EQUITY-BASED FINANCE FOR FIRMS

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ABSTRACT

Credit is a vital source of investment financing in most economies. Debt-based contracts allow cash-constrained firms to borrow against future profits without ceding control of their firm, using a relatively simple fixed repayment structure. However, excessive debt can lead to more fragile firms, and a misallocation of investment. While the optimal capital structure for a typical firm is likely to contain a combination of both debt and equity, most tax systems systematically discriminate against equity financing by subsidising debt. In Chapter 1, I investigate the effect of a policy change in Belgium that mitigated the classical tax discrimination between debt and equity financing through allowing firms to reduce their taxable income by an amount based on the equity in their capital structure. I find that this policy led to significantly lower leverage ratios, with the effect being greater for larger firms, as would have been expected given the relative incentives for large firms created by the policy change. Analysis of heterogeneous effects reveals that the decrease in leverage was most significant for those firms who were most exposed to risk in the pre-policy period, which provides favourable evidence for the effect of such policies on reducing leverage.

The predominance of debt-based financing is also evident in developing countries, which may benefit from a greater availability of equity-based financing products. In Chapter 2, I present results from work with two of the largest microfinance institutions in Pakistan to investigate the effects of 'microequity' contracts on microenterprises. I implement an artefactual field experiment with Pakistani microenterprise owners, designed using a simple model of investment choice. Results reveal that equity-financed microenterprise owners chose investment options with a greater expected profit than those under debt financing, with heterogeneity analysis suggesting a larger effect for more risk-averse individuals. In the second part of Chapter 2, I present results from a field survey that provides insights on the reasons for which most microfinance institutions do not actually offer microequity products, despite their potential benefits. Results indicate the practical implementation challenges related to costly state verification, adverse selection into income-sharing contracts and moral hazard caused by inappropriately-tailored profit-sharing ratios. Chapter 3 investigates the demand for a shared-ownership microfinance contract, using a field experiment with the same participants as Chapter 2. The contract is designed to help growth-oriented microenterprise owners who have reached their borrowing limit to expand their business with the purchase of a fixed asset. High take-up was observed for the shared-ownership product in general, with a strong preference for a more flexible repayment schedule, which was randomly offered to half of the treatment group. Analysis of heterogenous demand provides some evidence that the preference for flexible contracts is particularly strong among the most risk-averse microenterprise owners, who may benefit more from the implicit insurance inherent in shared-ownership contracts.

Supervisors This thesis was supervised by Colin Mayer and Simon Quinn from the University of Oxford.

Total words This thesis contains approximately 75,000 words.

Statement of authorship Chapters 1 and 2 are single-authored, and fully my own work. Chapter 3 is joint work with Faisal Bari and Kashif Malik from the Lahore University of Management Sciences, and Simon Quinn from the University of Oxford. Simon and I developed the overall research design and funding application, with some comments from Kashif and Faisal. I programmed all the electronic surveys and behavioural games and tested them in the field during a pilot, with feedback from Simon and Kashif. I was responsible for monitoring electronic data collection, with logistical support on the ground provided by Kashif. I conducted the initial empirical analysis, with comments from Simon, who also developed a Bayesian model to complement the main empirical analysis. I wrote the majority of Chapter 3, with input from Simon.

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Ethical approval For Chapters 2 and 3, and the ongoing work described in the conclusion, ethical approval has been sought and obtained from the University of Oxford CUREC committee.

Declaration The work in this thesis is based on research I have carried out at the University of Oxford between August 2014 and April 2018. No part of this thesis has been submitted for a degree at this, or any other, university.

Muhammad Meki (*April 2018)*

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INTRODUCTION

Credit is a vital source of investment financing in most economies. Debt-based contracts allow cash-constrained firms to borrow against future profits without ceding control of their firm, using a relatively simple fixed repayment structure. However, excessive debt can lead to more fragile firms, and a misallocation of investment. Highly-leveraged firms, when faced with a negative shock, may significantly reduce their investments in order to meet the fixed repayment obligations on their debt, even when faced with profitable growth opportunities. Equity financing, which typically involves a greater amount of risk-sharing through performance-contingent payments and shared-ownership, can provide implicit insurance to firms and a buffer against shocks that may be especially valuable in times of economic and financial crisis. While the optimal capital structure of a firm is likely to contain a combination of both debt and equity, most tax systems systematically discriminate against equity-based financing by subsidising debt. The predominance of debt-based financing is also evident in developing countries, which may benefit from a greater availability of equity-based financing products. In this thesis, I investigate the effect of equity-based financing on firms, using data from both a developed and developing country, and using a variety of empirical methodologies. The thesis comprises three chapters, each of which is presented as a distinct research paper.

Most corporate tax systems discriminate between debt and equity financing by allowing firms to reduce their taxable income through a deduction based on the amount they pay to their debt-holders, while payments to equity-holders are taxed. The 2007-2008 global financial crisis and subsequent European sovereign debt crisis have reignited the debate about the bias towards debt financing and the impact of leverage on individual firms and the wider economy. In Chapter 1, I examine the impact of a policy change in Belgium, which provides a unique setting to test the effect of a lower cost of equity financing for firms. In 2006 the Belgian government introduced the Notional Interest Deduction (NID), which mitigated the classical tax discrimination between debt and equity financing by allowing firms to reduce their taxable income by an amount based on the equity in their capital structure. One of the main motivations for the NID was a European Commission ruling that was related to a previous tax policy, rather than domestic conditions; as such, the NID provides plausibly exogenous time-series variation

in the cost of equity financing for Belgian firms. I use a difference-in-difference methodology to estimate the effect of the NID on the capital structure of Belgian firms by comparing outcomes prior and subsequent to the NID policy. The effect of the NID is expected to be most significant for large firms, who faced the greatest incentives to reduce their leverage in the post-policy period. I test for differential effects between small and large firms, which controls for some of the effects of domestic time trends and partially mitigates the concern that there may be trends in the leverage ratio for reasons other than the NID. I find that the NID was associated with significantly lower leverage ratios for Belgian firms, with the effect being greater for larger firms, as would have been expected given the relative incentives that the policy created for large firms. Results are robust to the use of different measures of leverage and inclusion of a number of covariates that have been demonstrated in the literature to be important determinants of capital structure decisions. Results are also robust to adding French firms as an additional control, given the geographic and cultural proximity to Belgian firms, and the fact that they are relatively integrated economically and exposed to similar shocks. In the final section of the empirical analysis, I investigate heterogeneous treatment effects along an important dimension of heterogeneity: risk exposure. As a proxy for risk exposure, the coefficient of variation of sales for firms is employed, using both a sector-specific and a firm-specific measure. Using both measures, I find a significantly greater increase in equity ratios for firms that were most exposed to risk in the pre-NID period. Results from Chapter 1 provide promising evidence for the impact of 'Allowance for Corporate Equity' (ACE) systems; by offering a more flexible form of capital, equity financing has the potential to more effectively encourage high-potential growth firms to undertake riskier but higher expected-return investments due to the implicit insurance of performance-contingent payments. More broadly, financial systems that are based predominantly on fixed-repayment obligation debt financing can be more fragile. