In the case of contingent loans, it is shown mathematically that the mechanism is not offered or adopted in equilibrium for a wide range of parameter values. This is due to the nuanced role that effort plays in affecting the incentive compatibility constraints and individual rationality constraints of individuals who are offered investment. This is the case both when the cost of effort is pecuniary and when high effort carries a non-pecuniary cost.

The model considers a situation where two types of investment contracts may be offered by investors and accepted by individuals – contingent loans with conditional repayments, and standard loans with fixed repayments. It is shown that an individual's expected utility from taking out a contingent contract and choosing high effort is weakly greater than the expected utility from taking out a standard-debt contract.²⁵⁵ In other words, individual rationality constraints indicate that, *inter alia*, an individual would choose a contingent contract over a standard contract (Proposition A.4).

However, it is also shown that high effort is harder to incentivise with a contingent contract than with a standard contract. It is proved that any parameter values that would result in high effort in a contingent contract would also result in high effort in a standard contract. Furthermore, there are cases where individuals would choose high effort in a standard contract but low effort with a contingent contract (Propositions A.1 - A.3). This finding is counterintuitive. The reason is that there are instances where an individual may exert high effort but that does not translate to improvements in their financial position. That is, the exertion of high effort increases *expected* incomes but there is income uncertainty. In some cases, high effort does not lead to higher incomes for reasons outside of the control of the investee. In such instances, the individual bears

²⁵⁵ In the model, this is expressed mathematically as $\varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \geq \varphi u(w + A - D - e_p)$.

the full cost of their high effort in the case of a contingent loan, but not the full cost with a standard loan. This is because, in these cases, *ex post* income levels with contingent loans are greater than *ex post* income levels with standard loans.²⁵⁶

As such, contingent loans only satisfy both of the constraints (the incentive compatibility and individual rationality constraint) for a narrow range of parameter values (Proposition A.5). This means that the mechanism only exists in equilibrium for a small range of parameter values. This is shown visually in Figure A.4, where the dotted region represents where contingent loans are adopted in equilibrium.

A similar result is found when the cost of high effort is non-pecuniary. It is proved that contingent loans are not adopted in equilibrium where a separate insurance market exists (Proposition A.7).²⁵⁷ This is because when consumers can purchase insurance in addition to a contingent contract, it is not possible for both the incentive compatibility constraint and the investor's break-even constraint to be simultaneously satisfied. Counterintuitively, it is the presence of insurance providers that means contingent contracts are not viable. If individuals were offered a contingent contract that provided less than full insurance, they would seek to maximize their expected utility by purchasing additional insurance. By purchasing this additional insurance individuals would increase their expected income in the bad state (that is, when income from the investment is low) and decrease it in the good state (that is, when income from the investment is high). However, as their *ex post* income in the good state (that is, when income from the investment is high) would now be lower, there is less incentive for them to exert effort to increase the probability that an investment is successful. As a result, the incentive compatibility constraint does not hold and so the investor would not break-even.²⁵⁸

As such, effort-related dynamics mean that investors are often unable to appropriate sufficient value from contingent loans to make those investments viable. This is the case both when the cost of high effort is pecuniary and when the cost of high effort is non-pecuniary. This finding helps to explain the rarity of contingent loans.

3.3 Separate Simultaneous Credit and Insurance

The second mechanism that Appendix A researches is separate but simultaneous standard debt financing and insurance. In this case, the equilibria that arises from the interaction between credit and insurance markets is characterised.

It is proved that the mechanism of debt financing with insurance leads to three different regions of equilibrium outcomes (Proposition A.6). These regions are shown in Figure A.5. At low levels of wealth,²⁵⁹ there is no insurance purchase in equilibrium even if that insurance is priced in an

²⁵⁶ For an individual with a low initial wealth (defined as where the size of the loan exceeds the initial individual wealth), if high effort is exerted but a higher income does not result, their *ex post* income is already negative, even before accounting for the pecuniary cost of high effort.

²⁵⁷ The exception to this, as discussed in Appendix A, where an individual's incentive compatibility constraint is satisfied for the full insurance contract.

²⁵⁸ The same logic does not apply in the case of standard debt financing, because with standard debt contracts a fixed amount needs to be repaid at all times. As such, when *ex post* incomes are low, insurance payouts are first used to repay the original loan. This reduces the value of insurance to the individual.

²⁵⁹ In the model, the region of low wealth is where $w < w(r)$.

actuarially fair way. For moderate levels of wealth,²⁶⁰ multiple equilibria exist. Either the investor sets a high interest rate on the standard loan and no insurance is purchased by the individual, or a low interest rate is set and insurance is purchased. At high levels of wealth,²⁶¹ full insurance is purchased in equilibrium.

This result is counterintuitive because one would, *prima facie*, expect risk-averse individuals at low wealth levels to purchase actuarially fair insurance. However, this model shows it is rational for individuals at low wealth levels to *not* purchase insurance. Insurance take-up rates are low, not because the aggregate benefits of insurance are less than the aggregate costs, but because a significant portion of the benefits do not go to the individual who purchases insurance. Instead, they go to the credit provider. This is because insurance payouts increase the capacity of the low-income individuals to repay loans. There is already implicit insurance provided by a standard debt contract where the size of the loan exceeds an individual's initial wealth. As such, when insurance is purchased, the benefits are divided between the individual and credit provider, but the cost is fully borne by the individual. In such a case, it may be rational for individuals to not purchase insurance, despite their aversion to risk.

Overall, the modelling of the two mechanisms of contingent loans and debt financing with insurance in Appendix A explains the puzzle of why these mechanisms are rare in practice. The low prevalence is explained as being a result of the role of effort and the failure of externalities to be internalised into the decision-making calculus of stakeholders. In this way, the model highlights that the failure of impact investing mechanisms to internalise positive externalities leads to lower social value creation.

3.4 Direct Government Provision with Taxation

This brings us to the second appendix, Appendix B, which focuses on contingent-repayment mechanisms that increase productivity via human capital accumulation. Two of the contingent-repayment mechanisms that are studied in this appendix are direct government investment with payment in the form of additional taxation revenue and social impact bonds.²⁶²

The microeconomic model developed is a one-period model that focuses on the problems with achieving first-best levels of social outputs in equilibrium. To begin with, the first-best levels of quantity, effort and taxation are established.²⁶³ Intuitively, this first-best investment quantity equates the marginal utility gain from higher income (due to higher q) with the marginal utility loss from additional taxation (required to pay for the additional q).

Appendix B then focuses on the mechanism of direct government investment with taxation. It is proved that this mechanism design does not lead to a sustainable first-best equilibrium. Not only that, but a much stronger result is proved. It is shown that *no* mechanism design without a form

²⁶⁰ In the model, the region of moderate wealth is where $w(r) \leq w \leq w(i^*)$.

²⁶¹ In the model, the region of high wealth is where $w > w(i^*)$.

²⁶² Note that this model (Appendix B) is also used to research an implied modified mechanism design in the extension chapter (Chapter 7).

²⁶³ It is shown in Section B.3 that the first-best occurs where all workers exert high effort ($\rho = 1$), where the investment quantity to a representative agent is $q^* = (\frac{a\theta}{c})^{\frac{1}{1-\theta}}$, and the corresponding disposable income is $y^{D^*} = aq^{*\theta} - cq^*$.

of public-private partnership (that is, with only involvement by *either* a public impact investor *or* a private impact investor) can sustain a first-best equilibrium.

To get to this result, it is first shown that without public-private partnerships, there are only two ways that the first-best can be achieved. The first is if the government fully provides the investment ($\eta = 1$),²⁶⁴ and sets a tax rate to cover the cost of the investment that is equal to the concavity of the income function ($\tau^* = \theta$). This result, Proposition B.2, is an elegant result analogous to the golden rule savings rate (Phelps, 1965; Phelps, 1967).²⁶⁵ The second first-best equilibrium is where the government does not make any investment ($\eta = 0$), sets a tax rate of zero ($\tau^* = \theta$), and individuals directly pay private firms to provide them with the optimal quantity of investment ($q_i = q^*$). This is Proposition B.3.

It is also shown that where the government invests in a portion of the population, $\eta \in (0,1)$, there is no first-best equilibrium (Proposition B.4). Intuitively, the first-best cannot be achieved when $\eta \in (0,1)$ due to the existence of a taxation externality. Part of the benefit that results from non-government investments still goes to the government in the form of greater taxation revenue. This taxation externality is not internalised or appropriated by the individual or investor that created it, because the government - as a benevolent social planner - uses this additional revenue to maximize aggregate social welfare. In this case, that means using the taxation revenue to make investments in individuals with the lowest levels of prior investment, as this maximizes aggregate welfare because the marginal utility from investments is greater at lower incomes. Put simply, the taxation externality leads to underinvestment.²⁶⁶

It is then proven that neither of the first-best equilibria are sustainable in equilibrium. The government-financed first-best breaks down for a large range of parameter values (Proposition B.8). This is illustrated in Figure B.1, which shows that performance-based contracts only incentivize high effort when a sufficiently small number of workers contribute to the same outcome. Beyond a threshold level, workers exert low effort in equilibrium. This may help to explain the lack of performance-based contracts in the public sector. Meantime, the individual-financed first-best is not subgame perfect (Proposition B.5). The reason for this, counterintuitively, is that the government is benevolent. The government's commitment to keep taxes at zero is not credible if the government's aim is to maximize the aggregate social welfare of citizens. Knowing this, individuals would deviate from the first-best equilibrium and not pay for private investments in themselves. This would cause the government to raise taxes on the population to fund investments in the deviating individuals. Deviating individuals have a higher utility than non-deviating ones, so all individuals end up deviating. Counterintuitively, it is the benevolent nature of the government that means that this first-best is not subgame perfect.

²⁶⁴ In Appendix B, η represents the proportion of the population receiving investment from the government.

²⁶⁵ In economics, the golden rate of savings is the proportion of income that, if set aside as savings, would maximizes the steady state growth in per capita consumption. See Phelps, E. S. (1965). Second essay on the golden rule of accumulation. The American Economic Review, 55(4), 793-814 and Phelps, E. S. (1967). Golden rules of economic growth: studies of efficient and optimal investment. Golden rules of economic growth: studies of efficient and optimal investment.

²⁶⁶ More formally, the equilibrium condition is given by $\eta \frac{\partial u^G}{\partial \tau} = -(1 - \eta) \frac{\partial u^P}{\partial \tau}$. This says that the government maximizes social welfare by equating the population-weighted marginal welfare gain to u^G (that is, the utility of those receiving government investment) from increasing the taxation rate τ with the population-weighted marginal welfare loss to u^P (that is, the utility of those receiving private investment). This result is proven in Section B.4.

As such, no mechanism design without a partnership between public and private investors is a sustainable first-best, including the case of direct government investment with returns in the form of ensuing taxation revenue. The primary reason for this is the existence of a taxation externality that occurs even when investments are rivalrous and excludable.

3.5 Social Impact Bonds

Given this finding that a mechanism design involving collaboration between public and private investors is necessary for a sustainable first-best equilibrium, the model is then used to research whether social impact bonds, a recent type of public-private sector partnership, can sustain the first-best in equilibrium.

It is shown that the first-best cannot be obtained with this mechanism design (Proposition B.11).²⁶⁷ This is because the profit-maximizing effort level in equilibrium is sub-optimal. As reaching a threshold level of social outcomes is necessary to trigger the payment from the government, an investor's profit-maximizing strategy is to incur the cost of high effort up to that threshold level, but not beyond. Any additional high effort, which would cause investment recipient incomes to rise above the threshold level, reduces profit as it increases investor costs without changing revenue. To the extent that the investor contracts with workers to implement an investment, an investor is incentivised to enforce high effort on a subset of workers, but counterintuitively to enforce low effort on the remaining workers. As such, with SIBs, the inherent potential of impact investments is not fully realised. Social value creation is not maximized because investors cannot capture the full benefits that they create.

It is further shown that two other existing public-private partnership mechanisms do not achieve the first-best in equilibrium either. These are output-based contracts (Proposition B.10) and outcome-based high effort contracts (Proposition B.12).

3.6 Taxation Deductibility

The final contingent-repayment impact investing mechanism design is taxation deductibility. This occurs when private investors make investments and receive a financial return from the government based on financial expenditure (that is, inputs into the creation of social value) rather than outputs or outcomes. This return takes the form of reduced taxation obligations.

A model of tax deductibility is developed in the third appendix (Appendix C), which is consistent with the model in Appendix B. This modelling results in several important findings.

It is proven that the investment quantity in equilibrium is not necessarily first-best (Proposition C.1). Intuitively, there is no aspect of the payment function to investors that enables the government to ensure the optimal investment quantity is obtained. The payment function to investors is linear with respect to investment cost,²⁶⁸ while incomes are a concave function of

²⁶⁷ Formally, this proposition is that "A contract of the form (q^P, P_1) , where $P_1 = J$ if $y \geq \mu$ and $P_1 = 0$ if $y < \mu$, cannot achieve the first-best outcome."

²⁶⁸ The payment function to investors is linear at all times on the assumptions that the taxation rate is fixed and some taxation is still owed, as in the model in Appendix C. If these assumptions were relaxed, the payment function would

investment expenditure. This means that there can be both overinvestment and underinvestment in equilibrium. As shown in Appendix C, there exists a range of parameter values for which the expected change in the government's financial position is negative. This corresponds to overinvestment, because the government is required to keep paying investors even when the marginal increase in social value at high levels of investment quantity is negligible.²⁶⁹ There is also a range of parameter values for which underinvestment occurs. In this case, the level of social value creation is suboptimal as a marginal increase in investment quantity would increase social value more than the cost incurred. This is shown visually in Figure C.1.

It is also shown that with taxation deductibility, there is suboptimal investment selection (Section C.4) and investment effort (Section C.5). When it comes to selection, there is no incentive for an investor to incur search cost to discover which investment is the most effective at creating social value. A profit-maximizing investor is always strictly better off randomly selecting which investment to undertake than discovering the most inherently effective investment. This suggests that, with the mechanism of taxation deductibility, the selection of investments to undertaken with negligible due diligence. Furthermore, once an investment has been selected, there is no incentive for an investor to exert high effort in ensuring the investment creates social value because they either have already been paid in the form of a tax deduction or know they will be paid regardless of the social value created.

3.7 First Main Link: Value Creation

Viewed collectively and analysed critically, the theoretical modelling of the five contingent-repayment investment mechanisms points to two main relationships between mechanism design and social value creation.

The first of these is that the design of an impact investing mechanism determines how much social value is created for a *given* investment expenditure. In other words, if a set amount of capital is going to be invested to achieve a social outcome, the degree of social value subsequently created is heavily dependent on the mechanism design.

The theoretically modelling also reveals that while social value often conceived as one metavariabe, is better conceived as a being a function of three social impact components or drivers. These are (a) the inherent potential effectiveness of the investment selected, (b) the quantity of investment undertaken, and (c) the extent to which potential effectiveness is achieved. When positive social value is created, it can unusually be attributed to a combination of these three factors – investment selection, investment quantity and investment effort. Conversely, when impact investments have significant shortcomings, the reasons also predominantly fall into these same three categories. As seen in the theoretical modelling findings, where impact investments occur yet that does not translate into intended social outcomes, it can be attributed to the mechanism design resulting in suboptimal investment selection, suboptimal investment quantity, and/or suboptimal investment effort.

still be linear within an income range when the taxation rate is stepwise, provided that a taxation threshold has not been passed and taxation obligations remain.

²⁶⁹ As discovered and discussed in Chapter 7, this violates the government's political constraint.

Let us now go through each of these three components of social value creation in more detail.

Selection

The first factor that determines the degree of social value created, as found in the theoretical modelling, is the inherent effectiveness of the investment undertaken. This is determined by both which investor makes the investment and which type of investment is made. Conceptually, we can view each investor-investment combination as having an inherent effectiveness, or underlying quality. Mathematically, we can denote the effectiveness of investor A at providing investment j as $a_{j,A} \geq 0$. Because there is often a range of possible investors and a myriad of possible ways to achieve the same social outcome, such as improved literacy, there is often significant variation in the inherent effectiveness of investments. As such, having the investments that are undertaken be those ones with the highest levels of inherent effectiveness is important for creating the most social value.

How, then, does mechanism design relate to inherent effectiveness? Put simply, the design of a mechanism determines how easy or difficult it is to select the investor-investment combination with the highest effectiveness level a from the set of all investor-investment inherent effectiveness levels. Some mechanism designs may enable full revelation of inherent investment quality in advance, thereby enabling optimal selection. Other mechanism designs reveal *some* information about inherent quality in advance. For example, an investor that is confident their investment will achieve the threshold social outcome level in a SIB contract is more likely to enter into that contract than an investor that knows their investment will definitely fail to reach that threshold level. Then there are other mechanism designs, such as taxation deductibility, that provide no assistance in determining which investment is the most effective in advance.

Being able to know and select the investor-investment combination with the greatest inherent effectiveness is difficult. Information regarding expected effectiveness is often private information, which not all stakeholders are privy to. There may also be an incentive for investors, or those carrying out investments, to misreport inherent quality if they believe it will increase the likelihood of being allocated capital or contracts. For example, if a government is deciding which private investor to allocate a SIB contract to, or a private investor is deciding which education training provider to select to carry out education investments in individuals, there may be an incentive for misrepresenting expected effectiveness if it increases the probability of selection. Due to this, governments are often forced to “pick the winners” and accept suboptimal selection (Chang, 1994; Cantner & Kösters, 2012).²⁷⁰ As such, information asymmetry makes it difficult for the entity doing the selection to know *ex ante* which investment has the greatest expected effectiveness for a given type social outcome.

Quantity

The second determinant of social value creation that the research reveals is the quantity of investment provided. It is clear from the theoretical modelling that the equilibrium levels of

²⁷⁰ Chang, H. J., & Amsden, A. H. (1994). The political economy of industrial policy (p. 112). London: Macmillan. Cantner, U., & Kösters, S. (2012). Picking the winner? Empirical evidence on the targeting of R&D subsidies to start-ups. *Small Business Economics*, 39(4), 921-936.

investments in individuals are often suboptimal, even if the nature of the investments are themselves effective. For example, even if the most effective possible approach to improving literacy is undertaken by the most effective investor, the quantity of that literacy training matters too.

In most cases, mechanism designs incentivise underinvestment due to the fact that investors are only able to capture part of the benefit of their investments but incur the full cost. To fully understand this, it is helpful to distinguish between investors' not capturing the full benefit of their investment at a point in time, and investors not capturing the full benefit of their investment for all time periods.

Some mechanism designs suffer from the former situation.²⁷¹ If costs are a linear function of investment quantity but returns to investments are a concave function of investment quantity, it mathematically follows that if investor returns are a fixed subset (that is, less than 100%) of the total value they create, their profit-maximizing investment quantity is less than what is optimal.

Other mechanism designs lead to underinvestment due to the latter reason.²⁷² Where the social value from investments accrue well into the future, such as in the case of education and preventative healthcare, but investor returns are only based on short-term value creation, a form of intertemporal externality exists that results in underinvestment (Dranove, 1998).²⁷³ Investors are only incentivised to take into account the short-term value created from their investments, rather than the long-term benefits. As such, mechanism design affects the quantity of investment by determining whether long-term value creation is incorporated into investors' short-term decision-making calculus.

While rare, there are also mechanism designs that may lead to overinvestment. One such mechanism is taxation deductibility, as previously explained in Section 3.6 and as proved in Appendix C.

Effort

The third and final determinant of social value creation revealed via the theoretical modelling is the level of effort exerted in the provision of the investment. This determines whether a given investment, with an inherent quality, achieves its full potential. This effort component differs from selection in that effort refers to realised effectiveness, whereas selection refers to potential (or inherent) effectiveness.

Through the theoretical modelling, it becomes evident that several mechanism designs are unable to achieve a first-best equilibrium level of social value creation because the designs do not adequately incentivize the exertion of high effort. In the case of SIBs, there is only a financial incentive to exert high effort up to the point where the threshold social outcome level is reached, but not beyond. In the case of government provision with subsequent taxation, government

²⁷¹ This includes mechanisms involving a taxation externality. See Appendix B, Section B.4, for an in-depth discussion on taxation externalities.

²⁷² See Appendix B, Section B.7, for a discussion of human capital investments in a multi-period setting.

²⁷³ Dranove, D. (1998). Is there underinvestment in R & D about prevention?. *Journal of Health Economics*, 17(1), 117-127.

workers are not incentivized to exert high effort even with performance pay where there are a sizeable number of workers involved in carrying out an investment. In the case of simultaneous but separate credit and insurance, there is limited incentive for individuals to exert high effort at low income levels. This is because any resultant increase in incomes is partly captured by the credit provider as loan repayments that would not have otherwise been fully made. With contingent loans, there is also suboptimal incentive for high effort exertion by investment recipients because a portion of the increase in incomes is taken by creditors in the form of higher contingent loan repayments. In all these cases, the cost of high effort is born by one stakeholder, but the benefits are dispersed between multiple stakeholders, which disincentivises the exertion of high effort. As such, the design of impact investing mechanisms affects whether high effort is incentivised or discouraged. It is important that impact investing mechanisms incentivize high-effort by investors and - to the extent that they directly hire workers, subcontract to service providers, or require effort on the part of investees - incentivize high effort by other stakeholders.

The important role of effort in the creation of social value is also highlighted in the literature. For example, in the case of literacy, even if the method of improving literacy and the quantity of literacy training are both optimal, it matters how much effort is exerted in making that literacy investment and carrying out the literacy training. Without high levels of effort being exerted, the full potential of educational investments is not realised (Woods & Montagno, 1997).²⁷⁴ This point is also made in Sawada (1999), which finds that educational attainment in schools in El Salvador's EDUCO Program is heavily determined by the effort levels exerted by invested stakeholders.²⁷⁵

Overall

Therefore, the first main way that mechanism design affects social value is by determining the degree of social value created for a given level of investment. While this may seem obvious, it is important to understand the components of social value creation that the research points to and understand the nuanced role mechanism design plays in affecting each component.

As has been explained in detail, the overall effectiveness of investments in generating social outcomes in individuals can be viewed as a composition of three variables, or a function of three determinants. These are the inherent potential effectiveness of the investment selected, the quantity of investment provided, and the extent to which potential effectiveness is achieved based on the effort level exerted. Where there is ineffective social value creation for a given investment expenditure, it is likely because the mechanism design leads to suboptimal investment selection, suboptimal investment quantity, and/or suboptimal investment effort.

This conceptualisation of the components of social value closely relates to the logic model of Hatry (2006).²⁷⁶ Hatry's 'activities' correspond to selection, while 'outputs' corresponds to quantity and effort. As such, we can view quantity and effort as the social outputs in the process. These outputs, together with selection, determine value creation.

²⁷⁴ Woods, R. C., & Montagno, R. V. (1997). Determining the negative effect of teacher attendance on student achievement. *Education*, 118(2), 307-317.

²⁷⁵ Sawada, Y. (1999). Community participation, teacher effort, and educational outcome: the case of El Salvador's EDUCO program.

²⁷⁶ Hatry, H. P. (2006). Performance measurement: Getting results. The Urban Institute.

3.8 Second Main Link: Value Capture

The theoretical modelling research reveals a second main relationship between mechanism design and social value creation.

Throughout the modelling, there is a clear recurring theme. Often impact investments create greater aggregate financial value than they cost in present discounted terms, however the realisable financial value to impact investors is less than the realised costs. This is because investment costs are typically borne entirely by impact investors, while investments benefits are dispersed over time and between multiple stakeholders. When this is the case, it is often rational for impact investors to not undertake the investments in the first place, even if those investments generate aggregate benefits that exceed aggregate costs.

This is ultimately a problem of positive pecuniary externalities. It is difficult for the financial value that arises from impact investments to be captured by impact investors because the value can be appropriated by entities other than the value creator. Private impact investors may cause individual incomes to rise via their investments, but part of that value created is normally captured by governments in the form of higher taxation revenue.²⁷⁷ This reduces the financial value able to be captured by other stakeholders - the private investors and the investment recipients. In the model of separate simultaneous credit and insurance, insurance investments are not undertaken in equilibrium for a large range of wealth levels because part of the value of the investment is captured by a different entity, the credit provider, since insurance payouts increase loan repayment capacity. In the model of government provision and taxation, neither first-best equilibrium is sustainable due to positive externalities. The equilibrium of full government investment and taxation cannot be maintained because high effort by the workers carrying out the investments is not possible for a large range of parameter values. This is because each worker bears the full cost of their high effort, but the benefits are dispersed between all workers. The other equilibrium involving individual self-financing is not subgame perfect because any deviation by individuals leads benevolent welfare-maximizing governments to raise taxes, which means other non-deviating individuals no longer capture the full benefits of their investments and are therefore incentivised to deviate from the original equilibrium as well. In all these cases, the mechanism designs fail – at least for a range of parameter values – to enable investors to capture enough of the value they create to offset the investment costs, which makes the investments themselves non-viable.

It follows that the second main link in the relationship between mechanism design and social value creation is that mechanism design affects the extent to which, and way in which, the positive pecuniary externalities that arise from impact investments can be internalised. In other words, mechanism design affects value capture. Whereas value created (the first main relationship) is for a given level of investment expenditure, the value captured by investors (the second main relationship) determines how much investment expenditure is actually undertaken. This is because value captured affects both the initial incentive for investment and the capacity for reinvestment in subsequent time periods. As such, mechanism design affects social value creation by influencing both the *incentives* for investment and *capacity* for investment, as these two factors

²⁷⁷ For a discussion on this, see Appendix B, Section B.4.

are dependent on whether the financial value that arises from impact investments can be captured by impact investors.

Not only does the research point to value capture as the second main relationship link, it also provides guidance as to how to appropriately break down value capture into its constituent components – something the incumbent literature provides little guidance on.

The findings suggest that it is appropriate to conceptualise the value captured from impact investing in individuals as being dependent on two factors. First, it is important to know the amount of financial value that has been created. The measure of the increase in financial value due to an investment can be referred to as attribution. As such, the first step in externality internalisation is the attribution of financial value. Secondly, it is necessary to have a means of capturing that value that has been created and to decide how much value to capture. This is a question of appropriation. In other words, the process of internalising externalities involves knowing what the externalities are, having a way to internalise them, and deciding how much to internalise. Attribution and appropriation are the prerequisites for externality internalisation.

One of the reasons for this conceptualisation is that it is impossible to properly research attribution and appropriation in isolation from each other. For while most literature treats them distinctly, they are inextricably linked. Appropriation is necessarily a function of attribution for both financial and political reasons. Financially, the amount of appropriation is constrained by the financial value created. Even if appropriation quantity can exceed attributed financial value in the short-term, it is unsustainable long-term. As such, there is an actual economic constraint. Appropriation is also dependent on attribution for political reasons. As will be seen in Chapters 4, there is evidence of a desire among impact investors for investor financial returns to be a function of the actual value created. Such alignment is not possible without attribution. The relationship goes the other direction too. Without appropriation of value, there is no financial return and no reinvestment, which reduces both the capacity and incentive for further financial value creation.

Importantly, the extent to which externalities can be internalised via value attribution and appropriation is highly dependent on the design of the investment mechanism. The mechanism design influences whether attribution of value is possible, the method of value appropriation, and what degree of value appropriation maximizes social impact.²⁷⁸

3.9 How are the Concepts of Value Creation and Value Capture Related to Each Other, to Social Impact Measurement, and to the Core Gap in the Literature?

Now that the research has identified the two main relationships between mechanism design and social value creation, it is worth investigating how the concepts of ‘value creation’ and ‘value capture’ are linked. While this may seem straightforward, it is surprisingly complicated and nuanced.

²⁷⁸ The final point here – the optimal degree of value appropriation – is subject to more in-depth research and discussion in Chapter 4.

The first step in understanding the link between the concepts of value creation and value capture is to understand, from existing literature, the link between social and financial value creation.

Link Between Social and Financial Value Creation

We have already identified the three components of *social* value creation (selection, quantity and effort), and defined the concept of attribution as the measure of the increase in *financial* value attributable to an investment. But how are social value and financial value connected to each other? Are they the same concepts or different concepts? Do they equate with each other?

As mentioned briefly at the end of Chapter 2 (Section 2.10), the economics literature reveals a reasonably consistent relationship between, and sequencing of, social value creation and financial value creation. In the vast majority of cases where impact investments are made in individuals – whether providing education, healthcare, housing, sanitation, or employment – the effect is increased expected lifetime incomes of the individuals receiving those investments. This, in turn, increases the expected taxation revenue for the government, as well as the purchasing power of individuals.

In the case of health, Jack and Lewis (2009) provide a comprehensive overview of the extent to which, and various ways in which, investments in health cause higher individual incomes and economic growth.²⁷⁹ Notwithstanding methodological challenges of establishing causal relationships, which the authors document, they nevertheless conclude the following:

Cross-country regressions using instrumental variables find quite large impacts of health on income... At the microeconomic level, clear causal relationships have been documented from health to earning potential and income... Microeconomic studies provide solid guidance on marginal benefits... Factors that foster greater productivity and higher wages are nutrition, early childhood education (both cognitive and noncognitive), education more generally, and mother's education in particular. Public health investments that eliminate pathogens raise health status and expand access to agricultural land, which translate into enhanced learning and rising agricultural yields, respectively, and serve to raise productivity, labor supply, and earnings. (Jack & Lewis, 2009, pp. 31-32)

As such, the economics literature reveals that social value creation often has second, third, or fourth order effects in the form of financial value creation. Social outcomes pave the way for subsequent financial value.

Hence, social value creation is linked to the attribution component of value capture by the fact that there is a sequential relationship between social value and financial value.²⁸⁰ Given this

²⁷⁹ Jack, W., & Lewis, M. (2009). Health investments and economic growth: Macroeconomic evidence and microeconomic foundations. *Health and Growth*, 1-41.

²⁸⁰ As an aside, it is worth noting that while the social impact measurement literature focuses on how social outcomes can be monetised in the measurement process, there is negligible focus on the common sequential relationship between social and financial value that the economics literature reveals. This highlights once more how the economics literature can contribute to, and complement, the social finance literature.

sequential relationship, it follows to ask what types of financial value commonly arise from social value creation.

Types of Financial Value Created

The financial value that is created from social value can be decomposed into three parts, which arise from the higher expected lifetime incomes of the investment recipients.

Income taxation is one form of financial value. This type of financial value is initially captured by the government due to its institutional capabilities. Notwithstanding the existence of tax thresholds in many jurisdictions, higher incomes typically result in greater taxation obligations. Even when an individual has an income below the taxation threshold, it is likely that higher incomes increase financial value to the government via reduced welfare expenditure in a way approximate to the value that would accrue in the absence of a taxation threshold and the absence of welfare. As such, it is reasonable to abstract from taxation thresholds and view the taxation payments (and taxation revenue) as an increasing function of individual incomes.

A second type of financial value is after-tax income. Conceptually, it is consistent with the economics literature to view after-tax income as being split into consumption expenditure and savings. Consumption increases present-period individual utility where the price is lower than the consumer's willingness to pay (that is, where consumer surplus is positive). Savings increases future individual utility. It is the former - consumption expenditure - that results in a third type of financial value, business profits.

A third way that financial value materialises is in the form of business profit. The more after-tax income individuals have, the more they are expected to consume in absolute terms. For example, Motaqed (2011) use time series techniques applied to the models of Friedman (1957) and Modigliani and Brumberg (1954) to estimate the marginal propensity to consume in southern provinces of Iran between 1983-2007.²⁸¹ They find that the marginal propensity to consume is 55% in the short-term and 66% in the long-term for urban households, and 66% in the short-term and 86% in the long-term for rural households. As such, if an individual moves up the income ladder, going from closer to the poverty line to having a higher disposable income, their expenditure capacity and expected expenditure both increase. This consumption expenditure means businesses have a larger market to sell to and can increase sales volume, so long as the products are classified normal rather than inferior goods.²⁸² Provided the price exceeds the marginal cost of the sale, businesses can be expected to profit from the greater consumption. As such, higher after-tax incomes lead to higher consumption that increases the profit-generating capacity of corporations, *ceteris paribus*. Because this type of financial value is derived from after-tax income, it is best viewed as both a distinct type of value and a subset of value creation in the form of after-tax income.

²⁸¹ Motaqed, S. (2011). Estimation the consumption function for urban and rural household in developing country: a case study of Iranian southern province. *European Journal of Economics, Finance and Administrative Sciences* ISSN, 1450-2275. Friedman, M. (1957). The permanent income hypothesis. In *A theory of the consumption function* (pp. 20-37). Princeton University Press. Modigliani, F., & Brumberg, R. (1954). *Utility analysis and the consumption function: An interpretation of cross-section data*. Franco Modigliani, 1.

²⁸² Inferior goods are goods for which demand decreases with rising incomes, while normal goods are those for which demand increases with rising incomes.

As such, impact investments result in social outcomes that lead to subsequent financial value to three main stakeholders - the government in the form of higher taxation revenue, individuals in the form of higher after-tax incomes, and businesses in the form of greater sales and profit.²⁸³ Given this, financial value can be conceived of as the sum of the positive pecuniary externalities that arise from impact investments plus any investor appropriation of value.²⁸⁴

Insights from the Research Regarding How Terms and Concepts Relate

At this point, it is worth identifying and clarifying the differences between several terms. This is important because there is substantial inconsistency in the existing literature regarding how terms are used. Different terms are often used erroneously to refer to the same concept, and the same term is often used erroneously to refer to different concepts. In particular, the notions of attribution, social value, financial value, and social impact are often treated as 'loose concepts' (Lyon & Fernandez, 2012),²⁸⁵ and are used in ways that are 'poorly defined' (Mair & Marti, 2006).²⁸⁶ This lack of precise differentiation in the literature between similar and related concepts has created significant ambiguity and disagreement amongst academics and practitioners. As such, it is necessary to precisely differentiate terms – something the previous research in this chapter assists with.

Degree and Nature of Equivalency between 'Social Value' and 'Financial Value'

Two terms that are often the source of confusion and ambiguity are *social value* and *financial value*. What is the relationship between these terms? If social value maps into financial value in a reasonably consistent sequential manner, as we have seen from literature analysis, does it mean that they should be conceived of as one and the same?

This research suggests that while distinct concepts, *social value* and *financial value* are closely related when it comes to quantification. As will be explained in more depth in Chapter 4, the social impact measurement literature has attempted to quantify social impact by giving social impacts a monetary value (Gibbon & Dey, 2011).²⁸⁷ Such monetisation of social impacts has been applied to a very wide range of types of social impacts (Epstein & Buhovac, 2014).²⁸⁸ There are rare instances in the literature where imputing a monetary value on a social impact is extremely difficult or impossible, however these do not tend to fall within the class of impact investments we are focused on – investments in individuals that improve their productive capacity. As such, it

²⁸³ It is not claimed that this is a collectively exhaustive list of the types of financial value that can be created. There are other types of financial value that are created, including consumption taxation revenue that accrues to the government. However, as this is a subset of both after-tax income and consumption-expenditure, its inclusion adds little to the analysis and does not change the findings in this chapter or subsequent chapters.

²⁸⁴ Given that we are interested in the internalisation of externalities, yet if those externalities are internalised they cease to be externalities, it is easy for there to be confusion regarding what is meant by externalities. Here externalities refer to the positive benefits to other stakeholders that remain after investors have captured some financial value as financial return, and not before.

²⁸⁵ Lyon, F., & Fernandez, H. (2012). Strategies for scaling up social enterprise: lessons from early years providers. *Social Enterprise Journal*, 8(1), 63-77.

²⁸⁶ Mair, J., & Marti, I. (2006). Social entrepreneurship research: A source of explanation, prediction, and delight. *Journal of world business*, 41(1), 36-44.

²⁸⁷ Gibbon, J., & Dey, C. (2011). Developments in social impact measurement in the third sector: scaling up or dumbing down?. *Social and Environmental Accountability Journal*, 31(1), 63-72.

²⁸⁸ Epstein, M. J., & Buhovac, A. R. (2014). *Making sustainability work: Best practices in managing and measuring corporate social, environmental, and economic impacts*. Berrett-Koehler Publishers.

is appropriate to abstract from the rare exceptions where a giving social impact a monetary value is impossible.

For the class of impact investments we are researching, the sequential relationship previously identified is valid. What this means is that social value has a corresponding financial value. As such, the financial value that arises from social value creation can be viewed as equivalent in size to social value. Note, however, that the reverse is not necessarily true. It is not claimed that every form of financial value, howsoever formed, has a social equivalent. Rather, it is argued that the financial value that arises *due to* social value creation has a social equivalent. The relationship is not bidirectionally identical.

Importantly, it follows that the quantity of social value creation can be determined by the corresponding quantity of financial value. This is consistent with, though different to, the approach of monetising the value of social outcomes in the social impact measurement literature. Whereas in the social impact measurement literature *each specific* social outcome tends to be given a monetary equivalent, here *aggregate* social value can be ascertained from an aggregate financial equivalent. One of the advantages of this approach, as will be seen in Chapters 5 and 7, is that it arguably captures more social outcomes and captures more of the interdependency between them. Indeed, many diverse and disparate social outcomes filter through to greater financial value in the form of higher expected individual incomes.²⁸⁹ As such, this approach avoids understating social value, which may arise if only some specific social outcomes are given a monetary value.

This argument and approach is similar to, but distinct from, Santos (2012). Santos argues that social and financial value should not be distinguished, but rather value should be viewed holistically. This is because “*distinguishing social and financial value involves subjective assessments of what is social... who is in need of ‘social help’... [which] requires normative judgments*” and because distinguishing between types of value suggests “*that profit cannot or should not be an outcome of fulfilling those needs*” (p. 7). Santos further argues that “*It is more effective for theory development to focus on a generic concept of value as defined in terms of the increase in the utility of society’s members. This is consistent with the treatment of the concept of value in economic theory, for which social welfare is defined by the aggregation of individual utility functions.*” (p. 7). The approach here is similar to Santos in the sense that social and financial value are viewed as equivalent in size, social value is based on aggregating individual utility functions, and decisions are made regarding what portion of value to appropriate. However, the approach here differs in two respects. First, we incorporate a sequential relationship between social value and financial value. Secondly, differences arise because the theory in this chapter distinguishes marginal and absolute notions of value. The importance of this will become apparent later in the chapter, as well as in Chapter 4 (Section 4.6 and 4.8).

Degree and Nature of Equivalency between ‘Social Value’ and ‘Social Impact’

Another common source of confusion in the literature and in practice is that the terms *social impact* and *social value* are often used interchangeably, inconsistently, and – as this research

²⁸⁹ Note that value in the form of higher expected individual incomes can be decomposed into the three types of financial value previously identified - after-tax income, government taxation revenue, and business profits.

discovers - incorrectly. As such, it is important to distinguish between these two oft-conflated concepts.

Recall that value capture is appropriately conceptualized as being comprised of attribution and appropriation. For value capture to occur, a certain quantity of financial value must be attributed to the investor, and part of that financial value must be able to be appropriated by the investor as financial return. In other words, part of the financial value that is created by the investor becomes the investor's financial return. We also know that the financial value that is created is equivalent to the social value created, as previously explained. It logically follows that *either* an investor's financial return must count as social impact (that is, be included in social impact measurements), *or* it is necessary to distinguish between value created including investor financial returns and value created excluding investor financial returns. Given that very few impact investors believe that their financial return should be included in the measure of social impact – a result discovered in Chapter 4 – and that the literature typically conceives of social impact as the value that accrues to stakeholders other than the investor - the latter option is definitely preferable. As such, it is necessary to have two different terms that differ on the basis of whether the quantity of financial value an investor appropriates is included or not.

Given this logical reasoning and finding, it is appropriate to differentiate 'social value' from 'social impact' in the following way. Social value is the amount of value created from an investment *ex ante* investor appropriation of financial value, while social impact is the amount of value created from an investment *ex post* investor appropriation of financial value. In other words, social impact is equal to the social value created (the first main relationship) less the value captured (the second main relationship). Put differently, social value is the maximum potential social impact – the social impact that would arise if an investor did not appropriate any financial value. This logic can be taken a step further. Since 'attribution' is the financial equivalent of 'social value', it follows that social impact is equal to attribution less appropriation. This is a novel way of framing the issue. As such, while attribution and social impact measurement are closely related, they are distinct concepts. Differences arise because part of attributed value can be appropriated, and value that is appropriated and becomes part of an investor's financial return is not considered social impact. To use the terms 'social impact' and 'social value' interchangeably is erroneous. They should not be conflated.

This discovery that social impact is a function of attribution and appropriation has an important implication. It means that social impact measurement *should* be resituated and brought into the core impact investing literature, and it shows *how* the social impact measurement literature can be embedded firmly within the core impact investing literature. By identifying value creation and value capture as the two key links between mechanism design and social value creation, and by conceptualizing value capture as a function of attribution and appropriation, social impact measurement becomes an integral part of the impact investing cycle. This contribution is not insignificant. To date, the social finance literature has largely treated the challenge of impact measurement as a separate challenge from generating social and financial value, and the act of impact measurement as a discrete undertaking (Figures 2.5, 2.11 & 2.22). This is consistent with how social impact is commonly measured in practice - as a standalone activity undertaken at discrete times and requiring separate funding to carry out. For example, as Sir Ronald Cohen

explained in an interview, “In the case of the Peterborough social impact bond, it took five years to do the work, and then one full year to get information to then measure the outcomes.”

How Appropriation Affects Social Impact

A related implication of this finding is that the appropriation of value affects social impact in two main ways. First, the value appropriated directly affects social impact because value that is appropriated involves a transfer of value from stakeholders where that value constitutes social impact, to investors where that value no longer constitutes social impact. Secondly, the appropriation of value affects social impact indirectly by altering investor incentives and their capacity for social value creation, as previously discussed.

What Fills the Core Gap in the Literature?

It should now be clear what fills the major gap in the literature that exists between financial value and financial return, which was discovered in the bibliometrics research in Chapter 2. What we have found in the research in this chapter is that value capture, comprised of attribution and appropriation, is what connects financial value with financial return. It has also been shown how social value creation links to financial value, and how attribution and appropriation of financial value relate to social impact measurement.

It is also possible to conceive of what fills the gap between financial value and financial return in terms of externalities. When an impact investment is made, this leads to social value creation which results in a range of positive pecuniary externalities. The sum of those externalities (*ex ante* any investor appropriation) is the attribution of financial value, which is equivalent to social value. Some of those positive pecuniary externalities may be able to be internalised and appropriated by the investor as financial return. When the internalised externalities are subtracted from financial/social value, that gives the social impact of the investment. Or, put differently, the externalities that remain *ex post* any investor value appropriation are appropriately classified as social impacts. This insight acts as a bridge between the public economics literature on externalities and the social finance literature on social impact.

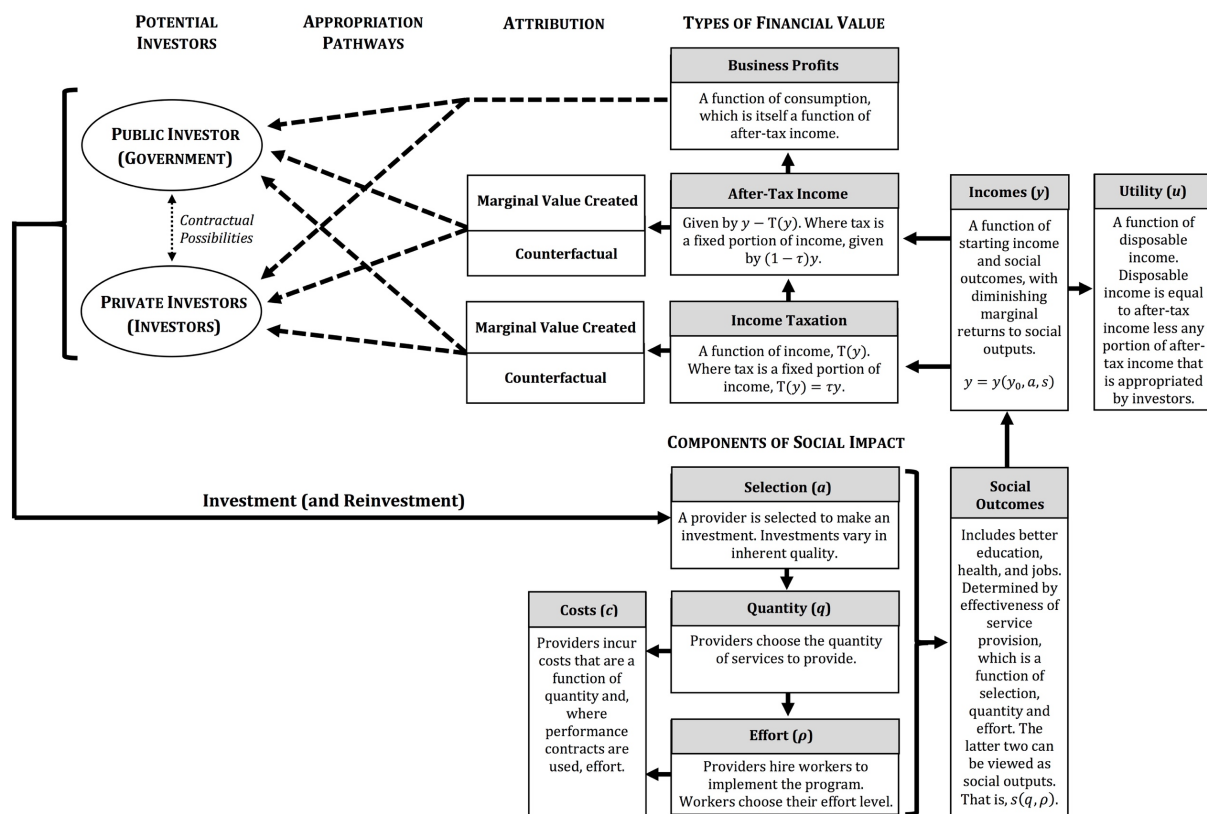
3.10 Bringing the Research Findings Together in a Unified Fundamental Model

It is now possible to bring all these research findings together in a consistent and comprehensive fundamental model of impact investing. Having such a model is important because to fill the core gap in the literature it is not sufficient to simply add the missing link between financial value and financial return and ignore the rest of the cycle. This would overlook the interconnectedness of different parts of the impact investing cycle and would lead to inconsistent approaches at different stages in the cycle. One cannot, for example, simply piece together analysis of the relationship between financial return and social value with a private investor investing in a firm, with analysis of the relationship between social value and financial value with a public investor investing in individuals. Rather than viewing each stage in isolation, it is necessary to view each stage as part of a single systems finance model.

This unified theory is represented visually in Figure 3.1. Whereas the three components of social value creation involved a reconceptualisation of the logic model, including translating it from the enterprise level to the individual level, this theory extends the logic model in light of the research findings. In doing so, it connects the oft-discrete concepts of social value creation, financial value creation, attribution of value, appropriation of value, reinvestment of appropriated value, and social impact measurement, into one consistent framework.

In Figure 3.1, the two types of potential investors are represented by ellipses – private investors and the government as a public investor. Each step in the flow of the model is represented by a rectangle. Solid arrows represent necessary flows, while dashed arrows represent possible flows.

Figure 3.1: A Unified Fundamental Model of Impact Investing in Individuals



In the model, the two types of potential investors may make an impact investment in a set of individuals in a community. This investment is of such a form that it increases the productivity of the investment recipients (which is consistent with the class of impact investments being researched). Making an investment involves three actions by the investor, which correspond to the three determinants of investment effectiveness (that is, social value creation). The first action investors take it to select what type of investment to make - in other words, which investment to fund from a set of possible investments. The second action is to decide what quantity of the investment to provide. The third action is to employ workers to implement the investment. These workers in turn choose what level of effort they will exert – either low effort or high effort. Both

the quantity provided and the effort exerted are the social outputs in the process. These outputs, together with selection, determine how effective the investment is at creating social outcomes.

These social outcomes then lead to higher expected individual incomes, with disposable income mapping into individual utility.²⁹⁰ As previously discussed, having income as a function of social outcomes is justifiable on the basis that many diverse and disparate social outcomes filter through to higher expected incomes. Individuals retain a portion of the higher income that is generated, some of which goes towards consumption expenditure that increases business profits. A portion also goes as taxation revenue to the government. For the investor to appropriate some of this financial value, there must be (a) attribution of value, (b) a means of appropriating the value, and (c) a decision of how much to appropriate. The last issue depends on whether reinvesting the appropriated value would increase or decrease social impact, which is discussed at the end of Chapter 4 in Section 4.9. As for the second issue of the means of value appropriation, it is worth explaining this in more detail.

Means of Value Appropriation

As already mentioned, the internalisation of externalities is dependent on having a way to appropriate that value. Given that there are two types of possible investors, and three types of financial value, there are six possible combinations of financial value and investor type. These six combinations, shown in Figure 3.1, can be viewed as the six possible avenues via which value can be appropriated. The two types of investors are treated distinctly because each has different constraints and capabilities that influence their capacity to appropriate different types of financial value. These constraints and capabilities are researched in Chapters 6. For now, the practical ability to appropriate is abstracted from. The various theoretical appropriation pathways are the focus.

The first type of value that could conceptually be appropriated is after-tax income. This would involve the investment recipient making a payment to the investor, in addition to any regular taxation payment. In this case, after-tax income would exceed disposable income. One mechanism design that uses this appropriation pathway is income-contingent loans.

The second type of value that could conceptually be captured is taxation revenue. Since the individual already pays taxation, the individual would not have to pay any extra amount in this instance. The holder of the value prior to any appropriation is the government, not the individual.

Finally, business profits could conceptually be appropriated by a public or private investor. It may be possible for investors to appropriate some of the business profits that arise from the social outcomes attributable to them. Ignoring practical considerations, *if* the change in itemised consumption expenditure could be known for the specific individuals who have received investment, then such value may be able to be appropriated.²⁹¹

²⁹⁰ Note that disposable income is not necessarily the same as after-tax income. In some mechanisms, such as income-contingent loans, a portion of after-tax income is appropriated by investors. In such cases, after-tax income and disposable income differ in value.

²⁹¹ Recent technological developments, including the emergence of the Internet of Everything, are enabling real-time tracking of consumption expenditure and the usage of goods and services (Atzori, Iera, & Morabito, 2010). Governments and businesses increasingly know exactly what consumers are purchasing and how consumers are using

Note that four of the six appropriation pathways (that is, the pathways not involving the appropriation of after-tax income) are not reliant on payments being made, or risk being borne, by the individuals receiving services. If those appropriation pathways are viable, this may increase the willingness of investors to invest in individuals at the base of the pyramid, with limited discretionary income and low risk tolerance.

Reinvestment of Value Appropriation

Provided that there is positive attribution of financial value, a means of appropriating that value, and that some of the value is in fact appropriated, it is then possible for investors to reinvest some of the appropriated value. As illustrated in Figure 3.1, this reinvested value may lead to further social value creation. As such, a cyclical relationship exists between social value and financial value. There is a sequential causal relationship between social value creation and financial value creation, and a facilitatory relationship between financial value creation and social value creation.

3.11 The Unified Fundamental Model as a Means of Differentiating and Understanding Conflated Concepts

The theoretical model developed in Section 3.11, based on the findings from modelling the mechanism designs, has an important additional benefit. It enables even more terms and concepts that are commonly confused in the social finance literature and practice to be precisely and formally distinguished within the one consistent framework. To date, this has not been done.

The Two Most Common Counterfactuals

One of the most common sources of confusion and disagreement in the literature and practice is around the use of counterfactuals. Whenever quantities are talked about, whether the quantity of ‘social value’ or ‘financial value’/‘attribution’ or ‘social impact’, it is often unclear what the quantity is relative to. However, close examination reveals that two types of counterfactuals are commonly used, even if they are not explicitly stated.

First, sometimes a counterfactual of *no investment* is used. For example, Kat Harrison (Director of Impact & Lean Data at Acumen) said at the World Impact Investing Summit in London in 2017 that Acumen calculates quantities relative to if no impact investment of a similar nature had been

products. This unparalleled data collection and tracking potentially enables new business models that involve appropriation of financial value from business profits. The exact nature of this appropriation could take many forms, including variable commission-esque payments from the businesses selling products to the investors who have enabled those purchases. Such payments could be required and enforced by governments, or could be voluntarily contractually agreed to by business if it makes financial sense to do so. While the change in expenditure is likely to be small for many goods and services, new technologies such as cryptocurrencies are making micropayments possible (Turpin, 2014; Pass, 2015). This may eliminate the fixed (albeit small) costs associated with using fiat currencies, potentially enabling new ways of appropriating business profits that are efficient and automated. See: Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey. *Computer networks*, 54(15), 2787-2805.; Turpin, J. B. (2014). Bitcoin: The economic case for a global, virtual currency operating in an unexplored legal framework. *Indiana Journal of Global Legal Studies*, 21(1), 335-368. Pass, R. (2015, October). Micropayments for decentralized currencies. In *Proceedings of the 22nd ACM SIGSAC Conference on Computer and Communications Security* (pp. 207-218). ACM

undertaken. We can refer to quantities measured relative to if no investment was undertaken as *absolute* quantities.

Secondly, sometimes a counterfactual of *the next best alternative investment* is used - the investment that would have occurred in the absence of the investment that did occur. That is, if the investor that made an investment did not exist, the investment that would occur in its place in this hypothetical scenario is the counterfactual investment. We can refer to quantities measured relative to an alternative, or counterfactual, investment as *marginal* quantities.

It follows that, in general terms, absolute quantities are equal to marginal quantities plus counterfactual quantities. This is represented in Figure 3.1 under the 'Attribution' heading by the fact that boxes representing absolute quantities are divided into marginal quantities and counterfactual quantities.

Distinguishing between Absolute and Marginal Versions of Attribution, Appropriation and Social Impact

Given that sometimes quantities are measured relative to a counterfactual investment and sometimes relative to a no-investment counterfactual, it is pertinent to formally distinguish between them.

When it comes to the concept of attribution, it follows from previous definitions and analysis that *absolute* attribution refers to the total financial value created relative to a no investment counterfactual. Based on the types of financial value in our model, this is equal to the sum of after-tax income created and taxation created. It is also equal to the value that accrues to the three stakeholders in the model – individuals (which we can denote Z), the government (which we can denote G), and a private investor (which we can denote P).

For precision and to avoid ambiguity, it is worth providing a formal definition. As before, a specific investor is denoted A while a specific type of investment is denoted j . In addition to this previous notation, the parameter V is used to refer to various quantities of value, while T denotes total and refers to all stakeholders ($T = Z + G + P$).

Definition 3.A. Absolute Attribution (V^T): *The total financial value created. The present discounted value of lifetime gross financial value from an investment. Mathematically, $V_{j,A}^T = V_{j,A}^P + V_{j,A}^G + V_{j,A}^Z$.*

In contrast, marginal attribution refers to the financial value created relative to the counterfactual investment. As such, in our model, marginal attribution is equal to the marginal increase in after-tax income and the marginal increase in taxation revenue.²⁹² It is also equal to the increase in value to the three stakeholders relative to the alternative investment, or equivalently to the quantity of absolute attribution less counterfactual value creation. Formally, denoting the counterfactual investor by C , we can write:

²⁹² Note that financial value in the form of business profits is excluded because it is a subset of after-tax income and is not mutually exclusive. To include this would be to double count and overstate the value created.

Definition 3.B. Marginal Attribution (V^M): The marginal financial value created. The present discounted value of lifetime gross financial value from an investment, relative to the counterfactual investment. Mathematically, $V_{j,A}^M = V_{j,A}^T - (V_{j,C}^P + V_{j,C}^G + V_{j,C}^Z) = V_{j,A}^T - V_{j,C}^T$.

When it comes to appropriation, seldom is there recognition in the literature of marginal and absolute versions. However, differentiation of such terms is important. It is appropriate to refer to absolute appropriation as the actual amount of financial value that the investor appropriates - in other words, the investor revenue. In our model, this is denoted V_A^P . On the other hand, marginal appropriation refers to how much more an investor appropriates from an investment than would have been appropriated from the counterfactual investment. In the model, this is equal to $V_A^P - V_C^P$.

This brings us to social impact. We already know that social impact is appropriately conceived as attribution less appropriation. Given that there are absolute and marginal versions of appropriation and attribution, it follows that there are also absolute and marginal versions of social impact. It is important for these two social impact variations to be distinguished.

Absolute social impact refers to the benefits that accrue to stakeholders other than the investor from an investment. It is equal to absolute attribution less absolute appropriated value. On the other hand, marginal social impact refers to the benefits that accrue parties other than the investor in addition to the benefits that would have accrued to those other parties anyway. In other words, marginal social impact is equal to marginal attribution less marginal appropriation. This may seem straightforward; however, this clarification is an important contribution to the literature. Often in the literature and practice, marginal social impact is incorrectly implicitly conceived as marginal attribution less *absolute* appropriation. Consideration is often not given to how much value would have been appropriated in the alternative investment.

Why This Model Suggests that A Focus on Marginal Value/Attribution/Impact is Preferable to a Focus on Absolute Value/Attribution/Impact

This then raises the important question of which version of social impact measurement is preferable and should be the default definition of social impact. This is an important issue because, as will be seen in Chapter 4, there is significant inconsistency regarding what version of social impact is measured in practice.

A key insight of the Unified Fundamental Model that has been developed is that the appropriate default measure of social impact is *marginal* social impact rather than *absolute* social impact. To understand why this is the case, a short illustration is useful.

Let social impact be denoted by R^S and recall that appropriated value is denoted by V^P .

Suppose that the default social impact was absolute social impact, meaning absolute attribution less absolute appropriated value. That is, suppose social impact was defined mathematically as $R^S = \text{Absolute Attribution} - \text{Absolute Appropriated Value} = V^T - V^P$. Now suppose an investor, investor A, created 50 *units* of financial value and appropriated 20 *units*, and the counterfactual investor, investor C, would have created 40 *units* and appropriated 10 *units*. Then

measured social impact would be $R_A^S = 30$, even though other stakeholders are no better off as a result of investor A making the investment.

Suppose instead that we defined social impact to be marginal attribution less absolute appropriated value. That is, $R^S = \text{Marginal Attribution} - \text{Absolute Appropriated Value} = V^M - V^P$. This may appear to be a reasonable definition; however, it is not. Using the previous example, this would give a negative measured social impact of $R_A^S = -10 \text{ units}$ ($50 \text{ units} - 40 \text{ units} - 20 \text{ units}$), even though the other stakeholders are no worse off as a result of the investment relative to the counterfactual. The problem here is that the counterfactual appropriated value was not considered.

Neither of these two definitions of social impact make intuitive sense. However, if the measured social impact incorporates both marginal attribution and marginal appropriation, then it does make intuitive sense. Then measured social impact would be $R^S = (50 \text{ units} - 40 \text{ units}) - (20 \text{ units} - 10 \text{ units}) = 0$.

It follows that marginal social impact should be the default measure of social impact, and that this measure needs to incorporate both the counterfactual attribution and the counterfactual appropriation. Therefore, mathematically, the social impact of investor A when investor C is the counterfactual is given by:

$$\begin{aligned} R_A^S &= (\text{Absolute Attribution}_A - \text{Absolute Attribution}_C) \\ &\quad - (\text{Absolute Appropriation}_A - \text{Absolute Appropriation}_C) \\ \therefore R_A^S &= (\text{Absolute Attribution} - \text{Absolute Appropriation})_A \\ &\quad - (\text{Absolute Attribution} - \text{Absolute Appropriation})_C \\ \therefore R_A^S &= \text{Marginal Attribution}_A - \text{Marginal Appropriation}_A \\ \therefore R_A^S &= V_A^M - (V_A^P - V_C^P) \end{aligned}$$

Intuitively, if the appropriated amount is less than the difference in absolute attribution, there must necessarily be a positive social impact, because the minimum counterfactual appropriation is zero. Note also that where the counterfactual appropriation is zero, the correct formulation of social impact is equivalent to our second formulation (that is, $R^S = \text{Marginal Attribution} - \text{Appropriated Value}$). This can therefore be viewed as a special case.

Another way of writing social impact is to say that it is the difference in value to individuals and the government, *ex post* any appropriation. That is,

$$R_A^S = V_A^Z + V_A^G - (V_C^Z + V_C^G)$$

Formally Defining Social Return

Given this insight from the model, it is appropriate to formally define social impact as follows:

Definition 3.C. Social Impact (R^S): The present discounted value of total lifetime non-appropriated marginal gross financial value from an investment.

In the above definition, ‘non-appropriated’ refers to the fact that benefits that are captured by the investor are excluded from the calculation.²⁹³ The term ‘marginal’ is used rather than ‘absolute’ because what matters is the social impact relative to the counterfactual – as we have discovered. ‘Lifetime’ refers to the fact that social impact must incorporate all future benefits that arise from the investment, and not just the impact in one time-period. ‘Total’ refers to the fact that all the externalities that an investment generates need to be included in the calculation, including taxation externalities and externalities that arise due to the interdependence between social outcomes.²⁹⁴ Discounting is applied so that impact is comparable across time periods.

Note that social impact is gross not net of investment cost. In other words, costs are not incorporated into the definition or calculation of social impact. The reason for this is discovered and shown in Chapter 4. However, in short, the reason is that because we are focused on marginal and not aggregate social impact, subtracting cost from the calculation would not have an intuitive interpretation. It is for this reason that social impact and social return are equivalent to each other when we are focused on marginal measures. As such, we can also define social return in the same way as social impact, as follows:

Definition 3.D. Social Return (R^S): The present discounted value of total lifetime non-appropriated marginal gross financial value from an investment.

Based on our analysis, there are also equivalent simplified versions of this definition. One simpler version is to just refer to total lifetime marginal net benefits as the marginal attribution. Then social impact is the present value of marginal attributed less marginal appropriated benefits. Note that taking the difference between marginal attributed benefits and marginal appropriated benefits does not imply that there is a trade-off between social and financial returns, since an investment can result in larger increase in marginal attributed benefits than the increase in marginal appropriated benefits. Hence, the difference between the two can increase simultaneously with an increase in marginal appropriated benefits. Another simplification is to refer to total lifetime non-appropriated marginal financial value as simply the marginal positive externalities, since externalities are by definition non-appropriated. Then social impact is simply the present value of gross marginal positive externalities. These two simplified definitions are equivalent to, and consistent with, the above formal definition.

The following table presents these different terms and their precise formulations.

²⁹³ The reason why returns to the investor are not counted as part of social impact is that there is a broad range of investors that differ dramatically in how they use any financial returns that accrue to them. As such, it is not possible to generalise regarding future usage of investor financial returns. The solution is to include the social impact of any future investments made possible via investor returns in ‘Multiplied Social Return’, which is a concept defined and explained in Chapter 4, Section 4.9.

²⁹⁴ The interdependency between social outcomes is explored in Jack and Lewis (2009), while the importance of taxation externalities to achieving the first-best level of investment is explored in Appendix B, Section B.4. See Jack, W., & Lewis, M. (2009). Health investments and economic growth: Macroeconomic evidence and microeconomic foundations. Health and Growth, 1-41.

Figure 3.2: Division of Investment Value by Stakeholder (Ex Post Appropriation) in the Unified Fundamental Model

	Investor		Stakeholder	Description
	A	C (Counterfactual)		
Value Created	$V_{j,A}^P$	$V_{j,C}^P$	Investor	Present Value of Appropriated Value
	$V_{j,A}^G$	$V_{j,C}^G$	Government	Present Value of Tax Revenue (Ex Post Appropriation)
	$V_{j,A}^Z$	$V_{j,C}^Z$	Individuals	Present Value of After-Tax Income (Ex Post Appropriation)
Total Value Created	$V_{j,A}^T = V_{j,A}^P + V_{j,A}^G + V_{j,A}^Z$	$V_{j,C}^T = V_{j,C}^P + V_{j,C}^G + V_{j,C}^Z$		
Marginal Value Created	$V_{j,A}^M = V_{j,A}^T - V_{j,C}^T$			
Marginal Social Return/Impact	$R_{j,A}^S = R_{j,A}^{MS} = V_{j,A}^M - (V_{j,A}^P - V_{j,C}^P) = V_{j,A}^Z + V_{j,A}^G - (V_{j,C}^Z + V_{j,C}^G)$		Investor	Actual Social Impact if Counterfactual Considered
Absolute Social Impact	$R_{j,A}^{AS} = V_{j,A}^T - V_{j,A}^P = V_{j,A}^G + V_{j,A}^Z$		Investor	Social Impact if No Counterfactual is Considered
Potential Social Return	$R_{j,A}^{PS} = (V_{j,A}^P + V_{j,A}^Z + V_{j,A}^G) - (V_{j,C}^Z + V_{j,C}^G) = V_{j,A}^T - (V_{j,C}^Z + V_{j,C}^G)$		Investor	Social Impact if No Appropriation
Direct Social Return	$R_{j,A}^{DS} = V_{j,A}^Z - V_{j,C}^Z$		Investor	Social Impact in Form of Marginal After-Tax Income
Indirect Social Return	$R_{j,A}^{IS} = V_{j,A}^G - V_{j,C}^G$		Investor	Social Impact in Form of Marginal Tax Revenue
Cost Incurred	C_j	C_j	Investor	Present Value of Investment Cost

Resolving Ambiguities by Distinguishing Between Conflated Terms

Another key application of the Unified Fundamental Model is that it enables us to precisely distinguish between, and formally define, five related terms and concepts that are commonly conflated in the literature and practice. As already stressed, the lack of precise differentiation in the literature between similar concepts has created significant ambiguity and disagreement amongst academics and practitioners. Given this, clarification and differentiation of terms is crucial for resolving ambiguities and improving the clarity and usefulness of research.

A major problem at present is inconsistency regarding what should and should not be included in different terms (Peredo & McLean, 2006; Perrini, 2006; Short, Moss, & Lumpkin, 2009).²⁹⁵ As is shown in Chapter 4, there is disagreement among impact investors as to whether taxation

²⁹⁵ Peredo, A. M., & McLean, M. (2006). Social entrepreneurship: A critical review of the concept. *Journal of world business*, 41(1), 56-65. Perrini, F. (2006). SMEs and CSR theory: Evidence and implications from an Italian perspective. *Journal of business ethics*, 67(3), 305-316. Short, J. C., Moss, T. W., & Lumpkin, G. T. (2009). Research in social entrepreneurship: Past contributions and future opportunities. *Strategic entrepreneurship journal*, 3(2), 161-194.

revenue should be included in the measure of social impact/return. To resolve this disagreement in a way that is palatable to both perspectives, it is possible to distinguish between direct social return, being the social impact in the form of additional after-tax income, and indirect social return, in the form of additional taxation revenue. The latter is indirect because the government can then use this additional taxation revenue to finance further investments to achieve additional social outcomes. In both cases, the social return is equal to marginal attribution less marginal appropriation, as before. Formal definitions are as follows:

Definition 3.E: Direct Social Return (R^{DS}): The portion of social return R^S that is captured by individuals in the form of higher incomes. Put differently, it is the present discounted value of the marginal increase in after-tax income from an investment over individuals' lifetimes. The direct social return from investor A undertaking investment j is given by:

$$R_{j,A}^{DS} = V_{j,A}^Z - V_{j,C}^Z$$

Definition 3.F: Indirect Social Return (R^{IS}): The portion of social return R^S that is captured by the government in the form of taxation, and retained by the government for further expenditure. Put differently, it is the present discounted value of the marginal increase in tax revenue from an investment over individuals' lifetimes. The indirect social return from investor A undertaking investment j is given by:

$$R_{j,A}^{IS} = V_{j,A}^G - V_{j,C}^G$$

Three other terms are also worth clarifying. It is often helpful in analysis to know the maximum social return that could be generated if no value was appropriated. This can be termed potential social return, and formally defined as follows:²⁹⁶

Definition 3.G. Potential Social Return (R^{PS}): The social impact that would result if none of the total value created from an investment were appropriated by the investor. This is equal to the difference in present discounted values between the total lifetime net benefits from an investment and the social impact of the counterfactual investment.

The potential social return from investor A undertaking investment j is given by:

$$R_{j,A}^{PS} = (V_{j,A}^P + V_{j,A}^Z + V_{j,A}^G) - (V_{j,C}^Z + V_{j,C}^G) = V_{j,A}^T - (V_{j,C}^Z + V_{j,C}^G)$$

Definition 3.H. Social Return on Investment (SROI): Social return divided by the cost of the investment. This differs from the traditional SROI calculation in that the investment cost is not subtracted from the numerator, and the social return term is explicitly marginal rather than absolute social return.

This is given by:

²⁹⁶ Note that it would be possible to divide Potential Social Return into Potential Direct Social Return and Potential Indirect Social Return.

$$SROI_{j,A} = \frac{V_{j,A}^Z + V_{j,A}^G - (V_{j,C}^Z + V_{j,C}^G)}{C_j} = \frac{R_{j,A}^S}{C_j}$$

Definition 3.1. Valued Return (R^V): The weighted sum of social return, R^S , and financial return, denoted R^F . In general, an investor's objective function is to maximize their valued returns R^V .

The valued return from investor A undertaking investment j is given by:

$$R_{j,A}^V = \omega_A^S \cdot R_{j,A}^S + \omega_A^F \cdot R_{j,A}^F$$

These formal definitions of 'direct social return', 'indirect social return', 'social return on investment', 'potential social return', and 'valued return' are important because currently the term 'social return' is often used as a general catch-all term to refer to all of these concepts, despite these concepts not being equivalent. By using the constructed Unified Fundamental Model to precisely distinguish between similar terms, greater clarity and reduced confusion may result.

3.12 Contributions of Theoretical Research and Theory Construction

Considered holistically, what the research in this chapter does is close the key gap in the impact investing literature that was discovered in Chapter 2. However, filling this gap is the end product of a number of smaller contributions to the literature.

First, we discovered the two main ways that mechanism design affects social value creation – namely value creation and value capture (the latter affecting the incentive for value creation). This was done by constructing and analysing three comprehensive theoretical microeconomic models to identify and understand the shortcomings of the five existing contingent-repayment impact investing mechanisms.

Secondly, we identified the components of each of these two main relationships. Specifically, the creation of social value is a function of effort, quantity and selection. These are the three primary drivers of value creation. Furthermore, value capture is appropriately conceived as a function of attribution of value, appropriation method, and quantity of appropriation.

Thirdly, it was shown that this second relationship – value capture – is what fills the gap in the literature between financial value and financial return. In other words, for financial value to translate into financial return, attribution and appropriation are necessary. Attribution is the measure of the amount of financial value created, while appropriation is the means of capturing that value that has been created. This conceptualisation of attribution and appropriation being the factors necessary for the internalisation of positive pecuniary externalities is a key contribution to the literature. This is because it gets to the heart of the shortcomings with existing mechanism designs. As is evident from the microeconomic models in the appendices, a key mechanism design challenge is how to internalise the financial benefits that arise from social impact creation, which is ultimately an issue of attribution and appropriation. Financial value needs to be attributed to the investor that financed the social outcomes that created the financial value. Without value attribution, it is difficult to have value appropriation, and without value

appropriation there are likely to be inadequate incentives for further financial value creation via better social outcomes. However, if the financial value that is subsequently created from social value can be adequately captured by those that finance investments, then there may be greater incentive and capability to provide investments in the first place. As such, it is the gap in the literature between financial value and financial returns that explains the low take-up rates of existing mechanism designs.

Fourthly, it is shown that the concepts of attribution and appropriation are connected to the concept of social impact. This finding brings social impact measurement theory into the broader social finance and development economics literature. Social impact measurement therefore becomes a theoretically integral part of the impact investing cycle, rather than a theoretical addition.

Fifthly, it is shown that the two main relationship pathways – value creation and value capture – are connected to each other because there is a common sequential relationship between social value and financial value.

Sixthly, based on these findings, a Unified Fundamental Model of impact investing is developed to bring together the theoretical findings into one consistent framework. This model brings development economics theory together with social finance theory in a consistent way. It works where other models have not because it brings to the field of social finance key features of the development economics literature – namely the concept of financial value and the individual as the unit of analysis.

Importantly, the research here is consistent with, and lends support to, the argument of Filipe Santos in his paper ‘A Positive Theory of Social Entrepreneurship’ (Santos, 2012).²⁹⁷ Santos makes the compelling case that entrepreneurs can be classified based on the dimensions of value creation and value capture, with social entrepreneurs being defined as those who prioritise value creation over value capture and who pursue ventures that involve neglected positive externalities. The research here differs in several important respects, including: focussing on impact investors rather than social entrepreneurs; distinguishing between marginal and absolute versions of value attribution and value appropriation; conceiving of social and financial value as equivalent but sequential rather than one and the same; disaggregating value creation and value capture into their components; showing how social impact measurement links to the concepts of attribution and appropriation; and using a more quantitative approach. Nevertheless, the research strongly complements and backs up the work of Santos (2012).

In addition to giving credence to Santos’ ‘A Positive Theory of Social Entrepreneurship’, the theory construction in this chapter has several applications.

Some of the applications have already become apparent. The model enables the identification of six possible pathways for the appropriation of financial value. It reveals the desirability and necessity of measuring attribution, appropriation and social impact in a marginal rather than

²⁹⁷ Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

absolute way. It also enables various social impact concepts that are commonly conflated to be precisely distinguished and defined.

Other applications of the theory construction will become apparent in subsequent chapters.

It lays the foundation for research in Chapters 4-6 into three intermediate ways that mechanism design affects social value creation – namely via social impact measurement, via the alignment of social and financial returns, and via stakeholder constraint adherence. As part of this, it enables questions to be answered that otherwise would be difficult. For example, a model with a full impact investing cycle is helpful for answering questions pertaining to the optimal degree of capital recycling. One of the main arguments for the hype around impact investing has been the argument that if mission-driven investors generate a financial return, that return can be reinvested to create additional social value in a recurring manner (Francis, 2016; Wong & Alto, 2014).²⁹⁸ This argument is inherently cyclical, and so it is difficult to research it properly with disjointed theory. By closing the impact investing cycle in the Unified Fundamental Model, questions such as the optimal degree of reinvestment can be asked and answered. This is done as part of Chapter 4.

This theory construction also lays the foundation for research in Chapters 6-7 into modifications to existing impact investing mechanism designs. By closing the theoretical gap between financial value and financial return, and completing the impacting investing cycle, the model enables research into how the financial value that arises from social value might be able to be translated into financial return via attribution and appropriation. Because financial value is the total value created, it represents the maximum possible amount that can be appropriated by investors as financial return from *any* present or future impact investing mechanism design. Financial return represents the actual amount appropriated by an investor from *one* specific impact investing mechanism. Given this, analysis of financial returns is necessarily restricted to past and present impact investing mechanisms. It is, in a sense, backwards looking.

To research the full spectrum of possible impact investing mechanisms and the full range of ways that financial returns can be obtained, it is necessary to begin with financial value. This is for two reasons. First, by beginning with the maximum possible amount that investors could theoretically appropriate, it is possible to identify gaps in the landscape of impact investing mechanisms. It is possible to identify (a) any types of financial value that are not currently being attributed to and appropriated by investors, and (b) any means of appropriating financial value that are not currently being employed. Secondly, by beginning with a fundamental framework, it is possible to determine the first-best properties of an impact investing mechanism and work backwards to ascertain whether these desirable properties are obtainable. In both ways, linking financial value to financial returns lays the foundation for modifications to existing impact investing approaches. This is why the link between financial value and financial returns is crucial.

Overall, the research in this chapter contributes to the literature by discovering reasons for low-take-up of existing contingent-repayment impact investing mechanisms, identifying the two main

²⁹⁸ Francis, G. (2016, July 25). Why social impact investing can reap rewards for clients. Retrieved from <http://citywire.co.uk/new-model-adviser/>. Wong, M. & Alto, P. (2014, August 25). Adopting the London Principles. Retrieved from <https://ssir.org/>.

ways that mechanism design affects social value creation, disaggregating social and financial value into their components, discovering the sequential relationship between social and financial value creation, closing the missing link in the impact investing cycle by conceptualising the internalisation of externalities as function of value attribution and value appropriation, integrating social impact measurement theory into the broader social finance and development economics literature by discovering how social impact relates to attribution and appropriation, discovering that marginal social impact is the appropriate measure of social impact, bringing together disparate strands of literature, and precisely distinguishing between terms that are typically sources of confusion and ambiguity. However, most importantly, this research and theory construction lays the groundwork and provides an analytical framework for further research into the relationship between mechanism design and social value creation.

IV.

First Intermediary Effect: How Mechanism Design Affects Social Value Creation via Social Impact Measurement

4.1 Shifting from Breadth to Depth

Whereas Chapter 3 had a broad research focus, Chapters 4-6 are focused on depth. Each chapter researches in detail a different intermediate, or indirect, link in the relationship between mechanism design and social value creation. The focus is on social impact measurement as the link in Chapter 4, the alignment of social and financial returns as the link in Chapter 5, and the degree of constraint adherence as the link in Chapter 6.

Research in these chapters is predominantly empirical in nature. Based on a decade of active participant observation, it is evident that the most appropriate and effective method for collecting data from a specific population of impact investors is to initially interact with individuals that satisfy the inclusion criteria in-person via conferences and events, before then obtaining data by way of a follow-up online survey and, in some cases, semi-structured interviews. As such, this is the methodology employed.

Primary data from impact investing stakeholders is gathered via 141 comprehensive survey responses and 19 in-depth stakeholder interviews. This data reveals information both about how impact investing is undertaken in practice, and about what impact investors deem to be desirable. The same primary data is used throughout Chapters 4-6, but it is applied in different ways. The research in Chapter 4 primarily utilizes the data on investor practices, the research in Chapter 5 primarily utilizes the data on investor preferences, and the research in Chapter 6 primarily utilizes data on where practices and preferences diverge from each other as this is indicative of mechanism design challenges and evidence of possible binding constraints. The data also enables identification of definitional and conceptual ambiguities based on where investor views on the same issue differ significantly, which lends support to the definitional clarifications provided in Chapter 3.

This empirical research is supported by a critical analysis of the relevant literature and some theoretical analysis that builds on the theory construction in Chapter 3.

4.2 The Two Parts of the Relationship between Mechanism Design and Social Value Creation via Social Impact Measurement

The first intermediate way that mechanism design affects social value creation is via social impact measurement. This relationship has two natural and logical parts to first. Together these two parts show the full nuance and complexity that the role that social impact measurement plays in linking mechanism design and social value creation.

The first logical part of the relationship is how mechanism design affects social impact measurement. This link is shown and investigated in-depth in Chapter 5 as part of broader research on the alignment of social and financial returns (the second intermediary pathway between mechanism design and social value creation). As will be seen, social impact measurement and mechanism design are connected to each other. Specifically, the extent to which mechanism design aligns social and financial returns influences whether financial tools can be used to obtain first-best social impact properties. Because some of the first-best properties pertain to social impact measurement, it follows that the design of impact investing mechanisms

either helps or hinders social impact measurement. This insight contrasts with the incumbent literature, which typically views social impact measurement as entirely separate from mechanism design.

The second logical part of the relationship is the reverse - how social impact measurement affects social value creation. This is the focus of the research in this chapter. As pertains this link between social impact measurement and social value creation, the literature tends to be limited in scope and complexity. There is some discussion of how measuring impact can lead to better selection of investments and therefore more efficient allocation of capital (Antadze & Westley, 2012).²⁹⁹ However, even on this point, the literature does not adequately explore the extent to which measured social impact is actually comparable – a prerequisite to improved selection. More generally, the literature does not capture the full spectrum of ways that social impact measurement contributes to social value creation.

Critical analysis of the primary data reveals four ways that social impact measurement affects social value creation in contingent-repayment financing mechanisms. Specifically, social impact measurement influences social value creation via (i) investment selection, (ii) the degree of financial value appropriation, (iii) the extent to which investors maximizing their measured social impact maximizes aggregate social value, and (iv) whether capital recycling is consistent with efforts to maximize social value. These are the four links between social impact measurement and social value creation.

In the former two cases, the links are identified from data on current impact investing practices – specifically how the metric of social impact is calculated and used. Where measured social impact is used by impact investors in a particular way, and where that application affects the social value created, then a relationship between impact measurement and social value creation exists.

In the latter two cases, the links are identified from research into common unanswered questions that impact investors have about social impact measurement. The data indicates that many impact investors have variations of the following two questions. First, does investor social impact measurement maximization result in aggregate social value maximization? Secondly, does the degree of social impact that is measured affect whether capital recycling increases or decreases social value? These are two areas of uncertainty in the impact investor community at present. Research into these two questions reveals the final two links between social impact measurement and social value creation.

Given the explicit focus on social impact measurement in this chapter, unlike Chapter 5 which is much broader in scope, it is worth providing a more comprehensive background on the history of, and literature on, social impact measurement. After this, the research methodology is detailed and the primary data is presented. Then each of these four relationship pathways linking social impact measurement and social value creation are investigated in turn.

²⁹⁹ Antadze, N., & Westley, F. R. (2012). Impact metrics for social innovation: barriers or bridges to radical change?. *Journal of Social Entrepreneurship*, 3(2), 133-150.

4.3 Background on Social Impact Measurement

By way of background, social impact measurement, also known as impact assessment (Reeder & Colantonio, 2013),³⁰⁰ has roots that go back to the emergence of social accounting in the 1970s. Social accounting, defined as “a systemic analysis of the effects of an organisation on its communities of interest or stakeholders” (Mook & Handy, 2010),³⁰¹ was an attempt to extend financial accounting to items without an established dollar value. While social accounting was limited in complexity and uptake, the underlying principle of recording and analysing outcomes that are not traditionally measured, forms the basis of impact measurement today.

In the years since the advent of social accounting, three main theories related to non-financial performance measurement have emerged. There is the positivist theory of accounting, which argues that the purpose of measurement is on accurately reporting the situation (Whittington, 1987).³⁰² This contrasts with critical theorists who emphasise the role of measurement for internal control and operations management (Chua, 1986; Power & Laughlin, 1996),³⁰³ and the interpretative approach which attempts to use accounting tools to stimulate dialogue and create social change (Gambling & Karim, 1993; Ryan, Scapens & Theobald, 2002).³⁰⁴ What is important for this chapter is that while the latter two approaches directly focus on the relationship between social impact measurement and social value creation, the positivist theory of accounting does not - and it is this positivist theory that has gained the most attention in literature and practice in the past two decades.

The increased focus on accurately measuring social impact over the past two decades has been driven by a number of factors. These include the existence of more data than was previously available, greater accountability and reporting requirements for socially conscious organisations, the realisation by philanthropists and investors that social returns should be treated as rigorously as financial returns, the emergence of organisations that attempt to compare charities and social enterprises on the basis of the impact they are having (such as Giving What We Can), and the demand by taxpayers, donors, and other program funders for greater transparency regarding the use of funds (Vo, Christie & Rohanna, 2016).³⁰⁵ As such, the reasons for the emergence of social impact measurement relate more to transparency and accountability, which is consistent with the positivist theory of accounting, than to increasing the social value created.

One implication of the dominance of the positivist theory has been the rise of Social Return on Investment (SROI). SROI emerged in the late 1990s out of traditional cost-benefit analysis and

³⁰⁰ Reeder, N., & Colantonio, A. (2013). Measuring impact and non-financial returns in impact investing: A critical overview of concepts and practice. *The London School of Economics and the European Investment Bank Institute*.

³⁰¹ Mook, L., & Handy, F. (2010). 18 Social accounting for value creation in nonprofits. *Handbook of Research on Nonprofit Economics and Management*, 263.

³⁰² Whittington, G. (1987). Positive accounting: A review article. *Accounting and business research*, 17(68), 327-336.

³⁰³ Chua, W. F. (1986). Theoretical constructions of and by the real. *Accounting, Organizations and Society*, 11(6), 583-598. Power, M., & Laughlin, R. (1996). Habermas, law and accounting. *Accounting, Organizations and Society*, 21(5), 441-465.

³⁰⁴ Gambling, T., & Karim, R. A. A. (1993). *Business and accounting ethics in Islam*. New York. Ryan, B., Scapens, R. W., & Theobald, M. (2002). Research method and methodology in finance and accounting.

³⁰⁵ Vo, A. T., Christie, C. A., & Rohanna, K. (2016). Understanding evaluation practice within the context of social investment. *Evaluation*, 22(4), 470-488.

forms part of a theoretic construct called Blended Value Accounting (Nicholls, 2009).³⁰⁶ It was initially developed by the Roberts Enterprise Development Fund (Rotheroe & Richards, 2007),³⁰⁷ with a later variation developed by the New Economics Foundation (Ryan & Lyne, 2008).³⁰⁸ While there is no agreed approach to impact measurement and methods differing substantially (Olsen & Galimidi, 2008; Rossi & Freeman, 1993),³⁰⁹ SROI is the most common way to monetize the value of social outcomes, which is the general approach that has gained the most traction. Empirical research by Millar and Hall (2013) found that approximately a third of UK based social enterprises used SROI as a tool to measure their impact.³¹⁰ This is largely due to the UK Government actively encouraging its use (Nicholls, 2007).³¹¹

SROI is both a metric and a methodology. It typically involves a multi-stage process including identifying desired social outcomes, using financial proxies to monetise the projected returns, discounting the returns by a social discount factor, and then comparing the net present social value (NPSV) to the level of investment required to achieve that. Other factors are also meant to be taken into account in the calculation, including attribution (how much of an outcome is attributable to the investor), displacement (were other outcomes displaced by this one), and deadweight (would the outcomes have occurred anyway).³¹² The headline measure is the SROI Ratio, which shows the socio-economic return for every monetary unit spent, and can be expressed as follows:

$$\text{SROI} = \frac{\text{Net Present Social Value}}{\text{Net Present Value of Investment}}$$

In monetising the value of social outcomes, a variety of approaches are used, including revealed preferences, the travel cost method, average household spending, contingent valuation, and expressed preference models (Nicholls, Lawlor, Neitzert & Goodspeed, 2009, p. 47).³¹³ Many of these approaches draw from the public welfare literature (Ebrahim & Rangan, 2010; Mulgan, 2010).³¹⁴

The process of monetising the value of social outcomes has been assisted by an organisation called New Economy, which has put together a unit cost database. This database consists of over

³⁰⁶ Nicholls, A. (2009). 'We do good things, don't we?': 'Blended Value Accounting' in social entrepreneurship. *Accounting, organizations and society*, 34(6-7), 755-769.

³⁰⁷ Rotheroe, N., & Richards, A. (2007). Social return on investment and social enterprise: transparent accountability for sustainable development. *Social Enterprise Journal*, 3(1), 31-48.

³⁰⁸ Ryan, P. W., & Lyne, I. (2008). Social enterprise and the measurement of social value: methodological issues with the calculation and application of the social return on investment. *Education, Knowledge & Economy*, 2(3), 223-237.

³⁰⁹ Olsen, S., & Galimidi, B. (2008). Catalog of approaches to impact measurement: assessing social impact in private ventures. *The Rockefeller Foundation*. Rossi, P. H., & Freeman, H. E. (1993). Program monitoring for evaluation and management. *Evaluation: A Systematic Approach*, 163-213.

³¹⁰ Millar, R., & Hall, K. (2013). Social return on investment (SROI) and performance measurement: The opportunities and barriers for social enterprises in health and social care. *Public Management Review*, 15(6), 923-941.

³¹¹ Nicholls, J. (2007). Why measuring and communicating social value can help social enterprise become more competitive. *London: Cabinet Office, Office of the Third Sector*.

³¹² Note that how these are meant to be calculated and what the right counterfactual is to use are largely abstracted from. As such, SROI does not approach the issue of marginality with the same degree of precision and rigour as provided by the theoretical analysis of social value in Chapter 3 and the formalisation of marginality as a social impact measurement first-best property in Chapter 5.

³¹³ Nicholls, J., Lawlor, E., Neitzert, E., & Goodspeed, T. (2009). A guide to social return on investment. *London: Office of the Third Sector, The Cabinet Office*.

³¹⁴ Ebrahim, A. S., & Rangan, V. K. (2010). The limits of nonprofit impact: A contingency framework for measuring social performance. Mulgan, G. (2010). Measuring social value. *Stanford Soc Innov Rev*, 8(3), 38-43.

600 cost estimates, which are predominantly obtained from academic studies and government reports. The database includes estimates for both the cost of inputs (such as the cost of housing provision) as well as the cost of outcomes (such as the cost of crime). The latter type of cost estimates enable translation of social outcomes to monetised values. However, this still only results in average figures and does not attempt to measure the actual costs of specific outcomes.

A recent study by Vo, Christie and Rohanna (2016) confirmed that in practice a broad range of approaches and technical procedures are used to measure impact. The authors used various data gathering methods to research 161 impact investors and impact analysts - the name given to practitioners who conduct impact measurement studies (Seymour, Ormiston & Dickson, 2013).³¹⁵ They found, *inter alia*, that the way that data is obtained by impact analysts varies considerably. 64% conduct surveys, 41% undertake individual interviews, 27% conduct focus groups, 18% observe behaviour, and 10% do cognitive or behavioural assessments. The way that this data is analysed also varies considerably, with 53% doing spreadsheet modelling, 16% regression analysis, 28% tabulating descriptive statistics, and 31% conducting longitudinal analysis. The authors posit that these divergent approaches can be attributed, in part, to the educational backgrounds of impact analysts, the purpose of the impact assessment, and the desire of impact analysts to “tailor their measurement to the program’s theory of change and the outcomes upon which it is focused” (p. 482).

The approach of SROI is similar to traditional cost-benefit analysis in that costs and benefits are quantified in monetary terms and then compared to assess the desirability of interventions. However, SROI is focused on the impact of organisations rather than public sector policies, and has much greater involvement of stakeholders through the assessment process (Nicholls et al., 2009, p. 95).

An alternative, though not mutually exclusive, approach to attempting to monetise all social impacts is to simply have greater standardisation of the metrics used to measure social impact. The Global Impact Investing Network (GIIN) has developed the Impact Reporting & Investment Standards (IRIS), which is an attempt to catalogue of generally accepted and commonly used performance metrics. While a common language via standard metrics may seem, *ceteris paribus*, like a good approach, it is worth examining the degree of traction IRIS has and the degree of comparability of investments. In IRIS Version 4.0 there were 559 metrics listed, which raises questions around comparability, and only 5000 organisations had adopted the metrics out of millions of potential adoptee organisations worldwide.

As such, the emphasis in the literature and in practice has been on the actual measuring and monetisation of social impact, in line with the positivist theory, rather than using social impact measurement to create greater social value. This motivates empirical research into how precisely social impact measurement affects the creation of social value.

³¹⁵ Seymour R., Ormiston J., & Dickson A. (2013) Exploring the relationships between social impact assessment, strategy, practitioners, and praxis. Paper presented at the annual meeting of the Society for the Advancement of Socio-Economics, Milan, Italy, June.

4.4 Research Methodology

The research here builds closely on the methodology and findings of Vo, Christie and Rohanna (2016).³¹⁶ However, it differs in three important respects. First, whereas Vo, Christie and Rohanna (2016) focus almost exclusively on investor practices, the focus here is on identifying both investor practices and investor perceptions, so that areas of alignment and divergence between practices and perceptions can be explored. This is important because where beliefs about what should happen differ from practices that do happen, this is suggestive of mechanism design challenges. Secondly, the lines of inquiry in our research are more theoretically grounded, building on the findings and modelling in Chapter 3. Thirdly, our research is more focused on the ways in which social impact measurement may link mechanism design and social value creation, rather than simply the accuracy of social impact measurement. As such, this research is more closely aligned with the critical theorists and interpretive approaches, whereas Vo, Christie and Rohanna (2016) is more in line with the positivist approach to social impact measurement.

The research design is as follows.

Sampling Approach and Research Participants

Survey participants were selected via a hybrid of a purposive approach and a snowball approach. As an initial step, 249 impact investors were identified from in-person contact and discussions at ten conferences that feature a significant number of impact investors as attendees. These conferences were: SOCAP Social Capital Markets (San Francisco, USA); World Impact Investing Forum (London, UK); Davos World Economic Forum (Davos, Switzerland); Skoll World Forum (Oxford, UK); St Gallen Symposium (St Gallen, Switzerland); Forbes 30 Under 30 Global Summit (Tel Aviv, Israel); WeWork Creator Awards Summit (Berlin, Germany); 180 Degrees Consulting Americas Summit (New York, USA); 180 Degrees Consulting Asia-Pacific Summit (Sydney, Australia); and the Inclusive Capitalism Summit (London, UK). These conferences represent a range of different investor types and geographies.

Following this, the pool of 249 impact investors was researched in more detail to determine whether or not each investor satisfies the following inclusion criteria:

- Seeks a combination of social and financial returns
- Has undertaken, or is open to undertaking, investments in individuals that are expected to increase their productivity and that involve contingent-repayments
- Is able to understand and communicate in written English

Based on this inclusion criteria, the pool was reduced to a smaller pool of 158 impact investors. These individuals were then asked to refer other impact investors that meet the inclusion criteria. 42 additional potential survey participants were recruited in this manner, bringing the total pool of potential survey participants to 200.

³¹⁶ Vo, A. T., Christie, C. A., & Rohanna, K. (2016). Understanding evaluation practice within the context of social investment. *Evaluation*, 22(4), 470-488.

Survey Procedure and Completion

The 200 impact investors satisfying the inclusion criteria were then invited to participate in the research by completing an online survey with a duration of approximately 10 to 15 minutes. Online surveys were opted for over in-person surveys due to the time poor and geographically dispersed nature of the sample population, as well as social dynamics in the impact investing ecosystem and investor perceptions regarding data confidentiality.

Specifically, each investor satisfying the inclusion criteria was sent a link to the survey via either an email or a LinkedIn message, using contact information obtained at the aforementioned conferences or from referrals. Of the 200 individuals that were invited to participate, 141 completed at least part of the survey ($N=141$), while 118 completed the full survey. 23 individuals completed only a portion of the questions.

Survey Lines of Inquiry and Question Randomisation

The survey itself consisted of a range of lines of inquiry, with questions carefully formulated to ascertain both the practices and perspectives of impact investors. Both the order of the questions and the order of the answer options provided were randomised for each survey participant to reduce bias arising from question or answer sequencing. Furthermore, where two questions were similar, with one asking what occurs in practice and one asking what an investor thinks should occur, these questions were separated, with at least two questions between them. This was done to try to reduce the possibility of one question influencing the answer provided to the related question. For each question there was also the option for survey participants to explain their answer in a text box. This optional explanatory text was included to assist in the accurate interpretation of the findings obtained.

Limitations

Several limitations are important to highlight.

The demographics of the sample population are skewed in two main ways. First, sample is restricted to English-speaking participants. There may be important differences between countries with different primary languages. Secondly, there is a disproportionate number of private sector impact investors relative to public sector impact investors in the sample. While this is to be expected, given that many public-sector impact investors either do not self-identify as such and operate in a large entity rather than as a small firm or as an individual, it is nevertheless a limitation. There may be crucial distinctions between private and public investors that the survey data does not capture.

There are other limitations too. There was less than 100% completion of the survey by participants, meaning that the sample size varies slightly between questions (from full completion of a question with 141 responses to the lowest completion rate of a question with 126 responses). While questions were intentionally made optional to increase completion rates and the quantity of data obtained, future research could make all questions compulsory so as to have identical sample sizes for all questions. Furthermore, the survey focuses on the class of impact

investing mechanisms that this overall research centres on. As such, impact investors that focus on issues such as climate change or only employ investment mechanisms that do not involve contingent-repayments, are not considered.

While the interviews with key stakeholders go some way towards remedying these limitations and reducing the likelihood of blind spots, these limitations nevertheless reduce the extent to which the results can be generalised.

Key Stakeholder Interviews

In addition to the survey, primary data was also obtained by way interviews with 19 impact investing authorities and practitioners ($N=19$). This included interviews with 11 impact investors from the pool of survey participants, and 8 other stakeholders representing governments, thinktanks and intermediaries. These interviews were semi-structured and lasted between 30 and 60 minutes each, so as to allow for in-depth exploration of investment practices and perspectives, constraints faced, and stakeholder characteristics. Where needed, follow-up interviews were undertaken to obtain additional data, especially in relation to the specific modified mechanism design researched as an extension in Chapter 7.

This combination of survey and interview primary data is consistent with the view of some academics that it results in more accurate interpretation of data and helps to overcome the weaknesses of each separate data collection method (Tashakkori, C Teddlie & CB Teddlie, 1998; Brewer & Hunter, 1989).³¹⁷

4.5 Primary Data

The most important primary data on social impact measurement is presented in the following four figures. Figure 4.1 is structured such that the middle column shows investor practices, while the right-hand column shows investor perceptions. This enables easy identification of areas of divergence between what investors do in reality and what they think should occur. Figure 4.2 builds on this by comparing what investors think should occur with how difficult those objectives are to attain. In other words, the degree of desirability of different social impact measurement objectives is compared to their degree of difficulty. Figure 4.3 goes into more detail on the use of discount rates, which is a component of Figure 4.1. Finally, Figure 4.4 shows the most common unanswered questions impact investors have, as revealed in both surveys and interview data.

These results are explained in detail later in this chapter, and in subsequent chapters, where the results are most relevant. However, they are presented here in one place.

³¹⁷ Tashakkori, A., Teddlie, C., & Teddlie, C. B. (1998). *Mixed methodology: Combining qualitative and quantitative approaches* (Vol. 46). Sage. Brewer, J., & Hunter, A. (1989). *Multimethod research: a synthesis of styles*. Sage Publications, Inc.

Figure 4.1: Impact Investor Practices and Perceptions

Answer Options	Practice	Perception
	Inquiry 1 (I1)	
	How frequently do you measure your social impact?	How frequently do you think social impact should be measured?
Never	34%	0%
Every 5+ years	5%	1%
Every 3-5 years	10%	4%
Every 1-3 years	27%	11%
Every 6 months to 1 year	9%	10%
Every 1-6 months	4%	21%
Every 1 Day to 1 Month	3%	13%
Continuously	8%	39%

	Inquiry 2 (I2)	
	If you do not currently measure your social impact, what is the primary reason for this?	What do you think is the primary reason why some impact investors do not currently measure their social impact?
Social impact measurement is not a priority	5%	16%
Social impact measurement is too difficult to accurately measure	40%	42%
Social impact measurement is too costly to undertake	11%	8%
Social impact measurement takes too much time to undertake	8%	6%
Social impact measurement is inherently too subjective	16%	11%
Another reason	7%	9%
Unsure	13%	8%

	Inquiry 3 (I3)	
	Which of the following do you include (that is, count) in the measurement of social impact?	Which of the following do you think should be included (that is, counted) in the measurement of social impact?
Past Realised Social Impact Only	24%	3%
Expected Future Social Impact Only	5%	1%
Both Past Realised Social Impact and Expected Future Social Impact	56%	94%
Neither Past Realised Social Impact nor Expected Future Social Impact	1%	0%
Unsure	14%	2%

	Inquiry 4 (14)	
	Do you think your organisation is intentionally or unintentionally biased in the measurement and/or reporting of social impact?	Do you think most organisations that undertake their own social impact measurement are intentionally or unintentionally biased in their measurement and/or reporting of social impact?
Yes, it tends to be biased upwards (that is, measured social impact tends to be overstated/inflated/exaggerated)	27%	63%
Yes, it tends to be biased downwards (that is, measured social impact tends to be understated)	21%	7%
No, it neither tends to be biased upwards or downwards	41%	9%
Unsure	11%	21%

	Inquiry 5 (15)	
	How often do you take into account the measured social impact of comparable ventures before making investment decisions?	How often do you think the measured social impact of comparable ventures should be taken into account when making investment decisions?
Never	7%	2%
Rarely	11%	2%
Sometimes	25%	11%
Often	39%	51%
Always	18%	34%

	Inquiry 6 (16)	
	If you take into account the measured social impact of comparable ventures before making investment decisions, do you only consider investments that your entity has undertaken?	If the measured social impact of comparable ventures is taken into account before making investment decisions, should consideration be limited to investments that the investor has personally undertaken?
Yes (only investments personally undertaken)	9%	8%
No (also investments by other investors)	87%	89%
Unsure	4%	3%

	Inquiry 7 (17)	
	Do you intentionally include (that is, count) increases in investor financial return in the measurement of social impact?	Do you think increases in investor financial return should be included (that is, counted) in the measurement of social impact?
Yes, all increases in investor financial returns	5%	3%
Yes, but only increases in the firm's financial return (not that of other firms)	4%	1%
No	91%	96%

	Inquiry 8 (I8)	
	Do you intentionally include (that is, count) increases in government income taxation revenue in the measurement of social impact?	Do you think that increases in government income taxation revenue should be included (that is, counted) in the measurement of social impact?
Yes	35	45%
No, but increases in pre-tax incomes are counted	27	24%
No, only increases in post-tax incomes are counted	24	26%
No, and increases in comes (whether pre-tax or post-tax) are not included either.	14	5%

	Inquiry 9 (I9)	
	Which of the following do you deduct/subtract from the measurement of social <i>impact</i> ?	Which of the following do you think should be deducted/subtracted from the measurement of social <i>impact</i> ?
The cost of undertaking the initiative/investment/program being measured	18%	19%
The cost of measuring social impact	7%	11%
Both of the above	13%	24%
None of the above	34%	28%
Unsure	28%	18%

	Inquiry 10 (I10)	
	Which of the following do you deduct/subtract from the measurement of social <i>return</i> ?	Which of the following do you think should be deducted/subtracted from the measurement of social <i>return</i> ?
The cost of undertaking the initiative/investment/program being measured	42%	38%
The cost of measuring social impact	7%	4%
Both of the above	5%	21%
None of the above	24%	13%
Unsure	22%	24%

	Inquiry 11 (I11)	
	Which of the following do you measure?	In your opinion, which of the following should be measured?
Social outcomes compared to the expected social outcomes of the investment that would have occurred in the absence of the investment/program that did occur. That is, the marginal social impact.	19%	63%
Social outcomes compared to the expected social outcomes over time if no investment of any kind had been undertaken. That is, the absolute social impact taking into account trends over time.	12%	10%
Social outcomes compared to the actual social outcomes prior to the start of the investment. That is, the absolute social impact not taking into account trends over time.	58%	18%
None of the above	7%	6%
Unsure	4%	3%

	Inquiry 12 (I12)	
	If you measure marginal social impact, which of the following do you do?	When measuring marginal social impact, which of the following do you think should happen?
Only take into account the value that is likely to have been created by an alternative investment	81%	40%
Take into account the value that is likely to have been created by an alternative investment, and subtract the value that is likely to be appropriated by the alternative investor	15%	48%
Unsure	4%	12%

	Inquiry 13 (I13)	
	As an impact investor, to what extent is your financial return based on your measured social impact?	To what extent do you think the financial return to impact investors should be based on measured social impact?
Not at all	68%	29%
Partly	18%	38%
Mostly	10%	19%
Entirely	4%	14%

	Inquiry 14 (I14)	
	Would you be willing to reinvest a portion of the financial value that you appropriate if it would increase social impact?	In your opinion, does the appropriation of financial value for the purpose of reinvestment normally lead to a greater social impact than maximizing social impact in one investment cycle?
Yes	55%	21%
Maybe	11%	7%
No	20%	24%
Unsure	14%	48%

	Inquiry 15 (I15)	
	What is the factor that most determines whether or not you appropriate financial value for the purpose of increasing social impact via reinvestment?	What do you think is the factor that most determines whether the appropriation of financial value for the purpose of reinvestment increases social impact compared with maximizing social impact in one investment cycle?
The number of investors	2%	6%
The income levels of investment recipients	4%	11%
The concavity of the expenditure to impact function	5%	7%
The size of measured social impact	8%	9%
A specific reason not mentioned above	14%	12%
No factors	35%	4%
Unsure	32%	51%

Figure 4.2: Degree of Desirability and Difficulty of Different Possible Social Impact Measurement Objectives

Possible Objective					
	Degree of Desirability				
	Very Undesirable	Undesirable	Neither Desirable or Undesirable	Desirable	Very Desirable
Measuring social impact in a completely unbiased, objective way	0%	1%	2%	61%	36%
Measuring social impact at no cost to any stakeholder	0%	3%	11%	42%	44%
Accurately measuring expected future social impact	2%	6%	21%	44%	27%
Knowing in advance which investment, from a set of possible investments, is objectively expected to create the most social impact	0%	0%	9%	40%	51%
Accurately ascertaining the expected counterfactual social impact (that is, the social impact that would have resulted from the next best alternative investment)	0%	4%	38%	39%	19%
	Perceived Degree of Difficulty				
	Extremely Easy	Easy	Moderate	Difficult	Impossible
Measuring social impact in a completely unbiased, objective way	6%	18%	22%	34%	20%
Measuring social impact at no cost to any stakeholder	1%	3%	6%	32%	58%
Accurately measuring expected future social impact	2%	6%	22%	39%	31%
Knowing in advance which investment, from a set of possible investments, is objectively expected to create the most social impact	1%	7%	10%	44%	38%
Accurately ascertaining the expected counterfactual social impact (that is, the social impact that would have resulted from the next best alternative investment)	0%	1%	5%	49%	45%

Figure 4.3: Discount Rates in Practice

Impact Investor Category	Discount Rate	What social impact discount rate do you typically apply to social impact measurement?
Impact Investors who Prioritise Social Returns over Financial Returns	No rate (that is, all time periods are treated equally)	21%
	0-3% per year	11%
	3-7%	27%
	7-15%	14%
	15-50%	5%
	50-100%	4%
	Unsure	18%
	No rate (that is, all time periods are treated equally)	8%
	0-3% per year	11%

Impact Investors who Prioritise Financial Returns over Social Returns	3-7%	16%
	7-15%	17%
	15-50%	24%
	50-100%	17%
	Unsure	7%

Figure 4.4: Identification of Areas of Social Impact Measurement Ambiguity

Common Unanswered Questions Impact Investors Have Related to Social Impact Measurement	
Variations on the Following Questions	Frequency
When should I try to make more profit at the expense of social impact for the purpose of reinvesting to create additional social Impact?	13
Does social impact maximization at an investor level lead to the greatest aggregate social impact?	10
What should and should not be included in calculations of social impact?	9
What discount rate, if any, should I be using?	8
Should I divert resources to social impact measurement, or just wait until I have additional funding and/or capacity?	8
I know that we're creating a lot of social impact, but it's hard to quantify some outcomes. Does everything need to be quantified?	6
How do I best measure and take into account social risk as well as financial risk?	5

Close analysis of this primary data reveals four links between social impact measurement and social value creation. These four links are explored in in Sections 4.6-4.9.

4.6 How Social Impact Measurement Affects Social Value Creation via Investment Selection

The first link between social impact measurement and social value creation is via investment selection. This link is evident in the data. As can be seen in Figure 4.1 I5, a majority of impact investors state that they “often” (39%) or “always” (18%) take into account the measured social impact of comparable ventures before making investment decisions. A further 25% “sometimes” take this into account. In addition, of those investors that “often” or “always” consider the social impact of comparable ventures, 87% do not restrict this consideration to investments they have personally made (Figure 4.1, I6). It mathematically follows that a majority of impact investors make investment selections at least partly based on the measured social impact of investments they have not personally undertaken. Given that investment selection affects social value creation, as shown in Chapter 3, it follows that social impact measurement affects the social value created via investment selection.

This brings us to the question of “how” investment selection affects the social value created. For while one may, *inter alia*, assume that consideration of comparable investments based on their measured social impact would increase the social value created, this argument is dependent upon the comparability of measured social impact in practice. If measured social impact is not comparable in practice, then basing investment decisions on measured social impact may be misleading at best and detrimental to social value creation at worst.

To what extent, then, are existing measures of social impact comparable? The primary data shows some areas of consistency with what and how social impact is measured. For example, almost all

impact investors (91%) do not include investor financial returns in the measurement of social impact (Figure 4.1, 17). However, there are many more areas of inconsistency in the way social impact is currently measured. The data points to four key areas of inconsistency: (a) what discount rate is used, (b) whether government taxation revenue is included, (c) whether costs should be subtracted from measures of social impact, and (d) whether marginal or absolute social impact is measured.

Use of Discount Rates

One inconsistency, which makes measured social impact difficult to compare, is differences in the discount rates that are applied to obtain present values of future social impacts. When impact investors were asked what discount rates they typically use, the answers varied considerably, as shown in Figure 4.3. While almost half of respondents commonly use either no discount rate or a discount rate between 0-7%, there is a significant proportion at the other end of the spectrum, with more the 10% commonly choosing discount rates of over 50%. Importantly, the discount rates vary substantially by the type of impact investor. For example, impact investors that identify as prioritising social over financial returns average significantly lower discount rates (or, equivalently, higher discount factors) than impact investors that prioritise financial returns over social returns. In the former category, 21% use no discount rate and only 4% use a discount rate between 50-100%, while in the latter category only 8% use no discount rate and 17% use discount rates in the 50-100% range. The reasons provided for the use of those discount rates in the surveys and interviews indicate that impact investors erring on the philanthropic end of the spectrum (such as those who previously did not seek any financial return on their investments) tend to select discount rates to simply reflect their willingness to delay a social outcome. The social risk component of the discount rate is often ignored altogether. In contrast, impact investors who err towards the profit-making end of the spectrum tend to select discount rates principally on the basis of the risk involved in the investment, with the willingness to delay a social outcome being only a small component of the discount rate. Differences based on investor type may also partly reflect the different types and risk profiles of the investments being undertaken.

Importantly, not only do discount rates vary by a significant amount, but discount rates themselves have a very substantial impact on the calculated social impact, especially where that social impact accrues well into the future (Gollier & Weitzman, 2010).³¹⁸ As such, comparing the measured social impact of different investments when discount rates vary is likely to render such comparisons of limited validity.

These finds are consistent with, and build upon, the existing literature. While to the best of our knowledge the existing literature does not break down the discount rates used by impact investor type, it nevertheless also finds variation in discount rates (Zhuang et al., 2007).³¹⁹ In particular, the literature shows variation between different social outcomes, from 0% for health and climate

³¹⁸ Gollier, C., & Weitzman, M. L. (2010). How should the distant future be discounted when discount rates are uncertain?. *Economics Letters*, 107(3), 350-353.

³¹⁹ Zhuang, J., Liang, Z., Lin, T., & De Guzman, F. (2007). Theory and practice in the choice of social discount rate for cost-benefit analysis: a survey (No. 94). ERD working paper series.

change investments (Freirich & Fulton, 2009),³²⁰ to 4% for drug criminal justice investments (Tuan, 2008),³²¹ to the average rate of government bonds for other social investments. Given that many impact investments are unproven and carry significant uncertainty, it has been argued that an approach that parallels venture capitalist discount rates for early-stage investments may be appropriate (Nicholls & Patton, 2015).³²² Nicholls and Patton propose a so-called Projection-Valuation-Pricing (PVP) approach to deal with social risk and return, and argue that a new way of measuring social discount rates is needed to achieve standardisation, but they do not propose any particular method.

Treatment of Government Taxation Revenue

Another source of inconsistency is whether additional income taxation revenue to the government is included in the measurement of social impact. The data in Figure 4.1 I8 indicates that 62% of impact investors and analysts include tax revenue in calculating social impact, however only about half of those do so intentionally (35%), while the other portion (27%) do so unintentionally by counting changes in pre-tax income rather than after-tax income as social impact. The latter is equivalent to counting both changes in after-tax income and changes in government taxation revenue. One of the common reasons mentioned for including it is that government taxation revenue is likely to have some degree of positive social impact because it increases the expenditure capacity of the government, so could be reinvested. The remaining 38% do not include government taxation revenue in calculating social impact.³²³

How significant a source of inconsistency is this? The answer largely depends on the income levels of the individuals we are talking about. This is because taxation thresholds and progressive taxation systems in most countries mean that differential treatment of government taxation leads to greater inconsistency in social impact measurement at higher levels of taxation. When comparing the measured social impact of investments in very low-income individuals, differential taxation treatment is likely to have a non-negligible but non-substantial effect on social impact measurement. In contrast, for investments in individuals with medium to high incomes, measured social impact may differ by as much as the top margin taxation rate depending on whether government taxation is included or excluded from social impact measurement.

One of the ways to overcome this source of inconsistency is to distinguish between ‘direct social return’ which excludes government taxation revenue, and ‘indirect social return’ that refers to it. This is the approach devised and formalised in the theory construction in Chapter 3 (see Definition 3.G and 3.H). Distinguishing between the two may appease both those stakeholders who currently measure government taxation revenue and those who do not. It may help to provide clarity and overcome confusion.

³²⁰ Freireich, J., & Fulton, K. (2009). Investing for social and environmental impact: A design for catalyzing an emerging industry. Monitor Institute, January.

³²¹ Tuan, M. T. (2008). Measuring and/or estimating social value creation: Insights into eight integrated cost approaches. Retrieved from the Gates Foundation website on February, 23, 2012.

³²² Nicholls, A., & Patton, A. (2015). Projection, Valuation, and Pricing in Social Finance. In Nicholls, A., Paton, R., & Emerson, J. (Eds.). (2015). Social finance. Oxford University Press, pp. 311-334.

³²³ This figure is obtained by adding the 34% of investors who include “none of the above,” and the 4% who include only “an increase in investor financial returns.”

Treatment of Costs

A fourth source of inconsistency is whether or not the cost of an investment is subtracted from the reported measure of social impact. It turns out that only 28% of impact investors subtract investment cost when calculating 'social impact' but a much higher percentage (48%) subtract cost when calculating 'social return' (Figure 4.1, I9 and I10). It is interesting, though not surprising, that impact investors differentiate between social impact and social return.

Further investigation into why this is, by way of analysing the comments of survey participants, reveals that 'social impact' is commonly conceived as being the social equivalent of 'financial value' or 'financial revenue', while 'social return' is commonly conceived of as being equivalent to 'financial return'. Applying this to the theoretical model in Chapter 3, what this means that many impact investors and analysts define social impact, social return, and social return on investment as follows:

$$\text{Social Impact} = V_{j,A}^Z + V_{j,A}^G$$

$$\text{Social Return} = V_{j,A}^Z + V_{j,A}^G - C_j$$

$$\text{Social Return on Investment} = \frac{V_{j,A}^Z + V_{j,A}^G - C_j}{C_j}$$

These above formulas assume that absolute impact is measured (that is, the counterfactual is no investment) and that government taxation revenue is included in the calculation. For impact investors that do not include government taxation revenue in social impact measurement calculations, the formulas above would be the same but without the term $V_{j,A}^G$.

This research postulates that while the thinking behind subtracting investment cost from social return is understandable, it is not logically sound. Importantly, financial returns are not equivalent to social returns because what matters is *absolute* financial return but *marginal* social return. While subtracting costs may make sense when absolute social impact is measured, it does not make sense when marginal social impact is measured. For example, suppose that an investment costs 100 units to undertake, and that investor *A* could create 180 units of social value while investor *C* could create 170 units of social value. Assuming no appropriation, then based on the above formulations, the marginal social impact from investor *A* making the investment instead of investor *C* is 10 units, but the social return is -90 units and the social return on the investment is -0.9. This is despite the investment being socially beneficial. It is for this reason that costs are not subtracted from the definition of social impact and return in the theory construction in Chapter 3.

In any case, the main point here is simply this. There is inconsistency with whether or not investment costs are subtracted from measures of social impact and social return. This inconsistency further reduces the comparability of social impact measures. This thereby limits the extent to which making investment selections based on measured social impact comparisons leads to greater social value being created.

Use of Marginal or Absolute Social Impact

A fourth major source of inconsistency the data reveals is the counterfactual social impact that is used. The data shows that in most cases, social impact is calculated by measuring the social impact of an investment relative to if *no investment* had taken place, rather than relative to if an *alternative investment* had taken place. As shown in Figure 4.1 I11, 70% of the time impact investors and analysts measure absolute social impact. Even this varies, with 58% of the time investors simply measuring differences in pre and post outcomes (that is, comparing to a counterfactual of ‘no investment’ at one point in time), and 12% of the time considering trends over time that are independent of investments (that is, comparing to a counterfactual of ‘no investment’ but over time). In both cases, consideration is not given to what alternative investments would have taken place if the current investment had not been undertaken. Furthermore, of the 19% that attempt to measure marginal social impact,³²⁴ most (77%) only take into account the counterfactual marginal attribution and overlook the counterfactual marginal appropriation (Figure 4.1 I12). As explained in Chapter 3, this means that marginal social impact is not being measured accurately. As such, if investors are making selection decisions based on similar investments, some with measured absolute social impact and some with measured marginal social impact, those social impact measurements are unlikely to be comparable. In this case, the investments would only be comparable where the alternative investment, in measures of marginal social impact, has no or a very negligible social impact.

This has interesting implications. As shown in Chapter 3, social impact is equally determined by the counterfactual investment as the actual investment. This is recognised and accepted by most impact investors, as the data in Figure 4.1 (I11-I12) and Figure 4.2 shows. However, despite the fact that most investors and analysts (63%) believe that marginal social impact is what should be measured, 70% of those same impact investors and analysts measure absolute social impact. In some ways, this is to be expected. After all, it is more difficult to know what would have occurred than what has occurred. Furthermore, despite its importance, ascertaining the counterfactual attribution and appropriation has been neglected in the literature relative to the ascertaining the actual attribution and appropriation. For example, the literature on SROI makes token gestures to “what would have happened” (Mulgan, 2010),³²⁵ but there is rarely clarity on what this means, and even less direction on how to calculate it. Indeed, to the best of our knowledge, there is no existing literature on how to accurately measure social impact relative to the best alternative investment, and no mechanism design that enables revelation of marginal social impact. It follows that one of the major conceptual and practical challenges in social impact measurement is measuring the attribution and appropriation of the counterfactual investment.

The findings here are consistent with those of Vo, Christie and Rohanna (2016). They find that 68% of practitioners just compare pre and post outcomes, 47% of the time analysts use a simple benefit to cost ratio without taking into account a counterfactual, and only 3% of the time is causal modelling used.

Overall, it is clear that social impact measurement affects social value creation via investment selection because the data shows (a) the measured social impact of past impact investments is a

³²⁴ Note that the remaining 11% answered the question by selecting “neither” (3%) or “unsure” (8%).

³²⁵ Mulgan, G. (2010). Measuring social value. *Stanford Social Innovation Review*, 8(3), 38-43.

determinant of investment selection, and (b) there is significant inconsistency with measured social impact due to differences in the treatment of taxation, discount rates, costs, and the counterfactual investment. These inconsistencies mean that selecting the investment with the greatest past measured social impact does not necessarily lead to greater social value creation. Adjustments are needed to past measurements of social impact to ensure they are consistent along the four dimensions explained.

4.7 How Social Impact Measurement Affects Social Value Creation via Financial Value Appropriation

A second link between social impact measurement and social value creation is via the appropriation of financial value. As shown in Figure 4.1 I13, most impact investors believe that financial returns should be at least partly based on measured social impact (71%), while a smaller proportion (32%) say that their financial returns are in practice at least partly explicitly based on social impact. One contingent-repayment mechanism with explicit financial returns based on social impact is SIBs. As such, there is evidence that financial returns are presently based on measured social impact in a subset of cases. Furthermore, given that a far greater percentage of impact investors believe financial return should be based on social impact than is the case in practice, it is reasonable to expect that financial returns will increasingly be a function of social impact.

How then does having financial return as a function of measured social impact measurement alter the social value created? This has already been touched upon in Chapter 3. However, nuance can be added to the finding in Chapter 3 that social impact is a function of marginal attributed value and marginal appropriated value.

When financial value is appropriated based on measured social impact (which *ex ante* appropriation is the same as social value), that appropriation alters the social impact created. This is because social impact is exclusive of the financial value that investors appropriate. What this means is that by basing financial returns on measured social impact, then measured social impact itself changes.

Recall that social impact can be expressed as.

$$R_A^S = \text{Marginal Attribution}_A - \text{Marginal Appropriation}_A$$

Since we know that marginal appropriation is often a function of measured social impact, this can be updated to be:

$$R_A^S = \text{Marginal Attribution}_A - \text{Marginal Appropriation}_A(\text{Measured } R_A^S)$$

It is therefore possible to conceptualize a three-way relationship between the notions of attribution, appropriation and social impact. R_A^S both determines measured social impact and is affected by it. Note that unless measured social impact explicitly takes into account its effect on social impact when investor financial appropriation is based on it, then measured social impact

becomes inaccurate the moment it is applied in practice. For this reason, measured social impact is denoted differently from social impact in the above expression.

4.8 Does Each Investor Maximizing their Measured Social Impact Maximize Aggregate Social Value?

So far, the research in this thesis has focused on the investor and investment level. However, it is now necessary to examine all investors and investments in aggregation. This is because, as shown in Figure 4.4, one of the two most common unanswered questions that impact investors have regarding the relationship between social impact measurement and social value creation, is whether they maximizing their measured social impact at an investor level leads to the greatest aggregate social impact when all investors are considered together. Put differently, could there be situations where an investor maximizing their measured social impact actually decreases the aggregate social value created? For example, one survey participant wrote, “*We always talk about ‘social impact maximization’ likes it’s one simple concept. But is an investor creating the greatest measured impact they can, always best for society? I’m not sure.*” Given this prevalent uncertainty in the impact investing community, it is worth researching the issue in more depth.

Mathematical Formulation of Question

For the purpose of precision, it is helpful to initially express this question mathematically.

The primary data indicates that impact investors typically attempt to maximize *their* measured social impact. As such, it is reasonable to assume that investments with a strictly (weakly) higher measured social impact are strictly (weakly) preferred by investors to investments with a lower measured social impact. This can be expressed as follows:

$$\begin{aligned} \text{If } R_{j,A}^S > R_{k,A}^S, \therefore i_{j,A} > i_{k,A} \\ \text{If } R_{j,A}^S \geq R_{k,A}^S, \therefore i_{j,A} \geq i_{k,A} \end{aligned}$$

This says that if the measured return from investor A making investment j is strictly (weakly) greater than the measured impact from investment k , then investment j is strictly (weakly) preferred by the investor. It follows that *for aggregate social impact to be maximized, each investor maximizing their measured social impact must maximize aggregate measured social impact.*

Mathematically, this can be written as follows:

$$\sum_{A \in P} \max \sum_{j \in I} R_{j,A}^S = \max \sum_{A \in P} \sum_{j \in I} R_{j,A}^S$$

Letting $R_A^S = \sum_{j \in I} R_{j,A}^S$, this reduces to the simpler form,

$$\sum_{A \in P} \max R_A^S = \max \sum_{A \in P} R_A^S$$

In order for this to hold, the measured social impact of an investment must be equal to the difference between the aggregate absolute social impact with that investment and the aggregate absolute social impact if that investment had not occurred. Mathematically, this can be written as:

$$R_{j,A}^S = \sum_{k \in I, B \in P} R_{k,B}^S - \sum_{k \in I, B \in P | (j,A) \neq (k,B)} R_{k,B}^S$$

The above equation says that the social impact of investment j by investor A is equal to the sum of social impacts across all investors (denoted by set P) and investments (denoted by set I), allowing for investment j by investor A , less the sum of social impacts across all investors and investments if investment j by investor A is not allowed.

The question then is, “Do existing methods of measuring social impact satisfy these above equations? Does investor impact maximization equate to aggregate impact maximization?”

As has already been established, social impact can either be measured in an absolute way with a no-investment counterfactual (which is often the case in practice) or a marginal way with a next-best-investment counterfactual (which is what is preferred in theory by impact investors, as seen in Figure 4.1 I11). Let us consider the question for both ways of measuring social impact.

Absolute Social Impact Maximization at the Investor Versus Aggregate Level

In the case of absolute social impact measurement, it is possible to prove that each investor maximizing their own social impact does not necessarily maximize aggregate social impact. This is a counterintuitive finding given that often it is assumed that each investor maximizing their own social impact is desirable. However, there are cases where investors can actually increase *aggregate* social impact by actually decreasing the social impact they create.

This finding can be proved with a simple illustrative example.

Suppose there are two villages each with ten residents, two investors p_L and p_R , and two investments that can be made in every individual – one in health i_h and one in education i_e . Initially investor p_L is based in Village 1 and investor p_R is based in Village 2, and each investor provides both health and education to residents in their village. Both investors have a budget constraint of 100 (that is, $b_L = b_R = 100$), and the cost per person of each investment is 5 (that is, $c_h = c_e = 5$). The effectiveness of the different investors at providing the different investments is shown in the table below.

Figure 4.5: Illustrative Example

Investment	Investor	
	p_L	p_R
i_h	$v_{h,L}^T = 12$	$v_{e,R}^T = 9$
i_e	$v_{e,L}^T = 4$	$v_{h,R}^T = 8$

As such, initially investor p_L creates a total value per person of $v_L^T = 12 + 4 = 16$ and a total aggregate value of $V_L^T = 160$, while investor p_R creates a total value per person of $v_R^T = 9 + 8 = 17$ and a total aggregate value of $V_R^T = 170$. Let us assume that none of this value is appropriated by the investors and that there is no tax, meaning that the total value created is equal to absolute social value created, or $v^T = v^A$. Then the income of individuals in Village 1 is $y_i = y_{0,i} + 16$ and the income of individuals in Village 2 is $y_i = y_{0,i} + 17$. Using an absolute measure of social impact, investor p_L has a social impact of 160 and investor p_R has a social impact of 170.

Now suppose instead that the investors specialised, with p_L providing health to both villages and p_R providing education to both villages. Then the incomes of individuals in both villages is $y_i = y_{0,i} + 12 + 8 = y_{0,i} + 20$, which is strictly higher than before. One may therefore expect that the measured social return of both investors would be higher than before. However, this is not the case. While the measured social impact of investor p_L has increased from 160 to 240, the measured social impact of investor p_R has decreased from 170 to 160.

If p_R wanted the highest measured social impact then they would specialise in health, leaving p_L to specialise in education. This would increase p_R 's measured social impact to 180, but it would cause individual incomes to be $y_i = y_{0,i} + 4 + 9 = y_{0,i} + 13$, which is strictly lower than before.

As such, this example proves the following proposition:

Proposition 4.A: Each investor maximizing their absolute social impact does not necessarily maximize aggregate social impact.

This example also highlights a key problem with the measurement of social impact in an absolute way. If investors make decisions to maximize their measured absolute social impact then this may lead to a misallocation of resources and suboptimal aggregate social impact.

This then leads us to ask whether this problem exists when marginal rather than absolute social impact is measured.

It is worth noting that the only time when absolute and marginal social impact are equivalent is when the following proposition holds.

Proposition 4.B: Absolute and marginal social impact are equivalent iff the effectiveness level $a_{j,A}$ for each possible combination of investments and investors can be written as a diagonal $W \times U$ matrix, where all off-diagonal elements are zero. Mathematically this can be written as:

$$\mathbf{a} = \begin{pmatrix} a_{1,1} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & a_{W,U} \end{pmatrix}$$

What this proposition says is that absolute and marginal social impact are equivalent if there is at most one investor $A \in P$ with a positive level of effectiveness ($a_{j,A} > 0$) for each investment $j \in I$. If this is the case then the second highest level of effectiveness for each investment is zero. In this case, the total value created from each investment equals the marginal value created from

each investment. This case, where either there are no alternative investments or alternative investments yield zero in value, is a special case. In general, absolute and marginal social impact differ.

Marginal Social Impact Maximization at the Investor Versus Aggregate Level

When it comes to marginal social impact, the problem is far less severe, but still exists to some extent.

In the case of two investors and two investments, as in the previous illustrative example, the problem does not arise. Each investor maximizing their marginal social impact is equivalent to each investor maximizing aggregate social impact. This leads to the following formal proposition.

Proposition 4.C: When the number of investors $U = 2$ and the number of investments $W = 2$, aggregate social impact is maximized by each investor choosing the investment that maximizes their marginal social impact. Mathematically,

$$\sum_{A \in P} \max R_A^S = \max \sum_{A \in P} R_A^S$$

However, this mathematical equivalence does not hold for an indefinite number of investors and investments. For larger number of investors and investments, each investor maximizing their own measured marginal social impact may not maximize aggregate social impact.

Formal mathematical treatment of what allocation of investors to investments maximizes aggregate impact when the number of investors or investments exceeds two is beyond the scope of this research. Nevertheless, it is worth providing some intuition. If there are no budget constraints, then the optimal allocation is simple. Investments should just be allocated to the investors with the greatest absolute and marginal impact (which would be the same in this case). However, where budget constraints exist, then the optimal allocation is much more complicated. Whereas with two investors, each has a comparative advantage in one investment, the same is not necessarily true for three or more investors. This is because of flow on effects. If, for example, investor A didn't undertake investment k and investor B did instead, then investor B might not have the capacity to undertake another investment – say investment g . As such, investment g may then go to another investor in turn, who may not be as effective at undertaking that investment. As such, the marginal impact of investor A undertaking investment k may actually be greater than suggested by focussing on investment k alone.³²⁶ This means that the sequencing of investments (the order in which investors make investments) matters.

Given this, if each investor just maximizes the marginal impact of their investments relative to the next best alternative investment, without considering flow-on effects, there is no guarantee that aggregate social impact is maximized. For aggregate social impact to be maximized, the full system of possible investor-investment combinations needs to be taken into account. As such,

³²⁶ In other words, when flow on effects are not taken into account then measured social impact may be biased downwards.

Proposition 4.A can be generalised so that it includes marginal social impact as well as absolute social impact.

Proposition 4.D: Each investor maximizing their own measured social impact does not necessarily maximize aggregate social impact.

Comparison of Degree of Divergence

Notwithstanding the previous finding, there is greater divergence between what maximizes investor social impact and what maximizes aggregate social impact in the case of absolute social impact than marginal social impact. This is because with marginal social impact, divergence arises due to flow-on effects. In other words, divergence arises due to the failure to take into account the counterfactual of the counterfactual, or second-order effects. In contrast, divergence with absolute social impact occurs due to a fail to take into account *both* the immediate counterfactual *and* the counterfactual of the counterfactual. In other words, both first-order and second-order effects are ignored.

As such, the finding that each investor maximizing their own measured social impact does not necessarily maximize aggregate social impact does not undermine the argument made in previous chapters that measuring marginal impact is preferable to measuring absolute social impact. It just adds an additional layer of nuance. Given this, a general principle, or “law of marginal impact,” can be written as follows.

Observation 4.A. Law of Marginal Impact: In general, investors should invest in those investments where they have the greatest impact relative to other investors.

This principle is somewhat analogous to the law of comparative advantage in the economics trade literature. Indeed, it may be helpful to conceive of the social impact analysis here as being somewhat analogous to the analysis of trade that is contained in the economics literature, especially the literature on gains from trade (Samuelson, 1939),³²⁷ and the law of comparative advantage (Deardorff, 1980).³²⁸ In our analysis, investors (countries) have budget constraints (endowments) that they use to make investments (goods) that benefit individuals (households), and there are benefits from specialization due to differences in effectiveness (autarky prices). However, differences arise due to our explicit focus on measurement and the existence of asymmetries between social and financial returns. Also, whereas most trade literature focuses on differences in quantity produced for a given cost, here the analysis is based on differences in quality for a given cost. Nevertheless, in a similar way to how the aggregate value of trade is not normally maximized by each country maximizing their own absolute production, so too is aggregate social impact not normally maximized by each investor maximizing their own social impact.

³²⁷ Samuelson, P. A. (1939). The gains from international trade. *Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique*, 5(2), 195-205.

³²⁸ Deardorff, A. V. (2011). Comparative advantage and international trade and investment in services. In *Comparative Advantage, Growth, And The Gains From Trade And Globalization: A Festschrift in Honor of Alan V Deardorff* (pp. 105-127).

4.9 Determining Whether or Not Capital Recycling is Optimal

Examination of the primary data reveals a fourth and final way that mechanism design affects social value creation via social impact measurement. This is that measured social impact determines whether the appropriation of financial value for the purpose of reinvestment increases or decreases the total social value created.

By way of background, one of the main arguments in the literature for why impact investors should generate a financial return on their investments is that any appropriated value can be reinvested, potentially leading to a multiplied social impact (Francis, 2016; Wong & Alto, 2014).³²⁹ Terms such as capital recycling, multiplied social impact, and reinvested impact are all used to refer to this same phenomenon. The potential for investors to reinvest appropriated value is captured in the Unified Fundamental Model in Chapter 3 by its very cyclical nature. Once an amount of financial value is attributed to an investor, and assuming the investor has a means of appropriating that value, the relevant question is, “How much of that attributed value should be appropriated?” We cannot simply assume that social return is always maximized by having no appropriated value. The reason is that any appropriated value might be able to be reinvested, thereby creating further social impact, which may lead to a greater overall impact than if no value were appropriated. As such, what maximizes lifetime social return from one investment may potentially differ from what maximizes social return when reinvestments are considered. Because such limited research has been undertaken on this topic, it is an open question in the incumbent literature as to whether, and under what conditions, capital recycling increases the total social value created. This may explain why, as shown in Figure 4.4, 13 survey participants identified this as an issue they are unsure about.

Other primary data reveals key insights on this issue. Three key data points are worth highlighting. First, a significant proportion of impact investors say they are willing (55%), or may be willing (11%), to reinvest a portion the financial value that they appropriate if it would increase social impact (Figure 4.1, I14). Secondly, despite this, a significant proportion (though not quite a majority) of impact investors (48%) are unsure of whether or not the appropriation of financial value for the purpose of reinvestment leads to a greater or lower social impact than maximizing social impact in one investment cycle (Figure 4.1, I14). Thirdly, even among those who are confident that appropriation for the purpose of reinvestment sometimes increases social impact, most (51%) are unsure of what determines the circumstances under which this is the case (Figure 4.1, I15).

Considered together, these data points reveal an important point. *If* reinvestment of capital does in fact sometimes increase social value, and *if* social impact measurement determines whether or not that is the case, *then* it logically follows that mechanism design affects social value creation via social impact measurement by way of capital recycling. The logic of this argument holds because we have already established that mechanism design affects social impact measurement. Furthermore, we know from the data that impact investors are willing to actually undertake capital recycling.

³²⁹ Francis, G. (2016, July 25). Why social impact investing can reap rewards for clients. Retrieved from <http://citywire.co.uk/new-model-adviser/>. Wong, M. & Alto, P. (2014, August 25). Adopting the London Principles. Retrieved from <https://ssir.org/>.

As such, it is necessary to ask, “Does the measured social impact affect whether capital recycling is socially beneficial?” To discover the answer to this question, a small amount of theoretical modelling is useful that builds directly on the theoretical model developed in Chapter 3.

Let us assume that total value $V_{j,A}^T$ is homogenous of degree one with respect to the cost of the investment, which is denoted C_j and assumed to be an increasing linear function of investment quantity.³³⁰ As such, the ratio of total value created to investment cost is constant for all levels of investment. It is further assumed that the division of total *ex post* appropriated value between the three stakeholders (the government, individuals, and the investor) occurs in the same proportions, irrespective of the size of the investment. The effect of this assumption, combined with $V_{j,A}^T$ being homogenous of degree one, is to make investments divisible and replicable. They can be repeated on a larger or smaller scale, with the same proportional results. It is arguable that this linearity assumption is valid in at least a subset of cases, given that the same investments could be made for a different group and number of individuals. However, if this assumption does not hold, such as it there are diminishing marginal returns, then the subsequent results may differ.

Suppose that an investor only cares about maximizing social impact from investment j and does not care about generating profit. Without capital recycling, the greatest possible social impact is $R_{j,A}^S = R_{j,A}^{PS}$, which occurs where no value is appropriated by the investor. That is, $V_{j,A}^P = 0$. A key question is whether this level of social impact can be improved upon. Are there circumstances where it is socially optimal to have $V_{j,A}^P > 0$? Put differently, what is the socially optimal division of $V_{j,A}^T$ between the different stakeholders?

Let us refer to the total impact with capital recycling as the multiplied social return.

***Definition 4.A. Multiplied Social Return (R^{MS}):** The limiting sum of discounted social returns when some portion of the amount appropriated from an investment is reinvested to achieve further social impact.*

***Definition 4.B. Social Impact Multiplier (m):** The proportion of the investment cost that is reinvested.*

It is assumed that the social impact multiplier, defined above, remains the same over successive reinvestments. That is, the proportion of investment cost that is reinvested is constant for a given investor and investment.

³³⁰ By way of illustration, suppose the pre-tax income for individual i in each time period after investments have been made is given by $y_i = y_{0,i} + \sum_{j \in I} a_{j,i} s_j^\theta$, where $y_{0,i}$ is the income of i at $t = 0$, and the term s_j^θ represents the social outcomes generated by investment j . Hence, the additional pre-tax income for i in each period due to investment j is given by $a_{j,i} s_j^\theta$. Another way to view this is to say that investment j by investor A creates $a_{j,A} s_j^\theta$ in value each period. It is assumed that returns in future time periods are discounted at a rate of $\delta \in (0,1)$ each period, and that the government imposes some flat tax rate $\tau \in (0,1)$ on individual income. Then the total value created is given by $V_{j,A}^T = \frac{a_{j,A} s_j^\theta}{1-\delta} N_j$. If total cost is a linear function of the individuals receiving services, then $C_j = c_j N_j$. Therefore $V_{j,A}^T(C_j) = \left[\frac{a_{j,A} s_j^\theta}{1-\delta} \right] \frac{C_j}{c_j}$, so $V_{j,A}^T(kC_j) = \left[\frac{a_{j,A} s_j^\theta}{1-\delta} \right] \frac{kC_j}{c_j} = k \left[\frac{a_{j,A} s_j^\theta}{1-\delta} \right] \frac{C_j}{c_j} = k \cdot V_{j,A}^T(C_j)$. As such, value $V_{j,A}^T$ is homogenous of degree one with respect to C_j .

Let V^R be the amount that is reinvested. Since no more than 100% of investor revenue can be reinvested, the social impact multiplier can be expressed as follows:

$$m = \frac{V^R}{C_j} \leq \frac{V^P}{C_j}$$

Note that the social impact from the initial investment is R^S , from the subsequent reinvestment is mR^S , from the following reinvestment is m^2R^S , and so on. As such, the multiplier m is also equal to the ratio of social impact from a reinvestment to the social impact from the previous investment, ignoring discounting.

Since the present value of social returns is the sum of a geometric sequence, we can write the multiplied social return as follows:

$$R^{MS} = \begin{cases} \frac{R^S}{1 - \delta m} & \forall \delta m \in [0, 1) \\ \infty & \forall \delta m \geq 1 \end{cases}$$

Note that the subscripts j, A have been intentionally left out here to simplify the expressions.

Proposition 4.E: Multiplied social return R^{MS} is maximized when the social impact multiplier is as follows:

$$m = \begin{cases} \left[\frac{1}{\delta}, \frac{R^{PS}}{C} \right) & \forall C \leq \delta R^{PS} \\ 0 & \forall C > \delta R^{PS} \end{cases}$$

This result says that the proportion of investment cost that is appropriated by the investor and reinvested should be zero where the cost strictly exceeds the discounted potential social return, and in the range $m = \left[\frac{1}{\delta}, \frac{R^{PS}}{C} \right)$ when cost is weakly less than discounted potential social return. The formal proof of this is as follows.

Proof:

Let us consider two mutually exclusive and collectively exhaustive cases. Case 1 is where $C > \delta R^{PS}$, and Case 2 is where $C \leq \delta R^{PS}$.

Case 1: $C > \delta R^{PS}$. In this case, if $V^R \in [0, R^{PS}]$ then $V^R < C$, as $\delta \leq 1$ and $C > 0$. Now if $V^R < C$, $\therefore m < 1$, since $m = \frac{V^R}{C}$. As $m < 1$, $\therefore R^{MS} = \frac{R^S}{1 - \delta m}$. We want to find what m maximizes this expression. Now $R^S = R^{PS} - V^P = R^{PS} - V^R - V^{NR}$, where V^{NR} is the part of V^P that is not reinvested. That is, $V^P = V^R + V^{NR}$. Given this, we can write $R^{MS} = \frac{R^{PS} - V^R - V^{NR}}{1 - \delta m} = \frac{R^{PS} - Cm - V^{NR}}{1 - \delta m}$. We can now differentiate R^{MS} with respect to m . This gives: $\frac{\partial R^{MS}}{\partial m} = \frac{-C(1 - \delta m) - (-\delta)(R^{PS} - Cm - V^{NR})}{(1 - \delta m)^2} = \frac{\delta R^{PS} - C - \delta V^{NR}}{(1 - \delta m)^2}$. Since $C > \delta R^{PS}$ and $\delta, V^{NR} \geq 0$, therefore the numerator is negative. Therefore

$\frac{\partial R^{MS}}{\partial m} < 0$. It follows that the maximum R^{MS} is at $m = 0$, which gives $R^{MS} = R^{PS} = R^S$. To complete Case 1 we also need to consider when $V^R > R^{PS}$. If this is the case, $\therefore V^P > R^{PS}$ as $V^P \geq V^R$. $\therefore R^{PS} - V^P < 0$. $\therefore V_A^Z + V_A^G - (V_B^Z + V_B^G) < 0$ as $R^{PS} = (V_A^P + V_A^Z + V_A^G) - (V_B^Z + V_B^G)$. Now since $R^S = V_A^Z + V_A^G - (V_B^Z + V_B^G)$, it follows that $R^S < 0$. Therefore $R^S < 0$ from each reinvestment, as the total value created is homogenous of degree one. $\therefore R^{MS} < 0$. We have now considered all options for V^R . Therefore when $C > \delta R^{PS}$, maximum R^{MS} occurs when $m = 0$, which gives $R^{MS} = R^{PS} = R^S$.

Case 2: $C \leq \delta R^{PS}$. Let us consider all possible values for m . If $m < \frac{1}{\delta}$, $\therefore \delta m < 1$, so R^{MS} is the limiting sum of the geometric sequence. As such, $R^{MS} < \infty$. If $m \geq \frac{R^{PS}}{C}$, therefore $V^R \geq R^{PS}$ since $m = \frac{V^R}{C}$. But then $R^S \leq 0$, as $V^R \leq V^P$ and $R^S = R^{PS} - V^P$. As $R^S \leq 0$, it follows that $R^{MS} \leq 0$. Now let us consider when $m \in [\frac{1}{\delta}, \frac{R^{PS}}{C}]$. In this range, $\delta m \geq 1$. Therefore, the sum of the geometric sequence has no limit. However, we need to show that each term in the sequence is positive. Now $R^S > 0$ if and only if $R^{PS} > V^P$. This condition can be written as $\frac{R^{PS}}{C} > \frac{V^P}{C}$, $\therefore \frac{R^{PS}}{C} > \frac{V^R}{C} + \frac{V^{NR}}{C}$, $\therefore \frac{R^{PS}}{C} > m + \frac{V^{NR}}{C}$. Therefore $R^S > 0$ if and only if $m < \frac{R^{PS}}{C} - \frac{V^{NR}}{C}$. The maximum m that satisfies this condition is $m = \frac{R^{PS}}{C} - \varepsilon$, which is when $V^{NR} = 0$, or equivalently where $V^P = V^R$. Therefore, for $m \in [\frac{1}{\delta}, \frac{R^{PS}}{C}]$, R^{MS} is a positive geometric sequence with no limit, so $R^{MS} \rightarrow \infty$. We have now considered all options for m . Therefore, when $C \leq \delta R^{PS}$, maximum R^{MS} occurs when $m \in [\frac{1}{\delta}, \frac{R^{PS}}{C}]$. $\square$

There are at least two equivalent ways of writing the previous proposition.

Proposition 4.F: Multiplied social return R^{MS} is maximized when investor revenue V^P is as follows:

$$V^P = V^R = \begin{cases} \left[\frac{C}{\delta}, R^{PS} \right) & \forall C \leq \delta R^{PS} \\ 0 & \forall C > \delta R^{PS} \end{cases}$$

Proposition 4.G: Let the proportion of potential social return that is appropriated by the investor and then reinvested be denoted by γ , so that $\gamma = \frac{V^R}{R^{PS}} \leq \frac{V^P}{R^{PS}}$. Multiplied social return is maximized when:

$$\gamma = \begin{cases} \left[\frac{C}{\delta V^P}, 1 \right) & \forall C \leq \delta R^{PS} \\ 0 & \forall C > \delta R^{PS} \end{cases}$$

This result is somewhat counterintuitive. One may expect *prima facie* that increasing the amount appropriated by the investor would weakly or strictly decrease social return, however this result shows that there are circumstances where increasing the amount appropriated by the investor increases multiplied social return. When the initial cost of an investment is less than the discounted potential social return, then impact is *not* maximized by setting $V^P = 0$, but rather by setting $V^P \in [\frac{C}{\delta}, R^{PS})$ and reinvesting all the revenue that is received. Conversely, the argument

that investor appropriation of financial value can increase social impact via reinvestment is only valid where $C \leq \delta R^{PS}$. Put differently, if it is possible to have the same or greater social return in subsequent periods than the first period, then that should occur. If that is not possible then no reinvestment should take place.

It is also possible to write out a more general form of the investor's objective function when capital recycling is incorporated. Recall from Chapter 3 (Definition 3.H) that valued returns without capital recycling is given by $R_{j,A}^V = \omega_A^S \cdot R_{j,A}^S + \omega_A^f \cdot R_{j,A}^F$. This can now be adjusted to incorporate capital recycling, as follows.

Definition 4.C. Multiplied Valued Return R^{MV} : The limiting sum of the weighted sum of discounted social and financial returns, when some portion of investor revenue from an investment is repeatedly reinvested.

As such,

$$R_{j,A}^{MV} = \begin{cases} \frac{\omega_A^S \cdot R_{j,A}^S + \omega_A^f \cdot R_{j,A}^F}{1 - \delta m_{j,A}} & \forall \delta m_{j,A} \in [0,1) \\ \infty & \forall \delta m_{j,A} \geq 1 \end{cases}$$

$$\therefore R_{j,A}^{MV} = \begin{cases} \frac{\omega_A^S \cdot R_{j,A}^S + \omega_A^f \cdot (V_{j,A}^{NR} - C_j)}{1 - \delta \frac{V^R}{C_j}} & \forall \delta m_{j,A} \in [0,1) \\ \infty & \forall \delta m_{j,A} \geq 1 \end{cases}$$

This is the multiplied valued return from investor A investing in j , where $j \in I$. If identical initial investments could be made, then the multiplied valued return from an investor investing up to their budget constraint (that is, investing the full initial pool of capital), denoted b_A , is given by:

$$R_{j,A}^{MV} = \begin{cases} \frac{b_A}{C_j} \left[\frac{\omega_A^S \cdot R_{j,A}^S + \omega_A^f \cdot (V_{j,A}^{NR} - C_j)}{1 - \delta \frac{V^R}{C_j}} \right] & \forall \delta m_{j,A} \in [0,1) \\ \infty & \forall \delta m_{j,A} \geq 1 \end{cases}$$

The investor's objective function is therefore:

$$\max_{j \in I} \frac{1}{(1 - \delta \frac{V^R}{C_j})} \left\{ \frac{b_A}{C_j} [\omega_A^S \cdot R_{j,A}^S + \omega_A^f \cdot (V_{j,A}^{NR} - C_j)] \right\}, \text{ where } \delta m_{j,A} \in [0,1)$$

This can be rewritten as:

$$\max_{j \in I} \frac{1}{(1 - \delta m_{j,A})} \left[\frac{b_A}{C_j} \cdot V_{j,A}^R \right], \text{ where } \delta m_{j,A} \in [0,1)$$

This shows that there are four ways to increase the multiplied valued return: increasing the budget constraint b , decreasing the cost of the investment C , increasing the multiplier m , or increasing valued return V^R . Increasing V^R could be done if a greater portion of the investment returns were in the category (out of social and financial) that the investor places more weight on, or by making an investment with higher returns.

What these research findings mean is that (i) reinvestment of capital does in fact sometimes increase social value, and (ii) measured social impact determines whether or not that is the case. As such, it logically follows that social impact measurement affects social value creation via social impact measurement by way of capital recycling. This is an important contribution to the literature because to the best of our knowledge, no research has been undertaken to date to determine if, and under what conditions, capital recycling leads to a greater overall social impact. By knowing the optimal degree of value appropriation, impact investors may be able to increase the social value they create.

4.10 Summary

Overall, the key contribution of this chapter is the identification and investigation of four ways that social impact measurement affects social value creation in contingent-repayment financing mechanisms.

First, social impact measurement affects investment selection, which is a component of social value creation. The data reveals that investment selection is often influenced by the measured social impact of past comparable impact investments. However, this does not mean that better investment selection occurs and that more social value is created. To the contrary, the data reveals that measured social impact is currently unreliable and non-comparable owing to significant inconsistency in the treatment of taxation, discount rates, costs and the counterfactual. This differential treatment means that investments with the highest *measured* social impact in many cases do not have the greatest social impact.

Secondly, measured social impact affects social value creation via the appropriation of financial value. The data shows that financial returns to investors are often performance based and a function of the measured social impact. Higher measured social impact increases appropriation of value. This, in turn, reduces social impact since investor returns are not commonly classified as social impact. As such, the relationship between social impact and financial appropriation goes both ways, with each affecting the other. Unless adjustments are made to measured social impact, that measured social impact becomes inaccurate when used as an input variable into an investor's financial return function.

Thirdly, social impact measurement is linked to social value by the degree to which maximization of one corresponds to maximization of the other. It is evident that many impact investors incorrectly assume that each investor maximizing their own social impact leads to aggregate social impact maximization. It is shown that this is not normally the case, with greater divergence between investor social impact maximization and aggregate social value maximization in the case of absolute social impact measurement than marginal social impact measurement.

Finally, measured social impact affects the social value created via capital recycling. Many impact investors are unsure of whether the appropriation of financial value for the purpose of reinvestment increases or decreases the social value they create. It is shown that the size of an investor's social impact affects the ratio of social impact to costs, and it is this ratio that determines whether reinvestment of appropriated financial value is optimal from a social impact maximization perspective.

In these four ways, social impact measurement affects the social value created. This finding, together with the result in Chapter 5 that mechanism design affects the accuracy of social impact measurement via the alignment of social and financial returns, means that social impact measurement acts as an intermediate pathway that links mechanism design and social value creation. Social impact measurement is not independent of mechanism design and independent of social value creation, as it is commonly treated in the literature and in practice. It should not be viewed as a standalone undertaking because it plays a key, multi-faceted and nuanced role in the relationship between mechanism design and social value creation.

V.

Second Intermediary Effect: How Mechanism Design Affects Social Value Creation via the Alignment of Social and Financial Returns

5.1 From Whether a Relationship Exists to How a Relationship Operates

The second intermediate way that mechanism design affects social value creation is via the degree of alignment of social and financial returns. One of the insights from the theoretical modelling in Chapter 3 is that different mechanism designs align social and financial returns to differing extents. For example, contingent loans mean that the higher the incomes of loan recipients, the higher the financial returns to investors. This close (albeit imperfect) alignment of social and financial returns contrasts with the mechanism of taxation deductibility, where financial returns to investors are completely independent of the social value these investments create. Given that we know mechanism design impacts the alignment of social and financial returns, it is worth researching this relationship in more depth to discover exactly how the alignment of social and financial returns affects social value creation.

5.2 Existing Justifications for Social and Financial Return Alignment

As previously mentioned, one of the principal justifications for impact investing in both the literature and in practice is that the alignment of social and financial returns is beneficial. Despite this common assertion, there is limited in-depth research or understanding as to *why* it is beneficial.

Seven of the reasons for aligning social and financial returns, which are mentioned in the literature and echoed in the primary interview data, are that alignment means all stakeholders are pushing in the same direction (Izzo, 2013),³³¹ that investors and entrepreneurs are less likely to experience mission drift where social impact objectives become secondary or token (Dees & Anderson, 2003),³³² that it enables the best of both worlds, that it leads to increased capital flows, that it means generating a financial return does not directly undermine other philanthropic undertakings (Rosqueta, 2017),³³³ that it incentivizes investors to put in more effort to help in the creation of social impact, and that it enables targeting of customers who value the social impact being generated (Dees & Anderson, 2003).³³⁴

Importantly, there has been negligible research and there is limited understanding of how the alignment of social and financial returns may influence whether specific first-best social impact properties can be obtained. Given that the literature provides little guidance on how to undertake research on the topic, a novel three-step approach is developed and employed.

5.3 Novel Methodology

The first step is the identification and formalisation of the precise properties that impact investing stakeholders would like to see an impact investing mechanism satisfy. These mechanism design objectives can be broken into social value creation objectives, which have been identified but not

³³¹ Izzo, D. (2013). Aligning interests in impact investing. Stanford Social Innovation Review.

³³² Dees, J. G., & Anderson, B. B. (2003). For-profit social ventures. *International Journal of Entrepreneurship Education*, 2(1), 1-26.

³³³ Rosqueta, K., (2017, October 26). Impact Investing: Aligning money, values, and social impact goals. [Web blog post]. Retrieved March 28, 2018 from <http://impact.upenn.edu>.

³³⁴ Dees, J. G., & Anderson, B. B. (2003). For-profit social ventures. *International Journal of Entrepreneurship Education*, 2(1), 1-26.

formalised in the research in Chapter 3, and social impact measurement objectives, which are able to be identified from the primary data presented in Chapter 4. Collectively, these objectives can be referred to as the first-best social impact properties. These are the properties which one would, in an ideal world, want contingent-repayment impact investing mechanisms to possess.

It is then necessary to investigate how the alignment of social and financial returns influences whether these properties are satisfied. This leads to methodological steps two and three. The second step involves writing out the financial equivalents of these first-best social impact properties. Then, as the third step, a comprehensive review of the economics and finance literature is undertaken to determine whether and how these equivalent financial properties might be obtained.

This approach works for the following reason. *If* there are financial equivalents of first-best social impact properties, and *if* those financial equivalents can be achieved via existent financial tools, it follows that when a mechanism design results in the alignment of social and financial returns, then those financial tools can be used to overcome mechanism design challenges and achieve first-best social impact properties. These properties, in turn, positively impact the social value created. In this way, it is possible to research how the alignment of social and financial returns influences the relationship between mechanism design and social value creation.

5.4 Formalisation of the First-Best Social Value Creation Properties

Based on the three components of social value identified in Chapter 3, it is possible to write out the first-best social value creation properties.

S1. Selection: Allocation is to the investor with the highest expected social return. That is, we want expected social impact to be truthfully revealed ex ante.

In other words, prior to contract allocation, it should be possible to accurately ascertain the expected effectiveness of each possible investment. Information about the expected effectiveness of possible investments is often not publicly known, but investors and those carrying out investments are often privy to this knowledge. If a government is deciding which investor to allocate an investment contract to, they should be able to ascertain the expected effectiveness of investors in advance. There should be no incentive for investors to misreport expected effectiveness. This is important as it enables capital allocation decisions to be based on expected effectiveness, rather than subjective assessment. This notion of revealed expected effectiveness is similar to the concept of revealed preferences in the economics of matching literature.

S2. Quantity: Expected future social returns are internalised and considered in present period decision-making, so that the optimal quantity of each investment is made.

This ensures that there is not underinvestment, as is common with some types of investments, such as preventative healthcare and education, that have long-term returns.

The third and final component of social value creation can be formalised as the following desirable property.

S3. Effort: High effort is exerted by providers in the generation of social returns. That is, high effort is consistent with a provider's incentive compatibility constraint.

5.5 Identification of Desired Social Impact Measurement Properties from Primary Data

This primary data presented in Chapter 4 enables us to identify seven desired social impact measurement properties based on properties where there is consensus regarding desirability. These are the properties which one would, in an ideal world, want a measure of social impact to possess. The properties are written in such a way as to be consistent with the theory construction in Chapter 3. The properties include formulation properties that concern *what* is measured, and methodological properties that concern *how* and *when* measurement occurs, as well as *who* undertakes the measurement.

Knowledge of Marginal Social Impact in Advance of Investment

The first of the desirable social impact measurement properties revealed by the primary data is also the most complicated one to understand. This property follows from three key data points. As shown in Figure 4.3, 91% of impact investors believe it is desirable to know “in advance which investment, from a set of possible investments, is objectively expected to create the most social impact,” with 40% indicating this is “desirable” and 51% saying this is “very desirable”. Also in Figure 4.3, 58% believe it is “desirable” or “very desirable” to accurately ascertain the expected counterfactual social impact. Then in Figure 4.1 I11, it is clear that there is a preference for marginal social impact to be measured, with 63% selecting this as preferable to absolute social impact measurement.

Combining these three findings gives us the following first-best measurement property:

***M1. Marginality:** There is knowledge of the marginal social return relative to the counterfactual.³³⁵ It should be possible to know the difference between the actual social return of the investment being undertaken, and the expected social return of the counterfactual investment.*

Not only does this property reflect the expressed preferences of impact investors, but it is also theoretically sound. By measuring marginal impact rather than absolute impact, we are measuring what would have occurred in the absence of *that* investment, rather than in the absence of *any* investment or any progression of time. Furthermore, this marginality property is consistent with, and follows from, the finding in Chapter 4, Section 4.8. Measurement of marginal social impact rather than absolute social impact means that investors maximizing their own measured social impact more closely corresponds to aggregate social impact maximization. As such, measuring marginal social impact is preferable.

³³⁵ The counterfactual here is defined as the investment that would have been undertaken in the absence of the investment actually undertaken.

Time of Social Impact

As shown in Figure 4.1 I3, 94% of impact investors believe that, at any point in time, both past social impact and expected future social impact should be incorporated in the measure of social impact. This consensus, that the impact of an investment into all time periods should be included in the calculation, is reflected in the following two properties.

M2. Intertemporal Inclusion: All expected future social returns are incorporated into present period social metrics.

M3. Intertemporal Accuracy: All past social returns are known with certainty.

Subjectivity and Conflicts of Interest

The primary data, presented in Figure 4.1 I4, reveals that more impact investors believe that their own measured social impact is biased (48%) than unbiased (42%), with the remaining 11% being unsure. Interestingly, almost equal numbers believe their own impact measurement is biased upwards (27%) as biased downwards (21%). Furthermore, 70% of impact investors believe that other entities are biased in their impact measurement, with 63% believing that bias to be upwards and 7% downwards. These results suggesting bias in practice are at odds with the fact that 97% of investors believe that “measuring social impact in a completely unbiased, objective way” is desirable (61%) or very desirable (36%), as shown in Figure 4.2.

These data points are partly explained by the findings of Vo, Christie and Rohanna (2016). The authors found that the way social impact is currently calculated involves significant potential conflicts of interest. They found that in most cases either impact analysts or data providers have a vested interest in there being favourable impact measurements. 37% of impact analysts worked for a non-profit organisation, often at the same organisation they were assessing. They also found that the data that is obtained for calculation purposes came mostly from beneficiaries and staff members, who were likely to benefit from additional funding. Furthermore, a large portion of impact analysts said that funders were the primary audience for the impact results. Indeed, one of the three most commonly reported aims of impact measurement in their study was to secure additional financial investment. As such, there is essentially self-reporting of social impact. Those undertaking impact measurements often have an incentive to over-report impact to attract additional funding and to retain employers. Even in cases where an independent third party is undertaking the measurement, the choice of inputs into the social impact calculation (such as data on investment outputs and outcomes) is often selected and made available by the investor or entity carrying out the investment. A similar point is made by Gibbon and Dey (2011),³³⁶ who find that there is effectively self-reporting of impact that is very open to manipulation given the inherently subjective nature of impact measurement.

This leads to the fourth desirable property, which can be expressed as follows.

³³⁶ Gibbon, J., & Dey, C. (2011). Developments in social impact measurement in the third sector: scaling up or dumbing down?. *Social and Environmental Accountability Journal*, 31(1), 63-72.

***M4. Objectivity:** The measure is an unbiased indicator of social value, determined via the utilization of all available information.*

In other words, there should be no incentive for biased measurement or misreporting. If there is an incentive for bias, the credibility of the measure is undermined. It would not be able to be relied upon and would be of negligible use.

Frequency of Measurement

As shown in Figure 4.1 I1, social impact measurement currently occurs discontinuously and infrequently in most cases. In many cases there are monthly or yearly delays between social impact calculations. There are various reasons why this is the case. As shown in Figure 4.1 I2, of the impact investors that do not currently measure their social impact, 40% say it is because it is too difficult, 11% because it is too costly, and 8% because it is too time consuming. This data is backed up by Gair (2009),³³⁷ which argues that social impact measurement is a very complex process, requiring a significant quantity of time and human resources.

Notwithstanding this, there is general consensus that frequent social impact measurement is preferable, with 39% of investors expressing continual measurement as their first preference (the highest preference of any option). Given this, a first-best property can be written as follows:

***M5. Continuity:** The measure is a continuous indicator of social value.*

At any point in time it should be possible to know the measured impact, otherwise the measure is of limited use.

Properties M4 and M5 ensure that after an investment has been made, the measurement of social impact is accurate and timely.

Degrees of Metric and Methodological Consistency

There is currently significant inconsistency with what is measured and how it is measured, as discovered in Chapter 4, Section 4.6. Different impact investors measure different outcomes, with different counterfactuals, and with different discount rates. This leads to significant errors in calculating the final indicator and means that social impact measurements are often not comparable between organisations and programs. This view is shared by Ryan and Lyne (2008).³³⁸

Ideally, one should be able to compare investments aimed at achieving the same social outcome, different social outcomes, or multiple social outcomes. As such:

***M6. Comparability:** The elements in the set of possible investments can be ranked and compared based on social return on the same cardinal scale.*

³³⁷ Gair, C. (2009). SROI act II: A call to action for next generation SROI. *San Francisco: REDF.*

³³⁸ Ryan, P. W., & Lyne, I. (2008). Social enterprise and the measurement of social value: methodological issues with the calculation and application of the social return on investment. *Education, Knowledge & Economy*, 2(3), 223-237.

In order for this to be achieved there must be, *inter alia*, consistency regarding whether investment costs are subtracted, whether taxation revenue is included, how discount rates are calculated, and what type of impact is measured.

Positive Externalities Arising from Complementarities

As previously mentioned, 21% of impact investors believe their own measured social impact is biased downwards and a further 11% are unsure of whether or not there is bias (Figure 4.1 I4). A common explanation given by survey participants for this downwards bias (in the optional explanatory text and in interviews) is that various social outcomes are often complementary. As such, measuring only some social outcomes may understate the overall impact. For example, one impact investor explained that they often invest in improving the health of low-income individuals. Measures of their social impact often focus solely on health outcomes, which they believe do not accurately capture spillover effects, such as how improved individual health may improve learning effectiveness in classrooms and lead to better educational outcomes.

Let us refer to situations like this, where externalities arise due to an interdependence between social outcomes, as interdependence externalities. Interdependence externalities occur where a change in one type of social outcome in an individual (such as educational competency) causes a change in other social outcomes for that same individual (such as health levels). We can therefore write the following property:

M7. Interdependency: Interdependence externalities from an investment are included in the calculation of social return.

Together, properties M2, M3, and M7 ensure that the full value that accrues from an investment is accounted for.

Overall, this means that there are ten first-best social impact properties, comprised of three general social value creation first-best properties (S1-S3), and seven social impact measurement first-best properties (M1-M7).

5.6 The Difficulty in Achieving These First-Best Social Impact Properties

Many of these first-best properties are very difficult to obtain. This is evident in the primary data. There is often a divergence between what impact investors believe to be desirable and what occurs in practice. As shown in Figure 4.2, almost all impact investors believe that completely unbiased, objective social impact measurement is “desirable” or “very desirable” (97%), but that it is either “difficult” or “impossible” to achieve (64%). Furthermore, most investors think that accurately measuring expected future social impact is a desirable objective (71%), but most believe that is “difficult” or “impossible” to do with accuracy (70%). In relation to investment selection, a majority of survey respondents believe that it would be “desirable” or “very desirable” to know *ex ante* which investment is objectively expected to create the most social impact (91%), but 38% think this is impossible to achieve.

When it comes to the counterfactual, only a slight majority of respondents see the value in knowing the expected social impact of the counterfactual investment (58%), while a very high percentage deem knowing the counterfactual social impact to be “difficult” or “impossible” (94%). In many ways, these two data points are to be expected given that knowing what would have occurred is inherently more difficult than knowing what is occurring or what did occur. Despite this, both of these data points are a cause for concern because of the finding from the analysis in Chapter 3 that social impact is equally determined by the counterfactual investment as the actual investment. Given the importance of the counterfactual, it is worrying that almost half of impact investors do not see the important role it plays in the creation of social value, and even among those who do understand its importance, most do not think it can actually be known. This again highlights that a major impact investing challenge is measuring the attribution and appropriation of the counterfactual investment.

Given the difficulty in obtaining the first-best social impact properties, as evidenced by the primary data, it is worth investigating how the alignment of social and financial returns may enable those properties to be achieved.

5.7 Financial Mechanisms That Enable the Financial Equivalents of First-Best Social Impact Properties

This brings us to steps two and three of the research on the alignment of social and financial returns. A wide and critical reading of the economics and finance literature reveals this finding: *The ten first-best social impact properties are the social equivalents of financial properties that we know from the literature how to obtain.* More specifically, there are five financial mechanisms that the literature shows can result in the ten financial equivalents of the first-best social impact properties. These financial mechanisms are: (i) a sealed-bid second-price auction; (ii) the process of securitization; (iii) the use of market exchanges; (iv) an initial lump-sum payment; and (v) discounted value aggregation. Each of these financial tools are discussed in turn, with a focus on the financial equivalent properties that each financial mechanism is able to satisfy.

Auction Mechanism

The first of these financial tools is a sealed-bid second-price (Vickrey) auction. First described academically by William Vickrey in 1961, a Vickrey auction is one where each bidder anonymously places bids, the winner is the bidder with the highest bid, and that bidder pays the amount bid by the second-highest bidder (Vickrey, 1961).³³⁹ This auction mechanism has several important characteristics. Unlike in other auction formats such as the first-price sealed bid auction and the Dutch declining-price auction,³⁴⁰ there is an incentive for bidders to truthfully reveal their valuation. It follows that if the auction is for something that generates profit, then each bidder's optimal strategy is to truthfully reveal their expected profit by bidding up to their zero-profit condition. This means that expected profit is truthfully revealed *ex ante*, so private information becomes public. It follows that entities can be ranked not only ordinally, but also cardinally, by

³³⁹ Vickrey, W. (1961). Counterspeculation, auctions, and competitive sealed tenders. *The Journal of finance*, 16(1), 8-37.

³⁴⁰ Vickrey (1961) proves that these two alternative auction formats are equivalent and the dominant strategy is to bid strictly less than one's maximum willingness to pay.

expected profit. Therefore, we can know the expected financial return of the firms with the highest and second-highest expected financial return. The firm with the second-highest expected financial return is the firm that would have won the auction in the absence of the bidder with the highest expected financial return. In this sense, the second-highest bidder is the counterfactual firm. Given this, a sealed-bid second-price (Vickrey) auction enables the following:

F1 (S1 Equivalent): Allocation is to the investor with the highest expected financial return.

F2 (M1 Equivalent): There is knowledge of the marginal financial return relative to the counterfactual. That is, it is possible to know the difference between the actual financial return of the investment, and the expected financial return of the counterfactual investment.

Securitization

The second financial tool is securitization. This is the process of converting illiquid assets that generate recurring revenues into securities that are small enough and standardised enough to be tradable, so they can be sold to investors in financial markets (Martinez-Solano, Yagüe-Guirao & Lopez-Martinez, 2009; Herig, 2010; Valdés-Prieto, 2006).³⁴¹ The securitization of future revenue streams enables the following:

F3 (M2 Equivalent): All expected future financial returns can be incorporated into present period financial metrics.

One such financial metric is the present discounted value of aggregate financial returns. Because this financial measure is the investor's objective function, meaning the investor attempts to maximize it, it follows that:

F4 (S2 Equivalent): Expected future financial returns are internalised and considered in present period decision-making, so that the optimal quantity of each investment is made.

As such, long-term financial returns are able to be brought forward to within investors' time horizons, and therefore incorporated into the short-term decision-making calculus of investors. Also, given that securities have disbursements in the form of dividends (in the case of shares) and interest (in the case of bonds), past financial returns are known to the security holders. In many cases this information is publicly accessible. As such, the following property holds:

F5 (M3 Equivalent): All past financial returns are known with certainty.

Market Trade

The third financial tool that enables the financial equivalent properties to be obtained is simply market trade. The literature on market pricing finds that if the market is efficient, the market

³⁴¹ Martinez-Solano, P., Yagüe-Guirao, J., & Lopez-Martinez, F. (2009). Asset securitization: effects on value of banking institutions. *The European Journal of Finance*, 15(2), 119-136. Herzig, M. (2010). U.S. Patent No. 7,809,621. Washington, DC: U.S. Patent and Trademark Office. Valdés-Prieto, S. (2006). A market method to endow NDC systems with automatic financial stability. *Pension Reform*, 149.

price is an unbiased estimate of true value and fully reflects all the available information on the securities (Malkiel & Fama, 1970).³⁴² The necessary conditions for an efficient market include low transaction costs and a sufficient number of profit-maximizing investors so that the securities can be traded until any excess returns are eliminated (Damodaran, 2012).³⁴³ In such markets, there is an incentive to form one's expectation based on all available information. Furthermore, market prices are dynamic, adapting continuously to new information.³⁴⁴ Given this, a traded security market price has the following properties:

F6 (M4 Equivalent): The measure is (with efficient markets) an unbiased objective indicator of financial value, determined via the utilization of all available information.

F7 (M5 Equivalent): The measure is a continuous indicator of financial value.

Lump-Sum Payment

A fourth financial technique sometimes employed in contracts is the use of a lump-sum payment. One area of the development economics literature that focuses on this is sharecropping – a type of agrarian contract between a landlord and a tenant in which the tenant pays the landlord a percentage of the crop produced in exchange for being able to cultivate the land. This arrangement was first rigorously analyzed by Alfred Marshall in 'Principles of Economics' (1920).³⁴⁵ He proved that this arrangement results in inefficient outcomes because the tenant is incentivised to exert low effort. Specifically, the tenant will only exert effort up to the point where the marginal product of labour equals the tenant's opportunity cost, which is below the first-best equilibrium. Marshall further shows that such inefficiency does not occur in a fixed rent contract, where the tenant pays the landlord a lump-sum initial amount, and then retains a greater percentage of the crop yield. This finding is not unique to sharecropping. More generally, an initial lump-sum transfer from an agent to a principal can ensure the following:

F8 (S3 Equivalent): The exertion of high effort by providers in the generation of financial returns. That is, high effort is consistent with a provider's incentive compatibility constraint.

Without an initial lump-sum, an investor's high effort incentive compatibility constraint is less likely to be satisfied. The optimal decision for an investor may be to provide the specified investment quantity at low effort and incur lower costs, while still reaping the specified benefits.

³⁴² Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The journal of Finance, 25(2), 383-417.

³⁴³ Damodaran, A. (2012). Investment valuation: Tools and techniques for determining the value of any asset (Vol. 666). John Wiley & Sons.

³⁴⁴ This is notwithstanding the fact that for some securities, there are minor discontinuities in measures of value. For example, share prices may be held constant between daily closing and next-day opening times. Between these times, it is fair to assume that the price at the previous close of trade is still an accurate indicator of market value, given the short time-lag. This compares with measure of value that are undertaken at discrete times with significant time intervals between measurements, often months or years. Therefore, it is still fair to state that market prices are a continuous indicator of financial value.

³⁴⁵ Marshall, A. (1920). Principles of economics: an introductory volume. Royal Economic Society (Great Britain).

Discounted Value Aggregation

A fifth and final financial tool commonly employed by firms is to discount and aggregate value where there are complementarities between different drivers or units of value. Such complementarities are widespread. For example, the business literature emphasizes that in many cases there are complementarities between product lines or departments within a business (Bernard, Redding & Schott, 2005).³⁴⁶ There may also be complementarities between product innovation and process innovation (Miravete & Pernias, 2006).³⁴⁷ As such, if product lines or departmental profit is measured in isolation, this may understate financial value by failing to capture positive interdependence externalities. However, by using an aggregate measure of financial value, such as total profit, these complementarities can be captured. Additionally, by using just one measure of financial value rather than different measures, and by discounting to a common time period, comparisons are possible. As such, discounting aggregated value enables the following:

F9 (M6 Equivalent): The elements in the set of possible investments can be ranked and compared based on financial return on the same cardinal scale.

F10 (M7 Equivalent): Interdependence externalities from an investment are included in the calculation of financial return.

5.8 Key Implication

As such, the literature from economics and finance suggests that the financial equivalents of the first-best social impact properties may be able to be obtained. Furthermore, the literature points to the financial tools that may be able to be used to obtain those equivalent properties.

This may not seem like a relevant result, but it is. To see why, it is necessary to draw from a different field of literature – mathematics. An important mathematics result is that if one variable is a monotonically increasing function of another variable, then knowledge of one variable enables knowledge of the other variable (Salem, 1943; Miller & Samko, 2001).³⁴⁸ A crucial finding follows from this. *If the design of an impact investing mechanism means financial return is a monotonically increasing function of the social value created, then financial tools can be used to obtain the first-best social impact properties by obtaining the equivalent financial properties.* In other words, if there is a one-to-one relationship between social and financial value, then by obtaining the financial equivalents of first-best social impact properties, those desirable social impact properties can be indirectly obtained. This constitutes an important contribution to the literature.

³⁴⁶ This paper finds that manufacturing firms regularly produce multiple products that span different sectors because of complementarities, such as a firm selling both lumber and furniture. Bernard, A. B., Redding, S., & Schott, P. K. (2005). Multi-product firms and the dynamics of product mix. Yale School of Management.

³⁴⁷ Miravete, E. J., & Pernias, J. C. (2006). Innovation complementarity and scale of production. *The Journal of Industrial Economics*, 54(1), 1-29.

³⁴⁸ Salem, R. (1943). On some singular monotonic functions which are strictly increasing. *Transactions of the American Mathematical Society*, 53(3), 427-439. Miller, K. S., & Samko, S. G. (2001). Completely monotonic functions. *Integral Transforms and Special Functions*, 12(4), 389-402.

This research suggests that when social and financial returns are aligned, the following are possible under certain assumptions:

- (a) profit expectation revelation via auction mechanisms can deduce social impact expectation prior to investment, thereby overcoming information asymmetry problems in the investment selection process;
- (b) auction mechanisms can be used to ascertain the expected social impact of the counterfactual investor;
- (c) the process of securitization can be used to bring long-term social impacts into the short-term decision-making time-horizon of for-profit investors, so as to help combat underinvestment in areas with traditionally long-term returns;
- (d) actual past profit can be used to determine actual past impact;
- (e) the traded price of securities can reveal objective and continuous market expectations about future social impacts;
- (f) a lump-sum payment from an investor may be able to incentivize the optimal degree of effort in the undertaking of the investment; and so on.

Note that while this research has identified financial tools that have the potential to satisfy the financial equivalents of *all* ten first-best social impact properties, this is not necessary for the underlying contribution of the research to stand. Indeed, even if only *one* of the financial equivalents of first-best social impact properties could be obtained, it would still prove the key point – that there is a benefit to the alignment of social and financial returns that has been overlooked to date.

5.9 Conclusion

It was shown in Chapter 3 that mechanism design influences the alignment of social and financial returns. The research in this chapter then finds that the alignment of social and financial return affects social value creation in a key way that has not been previously identified. It finds that a key benefit of aligning social and financial returns is that desirable social impact properties can be obtained via existing financial tools.

Since some of those first best properties pertain to social impact measurement, this research also shows a link between mechanism design and social impact measurement. Mechanism design affects social impact measurement via the alignment of social and financial returns. This was the missing piece of the logic in Chapter 4 that has now been filled in.

What this research also shows very clearly is that issues such as investment selection and social impact measurement are not independent of mechanism design and social value creation, as they are often treated in the incumbent literature, but are heavily influenced by it and heavily influence it.

VI.

Third Intermediary Effect: How Mechanism Design Affects Social Value Creation via Constraint Adherence

6.1 Chapter Overview

So far, two intermediate links between mechanism design and social value creation have been investigated – social impact measurement in Chapter 4 and the alignment of social and financial returns in Chapter 5. In the process of researching these two intermediate links, ten first-best social impact properties have been identified (three social value properties and seven measurement properties). What is stopping these first-best properties from being obtained via contingent-repayment investment mechanisms? The theoretical modelling of contingent-repayment mechanisms in Chapter 3 suggests that at least part of the explanation centres around constraints. Each stakeholder faces constraints that limit their capacity to adopt and employ some mechanism designs. Furthermore, the mechanisms themselves face constraints that limit the capacity of the mechanism to work as intended. As such, there exists both stakeholder constraints and practical constraints. If a mechanism design results in these constraints being binding, then the mechanism is not able to achieve the ten first-best properties, and therefore optimal social value creation is not obtained. In contrast, if a mechanism adheres to all constraints, stakeholders are more likely to be able to use the mechanism design, obtain the first-best properties, and generate the optimal degree of social value. In this way, constraint adherence acts as the third intermediate link between mechanism design and social value creation.

The primary data from interviews helps significantly in understanding how constraint adherence affects the relationship between mechanism design and social value creation in contingent-repayment mechanisms. More specifically, the interview data answers five key questions. First, what are the main characteristics of key stakeholder groups that affect their behaviour in undertaking investments? Secondly, what constraints limit the willingness and/or ability of key stakeholders to enter into contractual agreements for financing investments in individuals? Thirdly, what practical constraints limit the ability of contractual agreements to be implemented as intended? Fourthly, which constraints and properties do each of the existing contingent-repayment investing mechanisms fail to meet? Fifthly, and more generally, what combinations of mechanism design properties and constraints present a particularly difficult design challenge?

The key findings on each of these questions is presented. It is found that there are six main constraints that limit the ability of mechanism designs to create social value. This consists of four stakeholder constraints and two practical constraints. It is also found that none of the five contingent-repayment mechanisms satisfy all of these constraints. As such, the failure of mechanisms to adhere to these constraints helps to explain low adoption rates at present. More generally, the interviews reveal eight combinations of constraints and first-best properties that are difficult to satisfy simultaneously and so present a major design challenge.

Given the shortcomings of existing mechanisms and the difficulty in achieving certain constraint-property combinations simultaneously, the research then proceeds to ask, “Are there mechanism design characteristics that must *necessarily* be satisfied in order for all six constraints to be adhered to, while not eliminating the possibility of obtaining the ten first-best properties?” It is discovered via logical deduction that there are three implied characteristics that a mechanism design must possess to stand any chance of the six constraints and ten first-best properties being satisfied simultaneously.

This leads to the pertinent question, “Do these derived necessary characteristics correspond to a gap in the contingent-repayment mechanism landscape?” It is shown via gap analysis that the precise characteristics necessary for the constraints and first-best properties to be obtained are the precise characteristics *not* observed in existing contingent-repayment mechanisms.

As such, this research reveals the important role that constraints play in the relationship between mechanism design and social value creation. Constraints affect whether mechanism designs are adopted, whether they can be implemented successfully, and whether the first-best properties can be obtained.

6.2 Findings on Stakeholder Characteristics

Before outlining the research findings regarding stakeholder and practical constraints, let us first give an overview of the findings regarding the characteristics and capabilities of the two main types of investors – public sector impact investors and private sector impact investors.

Analysis of interview data highlights consensus on the following stakeholder characteristics. While there are exceptions to these characteristics, interview consensus that is consistent with the literature suggests these characteristics are valid in many cases.

Figure 6.1: Identification of Stakeholder Characteristics

Variable	Stakeholder	
	Public Impact Investors (Governments)	Private Impact Investors
Primary Objective	Welfare Maximization	Profit Maximization
Secondary Objective	Maximizing Reelection Chances <i>This is a function of financial factors and political factors. Specifically, there is a desire to (a) improve the budget balance, and (b) minimize political backlash at expenditure policies.</i>	Measured Social Impact Maximization
Decision-Making Time Horizon <i>This is defined as the time over which the stakeholder's objective function is maximized.</i>	Short-Term <i>In most cases, the expected duration of political office.</i>	Short-Term <i>In most cases, the fund time-horizon.</i>
Degree of Risk Aversion	Medium to High	Low to Medium
Variation in Inherent Effectiveness of Impact Investments	Low Variability <i>Often there is only a single investor, and a single entity carrying out the investments.</i>	High Variability <i>Often there are many investors, and many entities carrying out the investments.</i>
Acceptability of Securitizing Future Returns	Low	High

Ease of Firing Employees for Low Effort or Otherwise Poor Performance	Low to Medium	Medium to High
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As shown, the characteristics of public and private impact investors differ along several important dimensions. As Darian Stibbe, Executive Director at The Partnering Initiative, explained,

“When attempting to form partnerships, it is important to understand the differences between partners. Governments are typically risk-adverse and short-term politically motivated. However, they have institutional capabilities and can implement taxation policy. Most private investors are short-term profit-driven, and can bring greater efficiency and innovation than the government in many cases.”

The characteristics identified in the table are taken to be plausible assumptions of stakeholder behavior and capabilities. Both the government and private impact investors are assumed to be myopic, given that the government is seeking as a secondary objective to maximize chances of reelection, while investors may be required to generate returns within the fixed duration of an investment fund.

Note that the characteristics pertaining to effectiveness are about variability rather than averages. It is not assumed that private impact investors are on average more effective than public impact investors (even though there is compelling evidence for this from the Government Accountability Office’s study into the effectiveness of US publicly-provided employment and training programs).³⁴⁹ Rather, it is claimed that private investments have a greater variability in effectiveness. The data suggests that this is partly due to a smaller number of public impact investors than private impact investors. Furthermore, public investments tend to be carried out in a reasonably consistent manner (such as the provision of education), whereas private impact investments tend to be carried out in a wider variety of ways. The result of this is that the *most* effective private investment is typically more effective than the *most* effective public investment, even if they are the same on average. It follows that if a mechanism design enables the most effective investments to be identified *ex ante*, those investments are likely to be undertaken by private investors. However, if the mechanism design does not enable this, and instead allows for misrepresentation of investment expected effectiveness, there could be selection of private investments that are less effective than less-variable public investments.

Having identified the characteristics of these two key stakeholders, it is necessary to identify the constraints those stakeholders face in entering and implementing contingent-repayment investments.

³⁴⁹ A 2011 study by the United States Government Accountability Office (GAO) found that “only 5 of the 47 [employment and training] programs have had impact studies that assess whether the program is responsible for improved employment outcomes. The five impact studies generally found that the effects of participation were not consistent across programs, with only some demonstrating positive impacts that tended to be small, inconclusive, or restricted to short-term impacts.” (p. 11). See United States. Government Accountability Office. (2011). *Multiple Employment and Training Programs: Providing Information on Colocating Services and Consolidating Administrative Structures Could Promote Efficiencies: Report to Congressional Requesters*. US Government Accountability Office. Similar studies have also been undertaken by the U.S. Department of Labor’s Clearinghouse for Labor Evaluation and Research (CLEAR) and by Mathematica Policy Research.

6.3 Findings on Stakeholder and Practical Constraints

The interview data points to six main constraints. These constraints take the form of four stakeholder constraints (denoted S1-S4), which limit what actions stakeholders can undertake in equilibrium, and two practical constraints (denoted P1 and P2), which limit the type of mechanism designs that are feasible.

When it comes to governments, two constraints become apparent. As shown in Figure 6.1, governments often want to maximize their probability of being reelected. This probability is often a function of short-term economic performance and the degree of public support for policies. As such, government decision-making is constrained by both economic and political factors.

Economically, public officials generally want to improve the budget balance, and do not want to have to pay for any investment that ultimately fails. This point was highlighted by Cliff Prior, the CEO of Big Society Capital and Former CEO of UnLtd. When asked what he sees as the main reason SIBs have not become widespread, he replied, *“The main problem with SIBs is there is symmetric downside from a government’s perspective. Either the private investor achieves the threshold social outcome level, and the government needs to pay. Or the investment fails, and the government still needs to pay via other investments and higher welfare. Many governments see this as a lose-lose rather than win-win. Either way, they lose money in the short-term. Government’s want to make money in the short-term, not lose money.”*

Politically, governments are generally reluctant to spend too much taxpayer money on non-taxpaying individuals, such as refugees. Furthermore, they normally do not want to pay investors any money they would have had in the absence of the investment as “there is a public suspicion of value capture by the private sector, and governments cannot politically enable value to be captured” (Darian Stibbe). In other words, the government can only pass on what it otherwise would not have received.

This means there are two main constraints facing governments, as follows:

C1. Government Financial Constraint: *Need to be financially better off by the next election or by the end of their expected term in office, whichever is sooner.*

C2. Government Political Constraint: *Cannot pay investors revenue they would have had in the absence of the investment.*

In terms of private impact investors, the interviews highlighted investors’ relatively high risk tolerance and the desire for no trade-off between social and financial returns. However, the main factor necessary for impact investments to occur is short-term positive returns that can be realised at flexible times. As such, the third stakeholder constraint can be written as:

C3. Investor Constraint: *Investments must be liquid and able to generate a positive financial return within a typical investment fund time horizon.*

Finally, interview participants expressed consensus that low-income disadvantaged individuals are unable to bear any significant risk. There was consensus that they should only pay, if at all, when an investment leads to higher individual disposable incomes, and that ideally investments would be financed by a different stakeholder. Given this, a fourth stakeholder constraint is as follows:

C4. Individual Constraint: Cannot bear financial risk and can only pay for investments, if at all, when those investments lead to higher disposable incomes.

Note that if individual investment recipients are not the ones repaying investors in contingent-repayment mechanisms, then a different form of financial value would need to be appropriated, aside from additional after-tax income.

Practical Constraints

In addition to the four stakeholder constraints, there is evidence of two practical constraints that limit the type of mechanisms that are viable. One of the interviewees who focused on this point was Mark Evans, Founding Partner of Kindred Capital, who revealed the role of practical constraints when discussing the mechanism design of income-contingent loans. He explained, *“There used to be a lot of hype around income-contingent loans in all sorts of fields. I personally know several entrepreneurs and investors who tried to finance the development of sporting and music talent in return for a cut of future earnings. But these ventures all failed. It was difficult for them to track earnings accurately and enforce regular payments. Especially given the long time-horizon for investor returns. Also, the most promising talent would get financed in other ways, so only the less talented individuals would be left, which made the ventures non-viable.”*

This insight, along with data from other interviewees, points to the following two practical constraints that must be satisfied if a mechanism design is to operate as intended.

P1. Enforcement: Any financial value that is appropriated must be able to be enforced.

Without enforcement, there would only be partial, or no, financial value appropriation. The expectation of enforcement difficulty may prevent investment in the first place.

P2. Information Asymmetry: The mechanism should not result in information asymmetry problems such adverse selection, moral hazard, and income misreporting.

These hidden action and hidden information problems often make contingent-repayment impact investing mechanisms non-viable.

Figure 6.2 breaks down the applicability of these two practical constraints by stakeholder and by the three types of financial value that can be appropriated (as per Chapter 3). As shown, governments can enforce taxation payments and also additional payments from after-tax income owing to the fact that they (a) know an individual’s income from taxation reporting, and (b) have the institutional capability to collect it. Investors cannot collect taxation revenue due to a lack of authority and institutional capability, and can only imperfectly enforce the collection of payments

that are contingent on income because (a) they do not have taxation files to know true income levels, and (b) their institutional capabilities are less than that of the government. Neither stakeholder can enforce payments in the form of additional business profits because of two problems. First, neither stakeholder knows precisely how individuals spend their income and how this translates into greater business profit. There is a problem of attribution. Secondly, even if there was tracking of the expenditure of investment recipients, it would be difficult to appropriate that value.

Figure 6.2: Applicability of Practical Constraints by Financial Value Type

	Stakeholder					
	Public Impact Investors (Governments)			Private Impact Investors		
Type of Financial Value:	Additional After-Tax Income	Additional Government Taxation	Additional Business Profits	Additional After-Tax Income	Additional Government Taxation	Additional Business Profits
Practical Constraint						
P1. Enforcement Capability	High	High	Low	Low	None	Low
P2. Presence of Information Asymmetry Problems	Yes	No	No	Yes	No	No

When it comes to information asymmetry problems, both hidden action and hidden information problems are common in mechanism designs involving the appropriation of after-tax income, such as income-contingent loans. However, as shown in the table, this would not be the case for the appropriation of taxation because an individual pays the same taxation regardless of whether the taxation they pay is appropriated.

6.4 Existing Contingent-Repayment Financing Mechanisms by the Six Mechanism Constraints and Ten First-Best Properties

Now that the six constraints have been identified, it is possible to map out the five contingent-repayment investment mechanisms based on those constraints. By locating which constraints each mechanism fails to meet, this mapping helps explain why some contingent-repayment mechanisms have low adoption rates, and why the mechanisms that are commonly adopted may not create the social value intended. The mapping also helps in seeing how mechanism designs differ from one another. In these ways, the mapping assists in understanding the role that constraints play in the relationship between mechanism design and social value creation.

This mapping is presented in Figure 6.3. In addition to the six constraints, the three first-best social value creation properties are included in the table. The results pertaining to investment selection, quantity and effort, are based on the findings from Appendices A-C, as presented in Chapter 3.³⁵⁰

³⁵⁰ Note that the seven first-best social impact properties are intentionally not included in Figure 6.3 because the way social impact measurement is currently undertaken is often separate from, and independent of, the investing mechanism.

Figure 6.3: Properties of Existing Contingent-repayment Impact Investing Mechanisms

			Contingent-repayment Impact Investing Mechanism				
Property		Relevant Question	Income-Contingent Loans	Separate Simultaneous Credit and Insurance	Social Impact Bonds	Direct Government Provision	Taxation Deductibility
S1	Selection	<i>Does the investment with the highest expected effectiveness always receive the capital or investment contract?</i>	No	No	No	No	No
S2	Quantity	<i>Are all future impacts incorporated into investment decisions?</i>	No <i>(Investors place more weight on short-term than long-term impacts given short-term decision-making horizons.)</i>	No <i>(Investors place more weight on short-term than long-term impacts given short-term decision-making horizons.)</i>	No <i>(Measurement is typically only based on one social outcome, which does not fully take into account interdependency or intertemporal externalities.)</i>	No <i>(There is likely to be underinvestment in any services that generate returns beyond the government's decision-making time horizon, which is often less than long-term given electoral constraints.)</i>	No <i>(Those investing where the return is a tax deduction care more about inputs than outcomes.)</i>
S3	Effort	<i>Is there an incentive for maximum effort?</i>	No <i>(Because a portion of the benefits from high effort are captured by the government in the form of tax revenue, there is suboptimal effort exertion.)</i>	No <i>(Investor returns are capped at full loan repayment. The incentive for investor effort decreases as individuals' loan repayment capacity increases.)</i>	No <i>(Only until the threshold level is achieved.)</i>	No <i>(Even with performance contracts, it is not possible for high-effort to be a sustainable equilibrium for a broad range of parameter values.)</i>	No <i>(No incentive to exert search cost to find the most effective provider given identical returns in all cases.)</i>
C1	Government Financial Constraint	<i>Does this improve the government budget balance in the short-term?</i>	No <i>(If government is providing income-contingent loans it incurs the cost of provision in the short-term. If a private investor is providing, it makes no difference to the budget balance in the short-term.)</i>	No <i>(If government is providing standard loans it incurs a cost equal to the principal in the short-term. Any insurance premium received is unlikely to offset this. Also, any insurance payout would further worsen the government budget</i>	No <i>(In most cases, the government pays a private investor for outcomes in the short to medium term, and reaps financial benefits from reduced welfare and higher taxation in the medium to long-term. However, if private</i>	No <i>(Government spends in short-term and only receives higher taxation in medium to long-term.)</i>	No <i>(Government loses tax revenue in short-term.)</i>

				<i>position. If a private investor is providing, it makes no difference to the budget balance in the short-term.)</i>	<i>provision via SIBs were replacing short-term government expenditure, the answer would be "yes".)</i>		
		<i>If the investment fails, does the government receive more than it pays?</i>	Sometimes <i>(When a private investor is providing and the investment's success is below expectations but not a complete failure, the government's expected taxation revenue may still increase as this is a positive externality. If the government is providing and it fails, they are likely to have incurred more in costs than the increase in future tax revenue.)</i>	Sometimes <i>(If government provided, a failed investment is likely to reduce the repayment capacity of low-income individuals, thereby increasing default rates and making a government loss likely. If undertaken by a private investor, government taxation revenue may still increase and there is no cost to the government.)</i>	No <i>(There is what Cliff Prior refers to as "symmetric downside" where the government has to spend money when a SIB fails, such as by replicating investments and increasing welfare expenditure.)</i>	No <i>(Would have already incurred the cost of the investment.)</i>	No <i>(Payments are based on inputs not outcomes.)</i>
C2	Government Political Constraint	<i>Does it avoid spending taxpayer money on non-taxpaying individuals?</i>	Depends <i>(If financed by private investors, then yes.)</i>	Depends <i>(If financed by private investors, then yes.)</i>	No	No	No
		<i>Does the government, at most, only pay what it otherwise would not have received?</i>	No	No	Somewhat <i>(While one of the aims of SIBs is for the government to pass on a portion of savings, or a portion of higher taxation revenue, there is no guarantee of this built into the mechanism.)</i>	No	No
C3	Investor Constraint	<i>Are expected returns at or above market average?</i>	Yes	Yes	No <i>(While returns are often positive, they are generally set below market rate for political reasons.)</i>	n/a	No <i>(Investors receive a tax deduction, which corresponds to a negative return when the tax rate is below 100%.)</i>
		<i>Can returns be realised</i>	Depends	Depends	Somewhat	n/a	Yes

		<i>in the short-term?</i>	<i>(If future returns can be securitized, then returns can be short-term. Otherwise returns are medium to long-term.)</i>	<i>(If future returns can be securitized, then returns can be short-term. Otherwise returns are medium to long-term.)</i>	<i>(Investors normally have to wait at least several years.)</i>		
		<i>Is the investment liquid?</i>	Depends <i>(Loans may be able to be packaged and sold.)</i>	Depends <i>(Loans may be able to be packaged and sold.)</i>	No <i>(Returns can typically only be realised at one point in time.)</i>	n/a	No <i>(Returns can only be realised at the time a tax return is filed.)</i>
		<i>Is there an absence of trade-off between social and financial returns?</i>	Yes <i>(There is alignment for a given percentage of income to be repaid, but the percentage amount is not aligned.)</i>	No <i>(Loan repayments are due even when an investment does not increase individual incomes.)</i>	Yes <i>(To a certain threshold point.)</i>	n/a	Yes
C4	Individual Constraint	<i>Do individuals make no payment?</i>	No <i>(Payment as a proportion of income.)</i>	No <i>(Fixed repayment of loan and payment of insurance premium as a proportion of income.)</i>	Yes	Yes	Yes
		<i>Do individuals bear no risk?</i>	Yes	No <i>(Insurance does not eliminate risk at low income levels because (a) a portion of the insurance payout goes to the credit provider due to increased repayment capacity as shown in Appendix A, and (b) imperfection correlation between index insurance payouts and actual outcomes mean purchasing insurance may actually increase risk, as Clarke (2011) proves.)</i>	Yes	Yes	Yes
P1	Enforcement	<i>Can all the payments owed be collected?</i>	No	Yes <i>(Given loan repayments are independent of incomes.)</i>	Yes	Yes <i>(Future taxation revenue can be enforced given</i>	Yes <i>(The government is legally obligated to</i>

				<i>However, repayment default may still occur.)</i>		<i>the government's institutional capability.)</i>	<i>grant tax deductions it has committed to.)</i>
P2	Information Asymmetry	<i>Does it avoid problems with adverse selection and/or moral hazard?</i>	No	No <i>(At low income levels, moral hazard exists, since the cost of high effort is borne by the individual, but benefits are shared with the creditor due to high effort increasing incomes and repayment capacity.)</i>	Yes	Yes	Yes
		<i>Is there no incentive for individuals to misreport income?</i>	No	Yes	Yes	Yes	Yes

As is evident from this table, each of the five existing contingent-repayment mechanisms fail to adhere to all the stakeholder and practical constraints. Furthermore, none of the mechanism designs satisfy any of all three of the first-best social impact properties.

6.5 Constraints and Properties That Are Difficult to Satisfy Simultaneously

The primary interview data also reveals that even when a constraint can be adhered to by a mechanism design, this is often at the expense of satisfying other constraints or first-best properties. Specifically, the data reveals eight combinations of mechanism design constraints and first-best properties that are difficult to simultaneously satisfy. Satisfying these combinations simultaneously is therefore a major design challenge. These eight challenges are as follows.

First, it is difficult to simultaneously have that investment recipient bear negligible financial risk (Constraint C4), while also incentivising that individual to accurately report their income and to exert high effort so as to avoid moral hazard problems (Constraint P2). This is because the typical way that risk is transferred from individuals to investors is for the investment repayments to be a function of disposable income, as in the case of income-contingent loans. However, this means that individuals do not capture the full benefit of income increases and therefore are disincentivised from exerting high effort. They are also incentivised to misreport income because this may reduce payments due.

Secondly, it is difficult for a mechanism design to satisfy the enforcement constraint (Constraint P1) while also satisfying the requirement that the investment that is undertaken has the highest expected effectiveness of all possible investments (Property S1). This is because enforcement is more easily undertaken by public investors due to greater institutional capacity and less information asymmetry, as shown in Figure 6.2, but the most effective investment is more likely to be one undertaken by a private investor due to the greater variability of private sector investments, as shown in Figure 6.1 and as previously discussed.

Thirdly, it is challenging to have a mechanism that both improves the government's budget position in the short term (Constraint C1), while also enabling investors to have short-term returns (Constraint C3). Often mechanism designs involve one entity receiving financial value in the short-term, while the other entity receives financial value in the medium to long-run (if at all). This is normally the case with SIBs, where investors are paid, conditional on social outcomes being met, in the short to medium term, while the financial benefit to governments come in the long-term in the form of reduced welfare expenditure and higher taxation revenue.

Fourthly, it is hard to have the investment recipients bear negligible risk and not make repayment (Constraint C4) while also having the government not make payments to non-tax-paying individuals (Constraint C2).

Fifthly, it is difficult for a mechanism design to adhere to both the requirement that private investors receive returns at or above the market rate (Constraint C3), but for the government to, at most, only pay out what it otherwise would not have received (Constraint C2).

A sixth design challenge is ensuring that both high effort is exerted in undertaking investments (Property S3) and that the optimal quantity of investment is made (Property S2). Satisfying these two properties simultaneously is very difficult. This is because if an investor appropriates 100% of the value they create, then they are incentivised to exert optimal effort. But then none of that value goes to individuals or the government, so there is no social impact,³⁵¹ which defeats the point of impact investment. However, the alternative is equally problematic. If an investor only appropriates a portion (less than 100%) of the value they create, and if costs are linear but returns from investments are decreasing with investment quantity (that is, if social value is a concave function of investment quantity), as it is often assumed in the economics literature, it follows that an investor's return is maximized by providing a quantity less than the first-best amount,³⁵² which violates Property S2. As such, satisfying S2 and S3 simultaneously is extremely difficult. One implication of this is that performance pay does not necessarily ensure high investor effort and optimal investment quantity. This may help explain the empirical finding in Chapter 4 that only a small proportion of impact investors have their financial returns partly or fully dependent on the social impact they create (Figure 4.1 I13).

Relatedly, a private investor may find that their profit-maximizing action, upon signing a contract with pay as a function of the incomes of investment recipients, is to provide zero quantity of investment and incur no cost. They may rationally expect incomes to still increase in ways other than from their investment, meaning that would be paid without incurring any cost. Preventing such a situation (which would violate Property S2) is also a mechanism design challenge. This is particularly the case given that Property S1 requires that the investment undertaken is that with the highest expected effectiveness, and that is more likely to be an investment by a private investor (see Figure 6.1).

A final major design challenge is how to accurately know *ex ante* the expected effectiveness of possible investments. This is important because knowing the investment with the highest

³⁵¹ Recall from Chapter 3, that social impact can be expressed as attribution less appropriation.

³⁵² The first-best quantity is where the tangent of the social value function is parallel to the cost function, as shown in Appendix B.

expected effectiveness is essential for optimal selection (Property S1), while knowing the investment with the second highest expected effectiveness is necessary to satisfy the government's political constraint limiting payments to that which they otherwise would not have had (Constraint C2).³⁵³

6.6 Derivation of Necessary Mechanism Design Characteristics via Logical Deduction

As is evident from Sections 6.4 and 6.5, the existing contingent-repayment mechanisms fail to adhere to many of the identified constraints. Furthermore, many combinations of constraints and first-best properties appear difficult for a mechanism design to satisfy simultaneously.

This leads to an obvious question: If all the six identified constraints are to be satisfied simultaneously, without sacrificing the obtainment of the ten first-best properties, what must a mechanism design look like? What characteristics must a mechanism design have? In other words, are there implied or derived traits that we can deduce a mechanism must necessarily possess in order for the constraints and first-best properties to be met?

To discover this, let us proceed via logical deduction.

Step 1: Who Makes the Investment

As established in Chapter 3, one of the components of social impact is the inherent quality of the investment being undertaken. It follows that the first-best corresponds to the maximum level of inherent quality (S2). For the first-best to be achieved, the investor with the greatest inherent effectiveness must be the one making the investment.

As already discussed in relation to the interview findings presented in Figure 6.1, the most effective investment is likely to be one undertaken by a private investor. Mathematically, where there is normally-distributed variation in the level of effectiveness of private investors, but not variation in the effectiveness of the government due to it being a single provider, then as the number of private investors increases, it mathematically follows that the most effective provider is a private investor in the limit. Under these assumptions, the first-best provider must be a private investor.

As already explained, we are not making any assumptions here about differences in the *average* inherent quality of investments between private and public investors. We are simply focused on the upper limit of inherent quality for each investor type, and are arguing that the greater number of private investors, and therefore the greater variation in the inherent quality of private investors, makes it reasonable to assume that the investor with the highest inherent quality is private. Aside from the greater numbers of private investors, one could also argue that there is greater variation in inherent quality of private investments due to the generally greater risk-tolerance of private investors and the greater focus on innovation (Figure 6.1). As such, if the first-

³⁵³ Knowing the investment with the second highest expected effectiveness is also necessary to enable measurement of marginal impact (Property M1).

best properties can be achieved within stakeholder and practical constraints, the investor must necessarily be private.

Step 2: What Value is Captured

Some of the three types of financial value that are created from social value creation (a marginal increase in after-tax income, a marginal increase in taxation revenue, and a marginal increase in business profits via a marginal increase in consumption) have inherent limitations on the extent to which they can be appropriated by private investors.

The appropriation of a marginal increase in after-tax income violates the information asymmetry constraint P2 (see Figure 6.2). This is because investor attempts to appropriate disposable income typically encounter the problems of adverse selection, moral hazard, and/or income misreporting.

The appropriation of the marginal increase in business profits violates the enforcement constraint P1 (see Figure 4.2). It is not currently possible for investors to know precisely how investment recipients spend of all their income, which makes attribution problematic. Furthermore, even if there were not information asymmetry problems, it would be difficult for investors to appropriate the marginal increase in business profits that arises from investment recipient expenditure. It is unlikely businesses would voluntarily agree to pass on profits given the problem of free-riding. They would presumably receive the same revenue regardless of whether or not they consented to a portion of their profit being appropriated. Also, coercion of businesses is impossible from a private investor perspective, and politically problematic from a public investor perspective given that an electorate backlash is not impossible to envisage.

It follows that the only type of financial value that does not violate a practical constraint is the marginal increase in taxation revenue. Given investment recipients pay a specified taxation rate anyway, the appropriation of tax revenue does not change the behavior of the investment recipient, and therefore does not carry with it the problems that arise from attempts to appropriate disposable income. Given individuals already need to report income as part of taxation returns, and given that governments can utilize legal systems to enforce taxation payments, the information asymmetry and enforcement problems with attempts to appropriate business profits do not arise.

Step 3: How Value is Captured

From Steps 1 and 2, we know that if all the constraints are to be simultaneously satisfied without sacrificing obtainment of the first-best properties, the mechanism must involve investment by a private investor and appropriation of taxation revenue. However, we also know that only the government can collect taxation (Figure 6.2). Private investors have neither the legal justification nor institutional capabilities to do so. As such, if enforcement is to occur with respect to taxation collection, the entity collecting that financial value must be the government.

Necessary Characteristics of a First-Best Mechanism Design

The key finding of this derivation by logical deduction is that *if* there is a mechanism design that adheres to all constraints and first-best properties, then (a) investment needs to be done by private investors, (b) the type of financial value appropriated needs to be taxation revenue, and (c) enforcement needs to be done by the government. These three characteristics are necessary but not sufficient for a mechanism design to be first-best in the sense that all constraints and first-best properties are achieved.

It is worth noting that this derivation and characterization neither proves nor disproves the existence of a first-best contingent-repayment impact investing mechanism. Rather, we have characterized the nature of the first-best mechanism design *if* such a mechanism exists. In other words, *if* there is a mechanism that achieves the first-best levels of social impact within the stakeholder and practical constraints, we now know some characteristics that mechanism must *necessarily* have. As such, this derivation has approached the issue of contingent-repayment mechanism design from a first-principles perspective.

Given this narrow characterization of a first-best mechanism design, it is worth seeing how this implied mechanism design compares to the existing contingent-repayment mechanisms. To do this, the landscape of contingent-repayment mechanisms is mapped out based on which stakeholder bears financial risk and what type of value is appropriated.

6.7 Gap Analysis via Status Quo Mapping

Figure 6.4 maps the existing contingent-repayment mechanisms along two dimensions.

The first dimension is which stakeholder bears the financial risk of the investments. This could be either the government or private investors, depending on whose financial position is dependent on the effectiveness of the investment.

The second dimension is the type of financial value that is appropriated. As established in Chapter 3, there are three main types of financial value that can theoretically be directly appropriated. However, there are also cases in practice where financial value is not directly appropriated, but rather indirectly appropriated from consolidated government revenue. This occurs when, for example, the government pays an investor but that payment is not a direct function of the actual financial value created. The payment may, however, be positively correlated with the financial value created. This would be the case if an investment is expected to reduce government expenditure by a certain amount. Given that this indirect appropriation occurs in practice, it is appropriate to include *indirect* appropriation of financial value as well as direct appropriation of financial in the mapping analysis.

Combining these two dimensions gives us a total of eight possible contingent-repayment mechanisms. These eight combinations are shown in Figure 6.4. This table presents the five main types of contingent-repayment impact investment mechanisms according to the two dimensions previously described.

In the case of contingent loans, the stakeholder making the investment bears the financial risk as the repayment amount is a function of individual income, which is in turn a function of the effectiveness of the investment made. Such contingent loans may be made by either the government or a private investor.

When credit and insurance are provided simultaneously but separately, the type of value appropriated is, again, after-tax income. The investor providing the loan bears risk because there is non-zero probability of loan default and imperfect correlation between insurance payouts and actual loss, especially where the insurance is based on an index.

In the case of direct government financing of investments, the return to the government takes the form of additional taxation revenue. The government retains the taxation revenue collected, and so therefore bears the financial risk of the investment.

When investments are made that qualify for taxation deductibility, the financial return to investors is based on financial inputs and so is not uncertain. In contrast, governments pay investors in the form of reduced taxation obligations, but have uncertain financial benefits from the investments that private investors make. Given this, it is the government that bears the financial risk even though private investors are the ones making the investments.

Figure 6.4: Contingent-Repayment Financing Gap Analysis

Financial Risk Bearer	Type of Financial Value Appropriated		Contingent-Repayment Mechanism
Public Impact Investors (Governments)	Direct Appropriation	Disposable Income	Contingent Loans Separate Simultaneous Credit-Insurance
		Taxation Revenue	Direct Provision
		Business Profits	GAP
	Indirect Appropriation	Consolidated Revenue	Taxation Deductibility
Private Impact Investors	Direct Appropriation	Disposable Income	Contingent Loans Separate Simultaneous Credit-Insurance
		Taxation Revenue	GAP
		Business Profits	GAP
	Indirect Appropriation	Consolidated Revenue	Social Impact Bonds

When it comes to social impact bonds, payments to investors are typically not based directly on the financial value created but are based on whether a threshold level of a specific social outcome is achieved. Given this, there is only indirect appropriation and the private investor bears the financial risk.

This leaves three gaps in the map of possible contingent-payment impact investing mechanisms. Two of those gaps involve the appropriation of the marginal increase in business profits that arise

from the additional consumption by individuals receiving investments due to their greater disposable income. As has already been explained, such direct appropriation, while theoretically possible, is not currently feasible. This is because of both (a) information asymmetry problems that mean neither private investors nor governments know exactly what individuals consume, and (b) enforcement problems due to the free-rider problem and possible negative political repercussions.

There is one final gap in the landscape. This involves the direct appropriation of taxation revenue, but with private investors rather than the government bearing the financial risk. To the best of our knowledge, there is no existing contingent-repayment mechanism design that fits those characteristics.

6.8 Combining Research Components

When the results of the research by logical deduction and the results of the research by gap analysis are compared, a crucial finding emerges. The necessary requirements for a first-best contingent-repayment mechanism design precisely correspond to a gap in the contingent-repayment landscape. In other words, there is a gap in the impact investing landscape exactly where the first-best mechanism design has to be if such a mechanism exists.

This key result strongly justifies further research into whether a mechanism that directly appropriates taxation revenue, with enforcement by the government, and with a private investor making the investment and bearing the risk, can adhere to all six constraints and all ten first-best properties.

Before we proceed to do just that, it is worth asking why there has not been research into a mechanism design of this nature to date. Indeed, to the best of our knowledge, there is no academic literature on such a mechanism and no use of such a mechanism in practice. Two possible reasons for this are as follows.

First, it is generally assumed that the entity making the investment and the entity enforcing the payments are one and the same. Indeed, nothing about the five existing contingent-repayment impact investments violates that assumption. However, such an assumption ignores the possibility that the enforcer could act as a facilitator and pass on payments it enforces to a separate beneficiary. As such, the enforcer does not necessarily need to be the beneficiary of the investment. The prevailing assumption is not always valid.

A second possible reason is simply that a contingent-repayment mechanism with the characteristics described may not satisfy one or more of the first-best properties or constraints. So far we have not proven that there is a mechanism that satisfies all first-best properties and constraints.

Regardless of the reason for the limited literature on, and practice of, investor-provided government-enforced taxation-appropriated mechanisms, the findings via logical deduction and gap analysis in Sections 6.6-6.7 provide strong motivation that more research is warranted.

6.9 Capacity for Implied Mechanism Design to Satisfy First-Best Properties

As such, let us investigate whether it is possible for a mechanism design with the implied characteristics just described (with appropriation of taxation revenue, investment by a private investor, and enforcement by the government) to satisfy all six constraints and all ten first-best properties simultaneously.

Recall from Chapter 5 that if a mechanism design results in the alignment of social and financial returns, with social impact as a monotonically increasing function of financial return, then financial tools can be used to obtain the ten first-best social impact properties. This means that if it can be shown that the implied mechanism design can have social impact as a monotonically increasing function of financial return, it follows that the ten first-best social impact properties may be able to be obtained.

Can a Mechanism Design with the Implied Characteristics have Social Impact as a Monotonically Increasing Function of Financial Return?

As has already been established, social impact is the present discounted value of total lifetime non-appropriated marginal gross financial value from an investment (Definition 3.C). Also recall from Chapter 3 that social impact leads to, and materialises in the form of, additional financial value. This financial value initially takes the form of additional individual pre-taxation income. This additional pre-taxation income then gets broken down and divided into (a) additional government taxation revenue, (b) additional (non-investor) firm revenue from individual consumption, and (c) additional after-tax income. Part of this additional financial value may then be appropriated.

Applying the definition of social return to this framework, gives us the following result: Social return is equivalent to the non-appropriated marginal change in the present discounted value of lifetime income.³⁵⁴ It follows that where the amount appropriated by investors is a constant proportion of lifetime income,³⁵⁵ then social return is a monotonically increasing function of the present discounted value (PDV) of lifetime income.

As such, let us turn to the implied mechanism design, with the characteristic of taxation revenue appropriation, and see if social return can be a monotonically increasing function of the PDV of lifetime income.

Suppose there is a fixed government taxation rate $\tau > 0$ on an individual's income y , and that in each period the government passes onto a private investor an agreed portion, denoted $\alpha > 0$, of the taxation revenue it collects from individuals who have received investment.³⁵⁶ The investor

³⁵⁴ Recall that any marginal financial value that is appropriated by investors is not counted as social impact, however other forms of marginal financial value are included. This encompasses any additional individual disposable income (both that which goes to consumption and that which goes to savings) and any additional government taxation revenue that is not passed on to investors. Also recall that social return can be conceptualised as the sum of the marginal increases in positive pecuniary externalities that accrue from an investor making an investment in an individual.

³⁵⁵ This would be the case if both the taxation rate, and the portion of taxation paid to investors, were constant.

³⁵⁶ This implicitly assumes that there is no taxation threshold. This assumption results in financial return being a strictly monotonically increasing function of social impact. With a threshold, financial return would be a weakly monotonically

therefore receives $\alpha\tau y$ each period. If this were the case, then total investor revenue from an individual with a post-investment lifespan of n periods, in present discounted terms, is given by:

$$Revenue = \sum_{t=1}^n PDV_{t=0} \alpha\tau y_t$$

It follows mathematically that if investor expenditure on an investment is non-recurring or fixed, then investor profit is a monotonically increasing function of the PDV of lifetime income.

Importantly, if social return and financial return are both monotonically increasing functions of the PDV of lifetime income, then mathematically they must be monotonically increasing functions of each other (Ostrowski, 2016).³⁵⁷ This proves that financial return can be a monotonically increasing function of social return for a mechanism design with the implied first-best characteristics.

Given this result, it follows that the five financial mechanisms explained in Chapter 5 can be used to obtain the social equivalents of the ten financial properties they enable. All that remains, is to see if the four stakeholder constraints (C1-C4) can also be satisfied for this implied mechanism design.

6.10 Capacity for Implied Mechanism Design to Satisfy Stakeholder Constraints

The investor and government constraints can be addressed via the same financial mechanisms that enabled the financial equivalents of the first-best social impact properties to be obtained. As explained in Section 6.5, it seems difficult for both the investor and the government to be in a strong short-term financial position (C1 and C3). However, consider this.

Suppose that a private investor made an initial lump-sum payment to the government prior to investment. In addition to this lump-sum incentivising high-effort provision (Property S3), as already discussed in Chapter 5, it would also improve the government's short-term financial position. The government would then be receiving money prior to the end of the current term of office and prior to the next election (satisfying C1). This lump-sum transfer could be matched by a corresponding increase (in present discounted terms) in the proportion of taxation paid to the investor on a recurring basis. In such a case, the order of financial flows would be the reverse of what occurs with direct government provision and social impact bonds. The government would be receiving money in the short-term before passing on money in the medium to long-term. Such a situation would satisfy the government's financial constraint (C1) and may be an attractive government value proposition.

If, however, the investor makes an initial lump-sum payment to the government, how can the investor generate a financial return in the short-term? The answer lies in two other financial

increasing function of social impact, as financial return could stay constant even if social impact increases. However, financial return would not decrease if social impact increases.

³⁵⁷ Ostrowski, A. M. (2016). *Solution of Equations and Systems of Equations: Pure and Applied Mathematics: A Series of Monographs and Textbooks* (Vol. 9). Elsevier.

mechanisms identified in Chapter 5 – securitization and market trade. If the investor can sell securities it owns that pay out as a proportion of taxation revenue, then it can still generate a financial return in the short-term. Even if selling securities is only permissible after the completion of investment, an investor could still profit within a matter of months or a few years. As such, even though the order of financial flows for an investor is the reverse of that for the government, the investor financial constraint (C3) may still be satisfied.

This brings us to the government's political constraint (C2). Suppose the government awarded a contract to make an investment to a private investor, and that contract was awarded by way of a Vickrey auction, as described in Chapter 5. Then each investor's optimal strategy would be to bid their true valuation, meaning that they would bid up to their zero-profit condition - the point where they would make no profit and no loss. If social and financial returns are perfectly aligned, then the investment that is expected to be most profitable is also the investment that is expected to have the greatest social impact. As such, the highest bidder would be the one with the highest expected effectiveness, and the second highest bidder the one with the second highest expected effectiveness. As such, this selection method enables the government to know expected profit and expected effectiveness of the counterfactual investor.³⁵⁸ It follows that the government is able to know how much taxation revenue (in expectation) they would have received in the absence of the investment that wins the contract and is undertaken. This can be easily deduced from (a) the proportion of taxation revenue that is appropriated by investors, and (b) the expected profit of the counterfactual investor – both of which are known. Since the contract is awarded on the terms of the second-highest bid, and since the second highest bidder bids up to their zero-profit condition, the investor that is awarded the contract only generates a positive profit if they turn out to be more effective than the expected effectiveness of the counterfactual investor. In this way, the government would only ever pass onto the investor more than it receives as the lump-sum if it would not have had that money in the absence of the investment. The government only passes on what it otherwise would not have had, at least in expectation. Also, in this situation, it is not the case that tax-paying individuals are paying for investments in non-tax-paying individuals. One way to conceptualize it is that non-tax-paying individuals would be effectively paying for their own investments with their future taxation. Therefore, the political constraint (C2) can be satisfied.

Finally, the individual constraint (C4) is satisfied because the financial value being appropriated is taxation revenue. As such, individuals receiving investment neither pay for it nor bear financial risk. They simply pay the usual taxation rate and nothing more.

As such, there is evidence that a mechanism design with the characteristics that have been proven to be *necessary* for all six constraints and ten first-best properties to be obtained, may in fact be able to satisfy all constraints and first-best properties.

6.11 Conclusion

As is evident, the focus in this chapter has been researching how constraints affect the relationship between mechanism design and social value creation. In the process, this chapter

³⁵⁸ The counterfactual investor is the investor that bids the second-highest in the auction and would have been awarded the contract in the absence of the investor that was awarded it.

makes several important contributions. First, identifying, via primary data from interviews, the main characteristics of public and private impact investors that affect their behaviour in undertaking investments. Secondly, discovering six constraints on mechanism design, consisting of four stakeholder constraints and two practical constraints. The former type of constraint affects mechanism design adoption rates, while the latter type of constraint affects whether mechanisms are able to operate as intended. Thirdly, mapping the five existing contingent-repayment mechanisms according to the six constraints, which helps to clarify mechanism differences and explain low mechanism adoption rates. Fourthly, identifying what specific combinations of constraints and first-best properties are difficult to satisfy simultaneously and so present a mechanism design challenge. Fifthly, deriving via logical deduction the three characteristics that a mechanism design must necessarily possess if all constraints and first-best properties are to be satisfied simultaneously. Sixthly, finding via gap analysis that these derived mechanism characteristics correspond to a gap in the existing contingent-repayment mechanism landscape. Seventhly, discovering for this implied mechanism that social returns can be a monotonically increasing function of financial returns, which suggests that the ten first-best properties may be able to be obtained via the five financial tools discovered in Chapter 5. Finally, showing how the four stakeholder constraints may be able to be adhered to in a mechanism design of the nature implied.

This research into constraints therefore helps explain where the relationship between mechanism design and social value creation breaks down for existing mechanisms, and helps in discovering possible modifications to mechanism designs. These modifications may enable more constraints and first-best properties to be satisfied simultaneously, despite the design challenges faced, thereby enabling greater social value creation.

Given the research suggests that it may be possible, under certain assumptions, for all the six constraints and all ten first-best properties to be satisfied simultaneously via the implied modified mechanism design, this implied modified mechanism is researched in detail as an extension in Chapter 7.

VII.

Extension: Effect of a Specific Mechanism Design on Social Value Creation

7.1 Narrowing Focus to a Specific Mechanism Design

So far, the research in this thesis has focused on the general relationship between mechanism design and social value creation for the class of impact investments that are in individuals, have contingent-repayments, and are expected to enhance human productivity. As part of this, the focus has been on five mechanism designs that already exist and are used in practice.

This extension chapter builds on the research undertaken in Chapters 2-6 to research the relationship between mechanism design and social value creation for a specific mechanism design. This research involves asking and answering two questions.

First, how can the implied first-best mechanism design characteristics, discovered in Chapters 3-6, be brought together into a modified contingent-repayment mechanism design? Recall that Chapter 3 developed a Unified Fundamental Model of impact investing. This framework was then used in Chapter 6 to derive via first-principles analysis what a first-best mechanism design must necessarily look like if all first-best properties are to be simultaneously satisfied. It was discovered that the first-best must involve investment by a private investor, with payment enforcement by the government, and the appropriation of taxation revenue. It was also found that a mechanism with those characteristics corresponds to a gap in the existing contingent-repayment financing landscape. This finding, coupled with the research findings in Chapter 5 that the three first-best social impact properties and seven first-best social impact measurement properties may be able to be obtained via aligning social and financial returns and employing five specific financial tools, constitutes an implied mechanism design. Together, Chapters 3-6 imply what a first-best mechanism design may look like. The research suggests that there may exist a financing mechanism that simultaneously satisfies the ten first-best properties and the six stakeholder and practical constraints. Given this, it is now possible to bring together those research findings to outline in-detail the design of the first-best contingent-repayment financing mechanism that is implied by the research. This implied mechanism is referred to as Tradeable Income-Based Securities, or TIBS for short. The mechanism is outlined in Section 7.2, how the mechanism satisfies the first-best properties and constraints is explained in Section 7.3, and a full worked example is provided in Section 7.4.

The second question that this extension asks and answers is, “How does this specific mechanism design affect the creation of social value?” To answer this second question, the main concerns of 19 individuals, representing key stakeholder groups, regarding the mechanism’s design are identified via semi-structured interviews.

Interview participants were presented with identical descriptions of the implied mechanism design. They were then given five minutes to read the information, and to ask any clarifying questions they may have. After that time had elapsed, participants were asked to the following question,

“Suppose this financing mechanism was attempted. Further suppose that it turned out to either be not viable or not achieve its stated objectives. In your opinion, what are the most likely reasons why this would be the case?”

This question aims to elicit the concerns of the interview participants, many of whom have extensive experience in impact investing and public-private partnership formation. A list of potential concerns was not presented to interviewees so as to not bias the data.

As only a moderate number of interviews were undertaken, it is not claimed that the concerns of the participants are a representative or exhaustive list of concerns. However, that is not the purpose of the interviews. Rather, the objective is to (a) identify a subset of the broad pool of concerns, with stakeholder concerns being informed by their worldview frameworks, stated preferences, decision-making biases, and systems of belief, and (b) to evaluate those concerns based on their validity and importance. This does not necessitate a large sample study.

Given this objective, the data on concerns is then analyzed in-depth. This consists of four stages. First, the prevalence with which each concern was raised by participants is ascertained and presented. Secondly, concerns that were expressed by at least three participants are categorized. Sixteen concerns were raised at least three times, and these sixteen concerns are grouped into five categories. Thirdly, these sixteen concerns are evaluated to discover whether literature analysis and quantitative analysis support these concerns along the two dimensions of validity and importance. The quantitative analysis is based on formal microeconomic modelling of the implied mechanism design, which is found at the end of Appendix B (Section B.7) and which uses the same model setup as the two other mechanism designs in Appendix B (social impact bonds and direct government investment with taxation). As part of this quantitative analysis, it is proven mathematically that the implied mechanism design does indeed achieve the first-best where the five existing mechanism designs do not. This is an important result. The exact contract form necessary for the first-best to be obtained is also discovered and proven mathematically. Fourthly, the sixteen main stakeholder concerns are mapped on a two-dimensional plane with the axes of concern validity and concern importance. This analysis enables (a) identification of which concerns are most likely render the implied mechanism non-viable, and (b) uncovering insights into the relationship between concern type, prevalence, importance, and validity.

In this way, the second part of the extension seeks to more fully understand the relationship between the implied mechanism's design and the creation of social value. It does *not* seek to confirm that an investment mechanism design in the form of Tradable Income-Based Securities (TIBS) is viable, but rather to discover why it may not be viable and to understand the nuanced ways in which its design promotes and undermines social value creation.

Methodologically, it is worth noting the difference between Chapter 6 and Sections 7.2-7.4 on one hand, and Sections 7.5-7.13 on the other hand. Chapter 6 used a first-principles approach with deep theoretical underpinnings from Chapter 3 to research contingent-repayment financing mechanisms in a collectively exhaustive way, thereby enabling research findings via top-down logical deduction (Sternberg, 2009).³⁵⁹ These findings are brought together in Sections 7.2-7.4. In contrast, a bottom-up inductive approach is adopted from Section 7.5 onwards, with the data

359 As explained in Sternberg, R. J. (2009). *Cognitive Psychology*. Belmont, CA: Wadsworth. p. 578. deduction is a type of logical process where premises are specified. These premises lead logically to a certain conclusion that can be known for sure, given the initial premises. This contrasts with induction reasoning, where conclusions derived from evidence are probable but not certain. For a historical analysis of logical deduction, see Evans, J. S. B., Newstead, S. E., & Byrne, R. M. (1993). *Human reasoning: The psychology of deduction*. Psychology Press. p. 4.

coming from a critical reading of a wide range of literature, from semi-structured interviews, and from mathematical modelling.

7.2 The Implied Modified Mechanism Design in Detail

Let us now characterize the implied mechanism design in detail by bringing together the ways to achieve the first-best social impact properties discovered in Chapter 5 with the necessary first-best mechanism characteristics discovered in Chapter 6. In other words, let us describe a mechanism that (a) involves investment by a private investor, enforcement by the government, and appropriation of taxation revenue (the necessary first-best requirements from Chapter 6), (b) uses the five financial tools discovered in Chapter 5 that enable the financial equivalents of first-best social impact properties to be obtained (namely a Vickrey Auction, securitization, market trade, a lump-sum initial payment, and discounted value aggregation), and (c) aligns social and financial returns (as this is necessary for the financial tools to achieve the social impact equivalents of financial properties).

Description of the Implied Mechanism

Suppose there is a modified contingent-repayment impact investing mechanism whereby the government contracts with private investors to finance specific productivity-enhancing investments in specific disadvantaged individuals. Rather than paying the investors in traditional ways, the government instead issues the investors with securities that pay out every year as a function of the incomes of those receiving investments. The right to this flow of payments is tradable, so the price of the securities is a function of the present discounted value of the expected future incomes of the investment recipient population. This modified financing mechanism can be broken down into six key steps, as shown in Figures 7.1 and 7.2.

Step 1: Contract Auction

The government awards a contract to an investor via a competitive auction process. The contract has six components and takes the following form: $(s, q^P, N, P_0, \alpha, \tau)$. s is the specific type of investment that must be financed by the investor. q^P is the quantity to be provided. N refers to the population of individuals who have consented to receive such investments. P_0 is an initial lump-sum payment to be made from the investor to the government. α is a proportion of the taxation revenue from the individuals receiving investment, to be transferred annually by the government to the investor (or whoever owns the TIBS).³⁶⁰ τ is a flat income taxation rate that is fixed.

The auction takes the form of a second-price sealed-bid (Vickrey) auction, with potential investors placing bids of the form (P_0, α) .³⁶¹ In other words, the contractual terms s, q, τ and N are predetermined, while terms P_0 and α are not. As was explained in Chapter 5, each potential investor's optimal strategy in a Vickrey auction is to bid their true valuation. As such, each

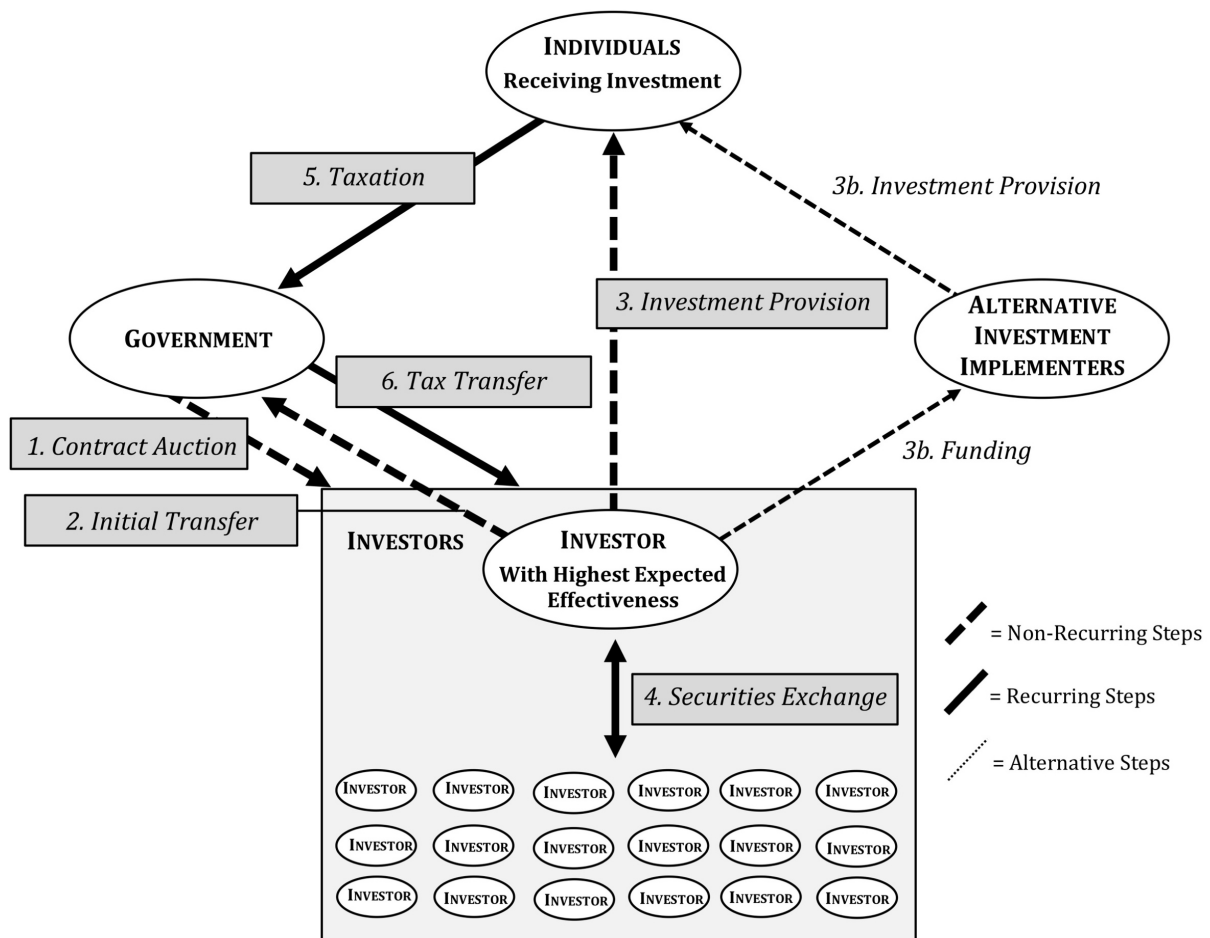
³⁶⁰ In the contract, $\alpha \leq 1$, so one can write the final contractual term as γ proportion of income, with $\gamma = \alpha\tau$, where τ is the tax rate.

³⁶¹ Note that initially, P_0 and α may need to be determined via negotiation. However, once enough investors are interested in this contractual arrangement, P_0 and α could be set via a competitive bidding process.

investor will bid up the point where they expect to exactly break-even, earning no profit and no loss.

The contract is awarded to the investor with the highest bid on the terms (P_0, α) of the second-highest bid. Therefore the (P_0, α) in the contract corresponds to the zero-profit condition of the counterfactual investment. In this way, the investor that is awarded the contract only generates a financial return if their investment is more effective than the expected effectiveness of the counterfactual investment.

Figure 7.1: How a Tradeable Income-Based Securities (TIBS) Mechanism Would Work



By way of illustration, suppose the German government auctioned a contract to finance a two-year plumbing training course to 5,000 newly resettled refugees. That is, $(s, q, N) = (\text{plumbing training}, 2, 5000)$. Further suppose that investor *A* placed the highest bid of $(P_0, \alpha) = (\text{€}10M, 0.3)$, while investor *C* placed the second-highest bid of $(P_0, \alpha) = (\text{€}10M, 0.2)$. Then Investor *A* would be awarded the contract at $(P_0, \alpha) = (\text{€}10M, 0.2)$.

Figure 7.2: TIBS Mechanism Design by Stakeholder Actions

Type of Step	Step	Step Name	Government	Investor	Other Investors	Individuals	Alternative Investment Implementers
				<i>With the Highest Revealed Expected Effectiveness</i>	<i>Those Without the Highest Revealed Expected Effectiveness</i>	<i>Those Receiving Investment</i>	<i>Including Non-Profits</i>
Non-Recurring	1	Contract Auction	Announces Auction				
			Seeks Bids				
				Makes Bid	Make Bids		
	2	Initial Transfer		Awarded Contract			
			Pays Lump-Sum				
	3	Service Provision	Receives Lump-Sum				
Recurring	4	Securities Exchange		Provides Investment (or sub-contracts to an alternative investment provider)			(Provide sub-contracted goods or services that constitute the investment)
						Receive Investment	
	5	Taxation		Can Sell the Right to the Payment Stream (from this point onwards)*	Can Buy Right to the Payment Stream (from this point onwards)*		
						Receive Income	
	6	Tax Transfer				Pay Taxation	
			Receives Taxation				
			Pays Tax Transfer				
				Receives Tax Transfer (if own securities)	Receive Tax Transfer (if own securities)		

Step 2. Initial Transfer

Once the contract is agreed, an initial lump-sum (P_0) is transferred from the investor to the government, which can be viewed as the purchase price of the TIBS. In our previous example, investor A would make an initial payment of €10 million to the German government.

This payment ensures that inaction or low-effort by investors would result in a financial loss. Investors only profit if they make investments of high enough quality so as to increase the expected future incomes of the recipients and thereby increase the stream of transfer payments to the point that it more than offsets the initial transfer. In this way, high effort is incentivized (thereby satisfying first-best effort property, S3, as explained in Chapter 3 and formalised in Chapter 5).³⁶²

Step 3. Investment Provision

The investor provides (or facilitates the provision of) the agreed investment to the group of individuals that have consented to such investment. The investor may either (a) provide the investment directly, or (b) sub-contract the investment implementation to another entity (such as a non-profit) with surplus capacity and/or existing expertise.

Even if the investor contracts with one or more other providers, the investor still has an incentive to select the most effective provider(s) and to hold them accountable for their effort and performance. This is because the investor benefits financially from good social outcomes.

³⁶² Recall the following property: “S3. Effort: High effort is exerted by providers in the generation of social returns. That is, high effort is consistent with a provider’s incentive compatibility constraint.”

Step 4. Securities Exchange

Any time after the completion of the investment, the investor may sell the TIBS that they own to others, who then acquire the right to the stream of transfer payments from the government. The market price of the TIBS reflects the present discounted value of expected future government transfers.

This ability for investors to sell the right to future streams of payments is of crucial importance. It means the long-term impacts of investments are incorporated into the short-term decision-making calculus of investors (thereby satisfying the first-best investment quantity property S2).³⁶³

Step 5. Taxation

Every year throughout the lifetimes of the individuals that have received investment, the government collects income taxation from them.³⁶⁴

Step 6. Tax Transfer

Every year, soon after taxation collection, until the TIBS contract expires, the government passes on to TIBS holders (initially the investor that won the contract) the agreed portion of taxation revenue it collects from the investment recipients.³⁶⁵ In our example, the German government would transfer 20% of the taxation collected from the 5000 trained refugees to investor A (or, if the securities are traded, to whoever owns the securities). In this way, the government utilizes its existing institutional role as the collector and enforcer of taxation payments to act as an intermediary facilitator between individuals and investors. This avoids the need for investors to collect and enforce income-based payments, which – as seen in Chapter 6 – is logistically, financially, and legally problematic.

Overall, this mechanism that has just been described satisfies all the implied first-best mechanism design characteristics discovered in previous chapters. It involves investment by a private investor, enforcement by the government, and appropriation of taxation revenue. It uses a Vickrey auction, securitization, market trade, a lump-sum initial payment, and discounted value aggregation. It also aligns social and financial returns because what maximizes social impact is what maximizes profit. The selfish action for investors to take is also the altruistic action – to generate social outcomes by providing the highest-quality investment with the highest level of effort to the target population. It is then that profit is maximized, because this maximizes the expected future incomes of the investee population, thereby increasing the price of TIBS.

³⁶³ Recall the following property: “S2. Quantity: Expected future social returns are internalised and considered in present period decision-making, so that the optimal quantity of each investment is made.”

³⁶⁴ Note that no assumption is made that the taxation paid by individuals to the government will be strictly positive every year. It is likely that in a subset of years an individual will pay no taxation. This is consistent with the financing mechanism.

³⁶⁵ This is equivalent to passing on a portion of those individuals’ incomes.

7.3 How This Implied Mechanism May Satisfy First-Best Properties and Constraints

Having described the mechanism design in detail, let us now consider the possible advantages of the mechanism in light of the 16 first-best properties and constraints that a mechanism design should satisfy.

Satisfying Investor Constraints

This implied mechanism design appears to satisfy investor constraint C3 from Chapter 6.³⁶⁶ The capacity for investors to sell TIBS allows realised returns within a typical fund time-horizon of 3-10 years, despite investments having longer-term benefits. This makes short-term profit possible, enabling investments to occur in the first place. Given that the potential financial upside for investors is uncapped, and that investment capital far exceeds philanthropic capital (O'Donohoe et al., 2010),³⁶⁷ investments in achieving social outcomes may increase significantly. TIBS may enable primarily profit-motivated investors to have a sizeable social impact without needing to reduce or share financial returns, and primarily impact-motivated investors to generate sufficient financial returns to enable reinvestment and thereby further social value creation.

Satisfying Government Constraints

The mechanism also appears to satisfy the constraints facing governments. Rather than spending taxpayer money on investments upfront, governments receive money upfront, which satisfies the government financial constraint C1 from Chapter 6.³⁶⁸ Even after investment provision, they do not pay anything. Rather, they simply transfer a portion of the taxation benefit. The taxation transferred only exceeds the initial lump sum when the investment turns out to be more effective than the expected effectiveness of the counterfactual investment. In other words, governments only have a positive net transfer to investors when they receive a marginal taxation gain that is attributable to those investors. They only pass on in the future what they otherwise would not have had, which satisfies the government's political constraint C2.³⁶⁹ There is also no need for the government to guess which private investors are the most effective. The investors with the greatest effectiveness expect to be able to increase incomes, taxation revenue, and therefore the price of TIBS the most. Since these investors expect to profit the most, they will bid the highest and win the contract. In this way, there is truthful revelation of effectiveness and the first-best selection property, S1, is satisfied.³⁷⁰ As such, there appears to be limited risk to the government, both financially and politically, from the implied mechanism design.

Satisfying Individual and Practical Constraints

³⁶⁶ Recall the following constraint: "C3. Investor Constraint: Investments must be liquid and able to generate a positive financial return within a typical investment fund time horizon."

³⁶⁷ O'Donohoe, N. et al., 2010. Impact Investments: An emerging asset class. JP Morgan Global Research (November).

³⁶⁸ Recall the following constraint: "C1. Government Financial Constraint: Need to be financially better off by the next election or by the end of their expected term in office, whichever is sooner."

³⁶⁹ Recall the following constraint: "C2. Government Political Constraint: Cannot pay investors revenue they would have had in the absence of the investment."

³⁷⁰ Recall the following property: "S1. Selection: Allocation is to the investor with the highest expected social return. That is, we want expected social impact to be truthfully revealed *ex ante*."

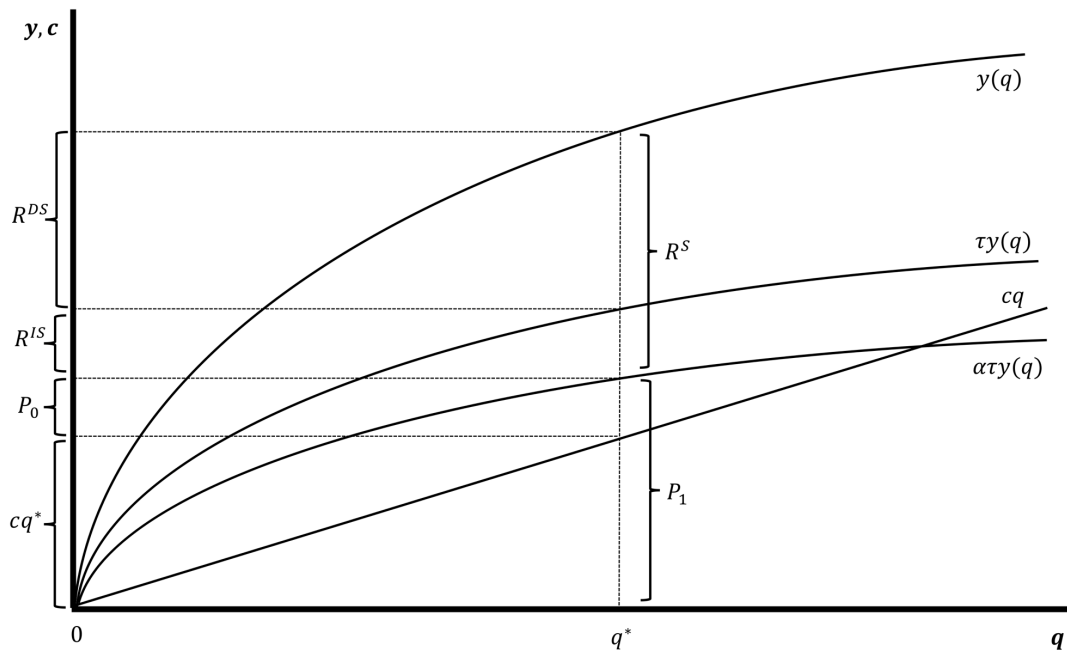
Individual constraint C4 also appears to be satisfied.³⁷¹ With this implied impact investing mechanism, disadvantaged individuals are able to receive the most inherently effective investments, with investors exerting the greatest effort, at zero cost. They just pay the usual taxation rate. As such, rather than other taxpayers paying for investments in disadvantaged individuals, such as refugees, disadvantaged individuals effectively pay for their own investments with their future tax money. Furthermore, given individuals simply pay the taxation they would have otherwise paid, there are no additional challenges regarding adverse selection, moral hazard, misreporting, or enforcement (thereby satisfying practical constraints P1 and P2).³⁷²

Satisfying First-Best Social Impact Measurement Properties

When it comes to satisfying the seven first-best social impact measurement properties (M1-M7), this implied mechanism design has a major advantage. It allows for a new market-based measure of social impact. This measure, which we can term Discounted Expected Marginal Impact (DEMI), uses the marginal change in the present discounted value of the expected lifetime incomes of investment recipients as a proxy for social impact.

This measure of social impact is represented visually in Figure 7.3.

Figure 7.3: Visual Representation of DEMI



³⁷¹ Recall the following constraint: "C4. Individual Constraint: Cannot bear financial risk and can only pay for services, if at all, when those services lead to higher disposable incomes."

³⁷² Recall the following constraints: "P1. Enforcement: Any financial value that is appropriated must be able to be enforced." and "P2. Information Asymmetry: The mechanism should not result in information asymmetry problems such as adverse selection, moral hazard, and income misreporting."

In this diagram, R^S is the social return at the first-best investment quantity q^* , which can be decomposed into direct social return R^{DS} and indirect social return R^{IS} . This is a similar graph to the visual representation of the TIBS mechanism in Figure B.3 in Appendix B.

In terms of calculating DEMI, since government tax transfers are a monotonically increasing function of income, the marginal change in the PDV of expected lifetime income can be determined from prior tax transfers (thereby satisfying intertemporal accuracy property M3) and the current market price of TIBS.³⁷³ By using traded prices, expected future social impact can be objectively ascertained before all the impacts are realised (thereby satisfying intertemporal inclusion property M2).³⁷⁴

While far from being a perfect measure of social impact, there are a number of advantages of DEMI over the prevailing approach of Social Return On Investment (SROI).³⁷⁵ These include: its objectivity as a market-based measure (objectivity property M4);³⁷⁶ its continuous rather than intermittent nature (continuity property M5);³⁷⁷ its ability to compare programs covering different social outcomes (comparability property M6);³⁷⁸ the lack of need for separate measurement financing to calculate social impact; and its explicit focus on marginal rather than absolute social impact combined with its ability to easily ascertain the counterfactual impact (marginality property M1).³⁷⁹ Furthermore, because a significant majority of social outcomes (such as better health and improved literacy) filter through to higher expected incomes, this measure satisfies the interdependence externality property M7 from Chapter 5.³⁸⁰ As such, DEMI may offer a credible alternative to SROI when it comes to measuring the social impact of investments.

As explored in Chapter 4, the decades-long movement aimed at measuring social impact has long sought a way of measuring social impact that is objective, scalable, continuous, comparable across different social impacts, uses a consistent discount rate, incorporates future impacts, does not require separate funding, and measures the counterfactual accurately (Lingane & Olsen, 2004; Pathak & Dattani, 2014; Rotheroe & Richards, 2007; Mulgan, 2010; Tuan, 2008).³⁸¹ DEMI arguably

³⁷³ Recall the following property: "M3. Intertemporal Accuracy: All past social returns are known with certainty."

³⁷⁴ Recall the following property: "M2. Intertemporal Inclusion: All expected future social returns are incorporated into present period social metrics."

³⁷⁵ See Gair, C. (2009), Millar, R., & Hall, K. (2013), and Nicholls, A. and Tomkinson, E., (2013) for analysis on the characteristics of Social Return On Investment (SROI).

³⁷⁶ Recall the following property: "M4. Objectivity: The measure is an unbiased indicator of social value, determined via the utilization of all available information."

³⁷⁷ Recall the following property: "M5. Continuity: The measure is a continuous indicator of social value."

³⁷⁸ Recall the following property: "M6. Comparability: The elements in the set of possible investments can be ranked and compared based on social return on the same cardinal scale."

³⁷⁹ This is possible as the contract is setup so that P_0 and γ correspond to the zero-profit condition of the next best alternative investment. In this way, investor profit represents how much more effective they were at providing the investment than the counterfactual investor. Recall the following property: "M1. Marginality: There is knowledge of the marginal social return relative to the counterfactual. It should be possible to know the difference between the actual social return of the investor that is generating social return, and the expected social return of the counterfactual investor."

³⁸⁰ Recall the following property: "M7. Interdependency: Interdependence externalities from an investment are included in the calculation of social return."

³⁸¹ Lingane, A., & Olsen, S. (2004). Guidelines for social return on investment. *California management review*, 46(3), 116-135. Pathak, P., & Dattani, P. (2014). Social return on investment: three technical challenges. *Social Enterprise Journal*, 10(2), 91-104. Rotheroe, N., & Richards, A. (2007). Social return on investment and social enterprise: transparent accountability for sustainable development. *Social Enterprise Journal*, 3(1), 31-48. Mulgan, G. (2010). Measuring social value. *Stanford Soc Innov Rev*, 8(3), 38-43. Tuan, M. T. (2008). Measuring and/or estimating social

satisfies more of these desirable social impact measurement properties than any existing approach. It may therefore improve social impact measurement, which may in-turn help capital allocation decision-making and result in a greater aggregate social impact.

7.4 A Full Worked Example of the Implied TIBS Mechanism

To further understand how this implied mechanism design could work in practice, it is helpful to provide a full worked example for illustrative purposes.

Disadvantaged Individuals

Suppose there are 1000 disadvantaged individuals that are either unemployed or are likely to become unemployed in the near future, and who would like to undertake vocational coding training. These 1000 individuals are comprised of 100 individuals from indigenous communities, 150 former inmates, 200 former taxi-drivers who have become unemployed due to the introduction of self-driving cars, 250 resettled refugees, 300 individuals with physical disabilities.

There are many programming training providers, including one called Codeify and another named Synergy. The cost of six-months of coding training is \$15,000 per person in both cases.

The disadvantaged individuals have struggled to finance the \$15,000 training. They have found that self-financing is not possible due to a lack of savings and low credit scores. They have found governments unwilling to fund their training because it would damage their bottom line in the lead up to an election and because governments tend to be risk averse. Furthermore, investors have been uninterested and/or unwilling to finance the training via income-contingent loans due to concerns regarding enforcement, adverse selection and moral hazard. Additionally, while some individuals have raised some money in the form of non-repayable grants and donations, this type of financing has proven to be insufficient in the vast majority of cases.

Impact Investors

Further suppose that there are impact investors that want to have a significant social impact but, due to fiduciary duties and pressure from shareholders, are unable to do so in a way that sacrifices financial returns. One such impact investor is Penford, which describes itself as a forwards-looking pension fund asset manager. Penford has \$5 billion in assets under management and invests in a diverse range of enterprises. A second impact investor is a venture capital firm called Envest, which has just raised a fund of \$100 million. Envest wants to invest the \$100 million within the next two years, but needs to exit those investments within five years.

value creation: Insights into eight integrated cost approaches. Retrieved from the Gates Foundation website on February, 23, 2012.

Contractual Agreement

Now suppose the government either decided (of its own or accord) or agreed (after being approached by an impact investor or a social finance intermediary) to facilitate vocational coding training for the 1000 disadvantaged individuals using the TIBS mechanism design.

The government then holds a Vickrey auction to allocate the TIBS contract. Suppose that in this case the TIBS contract is for a duration of 10 years. As already explained, each auction bid consists of two amounts - a lump-sum initial payment from the investor to the government (P_0) and a percentage of future taxation revenue (α) to be transferred annually from the government to the securities holder. The advantage of this type of auction is that each bidder's optimal strategy is to bid the maximum amount (that is, the highest P_0 and lowest α) that they would be willing to fulfil the contract for. In other words, they bid up to the P_0 and α that corresponds to their zero-profit condition.

In terms of bids, suppose Envest bids $P_0 = \$8$ million and $\alpha = 20\%$, with the plan to partner with Codeify. Meanwhile, Penford bids $P_0 = \$6$ million and $\alpha = 30\%$ with a planned partnership with Synergy. As such, Envest has bid the highest, while the bid by Penford is the second highest. Given this, the contract is awarded to Envest on the terms $P_0 = \$6$ million and $\alpha = 30\%$.

TIBS Process

After the contract is awarded, Envest pays the government \$6 million, which is effectively the initial purchase price of the securities. Envest then provides Codeify with the required \$15 million to train 1000 disadvantaged individuals as programmers over the course of six months.

Suppose that at the end of the six months of training, these individuals are placed into some form of employment, start working on software projects, and are able to earn an annual salary of \$60,000. As with other individuals, they pay income taxation to the government. Based on the taxation rate in Australia, for illustrative purposes, the amount paid in tax on \$60,000 is \$11,047 (\$3,572 plus 32.5% on income over \$37,000).

In some cases, incomes rise after a year or two due to the acquisition of greater experience and skills. In other cases, individuals decide to move to an alternative job with a lower salary. Given this, it is assumed that incomes remain at \$60,000 on average for the first few years.

After one year, the government passes onto Envest 30% of the tax revenue it has collected from the 1000 individuals. This corresponds to passing on \$3.314 million ($30\% \times \$11,047 \times 1000$). In years two and three, the same thing happens. During this time, Envest works hard to support Codeify to ensure that the coding training, on-the-job learning, and personal development of the individuals is of the highest possible standard. In other words, Envest exerts high effort in the investment process.

Now suppose that after three years, Envest wants to improve its investment portfolio liquidity and start exiting its investments. Fortunately, with TIBS they are able to sell the right to the remaining seven years of tax transfers from the government.

Envest shows other investors in the market a report explaining with evidence the social impact they've created, including the technical capabilities of the 1000 programmers and the past software projects that have been undertaken for businesses and governments.

Other investors do their due diligence, and analyse the evidence. The other investors determine that Envest and Codeify did such a good job training and supporting the programmers that it's likely that the average income for the remaining seven years of the TIBS contract (since the contract duration is ten years in this case) will be \$70,000 rather than \$60,000. This corresponds to an average annual tax of \$14,297 per person.

Given this, the holder of the securities expects to receive \$4.289 million per year ($\$14,297 \times 1000$ individuals $\times 30\%$). Assuming an investor discount rate of 10% per annum, investors are willing to buy the TIBS contract for \$22.969 million with seven years of the contract remaining. In other words, after three years, the market price is given by \$22.969 million.

For the remaining seven years of the contract, the government transfers 30% of tax revenue from the 1000 individuals to the new holder of the securities.

Outcome of TIBS for Envest

Envest makes a profit of \$5.323 million. The total cost of the investment is \$21 million (\$6 million in initial transfer and \$15 million in funding Codeify). The transfers from the government to Envest in the first three years are \$9.066 million in discounted value (using a discount rate of 10% to the time of the contract allocation). The sale price of the securities is \$22.969 million, which is \$17.257 million when discounted to the time of the contract allocation. As such, total revenue for Envest is \$26.323 million, giving a profit of \$5.323 million.

Outcome of TIBS for Codeify

Through this process, Codeify is able to scale its supply of coding training dramatically, without being burdened by debt financing, without having to sell a portion of the entity via equity financing, without needing donations, and without any grants.

Outcome of TIBS for the Government

The government receives \$6 million initially from helping disadvantaged individuals. This means a better, not worse, budget position. Furthermore, the government has not borne any financial risk, and there is no possibility of cost blowouts. In terms of tax revenue, the government collects \$87.743 million (in present discounted terms) and passes on \$26.323 million, leaving \$61.42 million in retained tax revenue. Adding to this the \$6 million initial payment, this means that the government receives \$67.42 million in total.

How does this compare with the counterfactual? Suppose that instead of the contract being awarded to Envest, it was instead awarded to Penford. We know from the bid from Penford that they objectively expected their training of the 1000 individuals (in partnership with Synergy) to

result in zero profit if the contract terms were $P_0 = \$6$ million and $\alpha = 30\%$ (as this was the maximum amount they were willing to fulfil the contract for). This means that they expected 30% of tax revenue from the 1000 individuals to equal \$21 million in present discounted terms (since \$6 million plus \$15 million equals \$21 million). If \$21 million is 30%, then they expected the total tax revenue to be \$70 million. If this were the case, the government would have \$49 million in retained tax revenue. As such, the counterfactual would result in the Penford making zero profit and the government receiving \$55 million in total (\$49 million plus \$6 million).

It follows that the government is \$12.42 million better off overall as a result of TIBS (as compared with the next best alternative investment option).

Combining the financial value to the investor and the government, we can see that \$17.743 million in additional financial value accrues to these two stakeholders from the TIBS arrangement. \$12.42 million goes to the government as tax revenue they otherwise would not have had, and \$5.323 million goes to the investor as profit. Note that the government is only passing on to the investor a portion/subset of the additional tax revenue – the tax revenue they otherwise would not have had.

Outcome of TIBS for the Disadvantaged Individuals

The individuals that receive training and employment do so at absolutely no cost to themselves. They just pay the usual tax rate.

Measurement of Social Impact

The social impact created by Envest in this example be calculated by using Discounted Expected Marginal Impact (DEMI). The general formula for DEMI, which is explained and proven later in this chapter, is as follows, where $\gamma = \alpha\tau$,³⁸²

$$DEMI = \pi \left(\frac{1 - \gamma}{\gamma} \right)$$

where

$$\pi = \sum_{t=1}^s PDV_{t=0} (\gamma y_t) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_t) - P_0 - C$$

$$\therefore \pi = \sum_{t=1}^s PDV_{t=0} (\gamma y_t) + P_s - P_0 - C$$

In this instance, $s = 3$ (the year of sale), $E(n) = 7$ (the years of the contract remaining at time of sale), $P_0 = \$6$ million, $C = \$15$ million, $\tau = 0.19463$ for the first three years (\$11,678 in tax divided by \$60,000 in income), and $\tau = 0.20874$ for the final seven years (\$14,612 in tax divided by \$70,000 in income). Given this, $\gamma = 0.19463 \times 0.3 = 0.058389$ for the first three years, and $\gamma = 0.20874 \times 0.3 = 0.062622$ for the final seven years.

³⁸² Note that here τ refers to the effective income taxation rate, rather than the fixed/flat taxation rate.

As such,

$$\pi = \sum_{t=1}^3 PDV_{t=0} (0.058389y_t) + \sum_{t=4}^7 PDV_{t=0} E(0.062622y_t) - \$6M - \$15M$$

$$\therefore DEMI = \frac{\$5.323M(1 - 0.06)}{0.06}$$

$$\therefore DEMI = \$5.323M(15.667)$$

$$\therefore DEMI = \$83.393667M$$

This means that Envest has created a discounted expected marginal social impact of \$83,393,667. In other words, they have created \$83 million worth of social impact above and beyond the social impact that Penford (the counterfactual impact investor) objectively expected they would create.

This marginal social impact is comprised of (i) a \$70.97M marginal increase in the disposable (after-tax) incomes of the 1000 disadvantaged individuals, and (ii) a \$12.42M marginal increase in government revenue. As explained in Chapter 3, the former can be considered direct marginal social impact, while the later can be considered indirect marginal social impact. Investor profit is not counted as a social impact, and so is excluded.

In this way, the TIBS mechanism design has created mutual benefits. The impact investor Envest has profited. The government has improved its financial position by receiving money upfront and only passing on a subset of what it otherwise would not have had. Furthermore, disadvantaged individuals have been able to obtain training, jobs, and better livelihoods.

7.5 General Unsolicited Interviewee Perspectives

Now that we have described the implied mechanism design in detail and provided a full worked mathematical example, let us turn our attention to more fully understanding how this specific mechanism design affects the creation of social value. As previously mentioned, this is done by obtaining data via 19 semi-structured interviews with individuals representing key stakeholder groups and then researching the validity and importance of the concerns raised during those interviews.

While the research focus is on identifying concerns with the implied mechanism, it is nevertheless worth first giving a brief overview of the general perspectives of interview participants. One common yet unsolicited perspective of interviewees was appreciation for the way the TIBS mechanism attempts to bring together stakeholders in a mutually beneficial way by aligning their incentives and working around their constraints.³⁸³ However, many perspectives were quite

³⁸³ Belinda Morrissey (CEO, English Family Foundation) said of the mechanism, “It is truly innovative! I can see that the concept is the culmination of many years of deep thinking, research and discussions within the sector... it seems to me to be a very mutually beneficial arrangement.” Víctor Mulas (Vocational Training and Investment Innovation Specialist, World Bank) expressed the view that “it is an ingenious impact investing mechanism.” Tobi Amos (Innovation and

qualified.³⁸⁴ Meanwhile, some interviewees viewed the TIBS mechanism as part of broader social finance trends.³⁸⁵ For others, the appeal was the fact that via securitization the long-term effects of investments might be properly considered in the short-term.³⁸⁶ Several interviewees also offered their own suggestions for additional modifications to the financing mechanism.³⁸⁷ As such, interviewees viewed the modified investment mechanism broadly positively, though to differing degrees and for differing reasons.

7.6 Identification of Stakeholder Concerns

More specifically, the data from the interviews reveals recurring concerns. Concerns that were identified by at least three interview participants are presented in the following table. As is evident, 16 concerns were raised by at least three individuals, and these concerns can be grouped into five categories – contractual structure, social impact measurement, external validity, investor risk factors, and government willingness to participate.

Figure 7.4: List of Main Concerns of Interview Participants

Category	Identifier	Concern	Prevalence (Times Identified)
Contractual Structure	A	<i>Whether the Contractual Form Can Achieve the First-Best</i>	9
	B	<i>Whether the Initial Lump-Sum Payment is Necessary</i>	6
	C	<i>Whether the Mechanism Would Still Work with Multiple Investors Investing in the Same Individual</i>	3
	D	<i>The Ease of Measuring Social Impact</i>	4

Investment Thought Leader, MIT) commented that it is “a brilliant stakeholder arrangement,” while Eugene Li (Co-Founder and President, Cortico) stated that “this is genuine systems innovation.”

³⁸⁴ This can be seen with Mark Evans (Founding Partner, Kindred Capital) stating, “this may be a gem of an idea,” Tony Eccles (Co-Founder and Development Director, Social Finance) saying, “I really like it as a theoretical model, but I’m not sure it would work in practice,” and Michael Fargher (Managing Director, Goldman Sachs) commenting, “I think it’s a great financing concept that definitely has enormous potential, but needs buy-in from the government to make it work.” Meanwhile, Jerome Haegel (Chief Economist and Former Head of Investment Strategy at Swiss Re) said during the interview that the TIBS mechanism is “an innovative, economically sound and highly promising investment mechanism, however I would need to have more information on how insurance would work in the case of government default as investors will not put blind faith into government agencies. Future income is also not straightforward to price.” Furthermore, Karthik Ramanna (Professor of Business and Public Policy, Blavatnik School of Government, Oxford University) said, “This impact investing mechanism may work from a technical and economic perspective, but I would not underestimate the branding challenge. A weakness of many new initiatives involving the government is the framing language. It makes a big difference.”

³⁸⁵ Stefan Chambers (Director, Marshall Institute at the London School of Economics and Political Science), for example, said, “I really like this idea. It works with the grain of a set of things that we know quite a lot about. Incentives, and how to value future cash flows, and the effect of bringing people into the tax code, and productive work, and so on.” Sir Ronald Cohen (Chairman, The Portland Trust and Bridges Ventures) described TIBS as “a great and interesting new approach that may attract more capital from the markets to tackle social issues... It also seems like a good way to overcome adverse selection problems and it fits with the broader trend towards pay for success.”

³⁸⁶ Madeline Kane (Manager, Google.org and Equal Justice Initiative) commented, “It’s such an interesting idea... I wish the broader health care financing system would internalise that. Truth is, all of us could benefit from this type of long-term thinking.”

³⁸⁷ For example, Amir Amel-Zadeh (Associate Professor of Accounting, Saïd Business School, Oxford University) said, “Investors want uncorrelated investments for diversification, and I’m not sure that the performance of these securities would add to diversity. However, there may be ways of structuring the security, such as with the government guaranteeing the first tranche, so that it becomes an attractive proposition for investors. In any case, it is important to estimate and fairly price the risk. It definitely has potential.”

Social Impact Measurement	E	<i>The Desirability of using the Non-Appropriated Marginal Change in PDV of Expected Lifetime Income as a Proxy for Social Impact</i>	5
External Validity	F	<i>Who It Would Be Applicable To</i>	8
	G	<i>Where It Would be Applicable</i>	4
	H	<i>What Types of Investments Would be Applicable</i>	7
Investor Risk Factors	I	<i>Migration Rates Reducing Investor Returns</i>	4
	J	<i>That Contracts Cannot be Enforced Against a Sovereign</i>	4
	K	<i>Macroeconomic Factors Affecting Security Returns</i>	3
	L	<i>The Limited Predictability of Income</i>	6
	M	<i>Intentional or Unintentional Manipulation of Actual or Reported Taxation Revenue by Governments</i>	5
Government Willingness to Participate	N	<i>The Contract Time Horizon is Too Great for Governmental Adoption</i>	6
	O	<i>Potential for Public Backlash and Negative Political Ramifications</i>	5
	P	<i>That the Government Would Be, or Would Perceive Itself to Be, Economically Worse Off Under TIBS</i>	7

Let us now explain and evaluate each of these 16 concerns in turn.

7.7 Category 1: Contractual Structure

A) Concern: Whether the Contractual Form Can Achieve the First-Best

Explanation:

A common question by interviewees was whether there is any mathematical basis for TIBS. Several participants asked whether it is possible to prove mathematically that there is always a contract of the form outlined (with the six contractual terms s, q^P, N, P_0, τ and α) that can be supported as a first-best equilibrium. Some interviewees thought that investors would win the contract and then either not provide the first-best investment quantity, or not exert the first-best level of effort in the provision of the investment. Three participants went further and asked it if is possible to specify the contractual terms necessary for the first-best equilibrium.

Evaluation:

This concern can be evaluated quantitatively via a formal mathematical model. Such a model is contained in Appendix B. As proven in the appendix, for the first-best to be obtained, the quantity of investment q must equal q^* , workers must exert high effort, and the full financial surplus from the investment must go to individuals in the form of higher disposable income, rather than to investors in the form of profit or governments in the form of additional revenue. As such, the profit-maximizing decision for investors must be to provide the first-best levels of quantity and effort.

The key finding from this research is as follows:

Proposition 7.A: There is always a contract of the form $(s, q^P, N, P_0, \alpha, \tau)$ that achieves the first-best levels of quantity and effort.

This result is of central importance. Whereas the five existing contingent-repayment impact investing mechanisms are unable to sustain the first-best in equilibrium, the TIBS mechanism can always sustain the first-best in equilibrium.

Another key result, also proven in Appendix B, is what specific contractual terms are necessary to achieve the first-best. These are as follows:

Proposition 7.B: When $q^\# < q^$, contracts of the form $(s, q^P, N, P_0, \alpha, \tau)$ achieve the first-best if and only if $q^P = q^*$, $P_0 = (\alpha - 1)c(\frac{a\theta}{c})^{\frac{1}{1-\theta}}$, $\alpha \geq 1$, and $\tau = \theta$.*

Proposition 7.C: When $q^\# \geq q^$, contracts of the form $(s, q^P, N, P_0, \alpha, \tau)$ achieve the first-best if and only if $q^P + q^G = q^*$, $P_0 = \alpha\theta a q^{*\theta} - c q^P$, $\alpha \geq \frac{c q^P}{a\theta(q^{*\theta} - q^{G\theta})}$, and $\tau = \theta$.*

As such, if $q^\# < q^*$ then private investors must make the full investments in individuals, while if $q^\# \geq q^*$ then there may be joint investment provision by private and public investors provided that each individual still receives the optimal quantity of investment q^* .

Another finding is as follows:

Proposition 7.D: The optimal taxation rate, denoted τ^ , is equal to θ , which represents the degree of concavity in the income function.*

θ represents the degree to which social outcomes have decreasing marginal returns. The greater the decreasing marginal returns, the lower the first-best tax rate, and vice-versa. This is an elegant and interesting result, analogous to the golden rule savings rate (Phelps, 1966).³⁸⁸

Given these results from quantitative analysis, concerns regarding the capacity of the TIBS contractual mechanism to achieve the first-best equilibrium do not appear to be valid from a mathematical perspective.

There is, however, one caveat. While not mentioned by any interviewees, there is an intuitive economic basis for concerns about achieving the first-best quantity of investment. Two microeconomic assumptions that are often made are as follows. First, that investors provide up to the quantity where marginal revenue equals marginal cost, as this maximizes their profit (Lipsey, 1975).³⁸⁹ Secondly, that income is a concave function of human capital investments

³⁸⁸ In his 1966 paper 'Golden rules of economic growth' Edmund Phelps built off the previous work of John von Neumann and Maurice Allais to look at intergenerational models of consumption. The golden savings rate is the rate which maximizes steady state level or growth of consumption. Mathematically, this optimal savings rate is equal to the marginal product of capital and the optimal k, divided by the average product of capital. It is a simple and elegant result, similar in simplicity and elegance to the result that $\tau^* = \theta$. See Phelps, Edmund (1966). Golden rules of economic growth. New York: Norton.

³⁸⁹ Lipsey, Richard G. (1975). An introduction to positive economics (fourth ed.). Weidenfeld and Nicolson. pp. 214–7, 245–47.

(Mincer, 1974).³⁹⁰ Under these assumptions, if there is also a fixed taxation rate and cost is a linear function of human capital investments, it follows that the investor's marginal revenue from TIBS (which is a fixed portion of taxation revenue) is tangential to marginal cost at a quantity that is less than the first-best level.

This underinvestment problem is overcome in our model because quantity of investment, q^P , is a term of the contract itself. It is assumed to be observable and enforceable. Such an assumption is common in the contracting literature (Grieco et al., 2016; Hildenbrand et al., 2014; Josephson et al., 2015).³⁹¹ However, our model does not force investors who have been awarded a contract to incur cost. They could choose to provide the designated quantity at low effort and incur no cost, which is the same cost to the investor as if they had not provided any investment quantity ($q^P = 0$).

There are at other ways that the first-best quantity level could be obtained in our model without making this assumption regarding observability. One option is to not make the assumption of decreasing returns to human capital, which could be justified on the basis of inconsistent empirical evidence (Psacharopoulos, 1981). Alternatively, given that the first-best quantity level is where marginal pre-taxation income equals marginal cost (see Appendix B), the proportion of taxation revenue payable to the investor, α , could be set so that the government passes on an amount equal to an individual's entire income. In this instance, $\alpha \geq 1$, since it is assumed that the taxation rate $\tau \leq 1$. For the government to afford this, and for the first-best to be achieved, the initial lump-sum transfer to the government would need to exactly offset the government's loss from paying out weakly more to the investor than it receives in taxation revenue. While such an arrangement is unlikely in practice, it is mentioned here to show that the result that the TIBS mechanism can always achieve the first-best level of quantity is not dependent upon the assumption that quantity is observable.

B) Concern: Whether the Initial Lump-Sum Payment is Necessary

Explanation:

Several interviewees thought that the inclusion of a lump-sum initial payment unnecessarily complicated the contractual structure, and was “an enhancement that could be left out” (Eugene Li). There was broad interest in knowing the precise conditions, if any, under which the lump-sum transfer could be omitted.

Evaluation:

³⁹⁰ Empirical evidence for this assumption is inconsistent, though broadly supportive. Hundreds of studies have been undertaken that examine returns to human capital, often using the Mincer earnings function (Mincer, 1974) that models the logarithm of earnings as a function of schooling and years of potential experience. Mincer (1974), Psacharopoulos (1981, 1994), and Harmon and Walker (1999) all find evidence of diminishing returns to education. Other studies, including Heckman et al. (2003), find the same result but only beyond a certain level of education. However, there are also several studies that come to an alternate conclusion. Heckman and Polachek (1974), Card and Krueger (1992), and Card (1993, 1999) find an approximately constant return to human capital. For a more comprehensive overview of the evidence on returns to education, see surveys by Psacharopoulos (1985, 1994), Ashenfelter et al. (1999), and Harmon et al. (2000).

³⁹¹ In the papers Grieco et al. (2016) and Hildenbrand and Duran (2014), the assumption is that quantity of good and services produced or traded is observable.

As with the previous concern, it is possible to evaluate this concern via quantitative analysis. As proven in Appendix B, the instances where the initial lump-sum transfer, P_0 , can equal 0 and the first-best can still be obtained are rare. The mathematical appendix considers the case where an individual has zero initial income ($y_0 = 0$) and can receive investment from a private investor (q^P) and/or the government (q^G). In this case, we prove the following:

Proposition 7.E: When $q^\# \geq q^*$ and $q^G > 0$, the first-best cannot be obtained with $P_0 = 0$.

Proposition 7.F: Where $q^\# < q^*$, there is always a contract of the form $(s, q^P, N, \alpha, \tau)$. That is, there is always a contract with $P_0 = 0$ that can be supported as a first-best equilibrium.

Note that we also know from Proposition 7.B that when $q^\# < q^*$, contracts of the form $(s, q^P, N, \alpha, \tau)$ achieve the first-best if and only if $q^P = q^*$. That is, where $q^G = 0$. When $q^G > 0$, then if the first-best is to be obtained, we know from Proposition 7.C that it must be that $q^\# \geq q^*$. However, if this is the case then mathematically $P_0 > 0$. As such,

Proposition 7.G: Where $q^G > 0$, the first-best cannot be obtained with $P_0 = 0$.

What this means is that P_0 is a necessary part of the contract when the government and the private investor both provide some investment in an individual. Where $q^G = 0$, $y_0 = 0$, and there is only one private investor, $P_0 > 0$ is not necessary but significantly broadens the range of possible contracts.

Intuitively, it is only possible for the first-best to be obtained and for P_0 to equal 0 if two requirements can be satisfied simultaneously. The first requirement is that the portion of tax paid to the investor, α , is the same as the proportion of an individual's total investment quantity that is provided by the investor. Mathematically, the requirement is that $\alpha = \frac{q^P}{q^*}$. The second requirement is that α equals the proportion of an individual's income that is attributable to the investor's investment provision.

The only time that both requirements can be satisfied is when there is no initial income and a single investor. If $y_0 > 0$ and $q^P = q^*$, then the first requirement necessitates $\alpha = 1$, but the second requirement necessitates $\alpha < 1$, which is inconsistent. If $y_0 = 0$ but there are multiple providers (either a government provider or multiple private providers) then the first requirement means $\alpha = \frac{q^P}{q^*}$, but the second requirement means $\alpha < \frac{q^P}{q^*}$ due to the concavity of the income function, which is assumed to have decreasing returns to investments. In both cases, if $P_0 = 0$, the investor's profit-maximizing strategy would be to provide the investment with low effort and minimize costs. To incentivise high effort, the payment to the investor must be greater than the investor's contribution, meaning that $\alpha > \frac{q^P}{q^*}$. However, to be able to pay a greater amount than the investor contributes, the government must collect a strictly positive payment from the private investor at $t = 0$. The combination of $P_0 > 0$ and $\alpha > \frac{q^P}{q^*}$ prevents the private investor from taking part of the benefit of other investments and others' high effort without incurring the cost of high effort themselves.

Therefore, in most cases it is necessary for $P_0 > 0$ for high effort to be incentivised and the first-best be obtained. As such, this concern is of limited validity. A lump-sum transfer is required in all but one case. This finding reinforces the importance of the finding in Chapter 5 that financing tools, including a lump-sum payment, may help an impact investing mechanism to obtain the first-best properties.

In terms of concern importance, as opposed to concern validity, this concern is of limited importance. This is because the requirement of a lump-sum does not necessarily make the contractual arrangement more difficult to form. It transfers risk from the government to the private sector and improves the government's financial position in the short-term at the expense of the investor. Therefore, it may increase the value proposition to the government while decreasing the value proposition to investors. The overall impact of this on mechanism design adoption is ambiguous.

C) Concern: Whether the Mechanism Would Still Work with Multiple Investors Investing in the Same Individual

Explanation:

There was a concern that the TIBS mechanism would only work with a single investment provider, and that the mechanism would break-down if individuals received investment from multiple investors.

Evaluation:

As proven in Appendix B, when there are multiple investors, such as a government investor and a private investor, the first-best can still be achieved. However, when there are multiple investors, both the initial payment to the government, P_0 , and the percentage of taxation revenue transferred, α , need to be of greater magnitude. This is to ensure that investor incentive compatibility constraints are satisfied. If there was not a larger initial payment, then the investor's optimal strategy would be to win the contract but to provide the investment with low effort rather than high effort. As such, this concern is not a valid criticism of the TIBS mechanism.

7.8 Category 2: Social Impact Measurement

D) Concern: The Ease of Measuring Social Impact

Explanation:

All but two interviewees viewed the notion of a market-based measure of social impact favourably. However, several were concerned that the actual calculation of social impact would be complicated and resource intensive. Questions were posed about whether there exists a formula to calculate social impact quickly, affordably, and continuously.

Evaluation:

Quantitative research reveals that this concern is not valid. It is possible to derive a simple expression for the social return of an investment financed via TIBS by using Discounted Expected Marginal Impact (DEMI).

Proposition 7.H: Social return, and its direct and indirect components, can be calculated for an investment financed via the TIBS mechanism, as follows:

$$\text{DEMI: } \begin{cases} \text{Social Return: }^{392} & R^S = \pi \left(\frac{1 - \gamma}{\gamma} \right) \\ \text{Direct Social Return: }^{393} & R^{DS} = \pi \left(\frac{1 - \tau}{\gamma} \right) \\ \text{Indirect Social Return: }^{394} & R^{IS} = \pi \left(\frac{\tau - \gamma}{\gamma} \right) \end{cases}$$

where

$$\pi = \sum_{t=1}^s PDV_{t=0}(\gamma y_t) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_t) - P_0 - C$$

$$\gamma = \alpha \tau$$

The first term in the profit equation is the value of disbursements to date, discounted to period $t = 0$ for consistency. The second term is the discounted market price of the security in period $t = s$. It is the residual value of the security and is equal to the PDV of expected future income. P_0 is the initial purchase price, $E(n)$ is the expected lifetime of individuals from the time of the investment until the end of the TIBS contract, while C denotes the cost of making the investment. As before, α represents the proportion of tax paid to the investor each period, while τ is the taxation rate. As such:

$$\pi = \sum_{t=1}^s PDV_{t=0}(\gamma y_t) + P_s - P_0 - C$$

This result is elegant in its simplicity. If the profit of an investor is known, then a simple adjustment gives the marginal impact of an investment. If profit is unknown, it can be calculated by summing the disbursements to date and the current market price of the security, P_s , less the initial transfer, P_0 , and investment cost C .

³⁹² Recall that social return (R^S) is defined as the present discounted value of total lifetime non-appropriated marginal gross benefits from an investment.

³⁹³ Recall that direct social return (R^{DS}) is defined as the portion of social return R^S that is captured by individuals in the form of higher incomes. Put differently, it is the present discounted value of the marginal increase in after-tax income from an investment over individuals' lifetimes.

³⁹⁴ Recall that indirect social return (R^{IS}) is defined as the portion of social return R^S that is appropriated by the government in the form of taxation, and retained by the government for further expenditure. Put differently, it is the present discounted value of the marginal increase in tax revenue from an investment over individuals' lifetimes.

Proof:

The profit of investor A on an investment is given by:

$$\pi_A = \sum_{t=1}^s PDV_{t=0}(\gamma y_{A,t}) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_{A,t}) - P_0 - C$$

If the next best investor had undertaken the investment on the same contractual terms, we know that their expected profit would be zero, since they will bid up to their zero-profit condition. As such the profit of the counterfactual is:

$$E(\pi_C) = \sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{C,t}) - P_0 - C = 0$$

Given this, we know that expected revenue for the counterfactual investor equals cost.

$$\therefore \sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{C,t}) = P_0 + C$$

We can therefore substitute counterfactual revenue for investor cost in the first equation and write:

$$\pi_A = \sum_{t=1}^s PDV_{t=0}(\gamma y_{A,t}) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_{A,t}) - \sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{C,t})$$

Dividing both sides by γ gives:

$$\frac{\pi_A}{\gamma} = \frac{\sum_{t=1}^s PDV_{t=0}(\gamma y_{A,t}) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_{A,t})}{\gamma} - \frac{\sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{C,t})}{\gamma}$$

Cancelling the γ 's on the right-hand side gives:

$$\therefore \frac{\pi_A}{\gamma} = \sum_{t=1}^s PDV_{t=0}(y_{A,t}) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(y_{A,t}) - \sum_{t=1}^{E(n)} PDV_{t=0} E(y_{C,t})$$

As total value created, V^T , is the present discounted value of lifetime net benefits from an investment, we can write:

$$\frac{\pi_A}{\gamma} = V_A^T - V_B^T$$

Since the marginal value created equals the difference in in present discounted values of expected income, this reduces to:

$$\frac{\pi_A}{\gamma} = V_A^M$$

All that remains to make adjustments based on how this marginal value is apportioned between the three stakeholders. The government collects τ portion of the value in tax but then passes on γ portion of the value to the investor. As such, γV_A^M goes to the investor, $(\tau - \gamma)V_A^M$ to the government, and $(1 - \tau)V_A^M$ to the individuals. Substituting in $\frac{\pi_A}{\gamma}$ for V_A^M gives $\pi_A(\frac{\tau - \gamma}{\gamma})$ to the government (which is indirect social return) and $\pi_A(\frac{1 - \tau}{\gamma})$ to the individuals (which is the direct social return).

Adding the direct and indirect social return gives the overall social return, as follows:

$$R_A^S = R_A^{DS} + R_A^{IS} = \pi_A \left(\frac{1 - \tau}{\gamma} \right) + \pi_A \left(\frac{\tau - \gamma}{\gamma} \right) = \pi_A \left(\frac{1 - \tau + \tau - \gamma}{\gamma} \right) = \pi_A \left(\frac{1 - \gamma}{\gamma} \right)$$

This concludes the proof. $\square$

To understand why these expressions work, recall that in a Vickrey auction, it is optimal for bidders to reveal their true valuation and to bid up to the point where they would receive zero-profit. The contract is awarded to the highest bidder on the terms of the second highest bid. In other words, the investor making the investment receives the contract on terms that the second-highest bidder expects would generate no profit for them. Hence, the profit generated by the investor is a reflection of how much more profitable they are than the second-highest bidder expected to be. As such, the auction mechanism results in *absolute* profit in this case being identical to *marginal* profit relative to the profit of the counterfactual investor. There is equivalence between the two in the mechanism.

Recall also the relationship between financial and social returns. Since investor profit is determined by the size of transfers from the government, and those transfers are a strictly monotonically increasing function of individuals' income, investor profit is therefore a monotonically increasing function of individuals' future income. It follows that *marginal* investor profit is a monotonically increasing function of the *marginal* change in individuals' lifetime income. As absolute profit and marginal profit are equivalent, it follows that absolute investor profit is a monotonically increasing function of the *marginal* change in individuals' lifetime income. This marginal change in individuals' lifetime income, less investor profit (the part of the increase in financial value from an investment that is appropriated), is the definition of social impact from Chapter 3.

Therefore, to determine marginal social impact from absolute profit, we can work backwards from absolute profit to ascertain the total marginal financial value created from an investment, which is $\frac{\pi}{\gamma}$ (or, equivalently, $\frac{\pi}{\alpha\tau}$), before subtracting profit π , which gives $\frac{\pi}{\gamma} - \pi = \pi \left(\frac{1 - \gamma}{\gamma} \right)$. This measure of social return can then be split into its direct and indirect component, with direct social return representing any impact accruing to the individual in the form of increased disposable

income, and indirect social return representing any impact accruing to the government in the form of increased revenue.³⁹⁵

The profit term itself is a combination of payments received to date (which reflects past marginal impact),³⁹⁶ the traded market price (which reveals expected future marginal impact), and the cost of the investment.

This explains why DEMI works. However, there are other ways to explain the logic of DEMI that may make more sense to some readers.³⁹⁷

While DEMI is intended for measuring marginal social impact, the approach can also be used to calculate absolute social impact - that is, social impact relative to a no investment counterfactual.

*Proposition 7.1: Absolute social impact, and its direct and indirect components, can be calculated for an investment financed via the TIBS mechanism, as follows:*³⁹⁸

³⁹⁵ Additional government revenue may increase the capacity of the government to spend money on worthwhile social outcomes, which may lead to indirect social impact.

³⁹⁶ It is the one-to-one relationship that enables one to work backwards to determine the total value created based on the total payments received.

³⁹⁷ An alternative explanation of why DEMI works is as follows. DEMI works due to three important features. First, the allocation of the contract via bidding enables one to discover the zero-profit condition for the next best alternative investment. Knowing this then enables one to determine the expected future income, and therefore the expected total value, of the next best investment. Since the investor that bids second highest would receive zero-profit from the contract (P_i, γ) , we know that $V_{j,c}^P = 0$, meaning that they would not have appropriated any portion of the value created in the form of profit. As such, the total value of the next best investment is the same as the absolute social impact of the next best investment. Mathematically, $V_{j,c}^T = V_{j,c}^G + V_{j,c}^Z$. Put differently, since no part of $V_{j,c}^T$ (the total value created of the counterfactual) is appropriated as profit, it is possible to use $V_{j,c}^T$ as the counterfactual social impact. If $V_{j,c}^P > 0$ and we used $V_{j,c}^T$ as the counterfactual social impact, then measured marginal social impact would be understated (Note that if we were not able to assume that $V_{j,c}^T = V_{j,c}^G + V_{j,c}^Z$, then another way to find the social impact component of the counterfactual investment would be to assume that the proportion of total value created that is appropriated by the investor is the same for the counterfactual investment as the actual investment - then the counterfactual social impact could be determined, allowing for marginal social impact to be calculated.) The second key feature that makes DEMI work is that by enabling the securities (that is, the right to disbursements) to be traded, the market can determine the expected future impact. Thirdly, the payments to the investor are a strictly monotonically increasing function of income. This one-to-one relationship enables one to work backwards to determine the total value created based on the total payments received. In other words, the bidding mechanism reveals the counterfactual social impact, the market price reveals the expected future revenue, the payment function reveals the total value created, and together they determine the discounted expected marginal impact.

³⁹⁸ *Proof:* The revenue of the investor is given by $\xi = \sum_{t=1}^S PDV_{t=0}(\gamma y_t) + P_S$. Since this revenue is made up of payments out of total income, we know that total value created is given by $V^T = \frac{\xi}{\gamma}$. We can therefore calculate the total value that accrues to each stakeholder. Individuals receive $V^Z = V^T(1 - \tau)$. The government receives the initial payment P_0 , collects τV^T in tax, and pays out γV^T to the investor, so $V^G = P_0 + V^T(\tau - \gamma)$. The investor pays P_0 initially and then collects γV^T , so $V^P = \gamma V^T - P_0$. Absolute social impact is given by $V^T - V^P$, or equivalently by $V^Z + V^G$. Therefore $R^S = V^T(1 - \tau) + P_0 + V^T(\tau - \gamma) = V^T(1 - \gamma) + P_0$. As we know $V^T = \frac{\xi}{\gamma}$, this can also be written as $R^S = \xi \left(\frac{1-\gamma}{\gamma} \right) + P_0$. $\square$

$$\text{DEMI: } \begin{cases} \text{Absolute Social Impact:} & R^S = \xi \left(\frac{1-\gamma}{\gamma} \right) + P_0 \\ \text{Absolute Direct Social Impact:} & R^{DS} = \xi \left(\frac{1-\tau}{\gamma} \right) \\ \text{Absolute Indirect Social Impact:} & R^{IS} = \xi \left(\frac{\tau-\gamma}{\gamma} \right) + P_0 \end{cases}$$

where ξ denotes revenue as is given by

$$\xi = \sum_{t=1}^s PDV_{t=0}(\gamma y_t) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_t) = \sum_{t=1}^s PDV_{t=0}(\gamma y_t) + P_s$$

This is very similar to Proposition 7.H, except for two adjustments. Revenue ξ is in place of profit π , and the initial buying price P_0 is added to total and indirect social impact. Note that P_0 does not appear in the expression for marginal social return since this applies to both the investor and the counterfactual investor, and so cancel out.

Since $\xi = \gamma \left[\sum_{t=1}^{E(n)} PDV_{t=0} E(y_t) \right] = \gamma V^T$, an equivalent way of writing the above proposition is as follows:

$$\text{DEMI: } \begin{cases} \text{Absolute Social Impact:} & R^S = V^T(1-\gamma) + P_0 \\ \text{Absolute Direct Social Impact:} & R^{DS} = V^T(1-\tau) \\ \text{Absolute Indirect Social Impact:} & R^{IS} = V^T(\tau-\gamma) + P_0 \end{cases}$$

It is also straightforward to calculate the absolute social impact of the counterfactual, and then show that the difference between the two absolute social impact measurements equals the marginal social impact formula.³⁹⁹

³⁹⁹ *Proof:* We know that for the counterfactual investment, $E(\pi_c) = 0$, so $\sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{c,t}) - P_0 - C = 0$. As such, $\sum_{t=1}^{E(n)} PDV_{t=0} E(\gamma y_{c,t}) = P_0 + C$. Dividing both sides of the previous expression by γ gives $V_c^T = \frac{P_0+C}{\gamma}$. Therefore the total value to the investor is $V_c^P = \left(\frac{P_0+C}{\gamma} \right) \gamma - P_0$, the total value to individuals is $V_c^Z = \left(\frac{P_0+C}{\gamma} \right) (1-\tau)$, and the total value to the government is $V_c^G = \left(\frac{P_0+C}{\gamma} \right) (\tau-\gamma) + P_0$. Therefore the absolute social impact of the counterfactual is $R_c^S = V_c^Z + V_c^G = \left(\frac{P_0+C}{\gamma} \right) (1-\tau) + \left(\frac{P_0+C}{\gamma} \right) (\tau-\gamma) + P_0 = \left(\frac{P_0+C}{\gamma} \right) (1-\gamma) + P_0$. Now we can subtract this from the absolute social impact of the actual investment, as follows:

$$\begin{aligned} R^S - R_c^S &= \xi \left(\frac{1-\gamma}{\gamma} \right) + P_0 - \left[\left(\frac{P_0+C}{\gamma} \right) (1-\gamma) + P_0 \right] \\ &\therefore R^S - R_c^S = (\xi - P_0 - C) \left(\frac{1-\gamma}{\gamma} \right) \\ &\therefore R^S - R_c^S = \left[\sum_{t=1}^s PDV_{t=0}(\gamma y_t) + \sum_{t=s+1}^{E(n)} PDV_{t=0} E(\gamma y_t) - P_0 - C \right] \left(\frac{1-\gamma}{\gamma} \right) \end{aligned}$$

As such, this quantitative research finds that social return can be calculated continuously from simple formulas using market prices, in a way that is unlikely to require significant time or monetary resources. Given this, concerns regarding the ease of social impact measurement are of limited validity.

E) Concern: The Desirability of using the Non-Appropriated Marginal Change in the PDV of Expected Lifetime Income as a Proxy for Social Impact

Explanation:

DEMI uses the present value of the non-appropriated marginal change in expected lifetime income as a proxy for social impact. As explained in Chapter 3, social impact is conceptualized as the sum of the marginal increases in positive pecuniary externalities that accrue from an investor making an investment in an individual. In other words, social impact is the non-appropriated marginal financial value that arises from an investment.

Several participants expressed concern that DEMI is an inaccurate measure of social impact. Three specific concerns were raised. First, that DEMI does not capture all desirable social and environmental impacts of an investment. One interviewee commented, “trees don’t pay taxes.” Secondly, that the measure is subject to fluctuations due to factors outside of the investor’s control, such as changes in government policy and economic growth. Thirdly, that Goodhart’s Law may apply here. This concept, named after Charles Goodhart for his 1975 paper ‘Problems of Monetary Management: The U.K. Experience,’⁴⁰⁰ is that “when a measure becomes a target, it ceases to be a good measure.”⁴⁰¹ In other words, when a feature of an economic system is selected to measure that economic system, it ceases to function effectively as a measure. One reason for this is that stakeholder may attempt to manipulate it. Alternatively phrased, if what one incentivizes is correlated with what one is trying to achieve, this relationship breaks down over time. This Goodhart Law is similar to the Lucas Critique in macroeconomics, which comes from Robert Lucas’ 1976 paper ‘Econometric Policy Evaluation: A Critique,’⁴⁰² and which argues that the effect of policy changes cannot be predicted from aggregated historical data.

Evaluation:

It is important to note that DEMI does not purport to be a perfect or complete measure of social impact. It falls short against that standard. What DEMI is, is a proxy for social impact. It is at least

$$\therefore R^S - R_C^S = \pi \left(\frac{1 - \gamma}{\gamma} \right)$$

This gives the same measure of marginal social impact as before. □

⁴⁰⁰ Goodhart, C.A.E. (1975). “Problems of Monetary Management: The U.K. Experience”. Papers in Monetary Economics. Reserve Bank of Australia. I.

⁴⁰¹ Manheim, D. (2016, September 29). Overpowered Metrics Eat Underspecified Goals [Web log post]. Retrieved January 26, 2017, from <http://ribbonfarm.com>.

⁴⁰² Lucas, Robert (1976). “Econometric Policy Evaluation: A Critique”. In Brunner, K.; Meltzer, A. The Phillips Curve and Labor Markets. Carnegie-Rochester Conference Series on Public Policy. 1. New York: American Elsevier. pp.19–46. ISBN 0-444-11007-0.

arguable that this proxy for social impact has more desirable properties than existing attempts to directly measure social impact.

Even if DEMI was used as a measure of social impact, other social impact metrics, including the 559 performance metrics put forward by The Global Impact Investing Network (GIIN) as part of their Impact Reporting & Investment Standards (IRIS) Version 4.0,⁴⁰³ would still exist and have an important role to play. Their role would just be different. Rather than being the final measure of impact, they could be intermediary metrics due to their predictive value. They could be used by investors to analyze what the market price of TIBS should be for a given investment in a population. For example, if a group of illiterate adolescents in Kenya were provided with language lessons, measures of literacy improvements could be an intermediary metric to help predict the likelihood of future employment and income, and therefore the price of TIBS. In this way, measures of education, health, and other social outcomes could support the functioning of the TIBS market by enabling the market price to more accurately reflect the true value of the securities. To the extent that these intermediary metrics mispredict the market value, it is reasonable to expect the market to correct for these errors and the predictive value of intermediary metrics to improve over time as more data about the relationship between intermediary metrics and true market value becomes available.

There are several arguments for why using the marginal change in the PDV of non-appropriated expected lifetime income may not be an undesirable measure of social impact.

First, as established in Chapter 3, there is a common sequential relationship between social value creation and financial value creation, whereby many social outcomes filter through to higher expected incomes. Better literacy, improved health, better sanitation, and relevant vocational training, for example, can all reasonably be expected to increase lifetime income.

Secondly, as explained in Chapter 5, Section 5.5, there is often an interdependence between social outcomes. This occurs where a change in one type of social outcome (such as education level) in an individual causes a change in other social outcomes (such as health level) for that same individual. Given this, measures of social impact that only focus on one social outcome may understate the true social impact of an investment. This is commonly the case with social impact bonds, where payments to investors are often a function of just one social outcome (such as recidivism rates or literacy levels). By measuring lifetime income, this interdependency is taken into account. This may reduce the extent to which true social impact is understated – which we discovered in Chapter 5 is a concern of a large number of impact investors. As such, DEMI satisfies the social impact measurement interdependency property M7,⁴⁰⁴ where some other measures of

⁴⁰³ The Global Impact Investing Network (GIIN) has developed the Impact Reporting & Investment Standards (IRIS), which is an attempt to catalogue of generally accepted and commonly used performance metrics. GIIN hopes that if more impact investors, non-profits and social enterprises use a common language, then there will be increased comparability of investments even if those impacts are not given a monetary value. This may in turn lead to better evaluation of funding opportunities and greater credibility for the industry. While a common language via standard metrics may seem, *ceteris paribus*, like a good approach, it is worth examining the degree of traction IRIS has and the degree of comparability of investments. In IRIS Version 4.0 there were 559 metrics listed, which raises questions around comparability, and only 5000 organisations had adopted the metrics out of millions of non-profit organisations worldwide.

⁴⁰⁴ Recall the following property: “M7. Interdependency: Interdependence externalities from an investment are included in the calculation of social return.”

social impact do not.

Thirdly, DEMI is a measure of social impact that is comparable across different types of social outcomes.⁴⁰⁵ Such comparisons are important for the effective allocation of capital (Geobey et al., 2012).⁴⁰⁶ It has traditionally been difficult to compare different development outcomes for two reasons. One reason is a lack of standardisation of outcome measurement, with the type of metrics used varying by the type of outcome. A second reason is that the social discount rates typically applied vary significantly, as shown in the primary data in Figures 4.3- 4.4 and explained in Section 4.6. This makes it difficult to compare social outcomes occurring in different time periods.⁴⁰⁷ In contrast, DEMI allows different investments to be ranked and compared on the same cardinal scale. This is possible because (a) investments are measured according to the same metric, and (b) a consistent social discount rate is applied. By using a financial measure as a proxy for social impact, a consistent discount rate is applied, namely the financial discount rate implied by the market price. As such, DEMI satisfies the social impact measurement comparability property M6.⁴⁰⁸

Fourthly, DEMI enables us to measure the *marginal* social impact rather than *absolute* social impact. Absolute social impact is commonly measured by alternative metrics, such as Social Return On Investment (SROI), due to the difficulty of knowing the counterfactual.⁴⁰⁹ With DEMI,

⁴⁰⁵ There are a few existing approaches that attempt to make investments comparable. First, there has been an emergence of organisations that attempt to compare charities and social enterprises on the basis of the impact they are having (see, for example, Giving What We Can). Secondly, Social Return On Investment (SROI) involves using financial proxies to monetise the projected returns, discounting the returns by a social discount factor, and then comparing the net present social value (NPSV) to the level of investment required to achieve that. A third and alternative, though not mutually exclusive, approach to attempting to monetise all social impacts is to simply have greater standardisation of the metrics used to measure social impact. This is what the Global Impact Investing Network (GIIN) has attempted to do with the Impact Reporting & Investment Standards (IRIS).

⁴⁰⁶ According to Geobey et al. (2002), a “lack of consistent performance data... reduces the effectiveness of subsequent capital allocation.” This view has been repeated many times, including by the Social Impact Investment Taskforce, which was established under the UK’s presidency of the G8. In their ‘Measuring Impact’ subject paper, they write that comparability of impact measurement enables “analyses that can unlock more capital and improve capital allocation for the greatest collective impact.” See Geobey, S., Westley, F. R., & Weber, O. (2012). Enabling social innovation through developmental social finance. *Journal of Social Entrepreneurship*, 3(2), 151-165. See also Taskforce, S. I. I. (2014). Measuring impact. Subject paper of the Impact Measurement Working Group. Social Impact Investment Taskforce, UK Presidency of the G8.

⁴⁰⁷ Note that there has been little rigorous analysis, and certainly no agreement, on what is the appropriate discount factor to apply to social returns. In many cases, the social risk component of the discount rate is ignored altogether and the discount rate is set to simply reflect the investor’s willingness to delay a social outcome (Zhuang 2007). Even this varies considerable, from 0% for health and climate change investments (Freirich and Fulton, 2009), to 4% for drug criminal justice investments (Tuan 2008), to the average rate of government bonds for other social investments. Given that many development interventions are unproven and carry significant uncertainty, it has been argued that an approach that parallels venture capitalist discount rates for early-stage investments may be more appropriate (Nicholls and Patton 2013). Nicholls and Patton propose a so-called Projection-Valuation-Pricing (PVP) approach to deal with social risk and return, and argue that a new way of measuring social discount rates is needed to achieve standardisation, but they do not propose any particular method. Hence, the existing literature provides little guidance as to what is the appropriate social discount rate.

⁴⁰⁸ Recall the following property: “M6. Comparability: The elements in the set of possible investments can be ranked and compared based on social return on the same cardinal scale.”

⁴⁰⁹ In most cases, SROI is calculated by measuring the social impact of an investment relative to if no investment had taken place, rather than relative to if an alternative investment had taken place. In the data obtained by Vo, Christie and Rohanna, 2016, 68% of the time impact analysts measured differences in pre and post outcomes, without comparing this to a control group, and without considering what alternative investments would have taken place if the current program had not been undertaken. Furthermore, 47% of the time analysts used a simple benefit to cost ratio without taking into account a counterfactual. Only 3% of the time was causal modelling used. As such, in the vast majority of cases SROI is calculated as the social impact relative to no investment

we are able to know the counterfactual – at least in expectation. This is possible because the contractual agreement is setup so that P_0 and γ correspond to the zero-profit condition of the next best alternative investment. The alignment of social and financial returns means that (a) the bidding mechanism reveals expected investor effectiveness and not just expected profit, enabling investors to be ranked by expected effectiveness, and (b) one can work back backwards from financial return to ascertain social return. In this way, investor profit represents how much more effective they are at providing services and generating social impact than the counterfactual investor. Hence, the social impact measurement marginality property, M1, is satisfied with DEMI.⁴¹⁰

Fifthly, DEMI is arguably an objective measure of social impact. Given that DEMI is determined by the market price of the securities, and given that market participants do not have an incentive to bid higher than their true valuation,⁴¹¹ the market price gives an accurate indicator of expected future social impact. This compares with many existing measures of social impact, where there may be an incentive for bias in impact measurement, since the stakeholders that commonly undertake the impact measurement often have a conflict of interest (Vo, Christie & Rohanna, 2016).⁴¹² Given this, DEMI-measured social impact may be more credible than alternative measures of social impact and may more closely satisfy the social impact measurement objectivity property M4.⁴¹³

Further benefits of DEMI over existing social impact approaches include that it is a continuous measure (M5),⁴¹⁴ does not require separate activities or funding to calculate, incorporates the positive externalities that accrue to the government in the form of higher taxation revenue, and incorporates benefits expected to accrue well into the future before they even happen (M2).⁴¹⁵

As such, DEMI assesses social impact objectively and continuously relative to a best-alternative-investment counterfactual. This contrasts with SROI, which assesses social impact subjectively and intermittently relative to a no-investment counterfactual.

⁴¹⁰ Recall the following property: “M1. Marginality: There is knowledge of the marginal social return relative to the counterfactual.⁴¹⁰ It should be possible to know the difference between the actual social return of the investor that is generating social return, and the expected social return of the counterfactual investor.”

⁴¹¹ Note that the securities have a common value, rather than private value, after the services have been provided. As such, if the securities were auctioned after the services have been provided, then the winner’s curse applies. In this case, investors should not bid their true *ex ante* valuation but rather bid based on their *ex post* valuation conditional on them winning the auction. Even in this case, there is not an incentive for market participants to bid above their valuation. See Thaler, Richard H. (1988). “Anomalies: The Winner’s Curse”. *Journal of Economic Perspectives*. 2 (1): 191–202. JSTOR 1942752. doi:10.1257/jep.2.1.191.

⁴¹² Data from Vo, Christie and Rohanna (2016) shows that in most cases either impact analysts or data providers have a vested interest in there being favorable impact measurements. They found that 37% of impact analysts worked for a non-profit organisation, often at the same organisation they were assessing. They also found that the data that is obtained came mostly from beneficiaries and staff members (via surveys and interviews), who were likely to benefit from additional funding. Furthermore, a large portion of impact analysts said that funders were the primary audience for the impact results. Indeed, one of the three most commonly reported aims of impact measurement was to secure additional financial investment.

⁴¹³ Recall the following property: “M4. Objectivity: The measure is an unbiased indicator of social value, determined via the utilization of all available information.”

⁴¹⁴ Recall the following property: M5. Continuity: The measure is a continuous indicator of social value.

⁴¹⁵ Recall the following property: M2. Intertemporal Inclusion: All expected future social returns are incorporated into present period social metrics.

Notwithstanding the advantages of using DEMI as a measure of social impact, there are several shortcomings.

First, DEMI can only be used to measure social impact for investments financed via TIBS. This necessarily limits the extent to which the measure can become mainstream. For example, DEMI is unlikely to be used to measure the effectiveness of interventions to help the environment and the elderly, given these investments are unlikely to be financed via TIBS due to the negligible impact those interventions are likely to have on expected lifetime incomes. As such, DEMI only applies to a subset of social impacts and does not apply to environmental impacts in general.

Secondly, DEMI measures the social impacts that arise from the investments in a population of individuals. Both the increase in disposable income and the increase in government taxation revenue (net of revenue paid to the investor) is captured. What is not captured is the impact an investment may have on those *not* in the population receiving investment. For example, if DEMI led to more carpenters being trained, this may increase the rates of unemployment among the population of carpenters who were already trained. Negative consequences on other populations are not captured by DEMI.

Thirdly, the social impact measured by DEMI could change due to macroeconomic factors and government policies outside of the control of the investor. While this is definitely a shortcoming, it is important to bear in mind that (a) almost all measures of social impact can be influenced by macroeconomic factors and government policies to some extent, (b) DEMI is arguably still more stable, with smaller fluctuations, than other metrics such as share prices, and (c) there may be ways to filter out the macroeconomic factors. For example, DEMI could be adjusted for the change in the market-determined present discounted value of GDP, which we can refer to as Discounted Expected National Income, or DENI. This may help to remove the effect of macroeconomic changes from the measure of social impact.

A fourth shortcoming is that DEMI relies on some implicit assumptions about the counterfactual – a point which closely relates to the discussion and findings in Chapter 4, Section 4.8. Specifically, with DEMI, we implicitly assume that the next best alternative investor would be subject to the same contractual terms as the investor undertaking the investment. However, if the most effective investor did not exist and the same bidding process was used, then the second most effective investor would win the contract on terms that would give the third most effective investor zero-profit. In addition, we abstract from flow-on effects that arise from finite budget constraints. If, for example, investor *A* didn't undertake investment *j* and the next best investor, investor *C*, did, then investor *C* might not have the capacity to undertake another investment – say investment *g*. As such, investment *g* may then go to another less effective investor, which would reduce the social impact from investment *g*. So if investor *A* did not undertake investment *j*, then social impact would be reduced for both investment *j* and investment *g*. Given this, the benefit of investor *A* undertaking investment *j* is likely to be greater than is measured. Put differently, the social impact measurement is biased downwards.

A final limitation of DEMI is that the approach relies on costs being either known or the same for both investors, which may not be the case. It may not be reasonable to assume similar costs for the same type of investment.

7.9 Category 3: External Validity (Degree of Applicability)

A large minority of interviewees voiced concerns about the external validity of the TIBS mechanism. These concerns about the range of cases where TIBS could be applied fell into three main categories – population, geography, and investment type.

F) Concern: Who It Would Be Applicable To

Explanation:

Several participants were concerned about *who* the investment recipients would be and the size of the potential investee population. Some interviewees enquired as to what types of individuals would be most appropriate to invest in via the TIBS mechanism, with some concern that the mechanism would only work for specific types of individuals that comprise a small portion of the population. Others were concerned that only individuals with the highest existing wealth or highest earning potential would receive investment. For example, Tobi Amos asked, “*Wouldn’t there be bias in provision to wealthy individuals?*” Deb Roy (Associate Professor, MIT) voiced the same concern, asking,

“Wouldn’t it only go to the highest earners? How do you make sure that lower paid individuals receive investments? Health insurance works because there is a pool of people and providers cannot disaggregate, but here investors may use data to bet on specific individuals.”

Evaluation:

There are a range of large populations who could receive investments financed via the TIBS mechanism. Three of the most obvious candidate populations are (a) the technology-induced unemployed, (b) resettled refugees, and (c) indigenous populations. None of those populations are of a negligible size.

One group that may be able to receive investments via the implied TIBS mechanism is the technology-induced unemployed. Numerous academic scholars have emphasized the likelihood of mass unemployment due to automation and deindustrialization (Targowski & Modrák, 2011; Hagedorn-Hansen et al., 2016; Strawn, 2016; Leontief et al., 1986; Deacu, 2016).⁴¹⁶ This expected mass unemployment is due largely to recent and expected advances in the fields of machine learning, artificial intelligence, big data, the Internet of Everything, and robotics. The tens of

⁴¹⁶ Targowski, A., & Modrák, V. (2011, October). Is advanced automation consistent with sustainable economic growth in developed world?. In International Conference on ENTERprise Information Systems (pp. 63-72). Springer, Berlin, Heidelberg. Hagedorn-Hansen, D., Steenkamp, L. P., Hagedorn-Hansen, E., & Oosthuizen, G. A. (2016). Investigating the Effects of Automating Process Chains towards Sustainable Manufacturing in South Africa. *Procedia Manufacturing*, 7, 262-268. Strawn, G. (2016). Automation and Future Unemployment. *IT Professional*, 18(1), 62-64. Leontief, W. W., Leontief, W., & Duchin, F. (1986). *The future impact of automation on workers*. New York: Oxford University Press. Deacu, C. (2016). The collapse of the state industry in Romania: between political and economic drivers. *Human Geographies*, 10(2), 115.

millions who will become unemployed over the coming decades may need retraining to improve their employment prospects. TIBS is one possible way to finance that retraining at scale.

A second group of potential investees is resettled refugees. In 2015 alone, over a million refugees were resettled across Europe. Millions more are living in low-income non-European destination countries. The human capital of refugees, both knowledge and skills, is often less applicable in destination countries than origin countries. Also, the primary language spoken in destination countries often differs from the primary language in countries of origin. The misalignment of human capital to employment opportunities, and the language barriers, are obstacles to employment and integration. However, vocational and language training may go some way towards remedying this. TIBS may provide a way to finance such training on the scale required.

A third group of potential investees is disadvantaged indigenous individuals. Indigenous populations worldwide typically have significantly lower education, health, and income levels than their country's non-indigenous population. In several cases, interventions have proven to be effective at bridging this socio-economic divide; however, these interventions are often too expensive to be undertaken at scale with existing financing models.⁴¹⁷ It follows that if such proven interventions could be financed via TIBS, then the socio-economic divide may be narrowed.

These three populations are especially appropriate for TIBS given the scale of the problems, the severity of the needs, the degree of political constraints, and the lack of obvious alternative financing mechanisms.

In relation to concerns about investments financed via the TIBS mechanism being restricted to investments in high income earners, these concerns are of limited validity. They stem from a misunderstanding regarding the profit function of investors. If the auction mechanism is a Vickrey auction, then the investor's profit is not a function of the absolute increase in the present discounted value of lifetime income of the recipients. Rather, it is a function of marginal increase in the PDV of lifetime income relative to the next best alternative investment. In other words, an investor's profit is based on how much more effective that investor is than the expected effectiveness of the second highest bidder. If an investor, for example, increases the PDV of expected lifetime income (relative to the expected counterfactual) by the same amount for a low-income individual and a high-income individual, the financial return to the investor would be the same in both cases.

One caveat here is that it is arguable that it is easier to increase the expected lifetime incomes of a high-income individual than a low-income individual, even if both are measured relative to their expected counterfactuals. One possible reason is that even if the *percentage* increase in income (relative to the counterfactual) is the same in both cases, the *actual* increase in income (relative to the counterfactual) would be greater for the individual with the higher income. Given this, the concern has some merit, albeit less than interviewees perceived.

⁴¹⁷ For example, Darkinjung is an innovative non-profit indigenous school in Australia (Barker, 2016). It has proven effective at bridging the significant educational gap between indigenous and non-indigenous populations, however it relies on over €600,000 per year in donations to educate just 28 students. To replicate Darkinjung for all 11,342 Australian indigenous students would require them to raise €243M annually – an improbable task. See Barker Darkinjung: About the School. (2016, December 14). Retrieved from <http://darkinjungbarker.nsw.edu.au/>.

A more valid concern, which was surprisingly not raised by any interviewee, is the probable bias towards younger populations at the expense of elderly populations. It is unlikely the TIBS mechanism would work as well for people above or nearing the age of retirement, given that investors may expect lower remaining lifetime income and therefore lower remaining taxation payments. However, where the investments are in individuals approaching retirement, the TIBS mechanism could be adjusted by shortening the time-span of the contract and increasing the proportion of taxation revenue that is transferred to the investors. For example, instead of an investor receiving 20% of the taxation revenue throughout the lifetime of individuals, they could instead receive 50% for five years, or 80% for three years. This may make investments via the TIBS mechanism possible even in cases where individuals are only expected to work for a few more years.

G) Concern: Where it Would Be Applicable

Explanation:

Another concern regarding the degree of applicability of TIBS was the geographic areas it can be applied to. It was felt by a few participants that there was a disconnect between where the financing mechanism is most needed, namely low-income countries with weak institutions, and where the financing mechanism is most suitable, namely middle-income countries with stronger institutions.

Evaluation:

It is logically consistent that the weaker a country's legal and taxation systems, the greater the perceived and actual risk of undertaking contractual arrangements whose successful execution is dependent on the strength of those institutions, *ceteris paribus*.

The TIBS mechanism depends on institutional strength in at least two ways. First, if taxation owed to the government is incompletely collected, this reduces the payments to the investor and therefore the investor's financial return. It follows that expected imperfect taxation collected translates to lower expected financial returns. Secondly, a stronger legal system may make it easier to hold institutions of government to account. For example, a strong legal system may reduce the likelihood of taxation misreporting by public officials and/or contractual breaches by executive powers. It follows that a stronger legal system may increase an investor's expectation of payment, and therefore their expected financial returns. As such, investors' perceived risk is likely to be, *ceteris paribus*, inversely correlated with the strength of a country's legal and taxation systems.

The fact that the TIBS contractual mechanism would carry additional risk in countries with weaker institutions is consistent with the literature. It is widely accepted that the strength of a country's institutions is an important determinant of business trust (Algan & Cahuc, 2013),⁴¹⁸ and

⁴¹⁸ Algan, Y., & Cahuc, P. (2013). Trust, Institutions and Economic Development. *Handbook of Economic Growth*, 2, pp. 40-43.

also economic growth (Acemoglu et al., 2005; Acemoglu & Robinson, 2010; Acemoglu & Robinson, 2013).⁴¹⁹

It does not follow, however, that TIBS cannot work in low-income countries. The existence of weak institutions increases investor risk and therefore the expected returns necessary to offset that risk. While this greater risk makes it less likely that investors and governments can reach a mutually beneficial agreement, it does not rule out the possibility. There are also a significant number of low-income countries that have disproportionately strong institutions. Research by Rice and Patrick (2008) of the Brookings Institution classified all 141 developing countries according to different categories, including economic prosperity and political institutions.⁴²⁰ The ranking of countries by economic prosperity included measures of GNI per capita, GDP growth, income inequality, inflation, and regulatory quality. The ranking of countries by political institutions included measures of government effectiveness, rule of law, voice and accountability, control of corruption, and a freedom rating. Importantly, the research shows that there are several countries which rank relatively poorly on economic prosperity but relatively well on the strength of political institutions. These include Lesotho, which was in the second highest (4th) quartile of countries for institutional strength but the bottom (1st) quartile for economic prosperity. Madagascar and Solomon Islands were both ranked two quartiles higher for institutional strength than economic prosperity. Other countries that ranked relatively highly on institutional strength include Mali, Colombia, Niger, Uganda, Zambia, Mozambique, Papua New Guinea, Burkina Faso, Malawi, Kenya, Gambia, Sri Lanka, and Tanzania.

Importantly, there are several reasons why TIBS may increasingly be able to be applied in low-income countries. First, the advent of new technologies is expected to increase transparency, reduce fraud, improve accountability, and lower transaction costs. This may make taxation collection less costly and government agencies more accountable. Technologies that the literature suggests are likely to help achieve such outcomes include the Internet of Everything (Borgia, 2014; Rifkin, 2014),⁴²¹ mobile banking (Mbiti & Weil, 2011),⁴²² and blockchain (Tapscott & Tapscott, 2016; Underwood, 2016).⁴²³ This view in the literature is supported by the view of practitioners. At the World Economic Forum's Annual Meeting of New Champions, which focuses on new technologies, over 800 business leaders, technology experts and political leaders were asked when they thought the government would collect taxation via blockchain. 73% of respondents thought it would happen before 2025.⁴²⁴ The reason, as Ainsworth and Shact argue in their 2016 paper,⁴²⁵ is that "it will reduce costs, and build critical inter-governmental trust

⁴¹⁹ Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a fundamental cause of long-run growth. *Handbook of economic growth*, 1, 385-472. Acemoglu, D., & Robinson, J. (2010). The role of institutions in growth and development (p. 135). World Bank Publications. Acemoglu, D., & Robinson, J. A. (2013). *Why nations fail: The origins of power, prosperity, and poverty*. Crown Business.

⁴²⁰ Rice, S. E., & Patrick, S. (2008). Index of state weakness in the developing world. *Global Economy and Development*, Brookings Institution.

⁴²¹ See Borgia, E. (2014). The Internet of Things vision: Key features, applications and open issues. *Computer Communications*, 54, 1-31., and Rifkin, J. (2014). The zero marginal cost society: The internet of things, the collaborative commons, and the eclipse of capitalism. St. Martin's Press.

⁴²² Mbiti, I., & Weil, D. N. (2011). Mobile banking: The impact of M-Pesa in Kenya (No. w17129). National Bureau of Economic Research.

⁴²³ See Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the technology behind Bitcoin is changing money, business, and the world*. Penguin., and Underwood, S. (2016). *Blockchain beyond bitcoin*. *Communications of the ACM*, 59(11), 15-17.

⁴²⁴ Ainsworth, R. T., & Shact, A. (2016). *Blockchain (Distributed Ledger Technology) Solves VAT Fraud*.

⁴²⁵ Ainsworth, R. T., & Shact, A. (2016). *Blockchain (Distributed Ledger Technology) Solves VAT Fraud*.

relationships... Most importantly, blockchain will immediately end [taxation] revenue losses.” A second reason why the TIBS mechanism is likely to have increasing applicability to low-income countries is that, to the extent that governments want to adopt TIBS, such as to replace direct government financing, there may be an incentive to improve the strength and transparency of institutions, including taxation and legal systems. For these reasons, TIBS is still applicable to low-income countries with weak institutions, at least in certain cases.

H) Concern: What Types of Investments Would Be Applicable

Explanation:

A repeated concern was that TIBS may not apply to interventions that would not increase incomes, and so may only be applicable in a small number of cases. On several occasions, participants enquired about whether particular types of investments would be covered by this financing mechanism.

A related concern was that investors may make investments in a way that maximizes the income of recipients, but at the expense of the recipients’ well-being. One participant gave the example that an investor may pressure individuals to become investment bankers even if those individuals wanted to become teachers. Another participant said, “*wouldn’t companies invest in an unethical way and manipulate the system so as to lead to perverse outcomes?*”

Evaluation:

Importantly, the TIBS mechanism design is investment agnostic. Suggestions of what types of investments to make could originate from the government (possibly after undertaking research or obtaining feedback), investors (by recommending to the government that specific investments be auctioned via TIBS), or potential investment recipients (who could provide suggestions on the types of investments they would like to receive). Regardless of where the investment proposal originates from, the TIBS contract would only be formed if it is mutually beneficial.

Conceptually, and as discussed in Chapter 1, a financing mechanism can only be mutually beneficial where the present value of the increase in lifetime financial value from an investment weakly exceeds the cost of that investment. Hence, the investments that could potentially be financed via the TIBS mechanism are those where the present value of the increase in lifetime financial value from an investment weakly exceeds the cost of that investment. On the other hand, if the cost of an investment exceeds the increase in lifetime financial value from an investment, a Pareto improvement is not possible (Ng, 2003).⁴²⁶ In such cases, the TIBS mechanism would not lead to a mutually beneficial outcome and would be unlikely to be entered into.

⁴²⁶ Pareto efficiency, named after economist Vilfredo Pareto (1843-1923), is a situation where nobody can be made better off without making someone worse off. A Pareto improvement is where someone can be made strictly better off with nobody becoming strictly worse off. In the case described, the fact that the total financial cost exceeds the total financial value created, means that a Pareto improvement is not feasible. For a more complete discussion of Pareto optimality, see Ng, Y. K. (2003). *Welfare economics: towards a more complete analysis*. Springer.

The types of investments that may fall into the former category are wide-ranging. Investments could include German language training for resettled refugees in Germany (which may improve employment prospects), interventions to increase the confidence of individuals in populations that often have low expectations for themselves (which may increase their willingness to apply for jobs), hospitality training for former taxi drivers given the rise of autonomous vehicles, coding courses for former coal workers, interventions to help autistic children fully integrate with their local communities, and immunizations for farm workers at risk of contracting diseases that would prevent them from working.

It is therefore true that not all types of investments would be able to be financed by TIBS. It is also impossible to rule out the possibility that investors could carry out investments in a way that was not intended. However, since investors are incentivized to maximize the present value of the lifetime incomes of the recipients, the likelihood of perverse outcomes is reduced. Contracts could also be written in a way that limits the scope for deviation. For example, a contract that specifies teacher training would prevent training individuals to become investment bankers.

Overall Evaluation of External Validity Concerns

Concerns about the applicability of the TIBS mechanism are of limited validity. An underlying reason is that TIBS is one of a constellation of mechanisms to finance investments. Just because a financing mechanism is inapplicable in some cases, does not mean it is not valuable for the cases where it is applicable. The standard by which to assess a contingent-repayment impact investing mechanism is arguably not whether it can be used in all cases, but whether it can be used in a reasonable number of cases to merit further research. While not applicable to all populations, all geographies, or all types of investments, there are a significant number of populations, geographies and investment types, where the mechanism has potential application. It should be viewed as a partial, and not complete, solution.⁴²⁷

7.10 Category 4: Investor Risk Factors

The next category incorporates all the concerns that relate to investors' perceived or actual risk of investing in individuals via TIBS-financing. As Stefan Chambers aptly enquired, "*How much does volatility and uncertainty turn this from a good idea into a not good idea?*"

I) Concern: Migration Rates Reducing Investor Returns

Explanation:

A commonly cited concern among interviewees was that of migration. The concern was that because government payments to investors are a function of taxation revenue, the mechanism is therefore dependent on the individuals receiving investments remaining in that taxation jurisdiction for an extended period of time, which may not be the case.

⁴²⁷ A relevant question for further research is what financing mechanism TIBS would be likely to replace, even if it becomes one of a constellation of financing methods.

There was particular concern about whether migration among refugee populations would render the TIBS mechanism inapplicable to that population. This was for two main reasons. First, because refugees may not have the legal status to work in a country for an extended period of time. Madeline Kane, for example, asked, “*How is the model impacted if refugees never obtain legal status?*” Secondly, because refugees may return to their home country in the short-term, which would reduce long-term taxation payments and therefore investor returns.

Evaluation:

It is important to look at the actual data on migration rates for the populations most likely to receive investments financed via TIBS. As previously explained, while TIBS could be used to finance investments in many populations, three of the most obvious candidate populations are indigenous populations, those who have become unemployed due to automation and deindustrialization, and refugees who have been resettled.

Historical migration rates to OECD destination countries are low for a wide range of countries, including low-income countries. In 2010/2011, the percentage of the population that had emigrated to OECD countries from India was 0.4% (3.2% of the highly-educated population),⁴²⁸ from China was 0.4% (1.8%), from Bangladesh was 0.5% (3.2%), from Thailand was 1.0% (2.6%), from Sudan was 0.4% (3.0%), from Egypt was 0.7% (3.2%), from Democratic Republic of Congo was 0.5% (6.5%), from Côte d'Ivoire was 1.2% (5.2%), from Peru was 3.8% (5.3%), and from Brazil was 0.7% (2.4%).⁴²⁹ There are also low emigration rates among many high-income countries including USA at 0.5% (0.5%), Australia at 1.8% (2.6%), Greece at 6.4% (5.8%), France at 2.5% (5.3%), Germany 4.2% (8.4%), and Spain at 1.9% (2.3%). Rates of emigration among indigenous populations are typically even lower due to a strong historical connection to their country of origin.

In terms of resettled refugees, evidence suggests that a large proportion will remain in their destination country for the long-term. The legal right for refugees to remain in a destination country varies by country. In the UK, refugees resettled via the Gateway Programme have indefinite leave to remain, while those on the Vulnerable Person's Relocation Scheme have five years of humanitarian protection.⁴³⁰ In Germany, refugees are initially granted a temporary residence permit, which then converts into a permanent residency permit after 1-3 years once the Federal Office for Migration and Refugees has examined, *inter alia*, the political, economic and security status of the country of origin.⁴³¹ In 2016, a total of 256,136 migrants were granted permanent residency, and in only 240 individual cases was protection status revoked within the

⁴²⁸ Highly educated is defined in the 'Database on Immigrants in OECD and non-OECD Countries: DIOC' as someone who has completed education at a tertiary level.

⁴²⁹ UN-DESA, O. E. C. D. (2013). World migration in figures. A Joint Contribution by UN-DESA and the OECD to the United Nations High-Level Dialogue on Migration and Development.

⁴³⁰ Refugee Council. (2017). Refugee Resettlement: The Facts. Retrieved July 6, 2017 from https://www.refugeecouncil.org.uk/what_we_do/refugee_services/resettlement_programme/refugee_resettlement_the_facts

⁴³¹ Pawel Swidlicki, P. (2016, January 18). EU migration crisis: will refugees acquire full free movement rights? Retrived 6, July, 2017, from <http://openeurope.org.uk/today/blog/eu-migration-crisis-will-refugees-acquire-full-free-movement-rights/>

first three years.⁴³² In Sweden, approved refugees are immediately granted permanent residency permits rather than temporary residency permits.⁴³³ A permanent residency permit comes with most of the same domestic benefits as full citizenship, including access to employment opportunities, however it does not bestow the absolute right to free movement within the EU that EU nationals have. This lack of an absolute right to free movement further reduces the likelihood of migration. Naturalization is, however, possible. The time of legal residence required before resettled refugees become eligible for citizenship varies by countries, from eight years in Germany, to five years in Italy, to four years in Sweden.⁴³⁴ As such, there are legal avenues which would entitle large proportions of resettled refugees to remain in destination countries for extended periods of time.

Not only do many refugees have a legal right to remain, many are likely to want to remain. In her book, *The Economic Life of Refugees* (2005),⁴³⁵ Jacobsen argues that if given the opportunity, resettled refugees are highly likely to remain in destination countries, rather than returning to countries of origin. This is primarily due to (a) safety concerns that are justifiable well after a conflict has ended because “peace is seldom spread homogenously across post-conflict countries,” and (b) the impossibility of reconstructing economic livelihoods after years of devastation due to the destruction of infrastructure and social networks. Other reasons Jacobsen mentions include the likelihood of relationships and work being established in the destination country, and refugees having negative memories of their origin countries.

Jacobsen’s arguments are especially applicable today, as over half of the 1,321,560 people that claimed asylum in the EU in 2015 came from three war-torn countries – Syria, Afghanistan, and Iraq.⁴³⁶ The combination of ongoing conflict in refugee countries of origin, and high percentages of refugees receiving permanent residency in resettlement countries, suggests migration rates are unlikely to be substantial.

Insofar as the formation of TIBS contractual arrangements is not possible due to the risk of refugees migrating, governments may be incentivised to grant refugees more permanent legal status at an earlier date. This may have the effect of reducing the likelihood of migration, therefore reducing investors’ perceived risks, and therefore increasing the likelihood of a mutually beneficial contractual arrangement.

Importantly, there is no additional incentive for individuals to migrate as a result of them receiving services financed via TIBS. This is because they pay the same taxation rate regardless of whether or not they have received investment. This contrasts with both standard loans and

⁴³² Leubecher, M. (2017, February 2). Almost all refugees are allowed to remain permanently. Retrieved July 6, 2017, from <https://www.welt.de/politik/deutschland/article161740112/Fast-alle-Fluechtlinge-duerfen-dauerhaft-bleiben.html>.

⁴³³ The Local SE. (2015, May 8). Should refugees get only 'temporary' permits? Retrieved July 6, 2017, from <https://www.thelocal.se/20150508/bid-to-grant-refugees-temporary-stay-in-sweden>.

⁴³⁴ Note that typically other requirements must be met to be granted citizenship, including having a clean criminal record and meeting language proficiency requirements.

⁴³⁵ Jacobsen, K. (2005). *The Economic Life of Refugees*. Kumarian Press. pp 8-9.

⁴³⁶ BBC World News (2016, March 4). Migrant Crisis: Migration to Europe Explained in Seven Charts. Retrieved July 6, 2017 from <http://www.bbc.co.uk/news/world-europe-34131911>.

income-contingent loans, where additional payments are required, which may incentivize migration to jurisdictions where payment enforcement is more difficult.

Notwithstanding this, let us assume for the moment that migration rates are significant. This does not in and of itself cause the TIBS mechanism to breakdown. It is unlikely that every individual in the population receiving investment will migrate, especially if investors diversify their TIBS investment portfolio. Migration is merely a risk that is taken into account in pricing securities. The price of securities will be lower the higher the expected migration rates, assuming (a) payments are still due beyond the expected date of migration, and (b) those or equivalent payments cannot still be collected post migration.

There are also several additional modifications to the TIBS mechanism design that could be made to reduce the risks associated with migration.

First, individuals could receive investments conditional on remaining in the country for a specified period of time. This is analogous to how medical training is commonly financed in Australia under the The Medical Rural Bonded Scholarship Scheme (Wilson et al., 2012).⁴³⁷ A significant number of these medical scholarships are typically provided the Australian Government. These are valued at AU\$23,686 per year for the duration of medical training, but require the recipient to work as a doctor in a rural or remote area for six years following tertiary education (Biggs & Wells, 2011).⁴³⁸

Secondly, there could be multinational agreements between countries to pass on specified portions of the taxation revenue collected from individuals who currently reside in one country but who received TIBS-financed investments in another. If individuals received investments financed via TIBS in Country *A* and then migrated to Country *B*, Government *B* could pass onto Government *A* a portion of the taxation revenue it collects from those residents, and vice versa. While such an arrangement may be difficult to form, tax treaties are not without precedent given they may be mutually beneficial.

Thirdly, the TIBS contract could convert into an alternative contractual arrangement, such as a fixed-repayment loan or income-contingent loan, in the event of migration. If this was the case, the investment recipients would only pay the usual taxation rate if they remained in the country where they received investment, but would have to repay an amount in addition to taxation if they migrated to another country.⁴³⁹ While fixed-repayment loans may cause individuals on low-incomes to bear additional risk, and while income-contingent loans suffer from information asymmetry problems including adverse selection and moral hazard, as well as income

⁴³⁷ Wilson, I. G., Roberts, C., Flynn, E. M., & Griffin, B. (2012). Only the best: medical student selection in Australia. *Med J Aust*, 5(5), 1-5.

⁴³⁸ Biggs, J. S., & Wells, R. W. (2011). The social mission of Australian medical schools in a time of expansion. *Australian Health Review*, 35(4), 424-429.

⁴³⁹ The effective enforcement and collection of payments in addition to taxation from individuals residing in other countries has precedent. For example, under the Australian Government's Higher Education Contribution Scheme (HECS), individuals receive a loan from the Australian Government equal to the fees of tertiary education, with this amount gradually repayable in addition to taxation owed after a personal income threshold has been reached. These payments to the Australian Government are still owed and collected even if an individual is residing in a country other than Australia. While it is possible to differentiate this example on the bases of citizenship, the point remains that the effective enforcement of contractual obligations can occur even when individuals reside outside of a country.

misreporting problems, this type of contract conversion is nevertheless a possible modification. One argument for it, in addition to potentially increasing the amount investors can recover in the event of migration, is that it may disincentivise migration in the first place. If this were the case, the problematic aspects of alternative contractual arrangements may not eventuate. As such, it may simply act as a credible deterrent to migration.

Fourthly, the TIBS contractual agreement does not necessarily need to be lifelong, as explained previously. The taxation could be passed from the government to the investor for a specified period of time, such as 2, 5, or 8 years. This may reduce the probability that investments recipients migrate prior to the conclusion of the contract duration.

In these four ways, the risks of migration may be able to be reduced.

A final point is that, counterintuitively, the phenomenon of migration could work in favour of the TIBS mechanism and enable it to work in an even more mutually beneficial way. To understand this, there are two important empirical observations to be aware of. First, that despite increasing globalisation, labour costs still differ dramatically around the world.⁴⁴⁰ Secondly, empirical evidence shows that in many cases individuals are approved, or are extremely likely to be approved, to move to a specified country well before migration takes place. In the case of refugees, the average time from the UNHCR officially referring a refugee for resettlement, to a country that is participating in the UNHCR's refugee resettlement program granting admission, is 18 to 24 months.⁴⁴¹ Despite this long process, the vast majority of referred refugees are accepted. According to Rush (2017) from the Center for Immigration Studies, 91.8% of refugees referred in 2015 were accepted, with refugees from Bhutan and Burma having an acceptance rate over 98%, Congo and Eritrea over 95%, and Syria at 92.6%.⁴⁴² Given this, where individuals are migrating from low labour cost countries to high labour cost countries, they could plausibly receive investment prior to migration in the country where the cost of making investments is lower, and receive income after migration in the country where the cost of labour is higher.

By way of illustration, suppose a refugee was living in a refugee camp in a low labour cost country for an extended period of time, and that a high labour cost country committed to accepting them in two years' time. During those two years prior to migration, investors could fund the provision of high-quality education for the refugee. High-quality education in refugee camps may be able to be provided relatively cheaply. This education may make it easier for the refugee to find employment and earn a good salary when they are resettled. Since, in the absence of education, the refugee may be on welfare or not paying taxation for several years, the government accepting the refugee could commit to pass on a portion of the taxation revenue from that refugee to the investor, as per the TIBS mechanism.

⁴⁴⁰ Global Wage Report 2014/15: Wages and Income Inequality (2015). Geneva, Switzerland. International Labour Organization.

⁴⁴¹ This average duration is according to the U.S. Refugee Admissions Program FAQs, US Bureau of Population, Refugees, and Migration. [Web post]. (2017, January 20). Retrieved 4 July, 2017, from <https://www.state.gov/j/prm/releases/factsheets/2017/266447.htm>. However, note that this average processing time varies between countries, with Australia having an average processing time in 2014-15 of 14.5 months (or 62.7 weeks). See Karlsen, E. (2016). Refugee resettlement to Australia: what are the facts?. Parliamentary Library.

⁴⁴² Rush, N. (2017) UN Report Shows Refugee System Needs Changes. Center for Immigration Studies.

Two advantages of this arrangement are (a) that it utilizes the differences in labour costs (and other investment provision costs) between countries, and (b) by bringing forward the investment provision to before the point of migration, individuals may start paying taxation sooner. In this way, investors may be able to generate a sizable return, refugees may benefit by receiving a high-quality education not otherwise possible, and governments may benefit because refugees may be less likely to be on welfare and more likely to pay taxation.

J) Concern: That Contracts Cannot be Enforced Against a Sovereign

Explanation:

Several interviews were concerned about contractual enforceability. For example, Thebe Ikalafeng (Director, Mercantile Bank and Founder, Brand Africa) commented,

“I worry that someone comes into government for his [or her] four years, and then he says ‘I’m going to reverse that policy. I’m not interested in that policy.’ So the poor investor who has put in the money and was expecting a return is actually never going to get his money because the policy has been reversed.”

Evaluation:

There are at least four reasons to expect sovereigns to not renege on contractual obligations.

The first reason is the possibility of a downgrade to the country’s credit rating. If the government were to default on the debt owed, this may cause it to lose its credit rating. This is likely to increase the cost of borrowing for the government (Hanusch et al., 2016),⁴⁴³ and reduce investor confidence and therefore investment levels (Almeida et al., 2014; Alessi et al. 2013).⁴⁴⁴ Both factors may deter the government from defaulting in the first place.

Secondly, contracts between a government and the private sector should be viewed as a repeated game. The microeconomics literature on game theory shows that when interactions are repeated over time, short-term selfish behavior may be deterred, because deviation from the agreed contract would make contracting, trust and cooperation more difficult in the future (Dasgupta, 2000; Benoit & Krishna, 1984; Wu et al., 2009).⁴⁴⁵ The potential financial benefits from future

⁴⁴³ Hanusch, M., Hassan, S., Algu, Y., Soobyah, L., & Kranz, A. (2016). The Ghost of a Rating Downgrade. In this paper, the authors research the impact of credit downgrades on government borrowing costs between 1998 to 2015 for a sample of 20 countries. They find that a downgrade by a major rating agency increases Treasury bill yields by a mean of 138 basis points, with any further downgrade corresponding to a statistically insignificant additional increase of 56 basis points.

⁴⁴⁴ Almeida, H., Cunha, I., Ferreira, M. A., & Restrepo, F. (2014). The real effects of sovereign credit rating downgrades. Research Paper. In this paper, Almeida et al. research the causal relationship between sovereign credit rating downgrades and firm investment levels. They find that public debt management, as reflected in the credit rating, has negative externalities on the private sector in the form of lower investment levels inter alia. This result is supported by Alessi et al (2013), which says that decisions by Standard & Poor’s to downgrade sovereign credit ratings have the effect of “weakening investor confidence” and “raising the cost of borrowing.” See Alessi, C., Wolverson, R., & Sergie, M. A. (2013). The credit rating controversy. Council on Foreign Relations.

⁴⁴⁵ Dasgupta, P. (2000). Trust as a commodity. *Trust: Making and breaking cooperative relations*, 4, 49-72. Benoit, J. P., & Krishna, V. (1984). Finitely repeated games. Wu, Y., Wang, B., Liu, K. R., & Clancy, T. C. (2009). Repeated open spectrum sharing game with cheat-proof strategies. *IEEE Transactions on Wireless Communications*, 8(4), 1922-1933.

contracts may be sufficient to more than offset any short-term financial gain from deviating from the agreed contract.

Thirdly, in many countries there is separation of powers, so the legal branch of government may be able to hold the executive branch to account for payments owed, even if the executive branch does not wish to make such payments.

A fourth reason is that even if a government attempts to renege on contractual obligations, there are various international legal avenues via which the payments could still be enforced. As pointed out in an interview conducted with Samantha Fang, a New York attorney at Wachtell, Lipton, Rosen & Katz, which has been regarded as the most prestigious law firm in America,⁴⁴⁶ one way to enforce payments owed by a sovereign is to seize assets elsewhere in the world. This was what occurred in the legal case of *Republic of Argentina v NML Capital Ltd.*,⁴⁴⁷ which focused on the issue of how to enforce security against a sovereign. The case involved Elliot Management Corporation seeking to get Argentina to pay for securities in the form of defaulted notes that Elliot had bought in 2004 following a notes exchange by Argentina after the country defaulted on its debt in 2001 (Guzman et al., 2016; Muse-Fisher, 2014).⁴⁴⁸ Because the indenture (that is, the document containing the terms and conditions) did not specify whether the debt was subordinate or superior, the pari-passu clause applied, which means that the debt was legally treated as the same as other debts. At the time, the United States was acting as a cleaning house for Argentina paying other notes. Elliot was able to successfully seize Argentinian assets, including a battleship, in another country, which forced the Argentinian government to pay Elliot what was owed. As Anna Gelpern, a law professor at Georgetown and a fellow at the Peterson Institute for International Economics, explained in an interview in 2014,⁴⁴⁹

“The entire battle over the meaning of sovereign debt as a contract is over enforcement... even if Argentina disregards a court order, the goal is to make it more expensive for a sovereign like Argentina to live the economic life of a sovereign in the global economy.”

In other words, there are legal avenues to make it more expensive for sovereigns to disregard international court orders than to adhere to them. This is just one of many precedents that illustrate how contracts against a sovereign can be enforced.

K) Concern: Macroeconomic Factors Affecting Security Returns

Explanation:

⁴⁴⁶ Each year the career information company Vault.com ranks law firms by reputation as determined by those in the legal industry. For thirteen consecutive years from 2003-2015, Wachtell, Lipton, Rosen & Katz was ranked as the most prestigious law firm in America. See <https://www.forbes.com/sites/karstenstrauss/2016/06/27/an-annual-ranking-of-the-most-prestigious-law-firms-in-the-u-s-in-2016/#5edb74093ec5>.

⁴⁴⁷ *Republic of Argentina v. NML Capital, Ltd.*, 134 S. Ct. 2250, 189 L. Ed. 2d 234 (2014).

⁴⁴⁸ For more information, see Guzman, M., & Stiglitz, J. E. (2016). How hedge funds held Argentina for ransom. *New York Times*, 1., Audit, M. (2014). Sovereign bonds and national relativism: can New York law contracts safely cross the Atlantic?, and Muse-Fisher, J. (2014). Starving the vultures: NML Capital v. Republic of Argentina and solutions to the problem of distressed-debt funds. *Cal. L. Rev.*, 102, 1671.

⁴⁴⁹ Blitzer, J. (2014, April). Argentina's Unending debt. *The New Yorker*.

Some interviewees, including Tony Eccles, were concerned that the price of the TIBS securities would be impacted by macroeconomic variables, which would increase investor risk.

Evaluation:

This concern is valid, yet not overly important. While macroeconomic factors would impact the price of securities, they could either increase or decrease the price of securities. The effect is in both directions. This is similar to numerous investments that are correlated with macroeconomic factors. Furthermore, investors could offset the macroeconomic risks of TIBS-financed investments by also having in their investment portfolio investments whose returns are negatively correlated with economic growth.

L) Concern: The Limited Predictability of Income

Explanation:

Several participants expressed concern that incomes may not increase, and that even if they did, it would be difficult to predict the size of the change. Madeline Kane, for example, said, *“Is it possible to predict lifetime income (or estimate the probability that it will increase)? Haven't MFIs had a hard time doing that, or a hard time proving their findings?”*

Evaluation:

TIBS does not rely on every investee income increasing. It relies on averages and expectations. Specifically, it depends on the present values of the expected marginal increase in future incomes being sufficient to offset the cost of investment provision. If no investors expect that to be the case, they would not enter into the contractual agreement. If investors do expect that to be the case, the contractual agreement could take place irrespective of whether those expectations are realised. As such, actual incomes do not determine contract formation, except insofar as the actual incomes from one investment provision inform future expectations. Which brings us to the second point regarding income predictability.

There is significant historical data on employment rates and incomes by occupation. This data comes from a variety of sources, including academic research, government institutions, and private firms. While not all is publicly accessible, much of it is. Since this is historical data it is, by its nature, an inaccurate predictor of future employment rates and incomes. The completeness of this historical data also varies by country, occupation, and time period. Nevertheless, given this data, it is reasonable to assume that incomes and employment would be easier to predict than many other variables that investors routinely attempt to predict, including the future valuation of startups and the share prices of established firms. If the lack of predictability of those investments does not deter investors to the point of non-viability, it is arguable that the greater predictability of TIBS-financed investments would also not deter investors to the point of non-viability.

Furthermore, to the extent that the market miscalculates future incomes, such errors will become apparent over time as the government pays security holders. It is arguable that the market will

correct itself and that the predictability of income will improve over time.

M) Concern: Intentional or Unintentional Manipulation of Actual or Reported Taxation Revenue by Governments

Explanation:

Future changes in the taxation code were identified as another possible source of investor risk. Some were concerned about the personal taxation rate being intentionally reduced for the population in question. Others were concerned with more wholesale changes to the taxation code, such as a movement away from income taxation towards consumption taxation. For example, Stefan Chambers commented,

“From the investor perspective, it’s hard enough valuing the future. It’s even harder if there is a significant extra element, which, let’s call it volatility - the effect on the future tax code of future and probability difficult to anticipate things.”

This concern was repeated by Thebe Ikalafeng, who commented,

“If you look at a country like the US, which last week, Trump proposed his new tax idea. Reducing corporate tax. Reducing personal tax. In other words, very little money is going to come into the state coffers.”

Other interviewees were less concerned about changes to the taxation code and more concerned about the possibility of government fraud and corruption. Various possible manifestations were mentioned, including the intentional misreporting of taxation revenue.

Evaluation:

It is true that governments may change the taxation code in the future, and that such changes are difficult to predict. While this may increase investor uncertainty, it does not necessarily mean financial returns will be lower. For example, the income taxation rate could increase in the future rather than decrease, which would increase investor returns. The impact therefore goes both ways.

In terms of fraud, there are incentives for governments to not misreport income. If a government wants to contract with private investors in the future, the perception of fraud or actual fraud may reduce investor willingness to do so. There may also be negative political or legal ramifications if fraud is proven.

If investors still deem the risk of manipulation of taxation revenue to be too great, adjustments to the TIBS mechanism are possible. One option is for the contract to be written in a conditional manner. The contract could specify that the government is to pass on $y\%$ of taxation revenue, conditional on a certain taxation rate or taxation rate range. If that taxation rate is reduced, the percentage of taxation revenue passed on could increase according to a predetermined formula. Alternatively, the contract itself could be based on income rather than taxation (though still paid

for by the government from tax revenue). The contract could state that $x\%$ of income is passed on rather than $y\%$ of taxation revenue. Provided that x is less than the taxation rate τ , the two can be equivalent. This may reduce the incentive for the government to decrease the personal income taxation rate, as if the contract was based on income, the government would need to pay the investor the same amount irrespective of their tax policy. Other possible ways to reduce the risk of taxation revenue manipulation include reducing the duration of the contract and increasing the percentage of tax passed on, as previously mentioned and even tracking individual expenditure and passing onto the investor a portion of the consumption taxation revenue that is attributable to the individuals receiving investment rather than the income taxation revenue.⁴⁵⁰

Further Strategies to Mitigate Investor Risk

Several interviewees offered their own suggestions for how to reduce investors' actual and perceived risk. These include arranging for companies to guarantee employment in advance to individuals receiving vocational training services (Mark Evans), utilizing tranching to have different TIBS investments with different risk-return profiles so as to appeal to a broader range of investors (Amir Amel-Zadeh and Mark Evans), and employing blockchain technologies to improve the transparency of taxation payments and reduce the risk of government fraud and misreporting (Michael Fargher).⁴⁵¹

7.11 Category 5: Government Willingness to Participate

N) Concern: The Contract Time Horizon is Too Great for Governmental Adoption

Explanation:

The concern expressed was that governments are more likely to enter into short-term contracts than long-term contracts because (a) long-term contracts may constrain future decision-making, and (b) there is too much uncertainty regarding the state of the economy in the long-term.

Evaluation:

The literature suggests this concern is of limited validity. There is evidence that governments routinely enter into long-term contracts, such as public-private partnerships for the provision of infrastructure and long-term debt repayment contracts such as the issuance of bonds.⁴⁵² There is also reason to suspect that governments may be *more* willing to enter long-term contracts than short-term contracts. This is because political terms of office are often relatively short, especially

⁴⁵⁰ Note that this second option would be significantly more difficult to implement than having the government pass on a portion of personal income taxation. However, with the emergence of big data, blockchain, and the Internet of Everything, it should not be viewed as impossible.

⁴⁵¹ An evaluation of the merits of these mitigation strategies is beyond the scope of this chapter.

⁴⁵² Contracts with maturity lengths exceeds twenty years are not uncommon. Treasury bonds, or T-Bonds, are fixed-interest U.S. government debt securities that have a maturity between ten to thirty years. In Australia, the Australian Financial Markets Association's (AFMA) 'Long Term Government Debt Securities Conventions' specifies the convention that government debt securities have terms to maturity between six months and 25 years. See <http://www.afma.com.au/standards/market-conventions/Long%20Term%20Government%20Debt%20Securities%20Conventions.pdf>.

in democratic systems of government. If contractual obligations fall due after a term of office has ended, there may be less political accountability and therefore less weight placed on potential negative consequences.

Even if this time-horizon concern were valid, there are simple adjustments to the TIBS mechanism that could shorten the time-horizon. As has been explained, the percentage of taxation revenue passed onto investors could be increased and the length of the contract shortened. Rather than an investor receiving $x\%$ of taxation revenue for t years, they could receive $y\%$ of taxation revenue for s years, where $y > x$ and $s < t$.

O) Concern: Potential for Public Backlash and Negative Political Ramifications

Explanation:

There was concern that if governments entered into TIBS public-private-partnerships, there may be negative political ramifications. The reasons specified for this fell into two broad categories. Some thought the government would be criticized for not fulfilling its proper function as an investment provider and safety net provider. Others felt that if governments supported a mechanism that involves transferring a portion of individuals' income to investors, they would suffer from political backlash because such a mechanism may have negative connotations - even connotations of slavery.

Evaluation:

It is difficult to say with confidence how the public would respond to governmental adoption of the TIBS mechanism. However, there are several reasons to expect that concerns about political backlash would not materialize.

First, there is still an important role for the state in the TIBS mechanism. It is just that the role of the state changes from being a direct investor to a facilitator of, or conduit for, investments. The government would also have control over what types of investments are made and to what populations, so its role as a social planner would largely remain. The role of the government is arguably not reduced, just adjusted.

Secondly, any concerns that the public may have about this being analogous to slavery are misguided. Such concerns may be valid in the case of income-contingent loans, where individuals pay a portion of their income on a recurring basis to investors in addition to taxation. However, here the individuals pay the same taxation rate regardless of whether or not they receive investments financed via TIBS. If the individuals receiving investments do not feel unfairly constrained, it does not seem reasonable for others to be concerned on their behalf.

Additionally, any concerns about potential political backlash should be weighed against the potential for political goodwill. TIBS could, in effect, enable non-taxpaying individuals to pay for their own investments with their future tax money, rather than tax-paying individuals paying for investments in non-tax-paying individuals. This is particularly relevant in the case of refugees,

where governments worldwide are under pressure to not spend too much taxpayer money on services for them (Aiyar et al., 2016).⁴⁵³

P) Concern: That the Government Would Be, or Would Perceive Itself to Be, Economically Worse Off Under TIBS

Explanation:

Some interviewees thought that governments would not enter TIBS contracts because it would involve them being financially worse off due to less taxation revenue that is retained. Others interviewed thought that the government would not actually be financially worse off, but would incorrectly think they would be worse off, which would have the same effect in terms of buy-in.

A related concern was what would happen if the investment was not successful. This concern was raised by Tony Eccles, who said, *"But if you fail, the government still picks up pieces."* Another interviewee, Cliff Prior, commented,

*"Wouldn't it be the case that if TIBS doesn't work, the government has to pick up the pieces and pay for those services. And if TIBS works and increases incomes, then the government still loses out, in a similar way to how there is symmetric downside with social impact bonds."*⁴⁵⁴

Evaluation:

As shown in Appendix B, there are ways of structuring the contract so that the government only passes on what it would otherwise not have had, at least in expectation. The only time the payments from the government to the investor exceed, in present discounted terms, the lump-sum initial payment from the investor to the government, is when the investor turns out to be more effective than the expected effectiveness of the investor with the second-highest bid. As such, the government cannot rationally expect to be worse off at the time the contract was signed. However, due to irrational perceptions, governments may still anticipate being worse off. As such, the possibility of inaccurate perceptions is valid, while concerns regarding actual financial loss are not.

⁴⁵³ According to the IMF research by Aiyar et al. (2016), the German government's expenditure on refugees was approximately 0.35% of GDP in 2016, compared with Sweden at 1.0% of GDP, Denmark at 0.57% of GDP, and Finland at 0.37%. This expenditure, to support the approximately 1.1 million refugees accepted into Germany in 2016, corresponded to a decline in Chancellor Merkel's approval rating (based on respected polling by public broadcaster ARD) from 75% prior to the increased refugee expenditure to 47% after policies were announced. See Aiyar, S., Barkbu, B., Batini, N., Berger, H., Detragiache, E., Dizioli, A., Ebeke, C., Lin, H., Kaltani, L., Sosa, S., Spilimbergo, A., Topalova, P. (2016). The refugee surge in Europe. Also, several media outlets have run stories with headlines including "Angela Merkel: Lots of foes, fewer friends" and "The lonely Chancellor" that express opposition to policies of refugee acceptance and expenditure (Nardelli, 2015; Küstner, 2016; Wagstyl, 2016).

⁴⁵⁴ Symmetric downside is the property that the government has to incur expenditure under a Social Impact Bond arrangement regardless of whether or not an intervention achieves the outcomes to trigger payment to the investor. If the intervention is successful, the government pays the investor. If the intervention is unsuccessful, the government will still need to pay, such as in the form of welfare expenditure or replacement service provision. This 'symmetric downside' was identified by Cliff Prior as a key reason why social impact bonds have not become widespread.

It is also not true that there is symmetric downside with TIBS. If an investment does not have the desired consequences, such as if a literacy program does not increase literacy in the way that was hoped for, the government has at least three options. One option is to make direct literacy investments themselves. This could be funded by using the initial lump-sum payment that the government received from the private investor. If this is how the government's direct investments are financed, the government may not be financially worse off. A second option is to auction off the right to make those investments to investors once again. In this case, the government would have to pass on more in taxation revenue than was previously the case, as they would still have to fulfil the contract with the initial investor, however the government would now have received two initial lump-sum payments rather than one. Again, it is not necessarily the case that this leaves the government financially worse off. A third option is to not provide further investments of that nature to the population in question. In such an event, the government would have received more in the initial lump-sum payment than it would now expect to pay out to the private investor, given the investments were less effective than originally expected. As such, the government's financial position would improve. Given this, concerns about symmetric downside seem misplaced.

There are also credible reasons to expect that the government would be better off financially under TIBS than alternative arrangements. In both the case of direct government investment and social impact bonds, the government incurs a financial loss in the short-term (in the form of investment provision costs or payments to investors) and receives financial returns (in the form of higher taxes and reduced welfare expenditure) in the medium to long-term. The order of financial flows is typically expenditure followed by revenue. For myopic governments that care more about the period before the next election than the period after the election, such financial flows are not necessarily desirable.

TIBS has the reverse order of financial flows. Governments receive money in the short-term (in the form of an initial lump-sum payment), and only pass on taxation revenue in the medium to long-term. The economic pitch to governments is, "Do you want to receive money in the short-term and only pass on in future what you otherwise would not have had?" It is at least arguable that this value proposition would have buy-in.

7.12 Category 6: Additional Concerns

Several other concerns were raised by only one or two interviewees.

These concerns included (a) that TIBS could lead to a crowding out of charities due to investment provision being undertaken by other entities, (b) that it would be difficult to deal with different levels of governments, such as state and federal governments, especially where those different governments each collect income taxation, (c) that the size of investor returns may be insufficient to incentivize investment in the quantity that is desirable, (d) that it may be difficult to match the taxation that governments receive to specific individuals who received investments financed via TIBS, and (e) that the private sector could potentially bear risk in a similar though simpler way by lending directly to the government instead.

In relation to this final concern, one interviewee asked, *"If it's that profitable, why doesn't the*

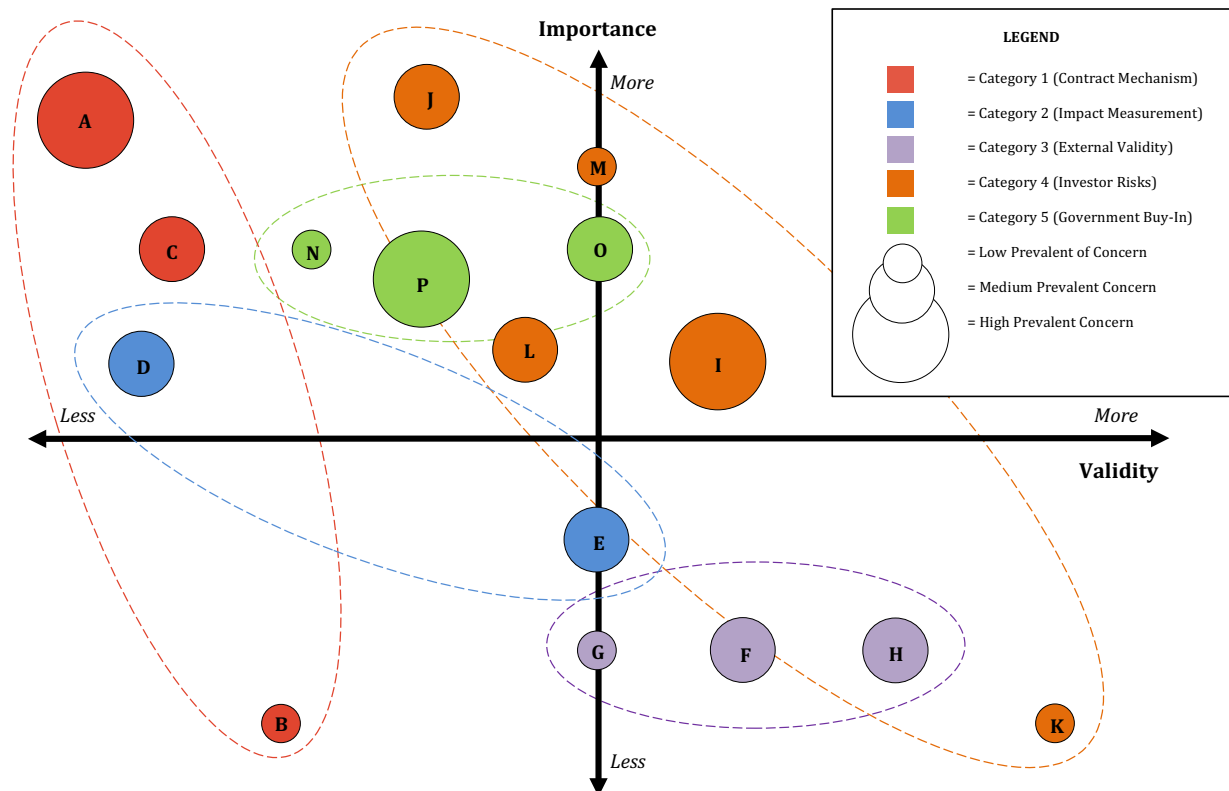
government do it by itself? Why does it choose to forgo future income at the benefit of private investors?" In answer to this question, while the private sector lending to the government may help to transfer risk from the government to the private sector, it would not address several other issues. First, if governments directly provide, they spend in the short-term and get money in the medium to long-term. With TIBS, it's the opposite order of financial flows. The government gets money initially and only passes on revenue in the future. This is arguably a much more attractive government value proposition. Secondly, as proven in Appendix B, direct government provision is not able to lead to first-best levels of effort for a large range of parameter values. This partly arises from the greater ease of hiring and firing workers in the private sector, which makes incentivising high effort in the provision of investments easier. Thirdly, both governments and the private sector are focused on the short-term given election constraints and investor constraints. However, because of the capacity of the private sector to more easily securitise future returns, those future returns can be brought into the present. The internalisation of externalities in this way means there is less underinvestment in the types of investments that involve long-term returns. Fourthly, counterintuitively, the government does not lose any money with TIBS. As shown in Appendix B, the profit function of investors is such that private investors only profit if they turn out to be more effective than the expected effectiveness of the counterfactual. If they are more effective, the government would not have received the taxation it passes on that is in excess of the initial lump-sum transfer (in present discounted value) anyway. If they aren't more effective, the government receives more than it passes on in present discounted terms. Either way, the government never loses. Fifthly, there is the issue of selection. As explained in Chapter 6, even if the government is on average as effective as the private sector, if there is greater variation in private sector effectiveness, it is reasonable to assume that the most effective private sector investment provider would be more effective than the government provider. Sixthly, direct government provision does not address the fact that there is significant political pressure on governments to not spend too much taxpayer money on disadvantaged populations such as refugees. For these reasons, direct government provision would struggle to achieve first-best levels of effort, quantity, or inherent effectiveness.

7.13 Overall Evaluation

The sixteen most prevalent concerns have each now been evaluated in-depth. These concerns are mapped onto a two-dimensional plane, as shown in Figure 7.5, to gain insights into relationships that exist between the type, prevalence, validity and importance of the concerns raised in the data.

As shown, each of the sixteen concerns is represented by a coloured dot. The colours of the dots represent the category of concern, as listed in the diagram legend, while the size of the dots represents the proportion of interviewees that expressed that concern. The larger the dot, the more prevalent the concern. The x axis represents the validity of the concern. The right-hand side of the y axis represents concerns that are mostly valid, while the left-hand side of the y axis represents concerns that are mostly not valid. The positioning of the dots along the x axis is based on the quantitative and qualitative evaluation undertaken hitherto. The y axis represents the importance of the concern, conditional on it being valid. Put differently, if the concern were valid, to what extent would it make the TIBS mechanism infeasible? If it would render TIBS contracts highly unlikely, then it is deemed important, while if it does not make a significant difference to the formation and execution of the contractual partnerships, it is deemed unimportant.

Figure 7.5: Map of Stakeholder Concerns by Prevalence, Type, Validity, and Importance



There are several important findings from this mapping analysis.

The majority of concerns fall into two quadrants. They are either important but invalid, or valid but unimportant. This means two things. First, that there is a solid basis for the majority of concerns. We could not say the same thing if the concentration of dots were in the invalid and unimportant quadrant. Secondly, that the majority of these concerns are unlikely to render the TIBS mechanism infeasible, since few concerns land in the valid and important quadrant.

Another finding is that concerns in the same category tend to have a similar validity-importance profile. Concerns about external validity are largely valid but unimportant, since the TIBS mechanism can still operate with a different combination of populations, geographies and investment types, if any type of population, geography or investment type is incompatible with the mechanism. The opposite validity-importance profile pertains to government buy-in. The analysis undertaken suggests these concerns are of limited validity, however if they were valid they would be problematic since the contract is a type of public-private partnership and needs government involvement to work. Also, concerns about the contractual mechanism itself are all positioned to the left-hand side of the diagram. Since these concerns can be evaluated quantitatively, we can say with reasonable confidence that the concerns are not valid. The same cannot be said of concerns labelled E to P, which are harder to evaluate quantitatively.

The diagrammatic analysis also suggests that the primary reason why the TIBS mechanism design would not work is due to various investor risks, as this is the category positioned closest to the top-right quadrant of the diagram.

7.14 Conclusion

As is evident, this extension chapter has applied the findings from the core chapters to research how a specific mechanism design affects the creation of social value.

The work in Chapters 3-6 implied that a first-best mechanism design may exist and pointed to the nature of such a mechanism. This chapter began by explaining in detail how the first-best necessary requirements discovered via logical derivation in Chapter 6 can be combined with a mechanism that (a) aligns social and financial returns, and (b) uses the five financial tools discovered in Chapter 5 to enable, via that return alignment, the first-best social impact properties to be obtained and the various constraints to be overcome. A full worked mathematical example of the implied modified mechanism was also provided for illustrative purposes.

The research then proceeded to use empirical methods to obtain primary data, identify perceived problematic relationships between the implied mechanism's design and social value creation, and evaluate these concerns via literature and quantitative analysis. From this research, it is not possible to conclude that a contingent-repayment financing mechanism in the form of TIBS is not viable. Evaluation of the sixteen primary concerns of interview participants finds that most fall into two quadrants on the importance and validity spectrum, namely the important and non-valid quadrant, and the not-important and valid quadrant. Our analysis also suggests that the most likely reason TIBS would not work in practice is due to factors associated with TIBS that increase investor risk, including the migration of investment recipients.

Overall, the research in this chapter lends weight to the findings from Chapters 3-6 that suggest that modifications to existing contingent-repayment impact investing mechanism designs are possible that enable impact investments to achieve greater social value creation. Specifically, the research suggests that the implied mechanism design of Tradeable Income-Based Securities merits further research and warrants one or more pilots to test the mechanism design in practice.

VIII.

Conclusion

8.1 Taking a Step Back

In the introduction, a crucial observation was made: often the aggregate benefits of potential impact investments exceed the aggregate costs, yet those investments do not take place. As a result, value is often unrealised and individuals who could benefit from those investment may be left worse off. Understanding why such investments do not take place is therefore of prime importance. That is what this dissertation set out to do.

Discovering why impact investments are often not undertaken, and why those that are undertaken often do not create the social value intended, is not straightforward. Impact investments utilize a range of financing mechanisms. These mechanisms: (a) are situated in different pools of academic literature with differing terminology and research methodologies; (b) involve different properties, incentive structures and practical constraints; (c) vary in terms of what value is appropriated, how it is appropriated, and how much is appropriated; and (d) involve multiple stakeholders, including different types of investors and investees, each with different objectives, characteristics and behavioural constraints. There are many moving, interconnected parts. To make matters more difficult, the field of social finance is itself underdeveloped, without a solid theoretical core and with inconsistency regarding important terms and concepts.

Despite these challenges, this research has attempted to make a contribution to the literature by beginning to address the question: *"How does the design of impact investing mechanisms affect the creation of social value?"* This has been done by focusing on the case of contingent-repayment investments that improve individual productivity and by having a research design that utilizes both quantitative and qualitative methods. Specifically: bibliometric analysis was undertaken of two corpora covering 1000 publications; the five main existing contingent-repayment investment mechanisms were modelled using theoretical microeconomics with accompanying mathematical proofs; theory was constructed to bring research findings into the incumbent literature, to resolve ambiguities and to lay a foundation for further research; the practices and perceptions of impact investors were analysed based on primary data obtained via 141 detailed survey responses and 19 semi-structured interviews; financial equivalency analysis, logical deduction, and financial gap analysis were undertaken to derive further insights; and validity-importance mapping was conducted to evaluate specific stakeholder concerns. In the process, this research has drawn from a wide range of strands of academic literature - from bibliometrics (Chapter 2), to auction theory (Chapter 5), to logic models (Chapter 3), to subgame perfect Nash equilibria (Appendix B), to the mathematical properties of monotonic functions (Chapter 5), to contract theory (Appendix A), to logical deduction (Chapter 6), to trade theory on comparative advantage (Chapter 4), to public-private partnerships (Chapter 7), to social return on investment (Chapter 4), to sharecropping (Chapter 5), and so on. Importantly, the methods used in this dissertation build on each other and complement each other, thereby improving the robustness of the research findings.

Through this comprehensive research, it has become evident that mechanism design plays an important, nuanced and multi-faceted role in explaining whether, to what extent, and how impact investments create social value. This is despite the fact that mechanism design as a topic is

isolated rather than integrated in the academic literature, as shown by the pink cluster in the publication bibliographic coupling map of both corpora (Figure 2.26).

8.2 Summary of Findings

In this thesis, it has been discovered that mechanism design affects social value creation in two main ways (value creation and value capture) and three intermediate ways (social impact measurement, social-financial return alignment, and constraint adherence).

Social Value Creation

First, the design of mechanisms influences the degree of social value creation for a given investment expenditure. It does so because mechanism design influences: (a) the extent to which the expected effectiveness of investor-investment combinations can be accurately ascertained *ex ante* so that there can be *selection* of the investment with the greatest inherent effectiveness; (b) whether those carrying out investments are incentivised to exert maximum *effort* so that the inherent potential of investments is realised; and (c) how closely the investment *quantity* that maximizes an investor's objective function corresponds to the socially optimal quantity.

Let us now summarise what has been found regarding how the intermediate pathways affect the three components of social value creation.

Selection

One component of social value creation is investment selection.

Selection is affected by the alignment of social and financial returns. As shown in Chapter 5, alignment determines whether financial tools can be used to obtain the first-best social impact equivalents of the financial properties they enable. Once such financial tool is a Vickrey auction, which is often used because a bidder's optimal strategy is to truthfully reveal their expected financial return. It follows that when there is alignment, an investor's optimal strategy is to truthfully reveal their expected social return. In this way, mechanism design can enable truthful revelation of expected effectiveness *ex ante*, thereby allowing both selection of the most effective investment and knowledge of the counterfactual expected social value creation (which is necessary for measuring *marginal* social impact and satisfying the government political constraint, C2).⁴⁵⁵

Selection is also affected by a second intermediate pathway – social impact measurement. This is because investment selection is often based on the measured social impact of comparable investments (Figure 4.1 I5), and mechanism design affects the accuracy and comparability of social impact measurement (Section 4.6).⁴⁵⁶ Furthermore, how social impact is measured

⁴⁵⁵ As discussed in Chapter 6, the government's political constraint (C2) says that a government is more able to enter into an investment contract when it only ever pays investors what it otherwise would not have had. For this constraint to be satisfied with certainty, knowledge of the counterfactual value creation is necessary.

⁴⁵⁶ For example, mechanism design determines whether the counterfactual can be known so that marginal rather than absolute impact can be measured, whether past social impacts can be known with certainty (such as via the PDV of

(whether marginal or absolute) affects the extent to which selection of the investment that maximizes measured social impact for *an* investment corresponds to *aggregate* social impact maximization (Section 4.8).

As such, while the incumbent literature treats investment selection as independent of mechanism design, this research discovers that the latter can play a key role in the former.

Quantity and Effort

The other two components of social value creation that the research points to are investment quantity and investment effort. These are conceived as the social *outputs* in the investment process, which together with investment selection produce social *outcomes* (Figure 3.1). Mechanism design influences these social outputs, and therefore social value creation, via the three intermediate pathways identified.

First, social outputs are influenced by social impact measurement. What quantity of investment is made by investors is partly determined by what value is incorporated into social impact metrics (Figure 4.1 I5). If measures of social impact fail to fully incorporate value that accrues in the long-term or to other stakeholders (Property M2), or to the investee due to interdependency between social outcomes (Property M7), then measured social impact is likely to be biased downwards and there is likely to be underinvestment (Figure 4.1 I4 & Section 5.5). On the other hand, if social impact is measured in an absolute way, without accurately taking into account the counterfactual investment (Property M1), then measured social impact is likely to be biased upwards (Section 3.12), which may lead to overinvestment.

Secondly, social outputs are influenced by the alignment of social and financial returns. Alignment enables financial tools (such as an initial lump-sum payment) to be used to make high effort the option that maximizes an investor's profit function. Other financial tools (such as securitization and market trade) can be used to bring long-term value creation into the short-term decision-making calculus of investors so that there is less underinvestment (Chapter 5, Chapter 7 & Appendix B).⁴⁵⁷ When this occurs, the quantity and effort that maximizes investor profit is the same quantity and effort that maximizes social value creation (Appendix B).⁴⁵⁸ As such, social-financial return alignment helps the first-best quantity and effort levels to be achieved. It reduces trade-offs when it comes to *how much* social value is created.⁴⁵⁹

disbursements that are a function of social return), and whether expected future social impacts can be accurately ascertained (such as by using a traded market price).

⁴⁵⁷ This also enables the investor's constraint to be satisfied (Property C3).

⁴⁵⁸ This reasoning may lead some to ask, "Is it not illogical and tautological to require the alignment of social and financial returns to obtain the alignment of social and financial returns?" However, this question stems from a misunderstanding of the argument. Achieving the first-best levels of quantity and effort is not as simple as having the partial derivative of profit with respect to social value be positive at a point in time. Importantly, investments are not static but take place over time. What has been found in this thesis is that the alignment of social and financial returns at a point in time, for a given selection and assuming that the investment takes place, can be used to ensure the investment does in fact take place, that selection to the most effective investment actually occurs, and that there is alignment in *all* time periods - even beyond the time-horizon of the investor. In this case, the lump-sum payment ensures that the investment takes place and that the investor's optimal strategy is not to accept the investment contract but to provide a quantity of zero.

⁴⁵⁹ Note that, as Santos (2012) observes, for a given degree of value creation and for a given investment selection, there is still a trade-off regarding how that value is divided between stakeholders. As argued in Chapter 3, social impact is equal to the value created less the value appropriated. It follows that how much value is appropriated, *inter alia*, affects

Thirdly, social outputs are influenced by whether constraints are adhered to. Stakeholder constraints affect the level of investment quantity, as if they are not satisfied then the investment is not undertaken in the first place and no quantity is provided (Chapter 6, Appendix B). Practical constraints also play a role. Mechanism design influences the severity of information asymmetry problems. If the practical constraint pertaining to information asymmetry (P2) is not satisfied, then moral hazard is likely to lead to suboptimal effort levels and therefore suboptimal social value creation (Appendices A & B).

As such, this research has found that mechanism design affects social outputs (and therefore social value creation) via the three intermediate pathways.

Importantly, social outputs are also heavily influenced by the structure of investor profit functions, which are determined by mechanism designs. As discovered by modelling the five existing mechanism designs, often levels of social outputs are suboptimal because the cost of making an investment and exerting effort is borne by one stakeholder, while the benefits are dispersed between many stakeholders and over time. In other words, impact investments involve positive pecuniary externalities. It is difficult for stakeholders to capture the value they create, especially when benefits are diffused, spatially or temporally, so that standard Coasian solutions involving negotiation are precluded (Coase, 1960; Harrison, Hoffman, Rutström & Spitzer, 1987; Clinch, O'Neill, & Russell, 2008).⁴⁶⁰ When stakeholders cannot appropriate a sufficient proportion of the value they create, it may be rational for them to under exert effort and underprovide quantity. This brings us to the second main way that mechanism design affects social value creation – value capture.

Value Capture

This research has shown that mechanism design affects the extent to which, and way in which, the positive pecuniary externalities that arise from impact investments are internalised. Whereas value created (the first main relationship) is for a given level of investment expenditure, the value captured by investors (the second main relationship) determines how much investment expenditure is actually undertaken in total. This is because value captured affects both the initial incentive for investment and the capacity for reinvestment in subsequent time periods. As such, mechanism design affects social value creation by influencing both the *incentives* for investment and *capacity* for investment.

More specifically, the research has found that it is appropriate to conceptualise the value captured from impact investing in individuals as being dependent on two factors. First, it is important to know the amount of *financial value* that has been created. Secondly, it is necessary for investors

the degree of social impact. However, as proved in Chapter 4, this is not as simple as saying that impact is maximized when no value is appropriated. There are cases when the appropriation and reinvestment of value increases the overall social impact. See Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

⁴⁶⁰ Coase, R. H. (1960). The problem of social cost. In *Classic papers in natural resource economics* (pp. 87-137). Palgrave Macmillan, London. Harrison, G. W., Hoffman, E., Rutström, E. E., & Spitzer, M. L. (1987). Coasian solutions to the externality problem in experimental markets. *The Economic Journal*, 97(386), 388-402. Clinch, J. P., O'Neill, E., & Russell, P. (2008). 'Pure' and 'impure' Coasian solutions in planning. *Town planning review*, 79(6), 623-650.

to have a means of capturing that value and to decide how much value to capture as *financial return*. In other words, the process of internalising externalities involves knowing what the externalities are, having a way to internalise them, and deciding how much to internalise. Attribution and appropriation are the prerequisites for externality internalisation.

The capturing of value via attribution and appropriation is also influenced by the three intermediate pathways. Social impact measurement ties together the concepts of attribution and appropriation because social impact can be defined as marginal attribution less marginal appropriation (Section 3.12). Practical constraints affect appropriation by determining what appropriation methods can be enforced (Constraint P1). Meanwhile, stakeholder constraints affect the quantity of appropriation by restricting how value can be divided between stakeholders in equilibrium (Constraints C1-C4). The amount of value appropriated is also determined by social impact measurement, because whether capital recycling is socially optimal depends on whether investment cost is less than discounted social impact (Proposition 4.7). Counterintuitively, there are cases where social impact is maximized by an investor appropriating value (albeit for reinvestment purposes).

Crucially, it is this second main link between mechanism design and social value creation that fills the gap in the social finance and development economics literature that was identified via bibliometrics research in Chapter 2 (Figure 2.41). Put simply, value capture (via attribution and appropriation) is the missing link between *financial value* and *financial return*.

Combining Research Findings

These research findings and relationship pathways are represented in the Unified Fundamental Model of Impact Investing, shown in Figure 3.1. This theory construction closes the missing gap and completes the impact investing cycle. It bridges the social finance and development economic fields conceptually by: combining theory into a single framework; disaggregating the concepts of value creation and value capture; clarifying concepts and differentiating terms to resolve uncertainties; bringing the social impact measurement literature from being a siloed to an integrated topic; and linking economic measures of positive externalities with social finance measures of social impact.

This theory construction also lays the groundwork for research into possible modifications to existing contingent-repayment investment mechanisms. It was discovered in Chapters 3-6 that an ideal mechanism design would satisfy 10 first-best properties (consisting of three social value creation properties and seven social impact measurement properties) and adhere to six constraints (four stakeholder constraints and two practical constraints). It was also shown in Chapter 6 that there are eight combinations of these properties and constraints that are very difficult for a mechanism design to obtain simultaneously. Nevertheless, the question was asked as to whether a first-best mechanism design is possible and, if so, what characteristics would it possess.

As seen in Figure 3.1, there are six possible value appropriation pathways. Logical deduction in Chapter 6 revealed that the pathway necessary for a first-best mechanism is the appropriation of a subset of taxation revenue by a private investor. Given the characteristics of stakeholders

(Figure 6.2), this must be facilitated by the government due to its institutional capabilities. Gap analysis in Chapter 6 showed that these necessary derived mechanism properties precisely correspond to a gap in the existing contingent-repayment landscape. Furthermore, it was shown that a mechanism of the nature implied can have financial returns as a monotonically increasing function of social impact, which – as we know from Chapter 5 - enables financial tools to be used to obtain the first-best social impact properties. In this way, this research has discovered a possible modification to existing contingent-repayment investment mechanisms that may enable greater social value to be created in some cases.

Applying Research Findings

This implied modified mechanism was then researched as an extension in Chapter 7. This research proved mathematically that the implied mechanism, TIBS, can achieve and maintain the first-best in equilibrium (Appendix B), which is in contrast to the five existing mechanisms that cannot (Figure 6.3 & Appendices A-C). The research also showed that the mechanism design enables a new way to measure social impact, DEMI, that may satisfy more of the seven first-best social impact properties than existing social impact measurement approaches. Furthermore, identification and evaluation of 16 stakeholders concerns suggests that only a few concerns are appropriately classified as both important and valid, and that investor risk is the most likely reason why the implied modified mechanism may not work in practice.

As is therefore evident, this comprehensive research makes a range of significant contributions to the literature.

8.3 Concluding Note

In his seminal 2012 paper,⁴⁶¹ Santos recognises that the internalisation of positive externalities is a central role of government (p. 21), and suggests various ways that governments may attempt to internalise externalities - including via direct provision, subsidies, taxation, regulation (p. 20), as well as market creation (p.18). The research in this dissertation suggests an additional role for governments when it comes to the internalisation of positive pecuniary externalities. That role is *facilitating taxation transfer*, so that private impact investors can appropriate a subset of the future taxation revenue of individuals who have received productivity-enhancing investments.

The research in this dissertation suggests that this modified mechanism design may be able to achieve the first-best level of social value creation, while adhering to stakeholder and practical constraints, and while also enabling social impact to be measured in a way that satisfies the seven first-best social impact measurement properties identified from primary data. At a minimum, the findings in this dissertation justify additional research into this topic. Further research could have a general focus (such as an investigation of social risk within the theoretical framework developed, or research into a different class of impact investments), or be specific to the implied mechanism (such as a simulation or a trial of the implied modified mechanism to detect weaknesses in the design). The limitations of this research, as outlined throughout (Chapter 2, 4, & Appendix B), should also be taken into account.

⁴⁶¹ Santos, F. M. (2012). A positive theory of social entrepreneurship. *Journal of Business Ethics*, 111(3), 335-351.

Overall, it is hoped that the research in this dissertation, in some small way, contributes to our understanding of how the design of impact investing mechanisms affects social value creation. By understanding this important, multi-faceted, and interdependent relationship, mechanism designs may be able to be refined so as to enable more impact investments to be undertaken that improve the lives of disadvantaged individuals.

Appendix A.

A Model of Contingent Loans and Debt Financing with Insurance

A.1 Overview

Two contingent-repayment impact investing mechanisms are (a) contingent loans and (b) the debt financing with separate yet simultaneous insurance. Empirical evidence reveals that both of these mechanisms have low adoption in practice, despite academics and practitioners alike emphasizing the complementarity of credit and insurance. This presents an empirical puzzle.

This first appendix, which is written in such a way so that it can also be a standalone paper, explains this puzzle by modelling the interaction between credit and insurance markets.

The rarity of contingent loans is explained as a consequence of effort choice. It is shown that when high effort carries a pecuniary cost, the individual's incentive compatibility constraint is satisfied for a larger range of parameter values in the case of a standard debt contract than in the case a contingent contract. When the cost of high effort is non-pecuniary, it is shown that unless the individual's incentive compatibility constraint is satisfied for the full insurance contract, no contingent contract can be provided in equilibrium. This explains the existence of standard debt financing.

A characterization of the equilibria that result from the provision of debt financing and insurance is then provided. At low levels of wealth there is a unique equilibrium with no insurance take-up due to the implicit insurance provided by the limited liability in standard debt contracts. At intermediate levels of wealth there exist multiple equilibria due to coordination problems between investors and insurers. At high levels of wealth there is a unique equilibrium with full insurance coverage. This explains why the mechanism of debt financing with insurance is rarely observed in low-income populations.

A.2 Introduction

Both the mechanism of contingent loans and debt financing with insurance have in common that they seek to combine credit and insurance. Many academics and practitioners alike have emphasized the complementarity of credit and insurance. Some simply take for granted that credit and insurance work well together. Others offer a formal treatment of the issue and find, with few exceptions, that the optimal lending contract has contingent-repayments.⁴⁶² The logic goes that by reducing the risks associated with investments, insurance makes risk-averse stakeholders more willing to undertake high-return investments. It is further reasoned that insurance, either as a stand-alone product or linked with credit in the form of contingent contracts, reduces the probability of individuals defaulting on loans:

'For microfinance institutions, microinsurance adds value. . . because insurance linked to credit can contribute to a lower risk of default. . . Microinsurance contributes to increase

⁴⁶²Two exceptions are where the cost of verifying a state is prohibitive or the cost of monitoring staff behaviour is high (Jeon & Menicucci, 2009).

the well-being of the clients by complementing the credit.' (Gonzalez, Piza, & Garcia, 2009)⁴⁶³

'By not offering insurance, but with strict enforcement of credit repayment, microcredit can be very risky and... may increase vulnerability considerably, particularly for large shocks. Risk-averse poor families might decide not to borrow to invest in profitable activities if there is a reasonable chance that they will be unable to repay the loan and will be severely punished... The case for offering insurance in this setting, for example by charging a higher rate of interest but forgiving the loan in the event of poor observed rainfall, is substantial as it would remove the major risk linked to the loan.' (Clarke & Dercon, 2009)⁴⁶⁴

Despite the apparent complementarity of credit and insurance, the empirical evidence tells a different story. The overwhelming majority of loans take the form of just standard debt contracts without insurance, rather than either contingent contracts or debt contracts with insurance.⁴⁶⁵ Other empirical realities are worth noting. Credit and insurance are often provided by different entities.⁴⁶⁶ Insurance take-up rates are consistently low when individuals are offered the chance to buy insurance with credit (Giné et al., 2009).⁴⁶⁷ Insurance take-up is positively correlated with wealth (Cole et al., 2009).⁴⁶⁸

If it was a simple case of credit and insurance being complementary, one may expect the opposite to be true. One may expect that contingent contracts would be common as they can reduce investment risk, that credit providers would offer more insurance than the oft-compulsory credit-life insurance, that individuals would purchase insurance with standard debt contracts, and that insurance take-up would be negatively correlated with wealth.

This appendix explains these empirical phenomena. It addresses the question of why, despite the apparent complementarity of credit and insurance, neither the mechanism of contingent loans or the mechanism of debt financing with insurance are widespread.

Of course, this is not the first time these empirical puzzles have been tackled. Over the years various possible explanations for them have been suggested. Candidate explanations for the rarity of contingent contracts include the presence of asymmetric information (Gale & Hellwig,

⁴⁶³ Gonzalez, L., Piza, C. T., & Garcia, D. B. (2009). Synergy between microinsurance and microcredit and the development of the markets in Brazil. FGV: São Paulo.

⁴⁶⁴ Clarke, D., & Dercon, S. (2009). Insurance, credit and safety nets for the poor in a world of risk.

⁴⁶⁵ For example, the classic Grameen bank used state non-contingent-repayment, which forces individuals to make repayments even under difficult circumstances.

⁴⁶⁶ For example, MicroEnsure (the largest microinsurance broker dedicated to serving people living in poverty in the developing world) provides the majority of their insurance as stand-alone products, either directly or in partnership with telecommunications companies.

⁴⁶⁷ Giné, X., Townsend, R., & Vickery, J. (2007). Patterns of rainfall insurance participation in rural India. The World Bank.

⁴⁶⁸ Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R., & Vickery, J. (2013). Barriers to household risk management: Evidence from India. *American Economic Journal: Applied Economics*, 5(1), 104-35.

1985),⁴⁶⁹ and the fact that staff members may embezzle borrowers' repayments by misrepresenting realised returns (Jeon & Menicucci, 2011).⁴⁷⁰ Explanations for low insurance demand include financial illiteracy, credit constraints, basis risk, implicit insurance, mistrust in insurance providers, and poor marketing (Giné et al., 2008; Giné & Yang, 2009; Cole et al., 2009; Cai et al., 2009; Clarke, 2011).⁴⁷¹ Postulated reasons for insurance demand being positively correlated with wealth include cash and credit constraints (Binswanger-Mkhize, 2011),⁴⁷² and that insurance products are themselves perceived as risks (Karlan & Morduch, 2009).⁴⁷³

As is evident, most existing explanations examine credit or insurance markets in isolation, and focus on a single empirical puzzle. This appendix takes a different approach, arguing that the interplay between credit and insurance markets offers a compelling and consistent explanation for all of the aforementioned empirical observations.

Here we must emphasise the important distinction between standard-debt contracts (uninsured loans), standard-debt contracts with insurance (insured loans), and contingent contracts. Standard debt contracts are contracts where the amount due is independent of variables such as income or the state of nature. Standard debt contracts with insurance are any contracts that are equivalent to a firm offering an individual both a standard-debt contract and contingent insurance. In this case, if the individual receives an insurance payout and has not fully repaid the loan, the insurance payout must first go towards the loan repayment. In contrast, contingent contracts refer to contracts that are contingent and where the amount repayable at any time is never more than the total wealth of the individual at that time. If the size of the standard debt contract sometimes exceeds the amount that the individual is able to pay, so that default on a standard debt contract occurs with non-zero probability, contingent contracts differ from standard debt contracts with insurance.

One of the few papers to examine the interaction between credit and insurance markets is a 2009 paper by Giné and Yang. They implemented a randomized field experiment to test whether the combined provision of insurance and credit by a firm leads to greater technology adoption than if only credit is provided. By taking out a loan, individuals could invest in high-yielding hybrid maize, which would generate greater expected returns but with larger variance than traditional

⁴⁶⁹ Gale, D., & Hellwig, M. (1985). Incentive-compatible debt contracts: The one-period problem. *The Review of Economic Studies*, 52(4), 647-663.

⁴⁷⁰ Jeon, D. S., & Menicucci, D. (2011). When is the optimal lending contract in microfinance state non-contingent?. *European Economic Review*, 55(5), 720-731.

⁴⁷¹ Giné, X., & Townsend, R. (2007). Statistical analysis of rainfall insurance payouts in Southern India. The World Bank. Giné, X., & Yang, D. (2009). Insurance, credit, and technology adoption: Field experimental evidence from Malawi. *Journal of Development Economics*, 89(1), 1-11. Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R., & Vickery, J. (2013). Barriers to household risk management: Evidence from India. *American Economic Journal: Applied Economics*, 5(1), 104-35. Cai, H., Chen, Y., Fang, H., & Zhou, L. A. (2009). Microinsurance, trust and economic development: Evidence from a randomized natural field experiment (No. w15396). National Bureau of Economic Research. Clarke, D. J. (2011). A theory of rational demand for index insurance. Department of Economics, University of Oxford.

⁴⁷² Binswanger-Mkhize, H. P. (2012). Is there too much hype about index-based agricultural insurance?. *Journal of Development Studies*, 48(2), 187-200.

⁴⁷³ Karlan, D., & Morduch, J. (2010). Access to finance. In *Handbook of Development Economics* (Vol. 5, pp. 4703-4784). Elsevier.

maize varieties. Half of the Malawian farmers in the sample were offered a standard debt contract, with the loan having to be fully repaid in all states of the world. The other farmers were offered a standard debt contract with insurance. In return for paying an insurance premium, the farmers would receive the equivalent of an insurance payout if rainfall levels were low.⁴⁷⁴ Contrary to expectations, they found that take-up was 13 percentage points lower for farmers offered insurance with the standard debt contract.

In attempting to explain this result, Giné and Yang intuit that the value of explicit insurance to Malawian farmers is negatively related to the degree of implicit insurance provided by the limited liability of the standard debt contract. That is, where the value of income in some states is less than the repayment required, repayment is already contingent. In bad states borrowers repay less. By taking up explicit insurance, *ex post* income in the good state decreases, as an insurance premium must be paid in addition to the normal loan repayment. However, the benefit of insurance in the bad state is only partially realised as some of it goes towards fully meeting repayment obligations. In such a case, the authors argue that farmers may prefer an uninsured loan to an insured loan.

The question arises as to whether this explanation for low insurance demand is generally applicable, or whether it only applies in this specific case due to a flawed experimental design and theoretical model.

In both the field experiment and theoretical model, individuals are charged the same interest rate (27.5% per annum) regardless of whether they are offered only credit or the credit-insurance bundle.⁴⁷⁵ This is despite the fact that the default rate is lower in the case of the credit-insurance bundle. Hence, investors generate a greater financial return on the insured loan than the uninsured loan. The paper does not compare like with like.

To determine what occurs in equilibrium, the experiment and model should have modelled the lending market in a consistent manner. The investor could have charged a lower interest rate on the insured loan than on uninsured loan and still broken-even. Alternatively, if the investor broke-even on the credit-only contract they would have still broken-even on the credit-insurance contract if they let the individual keep all of any insurance payout. Hence, either a lower interest rate should have been set on the insured loans than the uninsured loans, or the same interest rate should have been charged but with individuals allowed to retain any insurance payouts.

⁴⁷⁴The actual credit-insurance contract was such that the farmer's loan repayment obligation was partially or fully forgiven if rainfall levels were low. This contract is equivalent to a contract where the amount due is constant but the farmer receives an insurance payout if rainfall levels are low.

⁴⁷⁵Giné and Yang do point out that since the size of the insured loan is greater than the uninsured loan (as it includes the insurance premium), if individuals do not value insurance they face a higher effective interest rate on the insured loan. However, this is a different issue to whether the actual interest rate was lower for the insured loan. Indeed, if a lower interest rate had been charged on the insured loan, the effective interest rate may not have been higher even if individuals did not value insurance.

If Giné and Yang had designed the field experiment and setup the model in either of these two ways, it is not immediately obvious that the same result would obtain or that the reason they give for low insurance take-up would apply.

Suppose that instead of being offered a standard debt contract with insurance, individuals were offered a contract where they could retain any insurance payouts. Then insurance demand may have been higher and the implicit insurance argument would not apply. Hence, the paper's results are of little relevance unless there is a good reason why firms do not offer contingent contracts. Despite this, the authors offer no justification for why individuals are offered standard-debt contracts and why any insurance payouts must be used to first repay the original loan.

Even if there is a good reason why firms do not offer contingent contracts, it does not immediately follow that there is low insurance demand in equilibrium. If investors offered a lower interest rate when they knew individuals had insurance, then take-up of insurance may have been greater than when the investors charged all individuals the same interest rate.

This appendix explains why contingent contracts are not offered in equilibrium, and why insurance demand is low even when interest rates are set so that firms break-even. In so doing, we show that the intuition provided by Giné and Yang is both a valuable contribution to the literature and an incomplete picture of the dynamics between credit and insurance markets. We show why the two impact investing mechanisms of contingent loans and standard debt loans with insurance are both rare.

We proceed as follows. In Section A.3, a basic model is developed of impact investments in individuals. In this model, we use the example of investments that enhance individual productivity via improvements in the physical capital used in the production process. This example is used so that the research in this appendix can build directly on from the most closely related academic paper - Giné and Yang (2009). A different investment example is used in Appendix B, namely investments that enhance productivity via improvements in human capital. Both approaches are entirely consistent with, and fall within, the case of impact investments that are the focus of this dissertation research. This is because both human and physical capital improvements enhance individual productivity and lead, *ceteris paribus*, to higher expected individual incomes. As such, there is no loss of generality by following the example used by Giné and Yang (2009).

More specifically, in this model, investors are able to offer individuals different forms of impact investments, which they may choose to accept or reject. If an investment is made, the success of the investment is partly dependent on factors outside of the individual's control and partly dependent on factors within the individual's control. To capture this, we present a simple model with two states of the world and binary effort choice. Both endogenous effort choice and exogenous environmental factors affect investment success. If individuals choose to exert a high degree of effort, the probability that an investment is successful increases. However, high effort also comes at a cost.

In some cases, the cost of high effort is pecuniary. For example, an individual may forgo other sources of income in order to work more on an investment, or may hire additional labour for the project. Alternatively, the individual may exert high effort by purchasing physical capital, such as fertiliser or irrigation equipment. In any of these instances, the exertion of high effort carries with it a pecuniary cost. Where this is the case, we show that the individual's incentive compatibility constraint is satisfied more often when standard-debt contracts are offered than when contingent contracts are provided. Hence, there will be parameter values where only standard-debt contracts exist in equilibrium. The intuition for this result is that if an individual exerts high effort but the investment is unsuccessful due to factors outside of their control, they are no worse off for having chosen high effort if the impact investment takes the form of a standard loan, but are worse off for having chosen high effort if the investment mechanism is a contingent loan. This is developed formally in Section A.4.

In other cases, the cost of high effort is non-pecuniary. It is not hard to envisage instances where individuals might incur disutility from working hard on an investment but not be financially worse off. We show that in such cases, if a full insurance contingent contract does not satisfy the individual's incentive compatibility constraint then no type of contingent contract can exist in equilibrium. This result occurs because of the capacity of individuals to purchase insurance in addition to the original lending contract. Somewhat counterintuitively, it is the presence of insurance markets that means contingent contracts cannot be provided. This is the focus of Section A.5.

Hence, we show in Sections A.4 and A.5 that the rarity of the impact investment mechanism of contingent contracts can be explained due to the role of effort. This is regardless of whether the cost of effort is pecuniary or non-pecuniary.

We then proceed in Section A.6 to examine the mechanism of debt financing with separate yet simultaneous insurance. We find that the equilibrium outcome depends on the wealth of the individual. Any wealth level can be classified into one of three disjoint sets. For low levels of wealth, there is a unique equilibrium involving no insurance take-up due to the implicit insurance provided by the debt contract. At intermediate levels of wealth there exist multiple equilibria due to coordination problems between investors and insurers. Either investors set an interest rate above the risk-free rate and no insurance is purchased, or the risk-free interest rate is set and there is full insurance coverage. This result arises from the fact that insurance take-up affects loan repayment capacity, which impacts upon the interest rate that credit providers need to charge on loans. For high levels of wealth there exists a unique equilibrium where full insurance coverage is purchased. Thus, we show that implicit insurance and coordination problems explain why the mechanism of debt financing with insurance has low take-up rates. In the process, we explain the empirical puzzle of why insurance demand is both low and positively correlated with wealth.

Section A.7 discusses these findings and concludes. It is emphasised that credit and insurance are complementary but not when they are brought together in the form of contingent contracts or as

separate yet simultaneous products. There are logical reasons why neither of these impact investment mechanisms are widespread at present.

Unless otherwise stated, the proofs of all lemmas, observations and propositions are contained in Section A.8.

A.3 General Model

To capture the essence of the two impact investing mechanisms that involve interaction between credit and insurance markets, and the role that effort plays in this interaction, consider the following model.

There is a population of low-income individuals, each with initial wealth $y_0 = w$ and a von Neumann-Morgenstern utility function satisfying $u' > 0$ and $u'' < 0$. Investors may provide individuals with a loan in order to make an investment of fixed size C . As we are interested in low-income individuals in developing countries with limited collateral, our focus throughout is on instances where the investment to be made exceeds the wealth of the individual, that is $C > w$. As previously mentioned, no restriction is placed on the precise type of investment that is made. For example, the investment could be starting a textile business or adopting a new crop technology. A successful investment generates income of A in addition to initial wealth, whereas a failed investment generates no additional income.

Determinants of Investment Success

One of the main factors that affects whether or not an investment is successful is the level of effort exerted by the individual. We model this in a basic way by supposing effort choice is binary. An individual can choose to exert high effort at a cost $e > 0$, or low effort at no cost. As previously mentioned, in some cases the cost of high effort is pecuniary (such as the opportunity cost of spending more time on the business), whilst in other cases the cost of high effort is non-pecuniary (such as the unhappiness that may result from working long hours).

When the individual exerts high effort the probability of investment success is φ . If a low level of effort is chosen this probability decreases to $\varphi\beta$, where $0 < \beta < 1$. This is shown below.

Figure A.1: Probability of Investment Success

Effort Level	Investment	
	Failure	Success
High	$1 - \varphi$	φ
Low	$1 - \varphi\beta$	$\varphi\beta$

It is assumed throughout that high effort choice is productive but low effort choice is unproductive. This can be written as $\varphi A > (1 + r)C > \varphi\beta A$, where r is the risk-free interest rate. Without this assumption, an investment would not even be profitable for a risk-neutral agent. This assumption means that if the individual chooses low effort it is not possible for the individual rationality constraint and the investor's zero-profit condition to be simultaneously satisfied.

It is further assumed that neither effort choice nor investment success are observable to investors. This may be because the cost of monitoring effort and observing the outcome of an investment is prohibitively expensive. Alternatively, it may be because individuals can disguise their effort level or investment success. Either way, impact investors are not able to write contracts that are contingent on effort choice or investment success. Instead, they are only able to write contracts that are contingent on what is publicly observable, which we refer to as the state of nature.

In our model, state of nature does *not* refer to the complete listing of what can happen. Rather, state of nature refers to environmental factors that are outside of the individual's control, such as the level of rainfall in a region. These environmental factors can be measured by an index, which indicates either a 'good' state of nature or a 'bad' state of nature.⁴⁷⁶

Provided high effort is exerted, an investment is successful when the state of nature is good but unsuccessful when the state of nature is bad. For example, suppose a farmer grows rice or maize. If they choose a high level of effort and the level of rainfall is high, then we assume that the investment is successful. On the other hand, if there is a drought then the investment is unsuccessful.

Importantly, if the individual chooses a low level of effort, the investment may fail even when the state of nature is good. For example, if the farmer does not properly cultivate the soil then the investment may fail even if there is a high level of rainfall. As was the case with high effort, we assume that if the index indicates a bad state then the investment always fails. Hence, we are allowing for downside basis risk in the case of low effort. This is mathematically equivalent to the modeling approach of Doherty and Schlesinger (1991),⁴⁷⁷ who emphasize the possibility of contractual non-performance.

The relationship between investment success and the state of nature is shown in Figure A.2.

⁴⁷⁶ The reason why we have defined state of nature in this way is because effort and investment success are unobservable. It is only possible for firms to write contracts that are contingent on the environment. Hence, 'state of nature' should not be confused with 'state space'.

⁴⁷⁷ Doherty, N. A., & Schlesinger, H. (1991). Rational insurance purchasing: Consideration of contract non-performance. In *Managing the Insolvency Risk of Insurance Companies* (pp. 283-294). Springer, Dordrecht.

Figure A.2: Probability of Investment Success Based on Effort Choice

High Effort			Low Effort		
State of Nature	Investment		State of Nature	Investment	
	Failure	Success		Failure	Success
Good	0	φ	Good	$\varphi(1 - \beta)$	$\varphi\beta$
Bad	$1 - \varphi$	0	Bad	$1 - \varphi$	0
Total	$1 - \varphi$	φ	Total	$1 - \varphi\beta$	$\varphi\beta$

Credit Market

We assume that there exists a pool of risk-neutral investors. Before offering a contract, these investors can observe an individual's level of wealth but are not aware of any other individual-specific characteristics. They can then offer an individual a standard debt contract, a state-contingent contract, or neither.

***Definition A.1:** A standard debt contract is a type of loan that requires individuals to repay the same amount regardless of the state of nature.*

The amount repayable is denoted D . If the individual defaults on repayment of the loan, the investor can seize assets up to the amount due. Since the individual's wealth level is observable, the standard debt contract can be written as $D = (1 + i(w))C$, where $i(w)$ is the interest rate the investor sets for individual with wealth w . As $C > w$ it follows that $D > w$.

***Definition A.2:** A state-contingent contract is a type of contract where the amount to be paid or received by the individual is dependent on the state of nature, as indicated by an index, and requires the individual to repay no more than their wealth w in the bad state.*

The state-contingent contract can be written as (R, S) , where R is the amount that is payable to the investor if the good state occurs, and S is the amount received by the individual if the bad state occurs. Where S is positive the contract has a form of inbuilt insurance.

The reason why we define the lower bound of S as $-w$ is so as to distinguish between state-contingent contracts on one hand, and standard debt contracts with insurance on the other. In the region $C > w$, a standard debt contract requires the individual to repay more in the bad state than their wealth w , so the loan is not always fully repaid. This means that if the individual purchases additional insurance, part of any insurance payout in the bad state goes towards the loan repayment. In contrast, with a state-contingent contract, the most that is repayable in the bad state is w . Hence, if the individual purchases insurance on top of the state-contingent contract, they fully retain any insurance payout. Therefore state-contingent contracts are not equivalent to standard debt contracts with insurance in the region $C > w$.

In equilibrium, it is assumed that investors break-even, as it is the consequence of a competitive market. The zero-profit condition for an investor equates the expected rate of return to lending with the risk-free interest rate. If no insurance is purchased, the zero-profit condition for a standard debt contract is given by:

$$\varphi D + (1 - \varphi)w = (1 + r)C \quad (\text{A.1})$$

In contrast, the zero-profit condition for a state-contingent contract is:

$$\varphi R = (1 - \varphi)S + (1 + r)C \quad (\text{A.2})$$

Insurance Market

In cases where an insurance market exists, individuals may choose to purchase index insurance in addition to taking out a loan contract. In return for paying a premium prior to the realisation of the state of nature, individuals receive a payout when the bad state occurs. The insurance is priced at an actuarially fair rate. The individual pays a premium $P = (1 - \varphi)I$ for I units of insurance coverage,⁴⁷⁸ receiving a claim payout of I if the state is bad, and zero if the state is good.

General Individual Problem

In this setting, individuals are price takers. For a given investment contract and insurance premium (where insurance is offered), they choose an effort level and a level of insurance coverage so as to maximize their expected utility.

Figure A.3 shows the levels of *ex post* wealth for the different combinations of investment contract type, level of effort, state of nature (as given by an index), the success or failure of an investment, and whether insurance is purchased. The probabilities in each table add up to two because effort is a choice variable.

Figure A.3: Ex Post Wealth Levels

Standard Debt Contract					
Effort	State of Nature	Investment	Probability	No Insurance	Insurance
High	Good	Success	φ	$w + A - D - e$	$w + A - D - P - e$
High	Bad	Failure	$1 - \varphi$	$w - D - e$	$w + I - D - P - e$
Low	Good	Success	$\varphi\beta$	$w + A - D$	$w + A - D - P$
Low	Good	Failure	$\varphi(1 - \beta)$	$w - D$	$w - D - P$
Low	Bad	Failure	$1 - \varphi$	$w - D$	$w + I - D - P$

⁴⁷⁸ A more general way of writing the premium is as a multiple of $m > 0$. Then $P = m(1 - \varphi)I$. The premium is said to be actuarially unfair if $m > 1$, actuarially fair if $m = 1$, and actuarially favourable if $m < 1$.

Contingent Contract					
Effort	State of Nature	Investment	Probability	No Insurance	Insurance
High	Good	Success	φ	$w + A - R - e$	$w + A - R - P - e$
High	Bad	Failure	$1 - \varphi$	$w + S - e$	$w + S + I - P - e$
Low	Good	Success	$\varphi\beta$	$w + A - R$	$w + A - R - P$
Low	Good	Failure	$\varphi(1 - \beta)$	$w - R$	$w - R - P$
Low	Bad	Failure	$1 - \varphi$	$w + S$	$w + S + I - P$

Now that we have setup the general model, let us turn our attention to explaining why contingent loans are not provided in equilibrium. As previously mentioned, Section A.4 deals with those cases where high effort carries a pecuniary cost, whereas Section A.5 focuses on those cases where high effort involves a non-pecuniary cost.

A.4 Contingent Loans with Pecuniary Cost of Effort

We model investments in the form contingent loans where high effort reduces the income of individuals by including the cost e in the normal utility function. For the sake of clarity, pecuniary effort cost is written as e_p , and in the next section non-pecuniary effort cost is denoted by e_n .

If a state-contingent contract (R, S) intends the individual to choose the high level of effort, the following incentive compatibility constraint must be satisfied:

$$\begin{aligned} \varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \\ \geq \varphi\beta u(w + A - R) + (1 - \varphi)u(w + S) + \varphi(1 - \beta)u(w - R) \end{aligned} \quad (A.3)$$

The individual rationality constraint is given by:

$$(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \geq u(w) \quad (A.4)$$

In the case of standard debt financing, the following incentive compatibility and individual rationality constraints must hold for the individual to make an investment and choose high effort:

$$\begin{aligned} \varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p) \\ \geq \varphi\beta u(w + A - D) + (1 - \varphi\beta)u(w - D) \end{aligned} \quad (A.5)$$

$$\varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p) \geq u(w) \quad (A.6)$$

In order to compare when these different types of investment mechanisms are viable, let us define functions so that the incentive compatibility constraints are just satisfied.

Definition A.3: $\beta^*(e)$ is the value of β for a given e that means (A.3) holds with equality. $\beta^\wedge(e)$ is the value of β for a given e that means equation (A.5) holds with equality.

From inequalities (A.3) and (A.5) it is straightforward to obtain expressions for $\beta^*(e)$ and $\beta^\wedge(e)$. From the definition of a state-contingent contract it is known that $S \geq -w$. It follows from equations (A.1) and (A.2) that if the investor breaks-even it must be the case that $R \geq D$. This means that the amount the individual repays in the good state of the world is never more in the case of a standard debt contract than with a state-contingent contract. Since we also know that $D = (1 + i(w))C > w$, it follows that $u(w - R) = u(w - D) = u(w - D - e_p) = u(0) = 0$. Knowing this, we can write $\beta^*(e)$ and $\beta^\wedge(e)$ as:

$$\beta^*(e) = \frac{\varphi u(w + A - R - e_p) + (1 - \varphi)[u(w + S - e_p) - u(w + S)]}{\varphi u(w + A - R)} \quad (\text{A.7})$$

$$\beta^\wedge(e) = \frac{u(w + A - D - e_p)}{u(w + A - D)} \quad (\text{A.8})$$

Lemma A.1: $\beta^*(e)$ and $\beta^\wedge(e)$ are monotonically decreasing functions in the region $\beta \in (0,1)$ and $e > 0$.

Proposition A.1: For all e such that $\beta(c) \leq \beta^*(e)$, the state-contingent contract incentive compatibility constraint holds. For all e such that $\beta(c) > \beta^*(e)$, the state-contingent contract incentive compatibility constraint does not hold.

Proposition A.2: For all e such that $\beta(c) \leq \beta^\wedge(e)$, the standard debt contract incentive compatibility constraint holds. For all e such that $\beta(c) > \beta^\wedge(e)$, the standard debt contract incentive compatibility constraint does not hold.

Proposition A.3: $\beta^\wedge(e) > \beta^*(e) \forall e > 0$.

What this means is that any combination of β and e that would make the individual choose high effort with a state-contingent contract would also make the individual choose high effort with a standard debt contract. Moreover, we know from Propositions A.1 - A.3 that there are some combinations of β and e for which the individual would choose low effort if the contract was state-contingent but high effort if the contract was in the form of a standard loan.

The reason for this is that when the individual chooses high effort and the bad state occurs, output A is not realised. If the contract is in the form of a contingent contract the level of *ex post* income is then $w + S - e_p$. Hence, the individual bears at least some of the cost of high effort. In contrast, if the loan is a standard debt contract the level of *ex post* income is $w - D - e_p$. Since $D = (1 + i(w))C > w$, the individual does not bear the cost of high effort. Thus, the consequences of exerting high effort and the investment failing are greater when the contract is state-contingent

than when the contract is a standard loan. For this reason, individuals choose high effort for a larger range of β and e combinations when the investment is a standard debt contract rather than a contingent loan.

Having examined when the incentive compatibility constraints are satisfied, let us turn our attention to the individual rationality constraints. In a similar way to how we defined $\beta^*(e)$ and $\beta^\wedge(e)$, let us define values of e so that the individual rationality constraints hold with equality.

Definition A.4: e_p^* is the value of e_p that means equation (A.4) holds with equality. $e_p^\wedge$ is the value of e_p that means equation (A.6) holds with equality.

It is obvious that the individual rationality constraint is satisfied for a contingent contract whenever $e_p < e_p^*$ and for a standard debt contract whenever $e_p < e_p^\wedge$. Of greater importance is the following proposition.

Proposition A.4: $e_p^* \geq e_p^\wedge$.

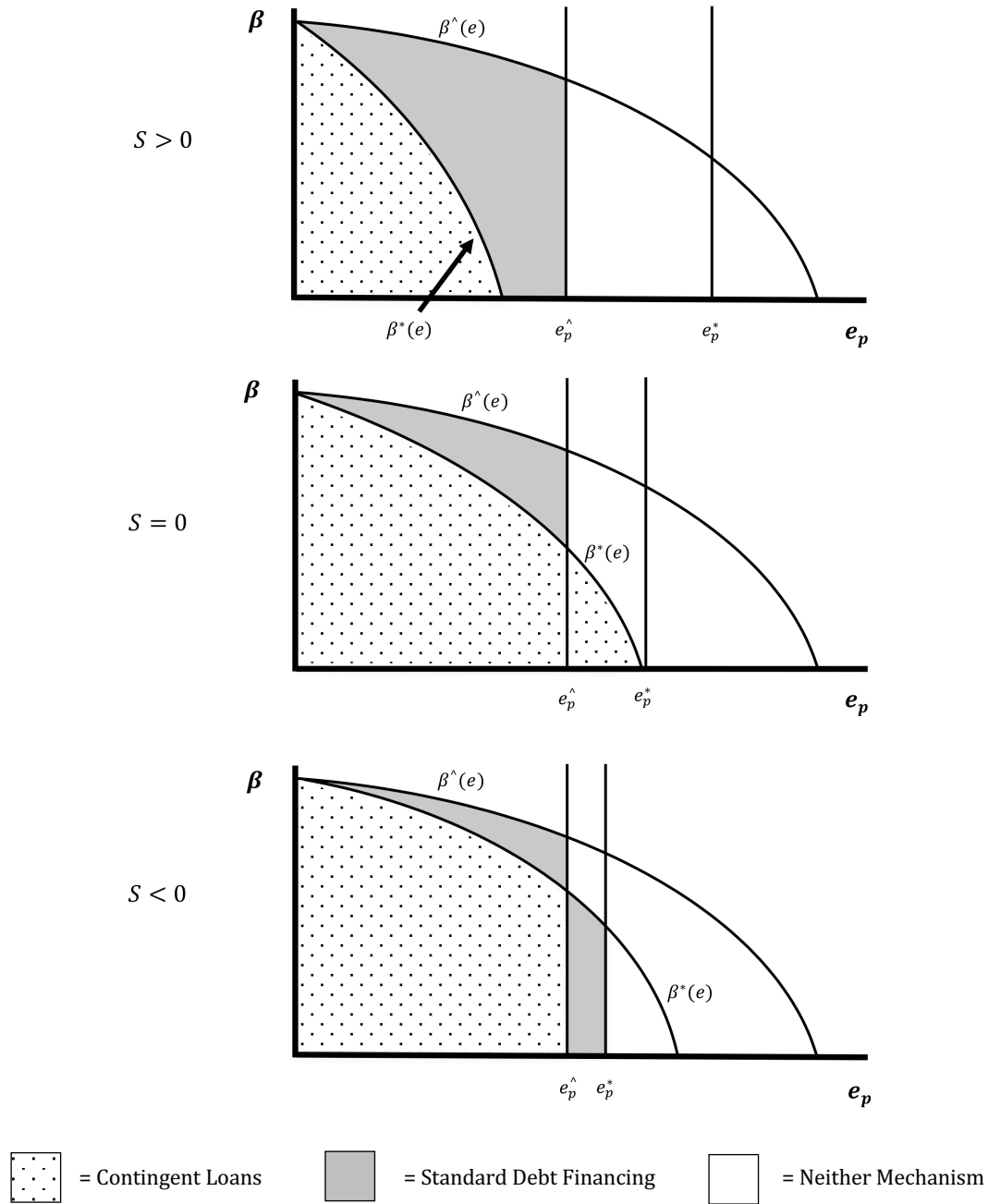
Importantly, the proof to the above proposition directly follows from the fact that the individual's expected utility from taking out a state-contingent contract and choosing high effort is weakly greater than the expected utility from taking out a standard-debt contract and exerting high effort. That is, the proposition is true because $\varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \geq \varphi u(w + A - D - e_p)$. Thus, even though standard-debt contracts can induce high effort for a greater range of β and e combinations, individuals do not take-up standard debt contracts when both types of contracts are offered. Knowing this, we can completely characterize what occurs in equilibrium.

Proposition A.5: In equilibrium: (i) investors offer and individuals take-up contingent loans in the region $\beta(e) \leq \beta^*(e)$ and $e_p \leq e_p^*$; (ii) investors offer and individuals take-up standard debt contracts in the region $\beta^*(e) < \beta(e) \leq \beta^\wedge(e)$ and $e_p \leq e_p^\wedge$; (iii) no investments are made in other regions.

Proof. In equilibrium the individual's utility is maximized subject to the investor's zero-profit condition. Hence, investments are only made when both the incentive compatibility and individual rationality constraints are satisfied. We know from Proposition A.1 and Definition A.4 that a state-contingent contract satisfies both constraints in the region $\beta(e) \leq \beta^*(e)$ and $e_p \leq e_p^*$. We know from Proposition A.2 and Definition A.4 that a standard debt contract satisfies both constraints in the region $\beta(e) \leq \beta^\wedge(e)$ and $e_p \leq e_p^\wedge$. From Propositions A.3 and A.4 respectively we know that $\beta^\wedge(e) > \beta^*(e)$ and $e_p^* \geq e_p^\wedge$, and from the proof to Proposition A.4 we know that individuals derive a greater utility from state-contingent contracts than standard-debt contracts. Proposition A.5 directly follows from this.

This central proposition is represented visually in Figure A.4. The shaded region shows where debt financing occurs in equilibrium, and the dotted region shows where contingent loans occur in equilibrium.⁴⁷⁹

Figure A.4: Existence of Investment Mechanism Designs in Equilibrium



⁴⁷⁹ It is straightforward to show that $\beta^{\wedge}(e)$ and $\beta^*(e)$ are concave functions. For example, $\beta^{\wedge}(e) = \frac{u(w+A-D-e_p)}{u(w+A-D)}$ and we know that $u'' < 0$. Therefore as e_p increases the numerator becomes smaller at an increasing rate whilst the denominator remains constant. This implies concavity.

In Figure A.4, three graphs are included, with the top, middle and bottom graphs representing state-contingent contracts (R, S) with $S > 0$, $S = 0$ and $S \in (-w, 0)$ respectively. These graphs illustrate a trade-off that exists. A higher S provides the individual with greater utility from a state-contingent contract, as it moves them closer towards full insurance. As such, a higher S means the individual rationality constraint is easier to satisfy. This is shown by the larger e_p^* in the upper graphs. However, a higher S has the downside that it makes the incentive compatibility constraint harder to satisfy. As previously mentioned, this is because a larger S means that individuals bear more of the cost of high effort when the bad state occurs and the investment is unsuccessful.⁴⁸⁰

Overall, we have shown in this section that where the cost of high-effort is pecuniary, investments via the mechanism of contingent loans are rare in equilibrium, even though they provide individuals with greater utility than standard debt financing.⁴⁸¹ With state-contingent contracts, individuals may be reluctant to exert lots of effort on an investment because if the bad state occurs then they bear the effort cost but do not get any benefit. This is not the case with standard debt contracts, as if the bad state occurs the loan is still repayable and the investor claims the individual's remaining wealth. Hence, if the individual spends extra time and money on an investment, this simply reduces the amount the investor can claim in the event of default. The investor, not the individual, bears the cost of high effort if an investment fails.

A.5 Contingent Loans with Non-Pecuniary Cost of Effort

There are some investments where the way that individuals exercise high effort leads to disutility but not as a result of lower income. Instead of forgoing other jobs to work on an investment, purchasing fertiliser, or hiring additional labour, the individual may exercise high effort by forgoing leisure activities, taking shorter meal breaks, exerting more physical effort, or simply concentrating harder. In these cases, the cost of effort is non-pecuniary and therefore independent of the utility that individuals derive from income.

In this section we show what occurs in the absence of a separate insurance market, and then show how the presence of an insurance market changes the outcome and means state-contingent contracts are rarely provided. To begin with, note that for the individual to choose high effort under a state-contingent investment contract it must be the case that:

⁴⁸⁰ Note that if $S = w$ then the curves corresponding to the state-contingent contract and the standard debt contract perfectly overlap.

⁴⁸¹ The same general result occurs when contracts are contingent on investment success rather than the state of nature. In the case of success-contingent contracts, the incentive compatibility constraint is $\varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \geq \varphi \beta u(w + A - R) + (1 - \varphi \beta)u(w + S)$. If $\beta^{**}(e)$ is the value of β for which this incentive compatibility constraint hold with equality, it is straightforward to show that $\beta^{\wedge}(e) > \beta^*(e) > \beta^{**}(e) \forall e_p > 0$. The intuition for this is that where a contract is contingent on investment success, a low effort means that the individual not only doesn't have to incur the cost of high effort, but they also don't have to repay the loan as often. For this reason, the incentive compatibility constraint is harder to satisfy when contracts are contingent on investment success. Thus, if we compared standard debt contracts with contracts contingent on investment success then standard debt contracts would occur even more frequently (and contingent contracts even less frequently) in equilibrium than is the case in our model.

$$\varphi u(w + A - R) + (1 - \varphi)u(w + S) - e_n \geq \varphi \beta u(w + A - R) + (1 - \varphi)u(w + S)^{482} \quad (\text{A.9})$$

When the state-contingent contract provides full insurance to the individual the incentive compatibility constraint is satisfied if and only if:

$$\varphi(1 - \beta)u(w + \varphi A - (1 + r)C) \geq e_n \quad (\text{A.10})$$

The above inequality is obtained from solving the two equations $A - R + S$ and $\varphi R = (1 - \varphi) + (1 + r)C$, which represent the definition of full insurance and the investor's break-even condition respectively. The full insurance contract is given by $R = A(1 - \varphi) + (1 + r)C$ and $S = \varphi A - (1 + r)C$.

Now suppose that (A.10) does not hold. In this case, let the contract $(\hat{R}, \hat{S})$ satisfy the following two equations.

$$\varphi(1 - \beta)u(w + A - \hat{R}) = c_n \quad (\text{A.11})$$

$$\varphi \hat{R} = (1 - \varphi)\hat{S} + (1 + r)C \quad (\text{A.12})$$

Equation (A.11) is obtained by simplifying constraint (A.9), noting that the terms $(1 - \varphi)u(w + S)$ cancel out, and imposing equality. (A.12) is the usual zero-profit condition.

The maximum value that any R can take is the R that corresponds to a full insurance contract. Hence, $R_{max} = A(1 - \varphi) + C(1 + r)$. The smallest possible value of R that satisfies investors' zero-profit condition occurs when S is as small as possible, which is when $S = -w$. Therefore, $\varphi R_{min} = (1 - \varphi)(-w) + (1 + r)C$, so $R_{min} = \frac{(1 - \varphi)(-w) + (1 + r)C}{\varphi}$. This is the same as the amount repayable in all states under a standard debt contract.

With this in mind, we can now characterize the optimal contract in the absence of an insurance market. By optimal contract we mean the contract that maximizes the individual's utility subject to the investor breaking even. The optimal contract is the contract that is offered by credit-providers. Whether or not this optimal contract occurs in equilibrium is a separate question that depends on whether the individual rationality constraint is satisfied.

Proposition A.6: In the absence of a separate insurance market, the optimal contract: (i) provides full insurance if (A.10) holds; and (ii) is given by $(\hat{R}, \hat{S})$ if (A.10) does not hold.

Intuitively, the optimal contract provides the individual with the maximum possible consumption smoothing subject to the incentive compatibility constraint being satisfied. The contract that

⁴⁸² As previously mentioned, there is no term $\varphi(1 - \beta)u(w - R)$ since $u(w - R) = u(0) = 0$.

provides the least consumption smoothing is $(R, S) = (R_{min}, -w)$ and the contract that provides the most consumption smoothing is the full insurance contract $(R, S) = (R_{max}, A - R_{max})$.

The more similar the individual's incomes in each state of the world, the greater their utility but the less likely it is that the incentive compatibility constraint holds. This is the same trade-off that exists when the cost of effort is pecuniary, however the reasons for the trade-off differ. To understand the reason for the trade-off in this case, remember that effort choice affects the likelihood that an investment is successful. It is successful with probability φ if high effort is chosen, and probability $\varphi\beta$ if low effort is chosen. Hence, the difference in *ex post* income in the good state between high effort and low effort is $(1 - \beta)(w + A - R)$. The larger the value of R , the smaller the income of the individual when the investment is successful (the smaller is $w + A - R$). As such, the individual receives only limited benefit from choosing high effort and increasing the probability of investment success. On the other hand, the smaller the value of R , the greater the difference in *ex post* income in the good state, and hence the more likely it is that this difference will outweigh the cost of high effort.⁴⁸³

Since the optimal contract provides the individual with the greatest possible utility subject to the investor breaking even, we know that if the optimal contract does not satisfy the individual rationality constraint then no contract satisfying the individual rationality constraint enables the investor to break-even.

Importantly, whilst the optimal contract is always contingent in the absence of a separate insurance market, this is not the case when an insurance market exists. Suppose that after signing a contract (R, S) with an investor, the individual can choose to buy additional insurance from an outside source.

Proposition A.7: If (A.10) does not hold and there is a separate market for insurance, then for any (R, S) the original investor does not break-even.

Proof:

As (A.10) does not hold, the individual chooses low effort if offered a full insurance contract. If offered a contract other than $(R, S) = (R_{max}, A - R_{max})$ the individual is less than fully insured. Hence, for a given (R, S) the individual chooses effort level and insurance coverage I so as to maximize their expected utility. Let $V(\cdot)$ be the expected utility from the utility maximizing choice of insurance I . The individual's problem can be written as:

$$V = \max_I \{ \varphi u(w + A - R - P) + (1 - \varphi)u(w + S + I - P) - e_n, \\ \varphi\beta u(w + A - R - P) + (1 - \varphi)u(w + S + I - P) \}$$

⁴⁸³Because the contracts are contingent on the state of nature rather than investment success, this result does not arise due to individuals receiving payout S more often when they choose low effort than when they choose high effort. To the contrary, the payout S occurs with probability $1 - \varphi$, independent of the level of effort chosen. If the bad state occurs, the individual has *ex post* income $w + S$. If the good state occurs, R needs to be paid to the investor.

Since $P = (1 - \varphi)I$ the problem becomes:

$$V = \max_I \{ \varphi u(w + A - R - (1 - \varphi)I) + (1 - \varphi)u(w + S + \varphi I) - e_n, \\ \varphi \beta u(w + A - R - (1 - \varphi)I) + (1 - \varphi)u(w + S + \varphi I) \}$$

As the insurance is at actuarially fair rates and $u' < 0$, the individual chooses I to equalise incomes across states. Hence, $w + A - R - (1 - \varphi)I = w + S + \varphi I$, so $\therefore I^* = A - R - S$.⁴⁸⁴ Therefore, the individual's maximum expected utility from high effort is $u(w + S + \varphi I^*) - e_n = u(w + \varphi A - \varphi R + (1 - \varphi)S) - e_n$, and their maximum expected utility from low effort is $(1 - \varphi + \varphi \beta)u(w + \varphi A - \varphi R + (1 - \varphi)S)$. It follows that the incentive compatibility constraint is $\varphi(1 - \beta)u(w + \varphi A - \varphi R + (1 - \varphi)S) \geq e_n$.

In order for the original investor to break-even it must be the case that the contract (R, S) both incentivizes the individual to choose high effort and also satisfies the condition $\varphi R \geq (1 - \varphi)S + C(1 + r)$. If the latter condition is satisfied,

$$\therefore \varphi R - (1 - \varphi)S \geq (1 + r)C$$

$$\therefore \varphi(1 - \beta)u(w + \varphi A - \varphi R + (1 - \varphi)S) \leq \varphi(1 - \beta)u(w + \varphi A - (1 + r)C)$$

However, as (A.10) does not hold we know that $\varphi(1 - \beta)u(w + \varphi A - (1 + r)F) < e_n$.

$$\therefore \varphi(1 - \beta)u(w + \varphi A - \varphi R + (1 - \varphi)S) < e_n$$

But this contradicts the requirement that the contract (R, S) incentivises the individual to choose high effort. Hence, it is not possible for both the incentive compatibility constraint and the original investor's break-even constraint to be simultaneously satisfied. $\square$

It follows that there are no state-contingent contracts in equilibrium where (A.10) does not hold and there is a separate insurance market. Counterintuitively, it is the presence of insurance providers that means state-contingent contracts are not viable. If individuals were offered a state-contingent contract that provided less than full insurance, they would seek to maximize their expected utility by purchasing additional insurance. By purchasing this additional insurance individuals would increase their expected income in the bad state and decrease it in the good state. However, as their *ex post* income in the good state would now be lower, there is less incentive for them to exert effort to increase the probability that an investment is successful. As a result, the incentive compatibility constraint does not hold and so the original investor would not break-even. This explains the rarity of state-contingent contracts.

⁴⁸⁴ It is easy to see that for contracts that do not provide full insurance, where $R + S < R_{\max} + A - R_{\max} = A$, then the level of insurance purchased is $I^* > 0$. If the contract was a full insurance contract $(R, S) = (R_{\max}, A - R_{\max})$ then the level of insurance purchased would have been $I^* = A - R_{\max} - (A - R_{\max}) = 0$.

The same logic does not apply in the case of standard debt financing, because with standard debt contracts a fixed amount needs to be repaid in all states of the world. As such, in the bad state any insurance payouts are first used to repay the original loan. This reduces the value of insurance to the individual.

We have shown in Sections A.4 and A.5 that effort-related dynamics mean that investors are often unable to appropriate sufficient value from contingent loans to make those investments viable in the first place. This explains the rarity of contingent loans, both when the cost of high effort is pecuniary and when the cost of high effort is non-pecuniary.

A.6 Debt Financing with Insurance

Now that we have explained the rarity of the mechanism of contingent loans and provided a theoretical justification for the existence of standard debt contracts in isolation, let us examine the mechanism of debt financing with insurance. This involves examination of the interaction between standard debt contracts and insurance markets.

We are interested in the case where a potential investor observes the individual's wealth and sets interest rate $i(w)$ on a standard debt contract. After taking out a standard debt contract, an individual may purchase insurance.

In order to focus on the key market interaction dynamics, we make two simplifying restrictions in this section. First, we abstract from effort choice as it does not add much to the analysis here. Secondly, we assume that individuals accept an investment. That is, we are assuming that $V(i)$ is greater than the individual's reservation utility $u(w)$. In the case of a standard debt contract, $V(i)$ is given by:⁴⁸⁵

$$V(i) = \max_I \{ \varphi u(w + A - D - P) + (1 - \varphi) u(\max[w + I - D - P, 0]) \} \quad (\text{A.13})$$

$$\therefore V(i) = \max_I \{ \varphi u(w + A - (1 + i(w))C - (1 - \varphi)I) + (1 - \varphi) u(\max[w + \varphi I - (1 + i(w))C, 0]) \} \quad (\text{A.14})$$

Observation A.1: A sufficient condition for $V(i) > u(w)$ to hold is that $\varphi^2 A > (1 + r)$.

As before, the zero-profit condition for the investor equates the expected rate of return to lending with the risk-free interest rate. However, now insurance payouts may increase the ability of the individual to repay the loan in the bad state. Therefore, the zero-profit condition becomes:

$$\varphi(1 + i(w))C + (1 - \varphi) \min\{w + I, (1 + i(w))C\} = (1 + r)C \quad (\text{A.15})$$

⁴⁸⁵ Recall that $V(\cdot)$ is the expected utility from the utility-maximizing choice of insurance I . Also recall that $D = (1 + i(w))C$ and $P = (1 - \varphi)I$.

Let us denote the interest rate that satisfies the investor's zero-profit condition as $i^*(w)$. Where insurance is not purchased ($I = 0$) and $w < (1 + r)C$, then $i^*(w)$ is given by:

$$1 + i^*(w) = \frac{(1 + r)C - (1 - \varphi)w}{\varphi C} \quad (\text{A.16})$$

It is clear from the above equation that i^* is a strictly decreasing function of w . Intuitively, an increase in w increases the amount that the individual is able to repay in the bad state, so decreases the interest rate required in the good state for the loan provision to be feasible.

In order to characterize the equilibria in credit and insurance markets, let us first note that there are only two types of potential equilibria.

Lemma A.2: If in equilibrium $i(w) = r$ for a given w , then $I = A$. If in equilibrium $i(w) > r$ for a given w , then $I = 0$.

Since $i \neq r$ in equilibrium, as then the investor's zero-profit condition would never be satisfied, the two cases of $i = r$ and $i > r$ are mutually exclusive and collectively exhaustive. Hence, there are two types of potential equilibria - one where a low interest rate r is set and full insurance is purchased, and the other where a higher interest rate $i^*(w)$ is set and no insurance is purchased.

We can now derive the equilibrium interest rate as a function of wealth level. For any given $i \geq r$ and $w < (1 + r)C$, let $\mathbb{E}(u|I = 0)$ be the expected utility when insurance is not purchased. This function is given by:

$$V(i) = \max_I \{ \varphi u(w + A - D - P) + (1 - \varphi)u(\max[w + I - D - P, 0]) \} \quad (\text{A.17})$$

Since the individual can always choose $I = 0$ it is known that $V(i) \geq \mathbb{E}(u|I = 0)$. Now let us define $w(i)$ as follows:

Definition A.5: $w(i)$ is the supremum of the set of w that satisfies $V(i) = \mathbb{E}(u|I = 0)$ for a particular interest rate i .

Lemma A.3: The set of w for which $V(i) > \mathbb{E}(u|I = 0)$ is convex.

It has already been established that $I > 0$ is incompatible with $i = i^*(w) > r$ in equilibrium, and that $I = 0$ is incompatible with $i = r$ in equilibrium. However, to show that $i = i^*(w)$ and $I = 0$ is an equilibrium outcome, one also needs to establish that given $i = i^*(w)$, the individual's optimal choice of I is in fact consistent with the requirement that $I = 0$. Likewise, to show that $i = r$ and $I = A$ is an equilibrium outcome, it is necessary to show that given $i = r$, the individual's optimal choice of I is in fact A . This is proved in the following lemmas.

Lemma A.4: Suppose that $w(i) > 0$ for a given $i \geq r$. Then, for all $w < w(i)$, an individual with wealth w chooses $I = 0$.

Lemma A.5: Suppose that $w(i) > 0$ for $i \geq r$. Then, for all $w > w(i)$, an individual with wealth w does not choose $I = 0$.

Lemmas A.2, A.4 and A.5 together establish that an equilibrium with $i = i^*(w)$, and $I = 0$ exists if and only if $w < w(i)$. Lemmas A.2 and A.4 also prove that there does not exist an equilibrium with $i = r$ and $I = 0$ for $w < w(i)$. It remains for us to show that an equilibrium with $i = r$ and $I = A$ exists for all $w > w(i)$.

Lemma A.6: Suppose that $w(i) > 0$. Then an equilibrium with $i = r$ and $I = A$ exists for all $w > w(i)$.

This completes the proof that an equilibrium with $i = i^*(w)$ and $I = 0$ exists if and only if $w < w(i)$, and an equilibrium with $i = r$ and $I = A$ exists if and only if $w > w(i)$.

Let us now turn our attention to the function $w(i)$ and examine its minimum and maximum values in equilibrium. The minimum possible equilibrium interest rate is the risk-free interest rate r . $w(r)$ is the maximum value of w for which $V(i) = \mathbb{E}(u|I = 0, i = r)$. Suppose that $w(r) > 0$. Then for individuals with wealth $w \in [0, w(r)]$ there exists a unique equilibrium where the interest rate is set at $1 + i^*(w) = \frac{(1+r)C - (1-\phi)w}{\phi C}$ and no insurance is purchased. This follows from equation (A.16) and Lemmas A.2 and A.4. The maximum possible equilibrium interest rate for any $w < (1 + r)C$ is given by $i^*(w)$. Any higher interest rate for a given wealth would violate the investor's zero-profit condition.

Lemma A.7: There exists $w > w(r)$ for which $i^*(w)$ can be supported as an equilibrium.

Now $w(i^*)$ is the supremum of w that satisfies $V(i^*(w)) = \mathbb{E}(u|I = 0, i = i^*(w))$. Substituting $i^*(w)$, given by equation (A.16), into (A.17) and (A.14), gives:

$$\mathbb{E}(u|I = 0, i = i^*(w)) = \phi u \left(A + \frac{w - (1+r)C}{\phi} \right) \quad (\text{A.18})$$

$$V(i^*(w)) = \max_I \left\{ \phi u \left(A + \frac{w - (1+r)C}{\phi} - (1-\phi)I \right) + (1-\phi)u \left(\phi I + \frac{w - (1+r)C}{\phi} \right) \right\} \quad (\text{A.19})$$

Lemma A.8: For any $w < w(i^*)$, $i^*(w)$ can be supported in equilibrium.

It follows that where $w(r) > 0$, then $w(r) < w(i^*)$. By a similar logic to the proof of Step 1 in Lemma A.7, it is easy to show that $w(i^*)$ is always less than $(1 + r)C$. To see this, observe from (A.16) that as w increases towards $(1 + r)C$, then $i^*(w)$ decreases towards r . Now

$\lim_{w \rightarrow (1+r)C} \mathbb{E}(u|I=0, i=i^*) = \varphi u(A)$ and $\lim_{w \rightarrow (1+r)C} V(i^*(w)) = u(\varphi A)$. Since $u(\mathbb{E}(\cdot)) > \mathbb{E}(u(\cdot))$, it follows that $\lim_{w \rightarrow (1+r)C} V(i^*(w)) > \lim_{w \rightarrow (1+r)C} \mathbb{E}(u|I=0, i=i^*)$. From Lemma A.3, if $V(i^*(w)) > \mathbb{E}(u|I=0, i=i^*)$ then $w > w(i^*)$. It follows that $w(i^*) < (1+r)C$. This also means that for all $w \geq (1+r)C$, then $w > w(i^*)$.

It is now possible to completely characterize the equilibria that occur when an investment takes the form of debt financing with separate yet simultaneous insurance.

Proposition A.8: (i) There is a unique equilibrium in the region $w < w(r)$ in which $i = i^(w)$ and $I = 0$; (ii) there exists multiple equilibria in the region $w(r) \leq w \leq w(i^*)$ in which $i = i^*(w)$ and $I = 0$, or $i = r$ and $I = A$; and (iii) there is a unique equilibrium in the region $w > w(i^*)$ in which $i = r$ and $I = A$.*

Proof. This follows from Lemmas A.2 to A.8.

Therefore, the impact investing mechanism of debt financing with insurance leads to three different regions of equilibrium outcomes. This is shown in Figure A.5, where the bold lines represent equilibria.

What explains these equilibrium outcomes? There are two main forces at play: implicit insurance and coordination problems. Both of these forces result from the fact that insurance take-up may affect the individual's loan repayment capacity.

In the region $w < w(r)$, the amount repayable, D , far exceeds the individual's wealth. If the individual purchases explicit insurance, a significant proportion of any insurance payout would go towards repaying the loan, so insurance is of limited benefit. Given this, the individual would not buy any insurance, even if the interest rate on the loan was r . As individuals would not buy insurance, the investor knows that there will be less than full repayment in all states. As such, the investor sets $i^*(w)$ so as to offset losses incurred in the bad state by gains in the good state.

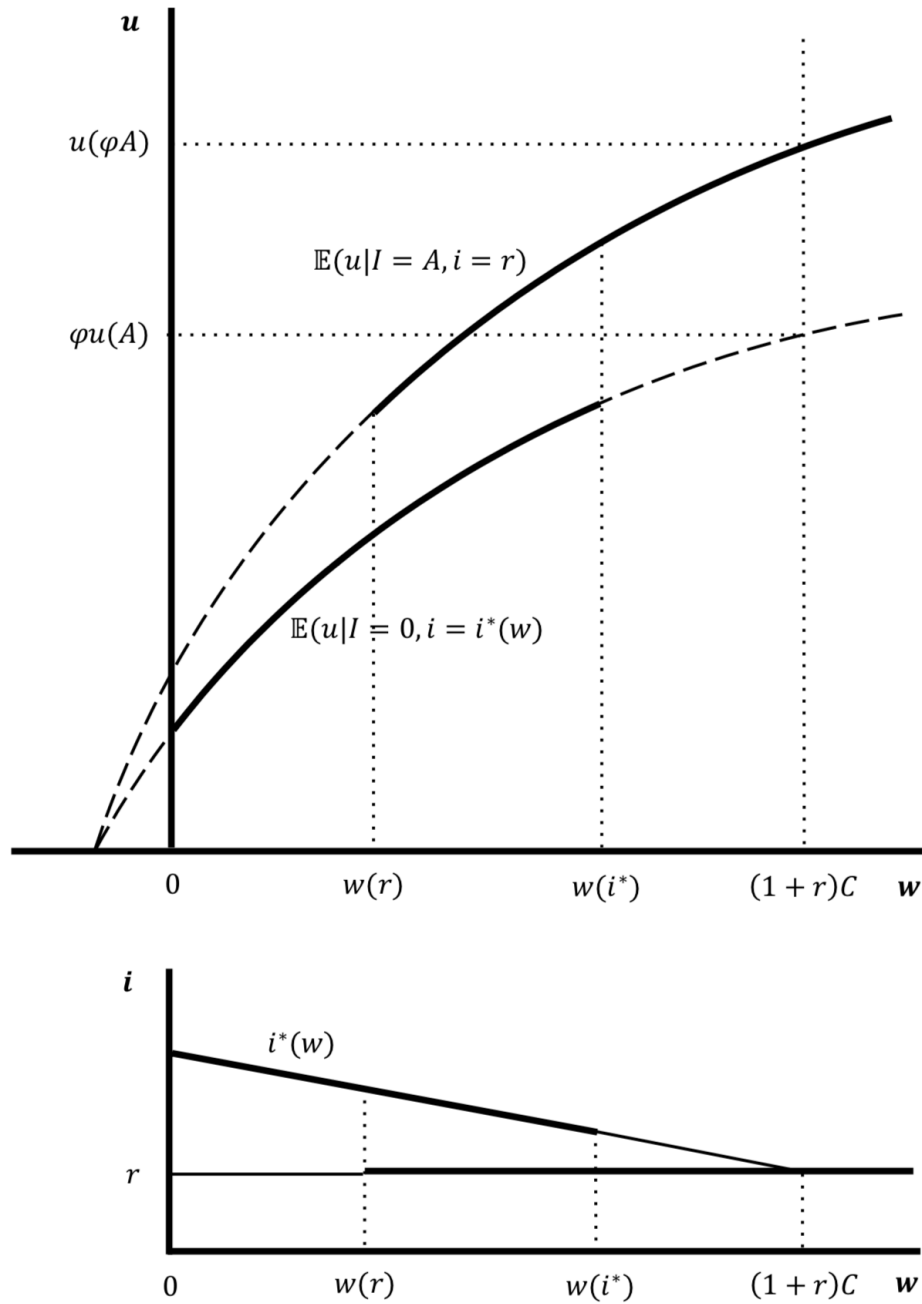
In the region $w(r) \leq w \leq w(i^*)$, the equilibrium outcome depends upon the interest rate that the investor sets. If the investor sets $i = i^*(w)$ then the repayment required in the bad state is relatively large. This reduces the value of explicit insurance and deters individuals from purchasing insurance. However, if the investor sets $i = r$ then the repayment required in the bad state is smaller, so the value of implicit insurance is less, and the value of explicit insurance is greater. Due to this, the individual purchases full insurance if $i = r$.

Importantly, an investor would only set $i = r$ in the region $w(r) \leq w \leq w(i^*)$ if the individual would subsequently choose to purchase insurance. Hence, if no insurance market exists in a geographic area, the investor would have to set $i = i^*(w)$. But then, with the interest rate at $i = i^*(w)$, no insurance would be purchased if it was offered, so insurance companies may not enter the market. Thus, we have a coordination problem. This is problematic because in the region $w(r) \leq w \leq w(i^*)$ the individual has a strictly higher expected utility from a standard debt

contract at r and insurance, to a standard debt contract at $i^*(w)$ without insurance. This is shown by the expected utility curves in Figure A.5.

Finally, in the region $w > w(i^*)$, the individual would purchase full insurance regardless of whether the investor set $i = i^*(w)$ or $i = r$. This is because the value of explicit insurance more than offsets the limited, if any, implicit insurance. As there is full repayment of the loan in all states, an interest rate of r is consistent with a competitive market.

Figure A.5: Equilibrium Outcomes



Hence, implicit insurance and coordination problems explain why the impact investment mechanism of debt financing with insurance is rare, especially at low and moderate wealth levels.

A.7 Conclusion

In summary, the common perception that credit and insurance are complementary may seem at odds with empirical observations regarding contingent loans and debt financing with insurance. We observe that both of these impact investing mechanisms have low take-up rates. This appendix attempts to reconcile the theory with the empirics.

The model developed recognises that both exogenous and endogenous factors affect the probability of investment success. Importantly, the choice of high effort by an individual increases the likelihood of success but carries with it either a pecuniary or non-pecuniary cost. Regardless of the type of cost, there are times when contingent loans cannot be provided. Where effort cost is pecuniary, the cost in the bad state in terms of utility is greater for a contingent contract than a standard debt contract. This means that high effort can be supported for a larger range of parameter values when the contract is a standard loan. Where effort cost is non-pecuniary, a dynamic analysis of credit and insurance purchasing decisions reveals that unless the individual's incentive compatibility constraint is satisfied for the full insurance contract, no contingent contract can be provided. Paradoxically, the presence of a separate insurance market means that individuals are not offered insurance in the form of a contingent contract. This explains the rarity of contingent loans.

In relation to the mechanism of debt financing with insurance, individuals may rationally decide not to purchase insurance due to the implicit insurance provided by the limited liability in standard debt contracts.⁴⁸⁶ At low wealth levels, the value of implicit insurance is large and so the value of explicit insurance is small. This problem is exacerbated by the fact that a lack of coordination between investors and insurers may mean the interest rate is set at a higher rate than what could be supported in equilibrium. This explains why the mechanism of debt financing with insurance is rarely observed.

Of course, one way to overcome the issue of implicit insurance would be write into credit contracts that insurance payouts are not claimable in the event of default. This would increase insurance take-up. However, then the contracts would be equivalent to state contingent contracts and so they would rarely be financially viable. Therefore, the lack of insurance take-up due to implicit insurance may be a necessary evil rather than a problem to be overcome.

In terms of who provides credit and insurance, many academics and practitioners alike have suggested that microcredit organisations are a good distribution channel for insurance. Commonly cited reasons for this are that they have already secured individuals' trust and that

⁴⁸⁶The finding that individuals sometimes choose zero insurance coverage on an investment is consistent with the result postulated by Giné and Yang (2009). However, Giné and Yang do not show that this is an equilibrium outcome. Nor do they explain why standard debt contracts exist or point out the multiple equilibria result.

their existing networks reduce the cost of administering insurance. An additional benefit implied by this paper is that it may help to overcome coordination problems.⁴⁸⁷

There are other ways the coordination problem can be overcome without credit and insurance being offered together. Indeed, the multiple equilibria result explains many field observations. For example, credit providers in India often require individuals to present certificates proving that they have insurance coverage before they are offered a loan. This insurance acts as a substitute for collateral, enabling the efficient equilibrium to be obtained.

It is therefore not inconsistent for credit and insurance to be complementary, but for the investment mechanisms of contingent loans and debt financing with insurance to have low take-up rates. This suggests that the underlying issue is not the degree of complementarity of credit and insurance, but rather the design of impact investing mechanisms.

A.8 Proofs

Proof of Lemma A.1:

Differentiating $\beta^*(e)$ gives $\frac{u'(w+A-D-e_p)(-1)u(w+A-D)-u(w+A-D-e_p)u'(w+A-D)}{[u(w+A-D)]^2}$. Since $u' > 0$ and $u \geq 0$ we know the numerator is negative and the denominator is positive. Hence, $\frac{\partial \beta^*(e)}{\partial e} < 0$. We can write $\beta^*(c) = \frac{\varphi u(w+A-R-e_p) + (1-\varphi)u(w+S-e_p)}{\varphi u(w+A-R)} - \frac{(1-\varphi)u(w+S)}{\varphi u(w+A-R)}$. For notational convenience let $x = w + A - R - e_p$, $y = w + S - e_p$, and $z = w + A - R$. Differentiating gives $\frac{\partial \beta^*(e)}{\partial e} = \frac{\varphi u(z)[\varphi u'(x)(-1) + (1-\varphi)u'(y)(-1)] - \varphi u'(z)[\varphi u(x) + (1-\varphi)u(y)]}{[\varphi u(z)]^2}$. The numerator consists of a negative term minus a positive term, so is negative. The denominator is a positive squared, so is positive. Thus, $\frac{\partial \beta^*(e)}{\partial e} < 0$.

Proof of Proposition A.1:

From Lemma A.1 we know that for each e_p there is only one value of β that makes the incentive compatibility constraint hold with equality. It is therefore sufficient to show that for one $\beta(c) < \beta^*(c)$ the constraint holds, and for one $\beta(c) > \beta^*(c)$ the constraint does not hold. We know by definition that the constraint holds if $\beta(c) = \beta^*(c)$. In this proof and subsequent proofs, let us denote the contingent contract by CC and the standard debt contract by SDC .

First, let us consider what happens in the limit as $\beta \rightarrow 1$ for $e > 0$. $\lim_{\beta \rightarrow 1} \varphi \beta = \varphi$. Therefore, $\lim_{\beta \rightarrow 1} \mathbb{E}(u|e = low, CC) = \varphi u(w + A - R) + (1 - \varphi)u(w + S)$. From Figure A.3 we know that $\mathbb{E}(u|e = high, CC) = \varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p)$. It follows that $\forall c > 0$, $\lim_{\beta \rightarrow 1} \mathbb{E}(u|e = low, CC) > \mathbb{E}(u|e = high, CC)$. Hence, the incentive compatibility constraint does not hold for $\beta(c) > \beta^*(c)$.

⁴⁸⁷ If the same provider offered both credit and insurance, a lower interest rate could be set on the loan in the region $w(r) \leq w \leq w(i^*)$, leading to a higher expected utility for the individual.

Now consider the limit as $\beta \rightarrow 0$ for $c = \varepsilon$. $\lim_{\beta \rightarrow 0} \mathbb{E}(u|e = \text{low}, CC) = (1 - \varphi)u(w + S)$. Recall that $\mathbb{E}(u|e = \text{high}, CC) = \varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \approx \varphi u(w + A - R) + (1 - \varphi)u(w + S)$, since $e_p = \varepsilon$. Now the maximum of R is $A(1 - \varphi) + C(1 + r)$ as this corresponds to full insurance. Substituting in for R gives $\mathbb{E}(u|e = \text{high}, CC) \approx \varphi u(w + \varphi A - C(1 + r)) + (1 - \varphi)u(w + S)$. As high effort is productive, $\varphi A > C(1 + r)$, so $u(w + \varphi A - C(1 + r)) > 0$. It follows that $\lim_{\beta \rightarrow 0} \mathbb{E}(u|e = \text{high}, CC) > \mathbb{E}(u|e = \text{low}, CC)$, so the constraint holds for $\beta(c) < \beta^*(c)$.

Proof of Proposition A.2:

We follow a similar approach to the previous proof. First note that $\lim_{\beta \rightarrow 1} \mathbb{E}(u|e = \text{low}, SDC) = \varphi u(w + A - D) + (1 - \varphi)u(w - D)$. Recall $\mathbb{E}(u|e = \text{high}, SDC) = \varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p)$. Therefore, $\forall e > 0$, $\lim_{\beta \rightarrow 1} \mathbb{E}(u|e = \text{low}, SDC) > \mathbb{E}(u|e = \text{high}, SDC)$, so the incentive compatibility constraint does not hold for $\beta(e) < \beta^\wedge(e)$.

$\lim_{\beta \rightarrow 0} \mathbb{E}(u|e = \text{low}, SDC) = (1 - \varphi)u(w - D) = (1 - \varphi)u(0) = 0$, because $C > w$, so $\therefore D > w$. Recall that $\mathbb{E}(u|e = \text{high}, SDC) = \varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p) \approx \varphi u(w + A - D)$, where $e_p = \varepsilon$. From zero-profit condition (A.1), $D = \frac{(1+r)C - (1-\varphi)w}{\varphi}$. Substituting this in gives $\mathbb{E}(u|e = \text{high}, SDC) \approx u\left(w + A - \frac{(1+r)C - (1-\varphi)w}{\varphi}\right) = u\left(\frac{w + \varphi A - (1+r)C}{\varphi}\right)$. As $\varphi A > (1 + r)C$, it follows that $\mathbb{E}(u|e = \text{high}, SDC) > 0$. Hence, $\lim_{\beta \rightarrow 0} \mathbb{E}(u|e = \text{high}, SDC) > \mathbb{E}(u|e = \text{low}, SDC)$, so the constraint holds for $\beta(e) < \beta^\wedge(e)$. As the constraint holds for $\beta(e) = \beta^\wedge(e)$ by definition, the proof is complete.

Proof of Proposition A.3:

If it is the case that $\beta^\wedge(e) > \beta^*(e)$,

$$\therefore \frac{u(w + A - D - e_p)}{u(w + A - D)} > \frac{\varphi u(w + A - R - e_p) + (1 - \varphi)[u(w + S - e_p) - u(w + S)]}{\varphi u(w + A - R)}$$

$$\therefore \varphi u(w + A - R)u(w + A - D - e_p) > \varphi u(w + A - R - e_p)u(w + A - D) + (1 - \varphi)u(w + A - D)[u(w + S - e_p) - u(w + S)]$$

Now we know that the term $(1 - \varphi)u(w + A - D)[u(w + S - e_p) - u(w + S)]$ is negative since $u(w + S) > u(w + S - e_p)$. Furthermore, we can show that $\varphi u(w + A - R)u(w + A - D - e_p) \geq \varphi u(w + A - R - e_p)u(w + A - D)$. To see why this is the case, first note that the sum of the parameters in the term $u(w + A - R)u(w + A - D - e_p)$ is equal to the sum of the parameters in $u(w + A - R - e_p)u(w + A - D)$. It follows from the expected utility theorem and the fact that $u'' < 0$ that if $|(w + A - R) - (w + A - D - e_p)| \leq |(w + A - R - e_p) - (w + A - D)|$ then $u(w + A - R)u(w + A - D - e_p) \geq u(w + A - R - e_p)u(w + A - D)$. It is known that $D \leq R$,

$$\therefore w + A - D \geq w + A - R \gtrless w + A - D - e_p \geq w + A - R - e_p$$

$$\begin{aligned}
&\therefore u(w + A - D) \geq u(w + A - R) \gtrsim u(w + A - D - e_p) \geq u(w + A - R - e_p) \\
&\therefore |(w + A - R) - (w + A - D - e_p)| \leq |(w + A - R - e_p) - (w + A - D)| \\
&\therefore u(w + A - R)u(w + A - D - e_p) \geq u(w + A - R - e_p)u(w + A - D)
\end{aligned}$$

The intuition is that the individual has a higher expected utility if his or her incomes in each state are more similar. The difference between an income of $w + A - D$ and an income of $w + A - R - e_p$ is never less than the difference between an income of $w + A - D - e_p$ and an income of $w + A - R$. Since $\varphi u(w + A - R)u(w + A - D - e_p) \leq \varphi u(w + A - R - e_p)u(w + A - D)$ and $(1 - \varphi)u(w + A - D)[u(w + S - e_p) - u(w + S)] < 0$, it follows that $\varphi u(w + A - R)u(w + A - D - e_p) > \varphi u(w + A - R - e_p)u(w + A - D) + (1 - \varphi)u(w + A - D)[u(w + S - e_p) - u(w + S)]$. Hence, $\beta^\wedge(e) > \beta^*(e)$.

Proof of Proposition A.4:

From (A.4), e_p^* is defined by $\varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) = u(w)$, and from (A.6), $e_p^\wedge$ is defined by $\varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p) = u(w)$. The left-hand side in each of these equations is the expected utility from high effort, whilst the right-hand side is the reservation utility. It is obvious that the partial derivative of the expected utility from high effort with respect to e_p is negative for both types of contracts. The partial derivatives, with a contingent contract denoted CC and a standard debt contract denoted SDC, are given by:

$$\frac{\partial \mathbb{E}(u|e = \text{high}, \text{CC})}{\partial e_p} = \varphi u'(w + A - R - e_p)(-1) + (1 - \varphi)u'(w + S - e_p)(-1) < 0$$

$$\frac{\partial \mathbb{E}(u|e = \text{high}, \text{SDC})}{\partial e_p} = \varphi u'(w + A - D - e_p)(-1) + (1 - \varphi)u'(w - D - e_p)(-1) < 0$$

Given this, in order to prove that $e_p^* \geq e_p^\wedge$ we simply need to show that $\mathbb{E}(u|e = \text{high}, \text{CC}) \geq \mathbb{E}(u|e = \text{high}, \text{SDC})$. As we have assumed that the investor makes zero-profit, the expected income under both contracts must be the same. Recall that since $S \geq -w$, $\therefore R \geq D$. Hence, $w - D - e_p \leq w + S - e_p \leq w + A - R - e_p \leq w + A - D - e_p$. As $u > 0$, it follows that $u(w - D - e_p) \leq u(w + S - e_p) \leq u(w + A - R - e_p) \leq u(w + A - D - e_p)$. By the expected utility theorem it follows that $\varphi u(w + A - R - e_p) + (1 - \varphi)u(w + S - e_p) \geq \varphi u(w + A - D - e_p) + (1 - \varphi)u(w - D - e_p)$. This proves that $e_p^* \geq e_p^\wedge$.

Proof of Proposition A.6:

For a contract (R, S) to be provided it must satisfy both the individual's incentive compatibility constraint (A.9) and the investor's zero-profit condition $\varphi R = (1 - \varphi)S + C(1 + r)$. All contracts that satisfy both requirements lead to the same expected income for the individual, given by $w + \varphi A - \varphi R + (1 - \varphi)S - e_p$. Therefore, by the expected utility theorem, the individual's expected utility increases as the *ex post* incomes in each state become more similar, that is when $|(w + A - R - e_p) - (w + S - e_p)|$ becomes smaller. Hence, if (A.10) holds, the full insurance contract is optimal.

If (A.10) does not hold, then the individual would choose low effort if offered the full insurance contract. But then the individual would no longer be fully insured, since with $\varphi(1 - \beta)$ probability the good state would occur, but the investment would be unsuccessful. Also, the investor does not break-even from a full insurance contract if (A.10) does not hold, since $\varphi\beta R + \varphi(1 - \beta)w < (1 - \varphi)S + C(1 + r)$. Thus, the optimal contract provides full insurance if and only if (A.10) holds.

If (A.10) does not hold, the optimal contract must still induce high effort and ensure the investor breaks-even. Therefore (R, S) must satisfy (A.2) and (A.9). (A.9) reduces to $\varphi(1 - \beta)u(w + A - R) \geq e_n$. As previously pointed out, an increase in R (and a corresponding increase in S) increases expected utility and leaves expected income unchanged if (A.2) is satisfied. The largest R that satisfies the incentive compatibility constraint is where the constraint holds with equality. It follows that the contract (R, S) that maximizes the individual's utility subject to the investor's zero-profit condition being satisfied is $(\hat{R}, \hat{S})$, as given by equations (A.11) and (A.12).

For sufficiently large e_n it is possible that no (R, S) can satisfy both (A.11) and (A.12), and so no $(\hat{R}, \hat{S})$ contract exists. However, if no $(\hat{R}, \hat{S})$ exists there is no optimal contract. Suppose that the $\hat{R}$ that solves (A.11) is less than D . If the investor offers a contract with $R \leq \hat{R}$ then the incentive compatibility constraint is satisfied and the individual choose high effort, but as $R \leq \hat{R} < D$, the investor does not break-even. Recall that zero-profit is given by $\varphi D + (1 - \varphi)w = (1 + r)C$, so if $R < D$ it does not hold. If the investor instead set $R > \hat{R}$ then the incentive compatibility constraint is not satisfied and the individual chooses low effort, which is unproductive. Therefore if $(\hat{R}, \hat{S})$ does not exist, an optimal contract does not exist.

This proves that the optimal contract provides full insurance if (A.10) holds and is given by $(\hat{R}, \hat{S})$ if (A.10) does not hold.

Proof of Observation A.1:

From (A.16), the maximum interest rate that ever satisfies the investor's zero-profit condition occurs at $w = 0$ and is given by $1 + i^*(0) = \frac{1+r}{\varphi}$. Suppose that the investor set this maximum interest rate and the individual purchased full insurance coverage. Then the individual's utility would be $u\left(w + \varphi A - \frac{(1+r)C}{\varphi}\right) = u\left(w + \frac{\varphi^2 A - (1+r)C}{\varphi}\right)$. It follows that if $\varphi^2 A > (1 + r)C$ then it is always the case that $V(i) > u(w)$.

Proof of Lemma A.2:

Suppose that in equilibrium $i(w) = r$ and $I = 0$. Then the investor would get back no more than $(1 + r)C$ in each state. From equation (A.15), the only region of w where this is feasible is $w \geq (1 + r)C$. However, in this region the individual prefers $I > 0$. To see this, note that the expected payoffs from $I = 0$ and $I > 0$ are equal at $i(w) = r$ and are given by $w + \varphi A - (1 + r)C$. Since for risk-averse individuals $\mathbb{E}(u(.)) < u(\mathbb{E}(.))$, it follows that $I > 0$ is preferred.

Let us now show that if $I > 0$, full insurance is optimal. From (A.14), if $I > 0$ and $i(w) = r$ it must be that $w + I > (1 + r)C + (1 - \varphi)I$. Otherwise the individual would not benefit from the

insurance payout as it would simply go towards the loan repayment in the bad state. Therefore, the borrower's payoff in the good state is $A + w - (1 + r)C - (1 - \varphi)I$ and the payoff in the bad state is $w + I - (1 + r)C - (1 - \varphi)I = w + \varphi I - (1 + r)C$. This gives an expected payoff of $\varphi u(A + w - (1 + r)C - (1 - \varphi)I) + (1 - \varphi)u(w + \varphi I - (1 + r)C)$. Differentiating with respect to I gives $\frac{\partial \mathbb{E}(u)}{\partial I} = \varphi u'(A + w - (1 + r)C - (1 - \varphi)I)[-(1 - \varphi)] + (1 - \varphi)u'(w + \varphi I - (1 + r)C)[\varphi]$. Setting this equal to zero gives us $I = A$. This is a maximum since $\frac{\partial^2 \mathbb{E}(u)}{\partial I^2} = \varphi u''(A + w - (1 + r)C - (1 - \varphi)I)[-(1 - \varphi)]^2 + (1 - \varphi)u''(w + \varphi I - (1 + r)C)[\varphi]^2 < 0$. This proves the first part.

Suppose the second part was not true and instead $I > 0$. For this to be the case, the borrower's payoff must be strictly positive even in the bad state. But then the investor is getting back his due with probability one. The zero-profit condition for the investor implies that $i(w)$ must equal r , but this contradicts our hypothesis that the equilibrium interest rate is greater than r . Therefore $I = 0$.

Proof of Lemma A.3:

Differentiating (A.14) and (A.17) with respect to w gives $\frac{\partial V(i)}{\partial w} = \varphi u'(w + A - (1 + i(w))C - (1 - \varphi)I) + (1 - \varphi)u'(\max[w + \varphi I - (1 + i(w))C, 0])$ and $\frac{\partial \mathbb{E}(u|I=0)}{\partial w} = \varphi u'(w + A - (1 + i(w))C)$ respectively. Since $w + A - (1 + i(w))C \geq w + A - (1 + i(w))C - (1 - \varphi)I$, therefore $u'(w + A - (1 + i(w))C) \leq u'(w + A - (1 + i(w))C - (1 - \varphi)I)$. It follows that $\frac{\partial \mathbb{E}(u|I=0)}{\partial w} \leq \frac{\partial V(i)}{\partial w}$. Hence, if for some w' , $V(i, w') > \mathbb{E}(u|I = 0, w')$, then for all $w > w'$ it must be that $V(i, w) > \mathbb{E}(u|I = 0, w)$. Conversely, if for some w' , $V(i, w') = \mathbb{E}(u|I = 0, w')$, then for all $w < w'$ it must be that $V(i, w) = \mathbb{E}(u|I = 0, w)$. The set is therefore convex.

Proof of Lemma A.4:

Since the set of w for which $V(i) > \mathbb{E}(u|I = 0)$ is convex (Lemma A.3), if $w < w(i)$ then it must be that $V(i) = \mathbb{E}(u|I = 0)$. Furthermore, $V(i)$ exceeds the utility from making no investment. Therefore, the utility from making the investment and buying no insurance is the maximum possible utility, so the individual chooses $I = 0$.

Proof of Lemma A.5:

It follows from Lemma A.3 that if $w > w(i)$ then it must be that $V(i) > \mathbb{E}(u|I = 0)$. But then for a given i the individual could make themselves better off by choosing I other than $I = 0$.

Proof of Lemma A.6:

It is known from the proof of Lemma A.2 that when $i = r$ and $I > 0$ the individual's utility maximizing choice of I is A . Also, when $i = r$ and $I = 0$ then the utility of the individual is $\varphi u(w + A - (1 + r)C)$. Now since $w > w(i)$ it is known that $V(r) > \mathbb{E}(u|I = 0, i = r)$. It follows that if $i = r$ then in the region $w > w(i)$, individuals maximize their utility by choosing $I = A$. This is an equilibrium because the investor and insurer's zero profit conditions are satisfied.

Proof of Lemma A.7:

From the definition of $w(r)$, it follows that at $i = r, I = 0$ is a utility maximizing level of insurance for an individual with the wealth level $w = w(r)$.

Step 1. Let us first show that $w(r) < (1 + r)C$. From (A.17), $\lim_{w \rightarrow (1+r)C} \mathbb{E}(u|I = 0, i = r) = \varphi u(A)$. Also, from the proof of Lemma A.2 it is known that when $i = r$ and $I > 0$ the utility maximizing choice of I is A . Therefore, $\lim_{w \rightarrow (1+r)C} V(r) = \max \{u(\varphi A), \varphi u(A)\}$. Since $u(\mathbb{E}(\cdot)) > \mathbb{E}(u(\cdot))$ for a risk-averse individual, $\lim_{w \rightarrow (1+r)C} V(r) > \lim_{w \rightarrow (1+r)C} \mathbb{E}(u|I = 0, i = r)$. However, if $V(r) > \mathbb{E}(u|I = 0, i = r)$ then, from Lemma A.3, $w > w(r)$. It follows that $w(r) < (1 + r)C$.

Step 2. For $i \in \left(r, \frac{1+r}{\varphi} - 1\right]$, $I = 0$ must be the unique utility maximizing choice at $w = w(r)$. By the definition of V and $w(r)$,

$$\begin{aligned} V(r) &= \max_I \left\{ \varphi u \left(\underbrace{w(r) + A - (1 + r)C - (1 - \varphi)I}_{\text{A}} \right) \right. \\ &\quad \left. + (1 - \varphi)u \left(\max \left[\underbrace{w(r) + \varphi I - (1 + r)C}_{\text{B}}, 0 \right] \right) \right\} \\ \therefore V(r) &= \mathbb{E}(u|I = 0, i = r) \\ \therefore V(r) &= \varphi u \left(\underbrace{w(r) + A - (1 + r)C}_{\text{C}} \right) \end{aligned}$$

Now suppose that at this wealth level $w = w(r)$ instead of the interest rate being $i = r$, it was $i \in \left(r, \frac{1+r}{\varphi} - 1\right]$. If $I > 0$ then $u(A)$ would decrease by more than $u(C)$ because $u''(\cdot) < 0$. Furthermore, $u(\max[B, 0])$ cannot increase from a higher interest rate. Hence, if $w = w(r)$, $i \in \left(r, \frac{1+r}{\varphi} - 1\right]$, and $I > 0$, it follows that $\varphi u(A) + (1 - \varphi)u(\max[B, 0]) < \varphi u(C)$. Thus, $I > 0$ cannot be a utility maximizing choice at $w(r)$. The unique utility maximizing choice is $I = 0$.

Step 3. To complete the proof of Lemma A.7, it is sufficient to prove that there exists some $w > w(r)$ for which the utility maximizing choice of individual with wealth w at the interest rate $i^*(w)$ is exactly $I = 0$. If this is false, then one can find a sequence w_j with $w_j > w(r)$ and $\lim w_j \rightarrow w(r)$ such that for all j , the utility maximizing choice I_j for the agent w_j facing the interest rate $i^*(w_j)$ is $I_j \neq 0$. If $I_j \neq 0$, then it must be that $\varphi I \geq (1 + i^*(w_j))C - w_j$ and thus in the limit, $\lim I_j = I^* \neq 0$. This is because $w(r) < (1 + r)C$. But as $j \rightarrow \infty$, $w_j \rightarrow w(r)$ and thus in the limit, I^* is an optimal choice for $w = w(r)$ at the interest rate $i(w(r))$. Since $I^* \neq 0$ and $i^*(w(r)) > r$, this contradicts what was established in Step 2. Thus, an equilibrium with $i = i^*(w) > r$ can be supported for some $w > w(r)$. This concludes the proof.

Proof of Lemma A.8:

From Lemma A.4 we know that at the wealth level $w(i^*)$, $V = \mathbb{E}(u|I = 0, i = i^*)$, and at this *same* interest rate $V = \mathbb{E}(u|I = 0) \forall w < w(i^*)$. Here we want to show that the *variable* interest rate $i^*(w)$ is an equilibrium for $w < w(i^*)$. Given Lemma A.4, Lemma A.8 holds if $\frac{\partial V(i^*(w))}{\partial w} \geq \frac{\partial \mathbb{E}(u|I=0, i=i^*(w))}{\partial w}$ because then for any $w < w(i^*)$ and interest rate function $i^*(w)$, the utility of the individual is maximized by choosing $I = 0$. Differentiating (A.18) and (A.19) with respect to w gives:

$$\frac{\partial \mathbb{E}(u|I = 0, i = i^*(w))}{\partial w} = \varphi u' \left(\underbrace{A + \frac{w - (1+r)C}{\varphi}}_{\mathbb{X}} \right) \left(\frac{1}{\varphi} \right)$$

$$\frac{\partial V(i^*(w))}{\partial w} = \varphi u' \left(\underbrace{A + \frac{w - (1+r)C}{\varphi} - (1-\varphi)I}_{\mathbb{Y}} \right) \left(\frac{1}{\varphi} \right) + (1-\varphi) u' \left(\varphi I + \frac{w - (1+r)C}{\varphi} \right) \left(\frac{1}{\varphi} \right)$$

Here $\mathbb{X} \geq \mathbb{Y}$, so $u'(\mathbb{X}) \leq u'(\mathbb{Y})$. Since $u'(\cdot) > 0$, therefore $\frac{\partial V(i^*(w))}{\partial w} \geq \frac{\partial \mathbb{E}(u|I=0, i=i^*(w))}{\partial w}$, as required.

Appendix B.

A Model of Direct Government Investment with Taxation, Social Impact Bonds, and Tradeable Income- Based Securities

B.1 Introduction

This appendix researches two existing contingent-repayment impact investing mechanisms. First, direct government investment with taxation. Secondly, social impact bonds. Whereas Appendix A focuses on impact investments that increase productivity indirectly via physical capital accumulation, the focus here is on impact investments that increase productivity directly via human capital accumulation. Both approaches are consistent with the class of impact investments that are the subject of this dissertation research.

To begin, a formal microeconomic model is developed, and the first-best level of social value creation is discovered. The appendix then proceeds to research whether the two existing mechanism designs can achieve and maintain the first-best in equilibrium. It is discovered that neither existing mechanism design is able to sustain the first-best in equilibrium. The mechanism design properties that prevent the first-best from being obtained are investigated and explained.

Given this, the appendix proceeds to research, within the same model framework, whether the modified mechanism design, implied by research in Chapters 3-6 and explained in detail in Chapter 7, satisfies the first-best. It is proven mathematically that this is the case – that the first-best can be achieved and sustained in equilibrium with the mechanism design of Tradable Income-Based Securities (TIBS). This is a significant finding. The exact contractual form necessary for the first-best is also discovered.

B.2. Model Setup

We begin with a basic model where impact investments are made in individuals in a community. Suppose that there is a community of N homogeneous individuals. Let this set of individuals be denoted Z so that $Z = \{z_1, \dots, z_i, \dots, z_N\}$.

For the sake of intuition, it is helpful to think of this community as a subset of a national population that has low-income levels and is initially neglected by the government when it comes to human capital investments.

There are a range of investments that can be made in individuals in the community – including the provision of health, education, sanitation, and housing. These goods/services can be provided to specific individuals and are considered excludable and rivalrous. However, their provision does create positive externalities in the form of greater taxation revenue for the government.

These investments can be made by one of two financiers - the government, denoted G , or a private investor, denoted P . Each investor can choose an investment quantity q , where $q \geq 0$. The quantity of investment is observable to both the government and the private investor. Let us denote q_i^P and q_i^G as the quantity of investment in individual i (that is, the quantity of goods/services provided) by the private investor and government respectively. The aggregate quantity of investment by each investor is Q^P and Q^G , the total investment in individual i is q_i where $q_i = q_i^P + q_i^G$, and the total overall investment quantity is Q where $Q = \sum_{i=1}^N q_i = Nq_i$.

The investments are made at a cost c per unit of investment, where $c \geq 0$. That is, cost is a linear function of investment quantity, cq_i , and is the same for private investors and the government.⁴⁸⁸ Total overall cost is given by $C = \sum_{i=1}^N cq_i = Ncq_i$.

To carry out the provision of goods, these investors employ M workers, where $M \geq 2$. Let the set of workers be $L = \{l_1, \dots, l_k, \dots, l_M\}$. Each worker can choose to exert low effort L at no cost, or high effort H at cost $e > 0$. That is, effort cost is given by $E = [0, e]$. As such, the vector of effort cost can be written as $E = (E_1, \dots, E_k, \dots, E_M)$, the average cost of effort can be expressed as $\bar{E} = \frac{\sum_{k=1}^M E_k}{M}$, and the proportion of workers exerting high effort is given by $\rho = \frac{\sum_{k=1}^M E_k}{eM}$. This effort level is assumed to be unobservable by the government and private investor.

The combination of the quantity of investment made and the effort level exerted by workers determines the social outcomes of individuals in the community. To understand what is meant by the term *social outcomes*, it is worth noting that the quantity of investment refers to measurable outputs such as years of schooling or number of hospital beds. In contrast, social outcomes refer to the actual results such as changes in literacy or health levels. The former is observable and independent of effort level, whereas the latter is not observable and depends on the effort exerted by workers.⁴⁸⁹ Put differently, effort determines quality.

More precisely, let the level of social outcomes for i be a continuous variable s_i . This is a weakly increasing function of q_i and ρ , so $s_i = s(q_i, \rho)$ and $\frac{\partial s_i}{\partial q_i}, \frac{\partial s_i}{\partial \rho} \geq 0$. Hence, social outcomes are a function of investment quantity and average worker effort, with increases in quantity or effort weakly increasing social outcomes. It is assumed that the function takes the form $s_i = q_i \rho$. The total level of social outcomes within the community is given by $S = \sum_{i=1}^N s_i$.

The level of social outcomes for an individual determines their income. Mathematically, let $y_i = y(s_i) = as_i^\theta$, where a is a positive parameter that is constant across individuals and $\theta \in (0,1)$. As such, social outcomes strictly increase income, but there are decreasing returns to social outcomes. It follows that quantity and effort weakly increase the incomes of the investment recipients. As such, the partial derivatives of income y with respect to q^G , q^P , and ρ are weakly positive, $\frac{\partial y}{\partial q^P}, \frac{\partial y}{\partial q^G}, \frac{\partial y}{\partial \rho} \geq 0$. It is also assumed that $\lim_{q_i \rightarrow 0} \frac{\partial y_i}{\partial q_i} > \frac{\partial cq_i}{\partial q_i}$. That is, the differential of the income function is greater than the differential of the cost function. Since the cost function is linear and not concave, this ensures the functions will cross and tangents will be parallel at some q .

Individuals pay a percentage share of their income as taxation to the government, denoted $\tau \in [0,1]$. Taxation revenue from individual i is then given by $T_i = \tau y_i$. It is assumed that taxation revenue is perfectly enforced with no non-compliance.

⁴⁸⁸ This means that isoquants and isocosts are linear and overlapping.

⁴⁸⁹ We assume unobservability of social outcomes, though the same results would be obtained if we equivalently assumed that measurement is prohibitively costly or sufficiently imperfect.

Utility is a weakly increasing concave function of disposable income y^D , where $y_i^D = (1 - \tau)y_i$. As such, $u_i = u(y_i, \tau) = u(y_i(1 - \tau)) = u(y_i^D)$. Also, $u'(y^D) > 0$, $u''(y^D) < 0$.⁴⁹⁰

The government acts as a risk-neutral benevolent social planner that seeks to maximize the aggregate well-being of the community by maximizing the individualistic egalitarian social welfare function $\Psi[u_1, \dots, u_i, \dots, u_N]$. Note that since all u_i 's are concave, we know the corresponding social welfare function will be concave.⁴⁹¹ It is assumed to be twice differentiable and increasing in all its arguments.

The government has no utility function of its own, sets the flat tax rate, can contract with private investors, can collect taxation at no cost, and has no endowment. It is further assumed that the government may financially incentivize workers to exert high effort but cannot sack workers for exerting low effort. This reflects the empirical reality that firing is normally more difficult in the public sector due to the greater prevalence of unions, industrial relations policy, and unfair dismissal laws.

Private investors are also risk-neutral with no utility function. However, unlike the government, they cannot collect taxation, their objective is to maximize financial return, and they have the capacity to sack workers.

As far as employment contracts go, employers of workers (that is, the government and private investors) can choose between two contracts. First, a wage-based contract that pays workers a wage of c for each unit of average output $\bar{q}$. Secondly, a performance-based contract that pays workers c for each unit of average outcome $\bar{s}$. It is assumed throughout that $c > e$, meaning that the wage rate exceeds the cost of high effort.⁴⁹²

A few other assumptions are made for tractability purposes. There is only one government entity, no migration in and out of the community, no fraud, no trade in goods or services, no interest rate ($r = 0$), and the same tax rate for all individuals. We also assume independence in the sense that investments in one person do not change the incomes for others within or outside the community, *ceteris paribus*. Furthermore, consumption taxation and corporate taxation are abstracted from. Finally, if the government or a private investor makes investments in a community, it is assumed that the same investment quantity is provided to all individuals. In the government's case, this uniformity can be thought of a political constraint.

B.3 The First-Best Quantity of Investment and Income

Having setup the model and articulated modelling assumptions, let us now determine the first-best level of investment q , the first-best proportion of workers exerting high effort ρ , and the first-

⁴⁹⁰ As such, we are assuming that social outcomes (such as good education and health) do not have utility separate from income.

⁴⁹¹ This follows from well-known theorems on concave functions. Specially, if $f_1, \dots, f_k$ are concave functions, each defined on the same convex subset U of $\mathbb{R}^n$, and where $a_1, \dots, a_k$ are positive numbers, then $a_1 f_1 + \dots + a_k f_k$ is a concave function of U . For a more detailed explanation, see Simon and Blume (1994) Chapter 21, page 519.

⁴⁹² It is assumed that workers collectively provide the goods in the community, meaning that no subset of individual social outcomes can be directly attributed to a subset of workers.

best disposable income y^D . Note that since individuals are homogenous, we can simply look at the representative agent.

As low effort is unproductive, the first-best is where high effort is exerted by all workers, so $\rho = \rho^* = 1$.

First-best q is simply where the income function is tangential to the cost function, so that marginal income equals marginal cost.⁴⁹³ Since the income function is $y = as^\theta = a(q\rho)^\theta$, then the derivative of the income function when $\rho = 1$ is given by:

$$\frac{\partial y_i}{\partial q_i} = \theta a q^{\theta-1}$$

Now the cost function is given by cq , so it follows that:

$$\frac{\partial c_i}{\partial q_i} = c$$

Equating the two,

$$\theta a q^{\theta-1} = c$$

$$\therefore \theta a q^{\theta-1} = c$$

$$\therefore q^{\theta-1} = \frac{c}{a\theta}$$

$$\therefore q^* = \left(\frac{c}{a\theta}\right)^{\frac{1}{\theta-1}}$$

$$\therefore q^* = \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}}$$

Note that the optimal aggregate quantity of investment is therefore given by:

$$Q^* = Nq^* = N \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}}$$

Intuitively, the first-best quantity q^* equates the marginal utility gain from higher income (due to higher q) with the marginal utility loss from additional taxation (required to pay for the additional q). For $q < q^*$, the marginal utility gained from income is higher than the marginal utility lost from additional taxation, while the reverse is true for $q > q^*$.

As for disposable income, this is simply the income when $\rho = 1$ and $q = q^*$, less the cost of goods cq^* . As such,

⁴⁹³ Note that the standard first-best welfare conditions are equality of marginal rates of substitution and transformation.

$$y^{D*} = aq^{*\theta} - cq^*$$

B.4 Mechanism: Government Direct Investment and Taxation

Let us now characterize the equilibrium for the form of impact investing where the government directly makes investments in individuals and generates a financial return in the form of future taxation revenue.

To do this, suppose that, for each person, investments are either made by the government free of charge, or made by individuals themselves by paying a private investor. Let η represent the proportion of the population that receives investment from the government, and $1 - \eta$ the proportion that finances individually. For the moment, let us assume that this is pre-determined. That is, individuals do not choose which category they fall into.

Now let us characterize the equilibria for the two extreme cases of $\eta = 0$ and $\eta = 1$, before then characterising the equilibria for where $\eta \in (0,1)$. As shall be seen, the only two first-best equilibria occur when $\eta = 0$ and $\eta = 1$. Furthermore, $\eta = 0$ is not a subgame perfect Nash equilibrium, and $\eta = 1$ is only a first-best equilibrium for a narrow range of parameter values.

Case of $\eta = 1$

In this case, the government chooses q and τ to maximize the social welfare function.

Proposition B.1: *When $\eta = 1$, the first-best is obtained in equilibrium.*

Proof:

Since individuals are homogenous, the government makes investments in all individuals, and the social welfare function is individualistic, it is sufficient to determine the q and τ that maximize i 's utility function. Furthermore, since u is a strictly increasing concave function of disposable income, it is sufficient to determine the q and τ that maximize i 's disposable income.

To solve this, we can form the following Lagrange function:

$$\mathcal{L} = (1 - \tau)aq^\theta - \lambda(\tau aq^\theta - cq)$$

Note that the first term is disposable income, whereas the final term in brackets represents the government's zero-surplus constraint. For first-best, taxation revenue must fully cover the investment cost. If $\tau aq^\theta < cq$ then tax revenue is insufficient, while if $\tau aq^\theta > cq$ then the government has surplus taxation and so utility (and therefore social welfare) could always be increased by decreasing τ . Hence, $\tau aq^\theta = cq$ for first-best.

The first order conditions are given by:

$$\frac{\partial \mathcal{L}}{\partial q} = (1 - \tau)a\theta q^{\theta-1} - \lambda\tau\theta aq^{\theta-1} + \lambda c = 0 \quad (\text{B.1})$$

$$\frac{\partial \mathcal{L}}{\partial \tau} = -aq^\theta - \lambda aq^\theta = 0 \quad (\text{B.2})$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = cq - \tau aq^\theta = 0 \quad (\text{B.3})$$

Now from (B.2),

$$\lambda = -1 \quad (\text{B.4})$$

Substituting into (B.1) gives:

$$(1 - \tau)a\theta q^{\theta-1} + a\tau\theta q^{\theta-1} - c = 0$$

This reduces to:

$$a\theta q^{\theta-1} - c = 0$$

$$\therefore q^{\theta-1} = \frac{c}{a\theta}$$

$$\therefore q^* = \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}} \quad (\text{B.5})$$

Which is the first-best level of goods, as required. $\square$

Proposition B.2: When $\eta = 1$, the equilibrium taxation rate τ^ equals θ , the concavity of the income function.*

Proof:

Substituting equation (B.5) into (B.3) gives:

$$\tau^* a q^{*\theta} = c q^*$$

$$\therefore \tau^* = \frac{c}{a} q^{*1-\theta}$$

$$\therefore \tau^* = \frac{c}{a} \left(\frac{a\theta}{c}\right)^{\frac{1-\theta}{1-\theta}}$$

$$\therefore \tau^* = \theta \quad \square$$

This is a very elegant and interesting result, somewhat similar to the golden rule savings rate (Phelps, 1965; Phelps, 1967).⁴⁹⁴ The optimal taxation rate is equal to θ , which represents the degree of concavity in the income function. That is, θ represents the degree to which social outputs have decreasing marginal returns. The greater the decreasing marginal returns, the lower the first-best tax rate, and vice-versa.

Case of $\eta = 0$

Let us now consider the equilibrium that arises when goods are only financed by individuals and are not made by the government. Individuals finance investments in themselves by paying a private investor to provide the goods or services. Each individual chooses q_i to maximize u_i , then the government sets and enforces τ .

Proposition B.3: *When $\eta = 0$, the equilibrium is first-best with $q_i = q^*$ and $\tau = 0$.*

Proof:

Let us work backwards. The government's problem is given by $\text{argmax}_{\tau} u = (1 - \tau)a(q\rho)^{\theta}$. Since the government does not need tax revenue to make investments, individual and social welfare is maximized by setting $\tau = 0$, since $\frac{\partial u}{\partial \tau} = -a(q\rho)^{\theta} < 0$ and $0 \leq \tau \leq 1$. Then the individual's problem becomes identical to the working that determined the first-best in Section B.3. Hence, when $\eta = 0$, then $q_i = q^* = \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}} \forall i, \rho = 1$, and $\tau = 0$. $\square$

As such, we have established that the equilibrium is first-best when $\eta = 0$ and when $\eta = 1$.

Case of $\eta \in (0, 1)$

It is possible to prove that for all $\eta \in (0, 1)$, the first-best cannot be obtained.

Proposition B.4: *There is no first-best equilibrium where $\eta \in (0, 1)$.*

Proof:

We know that for the first-best, it is necessary that average effort cost $\bar{E} = e$ (that is, $\rho = 1$) and that $q = q^* = \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}} \forall i$. As such, to prove that $\eta \in (0, 1)$ is not first-best, it is sufficient to prove that $q = q^* = \left(\frac{a\theta}{c}\right)^{\frac{1}{1-\theta}} \forall i$ cannot be supported in equilibrium.

Let us begin by obtaining expressions for q^P and q^G in equilibrium.

⁴⁹⁴ In economics, the golden rate of savings is the proportion of income that, if set aside as savings, would maximize the steady state growth in per capita consumption. See Phelps, E. S. (1965). Second essay on the golden rule of accumulation. The American Economic Review, 55(4), 793-814 and Phelps, E. S. (1967). Golden rules of economic growth: studies of efficient and optimal investment. Golden rules of economic growth: studies of efficient and optimal investment.

Individuals privately financing investments would choose q^P to maximize their utility. Since u is an increasing function of disposable income, this is equivalent to maximizing disposable income. Hence, individuals want to maximize $u[y^D] = u[(1 - \tau)aq^{P\theta} - cq^P]$.

$$\therefore \frac{\partial u}{\partial q^P} = u(.) \left[\theta(1 - \tau)aq^{P\theta-1} - c \right] = 0$$

$$\therefore q^{P\theta-1} = \frac{c}{a\theta(1 - \tau)}$$

$$\therefore q^P = \left(\frac{c}{a\theta(1 - \tau)} \right)^{\frac{1}{\theta-1}} = \left(\frac{a\theta(1 - \tau)}{c} \right)^{\frac{1}{1-\theta}}$$

This represents the quantity of investment that a privately funding individual would choose for any level of τ .

Now the government's problem is to choose τ and q^G so as to maximize social welfare.

Aggregate social welfare here can be expressed as $\Psi = N[(1 - \eta)u^P + \eta u^G]$, where u^P is the utility of a representative privately financed individual and u^G is the utility of a representative government financed individual. As $N > 0$, the government's problem reduces to maximizing average utility. Let $\frac{\Psi}{N} = \bar{u} = (1 - \eta)u^P + \eta u^G$. Hence, the government's objective function is given as follows:

$$\max \bar{u} = (1 - \eta)u[(1 - \tau)aq^{P\theta} - cq^P] + \eta u[(1 - \tau)aq^{G\theta}]$$

subject to the financing constraint that taxation revenue is not less than mean expenditure, which is expressed as:

$$\eta cq^G \leq \eta \tau a q^{G\theta} + (1 - \eta)\tau a q^{P\theta}$$

We know that for the first-best $q_i = q^* = \left(\frac{a\theta}{c} \right)^{\frac{1}{1-\theta}}$ for all i . From previous equations, we know that for $q^P = q^*$ it must be the case that $\tau = 0$. But from the equation above, if $\tau = 0$ then $q^G = 0 \neq q^*$. This contradicts the first-best requirement. $\square$

Intuitively, the first-best cannot be achieved when $\eta \in (0,1)$ due to the existence of a taxation externality. Part of the benefit that results from individuals investing in themselves goes to the government in the form of greater taxation revenue. This taxation externality is not internalised or appropriated by the individual that created it, because the government as a benevolent social planner uses this additional revenue to maximize aggregate social welfare. In this case, that means using the taxation revenue to make investments in non-privately financing individuals. Put simply, the existence of a taxation externality results in under-provision of privately financed investments as some of the investment benefits are captured by the tax.

The existence of a taxation externality, as captured by this model, is not a huge abstraction from reality. There are many situations, such as high-school education, where some individuals privately finance and others rely on government financing. Often those who privately finance are in a stronger financial position, and so benevolent planners often use the taxation revenue they obtain from those privately financing to help those in weaker financial positions. This may be for equality reasons, or because it is what maximizes aggregate welfare as the marginal utility from investments may be greater at lower incomes.

Having shown that the first-best cannot be achieved when $\eta \in (0,1)$, let us now characterize the equilibrium outcome.

Let us first build up some intuition by considering the limiting cases.

Suppose $\eta = 1 - \varepsilon \approx 1$. Then $\tau \approx \theta$, so substituting into $q^P = \left(\frac{a\theta(1-\tau)}{c}\right)^{\frac{1}{1-\theta}}$ gives $q^P = \left(\frac{a\theta(1-\theta)}{c}\right)^{\frac{1}{1-\theta}}$. This is the lower bound of q^P , given by the point where the disposable income function $(1 - \tau)y$ is tangential to the cost function cq , so that marginal revenue and marginal cost are equal. Let us denote this point q^ϕ . Intuitively there is a large taxation externality here due to the high τ , so there is significant underinvestment by individuals. Hence, $\lim_{\eta \rightarrow 1} q^P \rightarrow q^\phi$ from above, while $\lim_{\eta \rightarrow 1} q^G \rightarrow q^*$ from below.

Now suppose the other extreme, that is $\eta = \varepsilon \approx 0$. Then $\tau \approx 0$. As such, $q^P \approx q^*$. Intuitively, if the government only needs to finance goods for ε of N , then the rest of the population $(N - \varepsilon)$ only needs to be charged a very low tax rate to cover the expenditure. Here there is a negligible taxation externality. More specifically, $\lim_{\eta \rightarrow 0} q^P \rightarrow q^*$ from below.

Generally speaking, when $\eta \in (0,1)$, then $q^P \in (q^\phi, q^*)$.

Mathematically, the equilibrium condition when $\eta \in (0,1)$ can be found by differentiating mean utility $\bar{u}$ with respect to τ . This is given by:

$$\frac{\partial \bar{u}}{\partial \tau} = (1 - \eta) \frac{\partial u^P}{\partial \tau} + \eta \frac{\partial u^G}{\partial \tau}$$

Since $\frac{\partial u^P}{\partial \tau} < 0$, while $\frac{\partial u^G}{\partial \tau} > 0$, the equilibrium condition becomes:

$$\eta \frac{\partial u^G}{\partial \tau} = -(1 - \eta) \frac{\partial u^P}{\partial \tau}$$

This says that the government maximizes social welfare by equating the population-weighted marginal welfare gain to u^G from increasing the taxation rate τ with the population-weighted marginal welfare loss to u^P .

Note that we could break down each term further. For example, $\frac{\partial u^P}{\partial \tau}$ is comprised of (a) the direct decrease in utility from a higher τ and therefore less disposable income, (b) the indirect decrease in utility from a lower optimal q^P when τ increases, and (c) the indirect increase in utility from lower cost cq^P when optimal q^P is lower.

Limits to First-Best Equilibria

We have now characterized the equilibria for all η , and have shown that there are only two values of η for which the first-best is obtained ($\eta = 0$ and $\eta = 1$). That is, there are multiple first-best equilibria. However, as we will show, $\eta = 0$ is not a subgame perfect Nash equilibrium, and $\eta = 1$ is only first-best for a sufficiently small number of workers and sufficiently low effort cost.

Individual Financing First-Best Equilibrium (when $\eta = 0$)

While there is a first-best equilibrium at $\eta = 0$ where $q_i^P = q^*$, $q_i^G = 0$ and $\tau = 0$, however this is not a subgame perfect Nash equilibrium because it is not an equilibrium in every subgame.

Suppose the following timeline. First the government announces its intended taxation rate, then individuals choose the quantity of investment, then the government can choose whether to financially invest in individuals free-of-charge to the individual, and finally the government sets the taxation rate and enforces tax collection. This is a reasonable sequence of events, and broadly reflects what happens in the real world.

Proposition B.5: *The equilibrium $\eta = 0$, $q_i^P = q^*$ and $\tau = 0$ is not subgame perfect.*

Let us build up some intuition. Under the first-best equilibrium, the government would announce the tax rate at $\tau = 0$. However, this is not credible. Say an individual i deviates from $q^P = q^*$ and instead makes no investment, so $q_i^P = 0$. Then the government is faced with a new objective function. Since the government is a benevolent social planner, to maximize social welfare it would invest $q_i^G > 0$ in the individual that deviated. This is because of the concavity of the income and utility functions, meaning that investments in individuals with low q and u , financed by taxation from individuals with higher q and u , would improve overall well-being. Hence, the government would set $\tau > 0$ to finance $q_k^G > 0$. Essentially, those financing investments privately now face a taxation externality.

We know that Proposition B.5 holds because at $\eta = 0$, individuals would deviate from $q_i^P = q^*$. This is because individuals would choose whether or not to deviate based on what would maximize their welfare, and mathematically $u_{deviation} > u_{individual\ financing}$.

Observation B.6: *It is weakly socially optimal for the government to lie and say it will set $\tau = 0$ and $q_i^G = 0$ regardless of q_i^P .*

Since $\eta \in (0,1)$ is suboptimal, the government's welfare maximizing decision is to lie and to say it will not provide $q_i^G > 0$ for any i regardless of q_i^P , and will never set $\tau > 0$. If individuals are irrational and believe the government, this will be socially optimal and will result in the first-best.

If individuals are rational and do not believe the government, then lying will not change the outcome or overall social welfare. Hence, lying is weakly socially optimal.⁴⁹⁵

Proposition B.7: *The only stable equilibrium is where $\eta = 1$, $q_i^P = 0$, $q_i^G = q^*$ and $\tau = \theta$.*

This follows from the fact that $\eta = 0$, $q_i^P = q^*$, $q_i^G = 0$ and $\tau = 0$ is not subgame perfect. Mathematically, it is straightforward to show that not only would individuals deviate at $\eta = 0$, but individuals would deviate from self-financing private investments for any $\eta \in [0,1)$.

Overall, the first-best equilibrium at $\eta = 0$ relies on all individuals financing investments, but each individual has an incentive to deviate. This is because a benevolent social planner would provide $q^G > 0$ to deviating individuals, which would be funded with $\tau > 0$. As such, the government's promise to set $\tau = 0$ is not credible, which makes individual financing in the first place suboptimal. As such, $\eta = 0$, $q_i^P = q^*$, $q_i^G = 0$ and $\tau = 0$ is not a subgame perfect Nash equilibrium.

Government Provision First-Best Equilibrium (when $\eta = 1$)

As we have already established, $\eta = 1$, $q_i^P = 0$, $q_i^G = q^*$ and $\tau = \theta$ is the only stable first-best equilibrium. However, as we will show, this equilibrium is only stable for a small range of parameter values. For a large range of parameter values, high effort is not sustainable in equilibrium with government investment.

Recall that the government cannot sack workers, so financial incentives are required to extract high effort levels. With a performance-based contract, the incentive compatibility constraint for worker k is as follows:

$$\bar{s}_{k,H} - e \geq \bar{s}_{k,L}$$

This simply states that the average level of social outcomes with worker k exerting high effort, less the cost of high effort, exceeds the average level of social outcomes with worker k exerting low effort. Note that as the government is the only investor here, social outcomes are the same across individuals.

Lemma B.1: *There exists a nonempty subset of M for which $\rho \neq 1$ in equilibrium when $\eta = 1$.*

Proof:

Since $s_i = q_i \rho$, this constraint can be rewritten as follows:

$$q\rho_{k,H} - e \geq q\rho_{k,L}$$

$$q \cdot \frac{\sum_{k=1}^M E_k}{eM} - e \geq q \cdot \frac{\sum_{k=1}^M E_k - e}{eM}$$

⁴⁹⁵ Note that this assumes that either all individuals are rational or all individuals are irrational. If some are rational and others are irrational, it may be socially optimal for the government to move to the other first-best equilibrium by announcing $\tau = \theta$.

Now suppose the number of workers choosing low effort at any point is J . It follows that

$$q \cdot \frac{e(M-J)}{eM} - e \geq q \cdot \frac{e(M-J-1)}{eM}$$

Multiplying by M and cancelling e 's gives:

$$qM - qK - eM \geq qM - qK - q$$

Which reduces to:

$$M \leq \frac{q}{e}$$

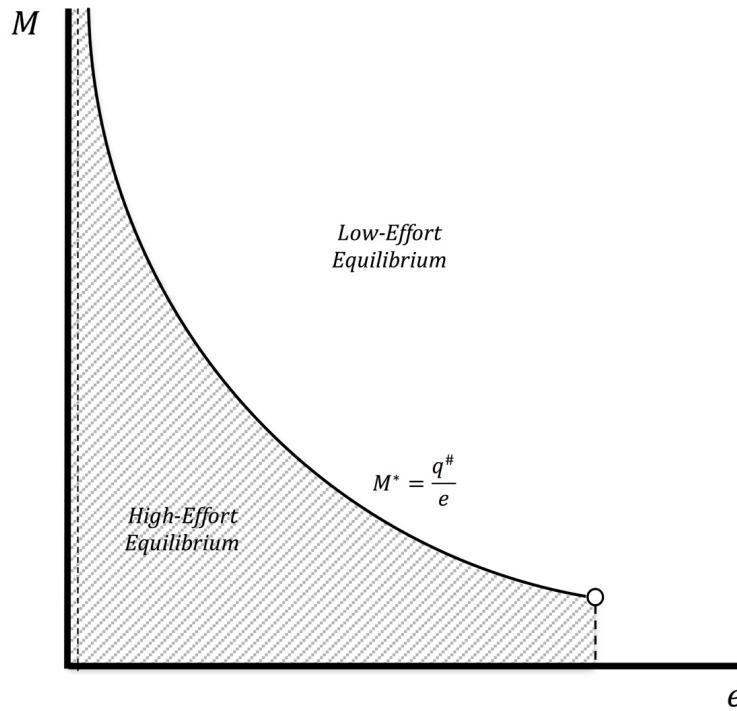
This is the incentive compatibility constraint. Note that this constraint is independent of the number of workers choosing low effort. Put differently, worker k will always make the same effort choice regardless of what other workers choose.

Let M^* and $q^\#$ be the values of M and q respectively for which the incentive compatibility constraint binds. That is,

$$M^* = \frac{q^\#}{e}$$

This is a convex function with a vertical asymptote at $e = 0$, as shown in the diagram below. Note that for a given $q^\#$, cutoff M^* decreases as the cost of high effort e increases.

Figure B.1: Effort Equilibria



Given this is a convex function, the incentive compatibility constraint does not hold, and therefore $E = (0, \dots, 0)$ in equilibrium, when $M > M^*$. In this case there is low-effort exerted by workers, so the performance-based wage is $c \cdot \bar{s} = c \cdot 0 = 0$ for each worker, and income is $y_i = 0 \forall i$. In contrast, when $M \leq M^*$, then $\rho = 1$ occurs in equilibrium, the performance-based wage is $c\bar{s} = c\bar{q}$ for each worker, and $y_i = aq_i^\theta \forall i$. $\square$

Proposition B.8: There exists a nonempty subset of M for which no government provision occurs in equilibrium. That is, $q_i^G = 0 \forall i$.

Proof:

Given the previous lemma, this proof only requires showing that when workers choose low effort, the government will not make any investment. If E is a zero vector,⁴⁹⁶ then $s_i = y_i = u_i = 0 \forall i$, irrespective of q_i . Since Ψ is increasing in its arguments, social welfare is minimized in this case, and is independent of q^G . Increasing q^G carries total cost $Nq^G c$ without increasing social welfare or generating any taxation revenue. As such, any $q^G > 0$ is suboptimal. It follows that when $\rho = 0$, $q^G = 0$ both satisfies the government's financing constraint and maximizes social welfare. $\square$

Note that for $M \leq M^*$, the equilibrium is characterized by the government offering performance-based contracts, high effort being exerted in equilibrium, and a non-zero level of investment being provided, $q^G > 0$.

Importantly, this result explains the empirical phenomenon that governments in low-income countries often do not make investments in individuals within communities. If political factors or industrial relations legislation (or some other reason) prevents the sacking of government workers, high effort needs to be incentivized. However, where workers are contributing to the same outcome, performance-based contracts only incentivize high effort for a sufficiently small number of workers. Beyond a certain point, it is rational for workers to choose low effort even with performance-based contracts. This low effort makes the investment non-viable, and so the government does not make investments in the first place.

B.5 Mechanism: Social Impact Bonds (SIBs)

Given the fact that the first-best outcomes cannot be achieved at scale via the mechanism of direct government investment financed by taxation, or via individual self-financing, let us consider a different type of impact investing mechanism – social impact bonds (SIBs).

As previously explained, this mechanism occurs when the government contracts with a private investor to finance investments, with investor returns contingent on some specific metric. In most cases, payments to investors are contingent on social *outcomes*, with the government paying the investor a pre-agreed fixed fee for outcomes above a threshold level. However, two variations of this mechanism are also possible and worth researching too. One variation is where a contract pays a fixed fee for a given quantity of *outputs*. Another is where a contract pays a fixed fee

⁴⁹⁶ That is, $E = (E_1, \dots, E_k, \dots, E_M) = (0, \dots, 0, \dots, 0)$.

conditional upon high effort being exerted by workers in the provision of the investment. The latter can be verified in this model on the basis of non-zero social outcomes.

Let us now show that in each of these three contract types that involve the government contracting with private investors to make investments, the first-best is not obtained.

Output-Based Contracts

Suppose there is a contract where the government pays some fixed fee F to a private investor to provide the first-best level of investment q^* to each person. We do not need to consider a contract where the payment is a function of quantity, since there is only one first-best quantity to consider. Since a private investor can sack workers, they can always enforce high-effort levels should they choose to do so. If high effort is enforced, there is no difference between the wage contract and performance contract as the wage contract pays c for each q , while the performance contract pays c for each s . If all workers choose high effort, then $\rho = 1$, so $s = q\rho = q \cdot 1 = q$.

***Proposition B.9:** A contract of the form (q^P, F) , where $q^P, F > 0$ and where F is a fixed payment for providing quantity q^P , results in a performance-based contract where low effort is enforced so that $\rho = 0$.*

Proof:

Faced with this form of contract, the private investor has four options. It can choose the wage contract or performance contract, and in each case can choose to enforce high effort H or low effort L . The private investor payoff from these four options is given by:

$$\begin{aligned}\pi_{H,Wage} &= F - cq^* \\ \pi_{H,Performance} &= F - cq^* \\ \pi_{L,Wage} &= F - cq^* \\ \pi_{L,Performance} &= F\end{aligned}$$

Now since $cq^* > 0$, the private investor would choose the performance contract and, counterintuitively, enforce low effort by sacking workers who exerted high effort. The intuition is simple. Low effort by workers decreases investor costs without affecting revenue. $\square$

***Proposition B.10:** A contract of the form (q^P, F) , where $q^P, F > 0$ and where F is a fixed payment for providing quantity q^P , cannot achieve the first-best outcome.*

Proof:

Given the previous result, the contract would result in $s = 0$, so $y = 0$, meaning that taxation revenue $T = 0$. Hence, the government would incur cost F and not generate any revenue. This would cause the government to make a financial loss, so the contract would not be offered in equilibrium. As such, the first-best is not achieved. $\square$

This result explains why empirically there is a lack of output-based contracts.

Outcome-Based Threshold Contracts (Social Impact Bonds)

Suppose that there is a finite threshold income level μ , where $0 < \mu < y(q^*, \rho = 1)$, and that the contract pays out P_1 as follows:

$$P_1 = \begin{cases} J & \text{if } y \geq \mu \\ 0 & \text{if } y < \mu \end{cases}$$

Proposition B.11: A contract of the form (q^P, P_1) , where $P_1 = J$ if $y \geq \mu$ and $P_1 = 0$ if $y < \mu$, cannot achieve the first-best outcome.

The logic for why this contract is not first-best is simple. Any income generated above the threshold level involves the incursion of costs by the investor in the form of higher wage payments to workers without any additional revenue from the government. As such, an investor's profit-maximizing strategy is to just reach the threshold level. In a one-period model, this is done by enforcing high effort for a subset of workers such that $\rho \in (0,1)$. In other words, once just enough workers are exerting high effort for the threshold level to be obtained, then low effort will be enforced on all other workers. Any additional high effort would incur costs without any additional payoff, and so would be irrational for the private investor. Since $\rho < 1$ here, the first-best is not achieved.⁴⁹⁷

Outcome-Based High Effort Contracts

Recall that for the first contract type, there was a fixed payment F for a given output q^* . This was not first-best as it resulted in low effort ($\rho = 0$) and therefore $y = 0$. In the case of the second contract type, low effort was exerted beyond the threshold level.

It therefore raises the question of whether a fixed payment contract can be supported as first-best if high effort can be guaranteed. Asking this question is useful because it helps us work out whether the previous results are dependent on the modelling of effort.

There are various ways in which $\rho = 1$ may be able to be guaranteed. For example, the government could have a controlling stake in the private investor. Alternatively, if the assumption is made that the private investor has to enforce either all high effort or all low effort, rather than differentially treating workers, then a contract that pays out only if $y > 0$ would also be a way to guarantee $\rho = 1$. Under this assumption, a contract conditional on high effort is equivalent to a contract conditional on simply obtaining positive (non-zero) social outcomes. As such, it is reasonable to think that under some circumstances high effort by workers can be guaranteed.

However, as we shall see, no set fee contract can be supported as a first-best equilibrium when income is uncertain, even if $\rho = 1$.

⁴⁹⁷ Note that it is not possible for a contract to simply be set so that $\mu = \max y$. This is for three reasons. First, due to income uncertainty. Where the income function and maximum y is unknown *ex ante*, contracting on maximum income is not viable. Secondly, due to income variability. When income varies without an upper limit, there is no need for the restriction that $\mu < y$. The exertion of high effort is not a private investor's optimal strategy beyond the threshold level, but since y has no upper bound and μ is finite, it follows that the high effort is not always optimal. Thirdly, due to individual heterogeneity. While in this model individuals are homogenous, in reality they are heterogeneous, so a contract that only pays out conditional on maximum y is not possible in practice due to variation in maximum y across individuals.

Let y be uncertain with lower bound 0 and no upper bound. That is, $y \in [0, \infty)$. Also let $E(y^*) = E(y(q^*, \rho = 1))$.

Proposition B.12: No contract of the form $(P_0, P_1 = K | \rho = 1)$, where P_0 is a payment from the private investor to the government at $t = 0$, P_1 is a payment from the government to the private investor at $t = 1$, and where K is a finite positive fixed amount, can be supported as a first-best equilibrium where y is uncertain.⁴⁹⁸

Proof:

For the first-best to be achieved, we know that $q^P = q^*$ and $\rho = 1$ are necessary. Further, the private investor's expected zero-profit constraint and government expected zero-surplus constraint must both bind.

The private investor's expected zero-profit constraint is given by:

$$-P_0 + E(P_1) - cq^* \geq 0 \quad (\text{B.6})$$

The government's expected zero-surplus constraint is given by

$$P_0 + E(T) - E(P_1) \geq 0 \quad (\text{B.7})$$

Now y has no upper bound, so as $y \rightarrow \infty$, $\tau y \rightarrow \infty$. Since K is finite, $\lim_{y \rightarrow \infty} \tau y - K > 0$. Therefore, there is a range of y for which $T > K$ and so K can be fully paid. That is, $P_1 = K$. It follows that there is a range of y for which $T > P_1$.

When $\tau y < K$, then K cannot be fully paid.⁴⁹⁹ As such, $P_1 = T < K$. It follows that $P_1 < K$. It is also noted that if $\tau y = K$ then $T = P_1$.

Given that $T = P_1 \forall \tau y \leq K$ and $T > P_1 \forall \tau y > K$, it follows that $E(T) > E(P_1)$. If $E(T) > E(P_1)$, then for (B.7) to bind, P_0 must be strictly negative. That is, the government must pay the private investor at $t = 0$. But if $P_0 < 0$, then for (B.6) to bind, it must be that $E(P_1) < cq^*$. Given $E(P_1) < cq^*$, the private investor's profit maximizing strategy is to make no investment in $t = 1$ and to just keep $-P_0$.

⁴⁹⁸ Note that where an investor can only enforce all high effort or all low effort by workers, the conditional part of the contract could be changed from $\rho = 1$ to $y > 0$.

⁴⁹⁹ Note that this is a one-period model, so government borrowing is abstracted from. However, there are two good reasons why incorporating borrowing into the model would be unlikely to change the result. The first reason is due to borrowing constraints. If borrowing was allowed but with constraint B, then it would still be the case that $P_1 < K$ when $N(K - \tau y) > B$, which is always true for a sufficiently large population N . The second reason is that a benevolent government's optimal strategy may be to default so that even if borrowing was allowed, it may not be a credible or viable option. To understand this, note that if $\tau Y \geq K$, then no borrowing would be needed. If $\tau Y < K$ then borrowing would be needed to fully repay K . However, the government's welfare maximizing option may be to not borrow and not pay the private investor, since this incurs cost to the government without increasing individual utility. Hence, the borrowing option is not credible. Knowing this, the private investor would not expect any borrowing, and the previous result would still hold even if borrowing was allowed. As such, because borrowing may have a constraint and because default may be the most benevolent option for a social planner, the result is likely to stand even in a multi-period model with borrowing.

This proves that contract $(P_0, P_1 = K|y > 0)$ cannot exist as a first-best where y is uncertain. $\square$

As such, social impact bonds (SIBs) and variations of the mechanism do not satisfy the first-best. Regardless of whether investor payments are contingent on (a) the optimal quantity of investment being provided, (b) the optimal quantity of investment being provided and a threshold level of social outcomes being obtained, or (c) the optimal quantity of investment being provided and maximum effort being exerted at all times, the first-best cannot be obtained in equilibrium. This is a strong result.

B.6 Mechanism: Tradeable Income-Based Securities (TIBS)

Now suppose there is a new type of contract where the private investor receives a portion of taxation revenue that the government collects from investment recipients. Crucially, it is possible to show that, unlike the existing contingent-repayment impact investing mechanisms, this modified mechanism can achieve and sustain the first-best in equilibrium. This is a powerful result.

Let the contract take the form $(s, q^P, N, P_0, \alpha, \tau)$. s is the type of social outcome sought from the investment, such as education or health improvements. Put differently, it is the broad investment category.⁵⁰⁰ q^P is the quantity of goods the private investor is contractually bound to provide. N is the number of individuals receiving investment.⁵⁰¹ P_0 is a lump sum payment at $t = 0$, which is positive if the transfer is from the private investor to the government. This can be thought of as the price of the security. That is, the price the private investor pays for the right to receive a given portion of taxation revenue. α is the portion of taxation revenue that the private investor receives, which we refer to as the attribution parameter. As before, τ is the endogenously set taxation rate. The remaining two parameters, s and N , make the contract complete

Note that the payment of α portion of taxation revenue occurs at $t = 1$ after the investment has been made and taxation has been collected. As such, we can denote this payment P_1 , where $P_1 = \alpha T = \alpha \tau y$. Also recall that $q^\# = eM$.

Lemma B.2: *For first-best to be obtained, it is necessary that $q^P = q^*$ if $q^\# < q^*$, and $q^P + q^G = q^*$ if $q^\# \geq q^*$.*

Proof:

We know that for first-best, $q = q^*$ and all workers must exert high effort. As previously established, the government can only maintain high effort where $q \leq eM$. Hence, the maximum per capita quantity for which high effort can be maintained for government workers is $q^\# = eM$. If $q^\# < q^*$, then government workers will exert low effort when $q^G + q^P = q^*$ even if $q^G \leq q^\#$. This is because government workers are paid in a performance-based contract based on social outcomes, and both government and private workers contribute to this. That is, what matters for

⁵⁰⁰ Note that the parameters s and N are not needed in this microeconomic model. However, they are included here to ensure consistently with the analysis in Chapter 7. In Chapter 7, an auction is included in the mechanism design as a way to allocate the investment contract. The auction is to provide an investment of type s to N individuals.

⁵⁰¹ This corresponds to the number of individuals in the community.

the government workers maintaining high effort is the total number of workers and not just the number government workers. Given this, if $q^\# < q^*$ then any government investment is sub-optimal as low effort would be exerted, thereby incurring cost without any additional income being generated. Hence, if $q^\# < q^*$ the private sector must fully provide the first-best level, so $q^P = q^*$. In contrast, if $q^\# \geq q^*$, then high effort can be maintained by both the government and private investor, so any combination of private and public investment is possible, provided the total provision is first-best. That is $q^P + q^G = q^*$. As such, $q^P \in [0, q^*]$ if $q^\# \geq q^*$. $\square$

Proposition B.13: There is always a contract of the form $(s, q^P, N, P_0, \alpha, \tau)$ that can be supported as a first-best equilibrium.

Proof:

For first-best, quantity provided must equal q^* , workers must exert high effort, and the full surplus from investment must go to the individuals rather than to private investor profit or excess government revenue.⁵⁰²

Let us first examine the case where $q^\# < q^*$. In this instance, as proved in Lemma B.2, a necessary condition for high effort to be exerted by all workers is that there is full private provision. That is, $q^P = q^*$ and $q^G = 0$.

A further necessary condition for high effort is that the incentive compatibility constraint is satisfied. The private investor has a choice of whether to enforce high effort or low effort, and whether to offer workers a wage or performance contract. The payoff from these four options is given as follows:

$$\begin{aligned}\pi_{H,Wage} &= -P_0 + \alpha T - cq^* \\ \pi_{H,Performance} &= -P_0 + \alpha T - cq^* \\ \pi_{L,Wage} &= -P_0 - cq^* \\ \pi_{L,Performance} &= -P_0\end{aligned}$$

Given this, the private investor's incentive compatibility constraint is given by:

$$\alpha T - cq^* \geq 0 \tag{B.8}$$

Provided (B.8) is satisfied and $q^P = q^*$, a sufficient condition for high effort is that the private investor's zero profit constraint is satisfied. Otherwise the private investor would never enter the contract in the first place.

The private investor's zero-profit constraint is given by:

⁵⁰² This is a one-period model, so any excess government revenue is not able to be reinvested to further improve social welfare. Excess government revenue is therefore not first-best. This is entirely consistent with the theory construction in Chapter 3 that argues that in a multi-period setting, increases in both individual incomes and government revenue are appropriately classified as social return, with the former classified as direct social return and the latter indirect social return.

$$-P_0 + \alpha T - cq^* \geq 0 \quad (\text{B.9})$$

For the full surplus to go to the individuals in the community, both (B.9) and (B.10) must bind. (B.10) is shown below and is the government's zero-surplus constraint. If (B.10) doesn't bind, the government would make a financial loss, which is not sustainable in equilibrium.

The government's feasibility constraint is given by:

$$P_0 + T - \alpha T \geq 0 \quad (\text{B.10})$$

As such, to show a first-best exists when $q^\# < q^*$ for the contract $(s, q^P, N, P_0, \alpha, \tau)$, it is sufficient to show that (B.8) can hold, and (B.9) and (B.10) bind, simultaneously.

Equating (B.9) and (B.10),

$$-P_0 + \alpha T - cq^* = P_0 + T - \alpha T$$

$$\therefore T = cq^*$$

$$\therefore \tau y = cq^*$$

$$\therefore \tau a(q^* \rho)^\theta = cq^*$$

Since high-effort is enforced, $\rho = 1$, so:

$$\therefore \tau a q^{*\theta} = cq^*$$

$$\therefore q^{*1-\theta} = \frac{\tau a}{c} \quad (\text{B.10b})$$

$$\therefore q^* = \left(\frac{\tau a}{c}\right)^{\frac{1}{1-\theta}} \quad (\text{B.11})$$

From (B.8) we know that:

$$\alpha \tau a q^{*\theta} - cq^* \geq 0$$

$$\therefore \frac{\alpha \tau a}{c} \geq q^{*1-\theta}$$

$$\therefore q^* \leq \left(\frac{\alpha \tau a}{c}\right)^{\frac{1}{1-\theta}} \quad (\text{B.12})$$

For (B.11) and (B.12) to both be satisfied, it must be that $\alpha \geq 1$.

It therefore follows from (B.10) that $P_0 \geq 0$.

We can obtain an expression for P_0 as a function of exogenous parameters by noting that where (B.9) binds, $P_0 = \alpha \tau a q^{*\theta} - c q^*$. If we rearrange (B.10b) so that $\tau = \frac{c q^{*1-\theta}}{a}$ and substitute it in, then P_0 reduces to the following expression:

$$P_0 = (\alpha - 1)c \left(\frac{a\theta}{c} \right)^{\frac{1}{1-\theta}}$$

It is clear from the above expression that if $\alpha \geq 1$, then $P_0 \geq 0$ too.

Since we know that first-best q is given by:

$$q^* = \left(\frac{a\theta}{c} \right)^{\frac{1}{1-\theta}}$$

It follows from (B.11) that $\tau = \theta$.

Hence, when $q^\# < q^*$, there always exists a first-best contract of the form $(s, q^P, N, P_0, \alpha, \tau)$. These contracts are characterized as follows: $q^P = q^*$, $P_0 = (\alpha - 1)c \left(\frac{a\theta}{c} \right)^{\frac{1}{1-\theta}}$, $\alpha \geq 1$, and $\tau = \theta$.

Now for $q^\# \geq q^*$, we know from Lemma B.2 that $q^P \in [0, q^*]$, so full private provision is always possible. Hence the first-best contracts when $q^\# < q^*$ can be maintained in this case.

This proves the proposition. $\square$

***Proposition B.14:** When $q^\# < q^*$, contracts of the form $(s, q^P, N, P_0, \alpha, \tau)$ achieve the first-best if and only if $q^P = q^*$, $P_0 = (\alpha - 1)c \left(\frac{a\theta}{c} \right)^{\frac{1}{1-\theta}}$, $\alpha \geq 1$, and $\tau = \theta$.*

Proof:

This follows directly from the proof of the previous proposition. $\square$

Intuitively, if $\alpha < 1$ then the government collects more tax than it gives to the private investor, so for the first-best with no government surplus, it must be that $P_0 < 0$, meaning the government transfers money to the private investor at $t = 0$. However, then the private investor's incentive compatibility constraint only holds if its revenue at P_1 exceeds its costs. That is, if $\alpha T > c q^*$. However, then the private investor makes a profit as $-P_0 + \alpha T - c q^* > 0$, so the zero-profit constraint does not bind and social welfare is not maximized.

An alternative explanation is as follows. Suppose $P_0 < 0$, so the government pays the private investor at $t = 0$. For the private investor's zero-profit condition to bind, revenue T_1 must be less than expenses $c q^*$. Then the private investor's incentive compatibility constraint is not satisfied, so $P_0 \nless 0$. Now suppose $P_0 \geq 0$. Then if $T > \alpha T$, the government gets in more tax than it transfers to the private investor, so individual utility (and therefore social welfare) can always be increased by decreasing τ . Hence $\tau \leq \alpha \tau$, so $\alpha \geq 1$. Provided the private investor's zero-profit condition also binds, which would be the case if P_0 equals the difference between tax compensation αT and expenses $c q^*$, then the first-best is satisfied.

We can also explain this result graphically. The three constraints are shown in Figure B.2 below. Since constraints (B.9) and (B.10) must both bind for first-best, and as they have the same gradient, they must perfectly overlap. This occurs when $\tau y = cq^*$. Furthermore, as (B.8) must be satisfied, we know that $P_0 \geq 0$. The region where all three constraints are satisfied is given shown by the bold segment of the (B.9) constraint.

Figure B.2: Graphical Representation of First-Best Contractual Requirements

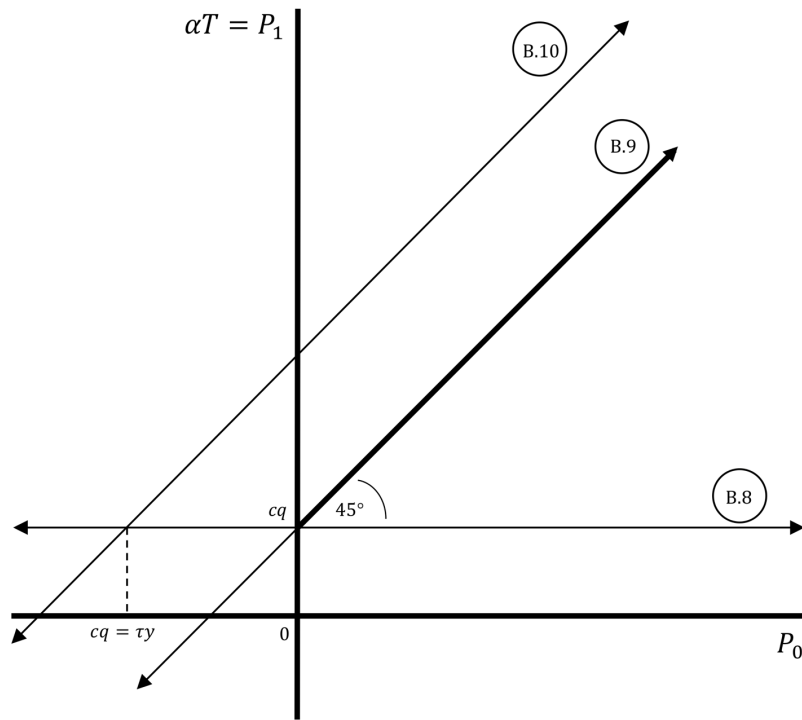


Figure B.3: Graphical Representation of TIBS Equilibrium

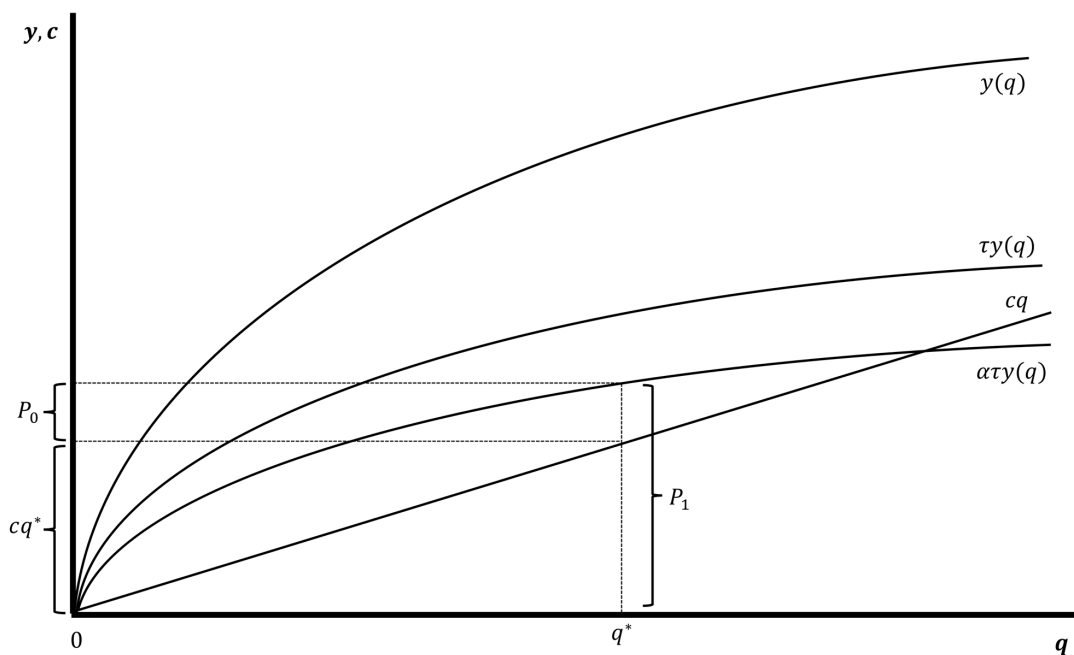


Figure B.3 shows the equilibrium in a different way, with income as a function of investment quantity. As is evident, the investment cost plus the initial transfer is equal to the amount the investor receives from the government, so that the investor exactly breaks even in equilibrium.

Proposition B.15: Where $q^\# < q^$, there is always a contract of the form $(s, q^P, N, \alpha, \tau)$ that can be supported as a first-best equilibrium.*

This proposition says that a first-best can always be supported in the region $q^\# < q^*$, even without any initial lump-sum payment P_0 .

Proof:

This follows from the proof of previous propositions. Since first-best P_0 when $q^\# < q^*$ is given by $P_0 = (\alpha - 1)c(\frac{a\theta}{c})^{\frac{1}{1-\theta}}$, therefore if $\alpha = 1$, then $P_0 = 0$. Hence, no payment at $t = 1$ is necessary for the first-best to be obtained. That is, there is always a first-best where $q^P = q^*$, $\alpha = 1$, and $\tau = \theta$. $\square$

Now let us characterize the first-best contracts when $q^\# \geq q^*$.

Proposition B.16: When $q^\# \geq q^$, contracts of the form $(s, q^P, N, P_0, \alpha, \tau)$ achieve the first-best if and only if $q^P + q^G = q^*$, $P_0 = \alpha\theta a q^{*\theta} - c q^P$, $\alpha \geq \frac{c q^P}{\alpha\theta(q^{*\theta} - q^{G\theta})}$, and $\tau = \theta$.*

Proof:

When $q^\# \geq q^*$, government workers provide high effort since the marginal income gain to individuals exceeds the marginal cost of provision, whereas private workers will employ high effort if the private investor chooses to enforce it.

Using a similar approach to previously, here the private investor has four options that give the following payoffs:

$$\begin{aligned}\pi_{H,Wage} &= -P_0 + \alpha T(q^*, \rho = 1) - c q^P \\ \pi_{H,Performance} &= -P_0 + \alpha T(q^*, \rho = 1) - c q^P \\ \pi_{L,Wage} &= -P_0 - c q^P + \alpha T(q^*, \rho = \frac{q^G}{q^*}) \\ \pi_{L,Performance} &= -P_0 + \alpha T(q^*, \rho = \frac{q^G}{q^*})\end{aligned}$$

Note that the term $\alpha T(q^*, \rho = \frac{q^G}{q^*})$ is α portion of tax. As before, ρ is the percentage of workers exerting high effort, but here it is less than 1. It is equal to the percentage share of investment made by the government.

Now $\pi_{L,Performance} > \pi_{L,Wage}$, as $c q^P \geq 0$. As such, the incentive compatibility constraint is given by:

$$\alpha T(q^*, \rho = 1) - cq^P \geq \alpha T(q^*, \rho = \frac{q^G}{q^*})$$

This can be rewritten as:

$$\begin{aligned} \alpha T(q^*, \rho = 1) - \alpha T(q^*, \rho = \frac{q^G}{q^*}) &\geq cq^P \\ \therefore \alpha \tau a q^{*\theta} - \alpha \tau a \left(q^* \cdot \frac{q^G}{q^*}\right)^\theta &\geq cq^P \\ \therefore \alpha \tau a (q^{*\theta} - q^{G\theta}) &\geq cq^P \\ \therefore \alpha &\geq \frac{cq^P}{\tau a (q^{*\theta} - q^{G\theta})} \end{aligned}$$

Now the private investor's zero-profit constraint is given by:

$$-P_0 + \alpha T - cq^P \geq 0$$

Also, the government's feasibility constraint is given by:

$$P_0 - cq^G + T - \alpha T \geq 0$$

For both of the two above constraints to bind, it must be that $cq^G + cq^P = T$, so $cq^* = \tau y$, which we know occurs when $\tau = \theta$. If this were not so, the individual could not receive the full surplus. Since $\tau = \theta$, and as $q^P = q^\theta - q^G$,

$$\therefore \alpha \geq \frac{c(q^\theta - q^G)}{\theta a (q^{*\theta} - q^{G\theta})}$$

Now as $\theta < 1$, if we differentiate the right-hand side of the above expression with respect to q^G , we obtain $\frac{\partial}{\partial q^G} < 0$ (or, equivalently, $\frac{\partial}{\partial q^P} > 0$). Hence, as q^P increases, the lower bound of α increases, meaning the private investor needs to get a larger portion of tax revenue for their greater investment expenditure. This makes intuitive sense.

Rearranging the private investor's zero-profit constraint when it binds gives

$$\begin{aligned} P_0 &= \alpha T - cq^P \\ \therefore P_0 &= \alpha \theta a q^{*\theta} - cq^P \end{aligned}$$

This proves the proposition. $\square$

Proposition B.17: When $q^\# \geq q^*$ and $q^G > 0$, first-best cannot be obtained with $P_0 = 0$.

Proof:

Suppose that $P_0 = 0$, then it follows from the expression for P_0 that $\alpha = \frac{cq^P}{\theta a q^* \theta}$. However this cannot be supported as a first-best, since $\alpha \geq \frac{c(q^\theta - q^G)}{\theta a (q^* \theta - q^G \theta)} > \frac{cq^P}{\theta a q^* \theta}$. $\square$

Therefore, P_0 is a necessary part of the contract when $q^\# \geq q^*$ and $q^G > 0$. When $q^\# < q^*$ or when $q^G = 0$, P_0 is not necessary but merely broadens the range of possible contracts.

Intuitively, P_0 can equal 0 when the portion of tax paid to the private investor at $t = 1$ (that is, α) can be the same proportion as the portion of the investment made by the private investor (that is, $\frac{q^P}{q^*}$). However, when $q^G > 0$, the payment to the private investor must be greater than the private investor's contribution so as to incentivize high effort. This arises due to the concavity of the income function. However, in order to be able to pay a greater amount than the private investor contributes, the government must collect a strictly positive payment from the private investor at $t = 0$. This, in effect, prevents the private investor from taking part of the benefit of government workers' high effort without incurring high effort themselves.

Observation B.1: When $q^G > 0$, α does not represent the percentage of income that is attributable to the private investor's investment. Rather, α is adjusted upwards so that high effort is exerted. This follows from previous propositions.

Observation B.2: $P_0 - P_1 = cq^P$, so the smaller the quantity of privately provided goods, the smaller the difference between the two payments.

This follows from previous propositions.

B.7 Discussion and Conclusion

Overall, it has been proven that the modified investment mechanism of TIBS is always able to obtain the first-best levels of quantity and effort in equilibrium. The exact contractual forms necessary to obtain the first-best under different conditions have also been discovered. This is a strong result. It is especially strong considering it has also been proven in this appendix that no investment mechanism that does not involve a form of public-private partnership can achieve the first-best, nor can the mechanism of social impact bonds achieve the first-best.

Given this result, further theoretical microeconomics research into the modified TIBS mechanism is warranted. Some avenues for future theoretical microeconomics research are as follows.

Investment Selection, Auction Allocation, and Variable Inherent Quality

The model in this appendix focuses on the levels of investment quantity and effort that are obtained by mechanism designs in equilibrium. However, there is also third component of social value creation – investment selection. Additional research could extend the model to investigate this component of social value creation as well.

There is a straightforward way to adjust the model to incorporate this. Each possible investment could have a different level of inherent effectiveness. Instead of parameter a in the income function $y_i = y(s_i) = as_i^\theta$ being a constant positive parameter, it could instead be variable, representing the inherent effectiveness of an investment. Suppose that there is a set of U private investors: $P = \{p_1, \dots, p_A, \dots, p_U\}$, and that these investors can make investments from a set of W possible investments: $I = \{i_1, \dots, i_j, \dots, i_W\}$. The effectiveness of investor A at providing investment j could be denoted $a_{j,A} \geq 0$, with the effectiveness vector for investor A given by $a_A = \{a_{1,A}, \dots, a_{j,A}, \dots, a_{W,A}\}$. Then the pre-tax income for individual i is given by $y_i = a_{j,A}s_i^\theta$. This means that the extent to which an investment increases individual incomes depends, *inter alia*, on the inherent effectiveness of the investment. Furthermore, the effectiveness level of the investor with the highest level of inherent effectiveness for investment j could be denoted $a_{j,H}$, and second highest effectiveness level denoted $a_{j,C}$, since this represents the counterfactual. A setup like this would enable research into whether the first-best level of investment quality can be obtained, in addition to the first-best levels of quality and effort.

One way this first-best quality may be able to be obtained is via an auction process to select the investment. One may expect that if the government offered a contract to private investors to finance investments, there would be misrepresentation by investors regarding their investment quality and, as such, the government would need to randomly select the investment. However, the research in Chapters 5 and 7 suggests that a Vickrey auction may be able to incentivise investors to honestly reveal their expected effectiveness for a given type of investment via the bidding process. If this is the case, then private information becomes public and information asymmetry is overcome. As such, the government could award a TIBS contract to the highest bidder, thereby selecting the investment with the highest inherent effectiveness $a_{j,H}$.⁵⁰³ Given the potential for truthful expected effectiveness revelation via contract auctioning, which would enable first-best selection to be obtained by the TIBS mechanism, this should also be incorporated into future research.

Multi-Period Model and Capacity to Trade Securities

It is also recommended that future research extend the one-period model of this appendix into a multi-period model.⁵⁰⁴ A multi-period model has several advantages over a single period model. Importantly, it enables the model to incorporate the ability of investors to trade the right to future taxation transfers from the government. This may bring the long-term value from investments into the short-term decision-making horizon of investors, thereby enabling first-best investment quantity to be obtained by private investors even when they are short-sighted. In other words, tradability may make myopic investors equivalent to investors with an infinite time-horizon. This contrasts with the government, which is unlikely to be able to achieve the first-best investment quantity in a multi-period model – unless its decision-making horizon exceeds the expected lifespan of individuals receiving investment. If the government faces an election constraint, or if for another reason it seeks to maximize social welfare during its term in office, investment

⁵⁰³ Intuitively, as discussed in Chapter 7, the private investor with the highest quality investment is likely to bid the highest and be awarded the contract because they expect to be able to increase incomes, taxation revenue, and therefore taxation transfers the most.

⁵⁰⁴ Individual utility could be discounted by δ in each successive period.

quantity is likely to be suboptimal and further from the first-best level than private investment. As such, a multi-period model would add nuance to results pertaining to investment quantity.

Relaxing Assumptions to Improve Robustness

Some of the assumptions in the model could also be relaxed to make the results more robust. Four assumptions that could be relaxed are as follows.

First, positive pre-investment income could be incorporated. An assumption made in the model is that individuals initially, or in the absence of investment, have an income of 0. This result could be generalized by making the initial income $y_0 > 0$.

Secondly, the assumption that there is no income uncertainty could be relaxed. The setup could be adjusted so that the expected income in time period one is the same as previously, but now income is uncertain with lower bound y_0 . That is, $y_1 \in [y_0, \infty)$. Then $y_1^* = y_1(q^*, \rho = 1)$, so $E(y_1^*) = E(y_1(q^*, \rho = 1))$.

Thirdly, the taxation rate τ could be made exogenous. In this appendix, it is assumed that τ is endogenous. However, there may be cases where the tax rate is predetermined and cannot be adjusted. The government may set a tax rate for an entire country, while this tax-based contract may only apply to a subset of the population. In such a case, requiring the government to set a specific tax rate τ may be overly restrictive. One way to adjust the contract structure to accommodate an exogenous τ is to allow the government to make a lump-sum transfer P_2 to investment recipients after tax has been collected. With this addition to the contractual form, it is possible to prove that even when the tax rate is exogenous, a contract always exists that achieves the first-best, provided that $\tau \geq \theta$. The necessary first-best contractual form in this case is given by: $\alpha \geq \frac{q^P}{q^*} \left[\frac{E(y_1^*) - y_0}{E(y_1^*)} \right] \frac{\theta}{\tau}$, $P_0 = \alpha \tau E(y_1^*) - c q^P$, $P_1 = \alpha T = \alpha \tau Y_1^*$, and $P_2 = (\tau - \theta) y_1^*$.

Fourthly, there could be joint investment in the same individuals by multiple private investors. In this case, the contractual form required for the first-best is similar to where investments are jointly made by the government and a private investor. That is, there needs to be a transfer $P_0 > 0$ from each private investor to the government so as to incentive high effort and achieve the first-best outcomes. Intuitively, the greater the number of private investors and the lower each q^P , the higher the P_0 and α required, relative to the investment quantity, to incentivise high effort and to achieve the first-best effort level.

Questions for Further Investigation

As part of this suggested future research, three questions worth researching are as follows. First, does it matter whether private investors bid for a percentage of individuals' taxation revenue or for the size of the upfront lump-sum payment to the government? What variable bidding occurs over may affect the division of social value between stakeholders. Secondly, does it matter which investor the contract is initially awarded to if trading of the contract is possible at any time and not just post investment? This question has parallels to Coase's work on the allocation of

environmental property rights (Coase, 1960).⁵⁰⁵ Mutually beneficial trades may be possible that render the initial contract allocation less relevant. Thirdly, if individuals are heterogeneous rather than homogenous, what is the optimal division of investment between public and private investors? In other words, is it more socially optimal for private investors or a public investor to finance investments in the least well off individuals? It is not immediately obvious what division of investment, if any, would maximize aggregate social welfare. As such, allocative considerations are worth researching.

⁵⁰⁵ Coase, R. H. (1960). The problem of social cost. In *Classic papers in natural resource economics* (pp. 87-137). Palgrave Macmillan, London.

Appendix C.

A Model of Taxation Deductibility

C.1 Introduction

Appendices A and B focus on four existing contingent-repayment impact investing mechanisms. There is, however, a fifth and final existing mechanism design. That is the mechanism of taxation deductibility. This occurs when investors make investments that reduce their taxation obligations. In other words, the financial return to investors takes the form of taxation deductions. For while taxation deductibility in isolation normally does not lead to positive returns (that is, repayments greater than the principal invested), it still leads to returns greater than negative 100% (that is, no repayment of capital). This is consistent with the empirical observation in Chapter 1 that there is now a full range of impact investors, including some seeking partial repayment of capital with financial returns in the range between -100% and 0%.

The key question that this appendix asks is as follows: “In what ways does the mechanism design of taxation deductibility fail to meet the first-best level of social value creation?”

C.2 Model Setup

Let us begin with a very simple model, which is consistent with the modelling approach in Appendix B. An investor is prepared to make a financial loss of $L \geq 0$ in order to support a particular cause. The initial investment size in monetary terms is given by $C \geq 0$, which is the cost of the investment or the investment principal. This corresponds to an investment quantity of $Q(C) \geq 0$ in non-monetary terms.

For ease of traction, suppose there is one investor who makes one investment in one tax-deductible entity, with the capital then reinvested in one individual. There are many tax-deductible entities for the investor to choose from, with these entities differing in unobserved inherent effectiveness. These tax-deductible entities spend the entirety of any investment amount on improving the productivity of disadvantaged individuals, such as by providing vocational training. Investments in them are therefore equivalent to investments directly in individuals. The tax-deductible entities are merely intermediaries. As such, this setup is entirely consistent with the case of investments in individuals that this dissertation research is focused on.

In making an investment, the investor may choose whether to exert high effort at two times in the process. First, when selecting which precise type of investment to finance. An investor can either randomly select an investment to finance without incurring any search cost. Alternatively, an investor can incur search cost ϑ to determine the specific investment with the highest expected social value creation. Secondly, once a specific type of investment has been selected to finance, the investor may choose how much effort to exert in the implementation of the investment. For example, they may choose to monitor the entity carrying out the investment provision, or routinely monitor the progress of the investment recipients against key performance metrics. If high effort H is exerted in this implementation phase, the investor incurs cost $e > 0$ per unit of investment quantity q (as per Appendix B), while if low effort L is exerted then no cost is incurred.

A few further assumptions are made. First, that individual incomes and the level of productivity-enhancing investments are both 0 initially. Secondly, that the government either cannot or does not restrict the size of investor financial loss L . Thirdly, that investment cost is a linear function

of investment quantity, while income Y is a concave function of investment quantity. That is, $C''(Q) = 0$ and $Y''(Q) < 0$. Fourthly, that at the origin, $Y'(Q) > C'(Q)$.⁵⁰⁶ Fifthly, that the taxation rate is $\tau \in (0,1)$. Sixthly, that the investor's income upon which tax is levied is reduced by the amount of the investment made. As such, if an investor invests $C(Q)$, then their income subject to taxation reduces by $C(Q)$ and the taxation owed reduces by $\tau C(Q)$. Seventhly, that the total amount of the investor's taxation obligation prior to this investment is greater than or equal to the taxation deduction that is eligible. In other words, the investor can claim the full tax deduction it is entitled to.

We proceed by examining the equilibrium outcomes for the three different components of social value creation – investment quantity, investment selection, and investment effort.

C.3 Investment Quantity with Taxation Deductibility

We know that the investor can only lose L . As such, the investor's constraint is given by the following, where π^I denotes the investor's net profit from the investment.

$$\begin{aligned}\pi^I &\geq -L \\ \therefore -C(Q)(1 - \tau) &\geq -L \\ \therefore -C(Q) &\geq \frac{-L}{(1 - \tau)} \\ \therefore C(Q) &\leq \frac{L}{(1 - \tau)}\end{aligned}\tag{C.1}$$

Since $\frac{L}{(1-\tau)} > 0$, the maximum investment expenditure is given by:

$$C^M = \frac{L}{(1 - \tau)}\tag{C.2}$$

It is worth noting that this is the sum of a geometric sequence with the taxation rate as the common ratio. It is equivalent to if an investor made an investment of L , then got back τL and invested that, then got back $\tau^2 L$ and invested that, then got back $\tau^3 L$ and invested that, and so on. In other words, a one-time investment of $\frac{L}{(1-\tau)}$ is equivalent to multi-period investments in a geometric sequence with the starting term L .

Given (C.2), the maximum quantity of investment is:

$$Q(C^M) = Q\left(\frac{L}{1 - \tau}\right)\tag{C.3}$$

This corresponds to the following expected income of the investment recipient:

⁵⁰⁶ This assumption ensures that the income and cost functions to intersect.

$$\mathbb{E}(Y) = Y\left(Q\left(\frac{L}{1-\tau}\right)\right) \quad (\text{C.4})$$

The corresponding expected government taxation is given by:

$$\mathbb{E}(\text{Tax}) = \tau \mathbb{E}(Y) = \tau Y\left(Q\left(\frac{L}{1-\tau}\right)\right) \quad (\text{C.5})$$

As such, the expected change in the government's financial position is:

$$\tau Y\left(Q\left(\frac{L}{1-\tau}\right)\right) - \tau \cdot \left(\frac{L}{1-\tau}\right) = \tau \left[Y\left(Q\left(\frac{L}{1-\tau}\right)\right) - \left(\frac{L}{1-\tau}\right) \right] \quad (\text{C.6})$$

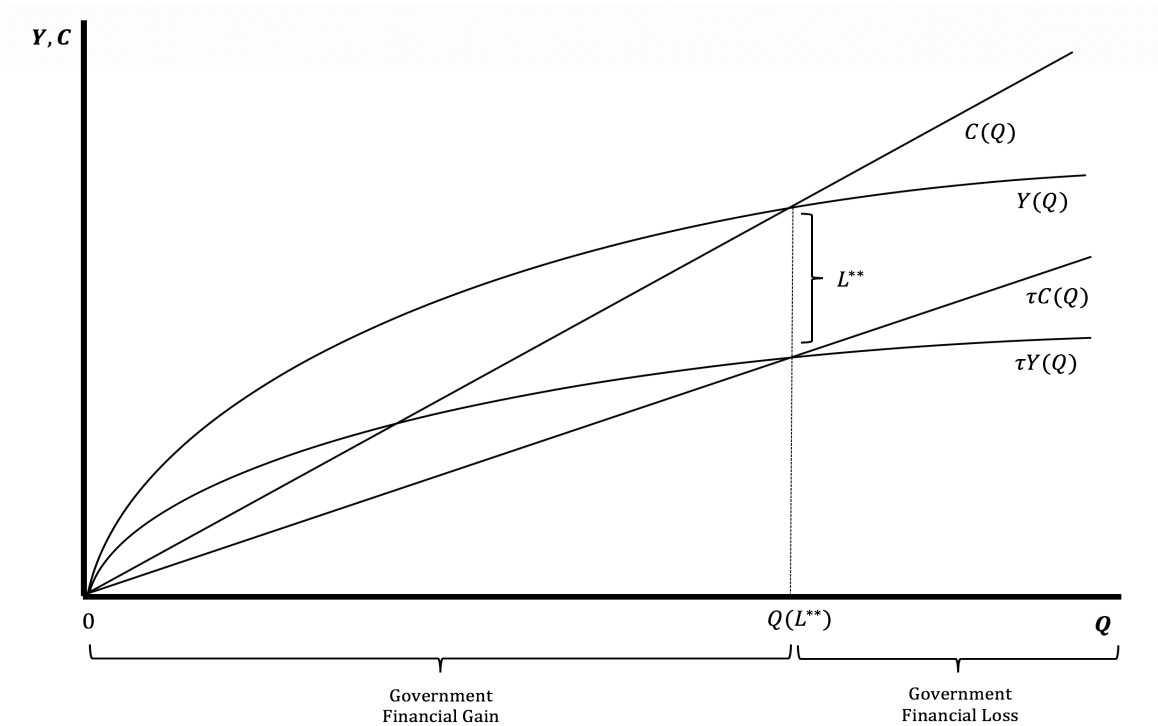
This leads to the following proposition.

***Proposition C.1:** There exists a range of L for which the expected change in the government's financial position is negative.*

This follows from the fact that both $Y(Q)$ and $C(Q)$ pass through the origin, $Y'(Q) > C'(Q)$ at origin, and $C(Q)$ is linear while $Y(Q)$ is concave.

The region where the change in the government's financial position is negative is represented visually in Figure C.1.

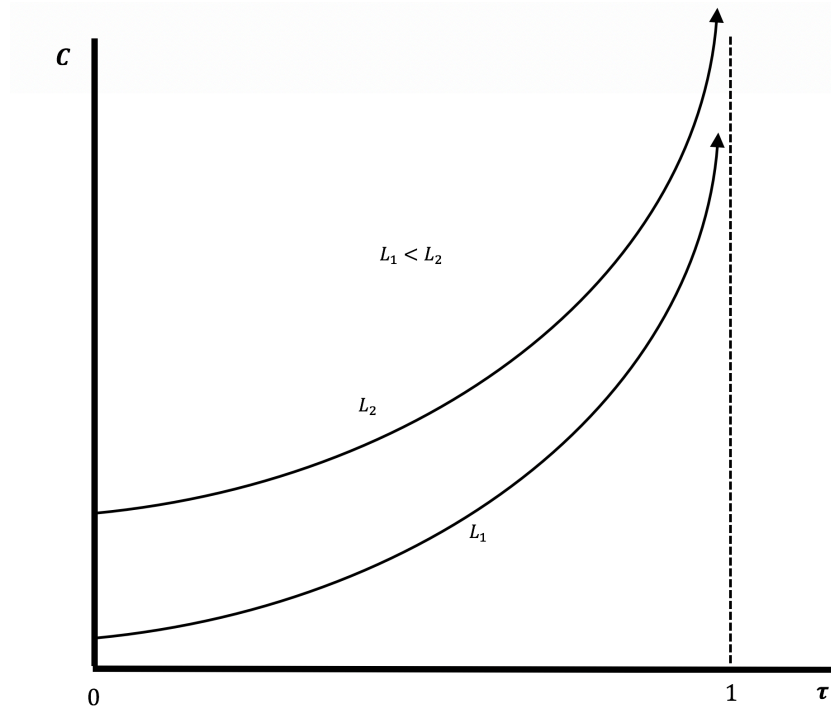
Figure C.1: Region of Government Financial Loss from Taxation Deductibility



Let L^{**} be the point at which $Y\left(Q\left(\frac{L}{1-\tau}\right)\right) = \frac{L}{1-\tau}$. If $L < L^{**}$ then the expected change in the government's financial position is positive. If $L > L^{**}$ then the expected change is negative. This is because the government receives $\tau Y(Q)$ in additional taxation revenue from the individuals receiving investment courtesy of their higher incomes but forgoes $\tau C(Q)$ in taxation revenue from the investor. In the region $L > L^{**}$, $\tau C(Q) > \tau Y(Q)$. If $L = L^{**}$ then the expected change in the government's financial position is zero. This is shown in Figure C.1.

Building on from this, it is straightforward to graph how the investment expenditure varies with changes in the loss threshold L and the taxation rate τ . As shown in Figure C.2, $C(\tau)$ is a convex function with an asymptote at $\tau = 1$. This makes intuitive sense. As the taxation rate increases for an investor, the amount they receive as a taxation deduction increases, which in turns means that they can make a greater initial investment for the same L . An increase in L shifts the curve up, leading to a greater C .

Figure C.2 Investment Expenditure as a Function of Taxation Rate and Loss Threshold



C.4 Investment Selection with Taxation Deductibility

This brings us to the question of whether an investor would incur the search cost, which in our model is necessary to discover the investment that is most inherently effective. The intuition here is straightforward. Discovering the investment option that is the most effective incurs the investor a cost without changing their revenue, which means searching always strictly worsens the investor's financial position. In other words, $\pi^I|_{search} = \pi^I|_{no\ search} - \vartheta$. As $\vartheta > 0$, it follows that $\pi^I|_{search} < \pi^I|_{no\ search}$. A profit-maximizing investor is always better off randomly selecting which investment to make than discovering the most effective investment. There is suboptimal selection with taxation deductibility.

C.5 Investment Effort with Taxation Deductibility

A similar result obtains in relation to the exertion of effort during the investment implementation phase. Investor revenue is based on investment inputs alone, not outputs or outcomes. As exerting high effort carries cost $e > 0$ per unit of quantity but never increases revenue for the investor, the investor is always strictly worse off exerting high effort. That is, $\pi^I|(E = H) = \pi^I|(E = L) - e \cdot q$. As $e > 0$, it follows that $\pi^I|(E = H) < \pi^I|(E = L)$. It follows that high effort is never exerted by a profit-maximizing investor.

C.6 Modified Implied Mechanism Design

Now that we have established that taxation deductibility does not lead to a first-best level of investment quantity, selection or effort, it is worth briefly considering how this compares to the modified mechanism design implied by the research in Chapters 3-6, described and researched in Chapter 7, and modelled rigorously at the end of Appendix B. As before, let us refer to this modified mechanism design involving taxation securitization as Tradeable Income-Based Securities (TIBS).

Whereas a full formal model of TIBS is provided in Appendix B, here a simplified model is offered for comparison purposes. As was the case in Appendix B, here the investor pays the government $P_0 \geq 0$ initially, makes an investment of monetary cost C , and gets back $\alpha\tau Y$. However, one difference with this model, compared to Appendix B, is that here we allow an investor to make a loss up to L . This is so that taxation securitization and taxation deductibility can be more easily and accurately compared. It is also assumed in this model that $\alpha \in (0,1]$.⁵⁰⁷

The expected financial position of the investor, post investment, is given by:

$$\pi^I = \alpha\tau\mathbb{E}(Y) - C - P_0 \quad (\text{C.7})$$

The investor constraint is given by:

$$\alpha\tau\mathbb{E}(Y) - C - P_0 \geq -L \quad (\text{C.8})$$

As such, the maximum investment expenditure is given by:

$$C^M = \alpha\tau\mathbb{E}(Y) + L - P_0 \quad (\text{C.9})$$

Now the expected government tax revenue is:

$$\mathbb{E}[\tau Y(Q)] = \tau \mathbb{E}Y(Q(C)) \quad (\text{C.10})$$

⁵⁰⁷ Note that Appendix B shows that the TIBS mechanism design can still achieve the first-best without this assumption. There does not need to be an upper limit of 1 on the alpha parameter, because if the transfer from the government to the investor exceeds the taxation revenue the government collects, this can be offset by a higher initial transfer P_0 to the government.

Combining the initial lump-sum payment and taxation revenue gives the expected government revenue, as follows:

$$P_0 + \mathbb{E}[\tau Y(Q)] = P_0 + \tau \mathbb{E}Y(Q(C)) \quad (\text{C.11})$$

Given this, the expected change in the government's financial position is given by:

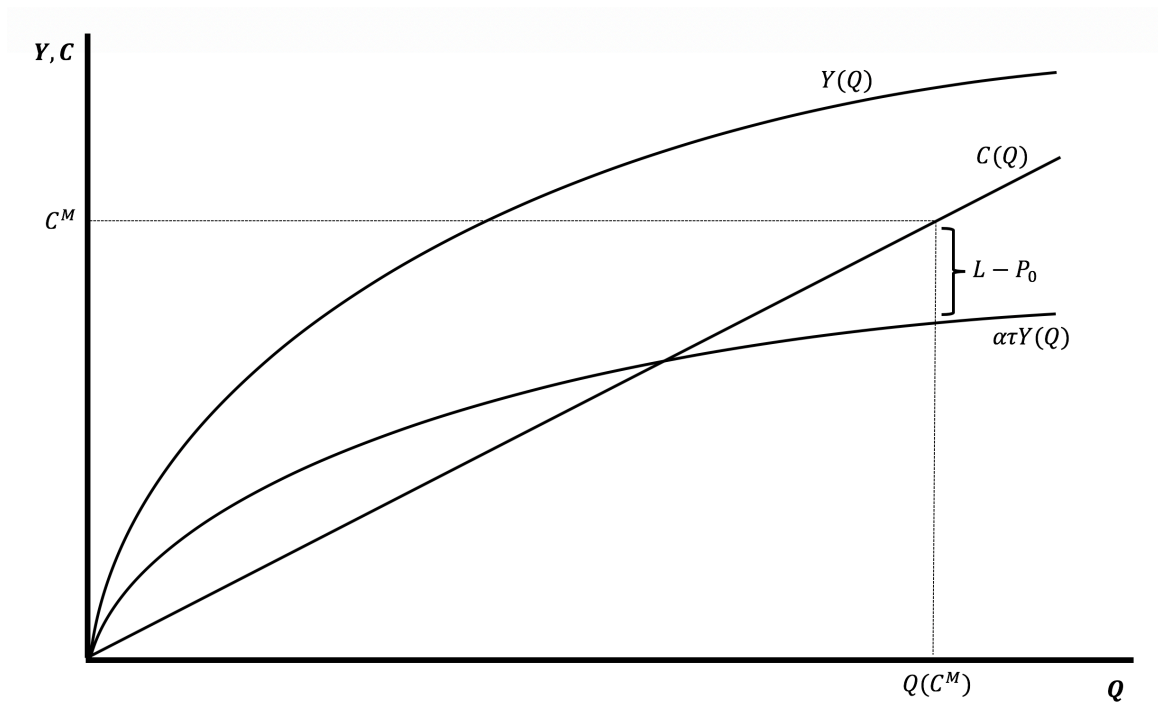
$$P_0 + (1 - \alpha)\tau \mathbb{E}Y(Q(C)) \quad (\text{C.12})$$

Observation C.1: The change in the government's financial position is never negative.

We know from (C.12) that the actual change in the government's financial position is given by $P_0 + (1 - \alpha)\tau Y(Q(C))$. Since $P_0 \geq 0$, $Y \geq 0$ and $\alpha \in (0, 1]$, it follows that $P_0 + (1 - \alpha)\tau Y(Q(C)) \geq 0$.

Graphically, the investor will provide an investment $Q(C^M)$ such that the vertical distance between the cost function $C(Q)$ and the revenue function $\alpha\tau Y(Q)$ is equal to $L - P_0$.

Figure C.3: Graphical Representation of the TIBS Mechanism



Observation C.2: With TIBS, there is a combination of the parameters α and P_0 that can achieve the optimal quantity, Q^ .*

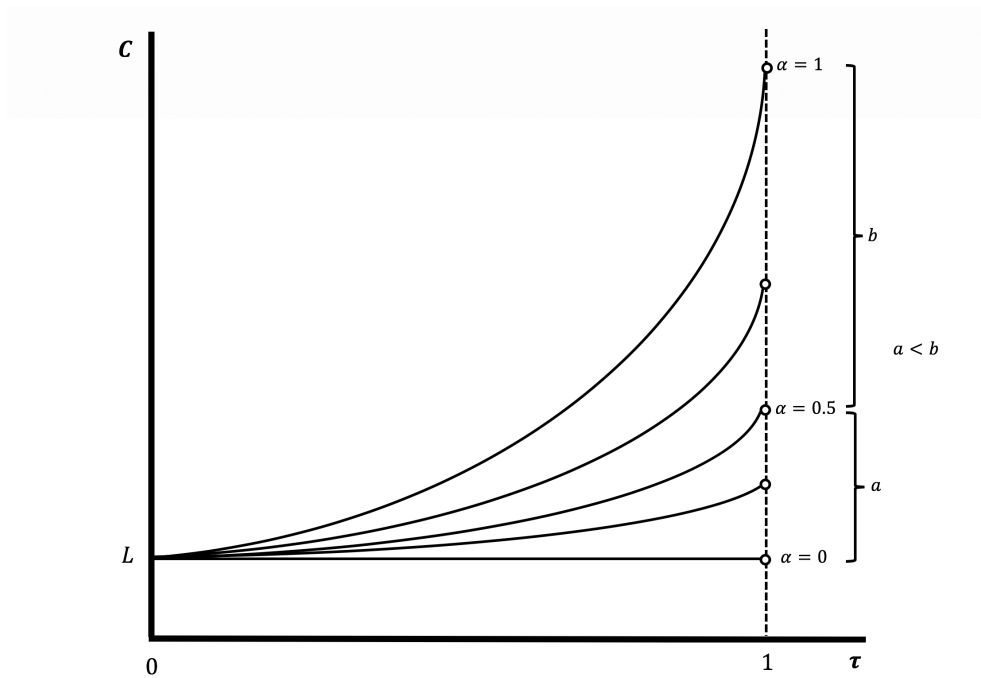
The optimal quantity is where the cost and income functions are tangential. Let C^* be the investment expenditure that leads to Q^* . We know that an investor that is prepared to lose up to L will make investment of size $C^M = \alpha\tau \mathbb{E}(Y) + L - P_0$. As such, all that is needed is for α and P_0 to satisfy $C^* = \alpha\tau \mathbb{E}(Y) + L - P_0$. For this to be the case, $\alpha = \frac{C^* - L + P_0}{\tau Y}$. We know the denominator is

always positive. As such, there is always a P_0 that makes the fraction non-negative by making the numerator positive.

Note that the above reasoning shows that it is always possible to obtain Q^* with the investor making their maximum loss L . However, this is not a necessary condition. The parameters α and P_0 could also be such that $Q^* < Q(C^M)$. In this case, the optimal quantity could be obtained without the investor making their maximum loss.

We can also graph how the investment quantity changes based on τ and α , as shown below. As is evident, this graph is convex, which is known because of the fact that $Y(Q)$ is concave and $C(Q)$ is linear. Unlike in the case of tax deductibility, there is no asymptote at $\tau = 1$. Furthermore, the investment amount is increasing in α , τ and L . As such, $\frac{\partial C}{\partial \alpha}, \frac{\partial C}{\partial \tau}, \frac{\partial C}{\partial L} > 0$. A higher alpha means that investments are greater.

Figure C.4: Investment Expenditure as a Function of τ and α



When it comes to selection search and implementation effort, the equilibrium outcomes with taxation securitization differ from that with taxation deductibility. It has already been shown that with taxation deductibility, the exertion of effort by the investor in either the selection or implementation phases never increases revenue and is therefore never optimal. With taxation securitization, the exertion of high effort in either stage increases expected incomes and therefore expected transfers from the government. Where the increase in expected transfers exceeds the cost of selection search or implementation effort, such costs would be incurred in equilibrium. This observation is consistent with the formal treatment provided in Appendix B, which proves mathematically that high effort is always exerted with the TIBS mechanism in equilibrium.

C.7 Discussion and Conclusion

Overall, this appendix has shown that the tax deductibility mechanism does not achieve the first-best for any of the components of social value – quantity, selection and effort.

When it comes to achieving the optimal investment quantity, the mechanism of taxation deductibility does not enable the government to control the investment quantity provided. The mechanism does not take into account that income as a function of investment quantity is concave. As such, there may be underinvestment or overinvestment. When there is overinvestment, there may be a decline in the government's financial position as a result of allowing taxation deductibility.⁵⁰⁸

There are other ways that the mechanism of tax deductibility undermines the creation of social value. There is no additional return, but there is cost incurred, when an investor exerts effort in either (a) searching for the best investment to undertake, and (b) carrying out that investment. As such, the investor's optimal strategy is to exert no selection effort so that no search cost is incurred, and to not incur effort in the investment implementation. This leads to suboptimal social value creation.

These shortcomings are in contrast with the implied modified mechanism design of Tradeable Income-Based Securities. Unlike taxation deductibility, the government's expected financial position is never negative, the parameters α and P_0 can be set such that the first-best Q is obtained. Furthermore, there is a financial incentive in the form of greater revenue for investors to (a) make those investments that create the greatest social value and (b) exert high effort in the provision of investments.

Considered collectively, the research in the three appendices reveals the shortcomings of the five existing contingent-repayment impact investing mechanisms. Importantly, and as discussed in-detail in Chapter 3, these shortcomings reveal the two main ways and three intermediate ways that impact investing mechanism design affects social value creation.

⁵⁰⁸ Note that this would violate the government's political constraint discussed in Chapter 6 that requires a government to never lose out financially (at least in expectation) from an impact investment.

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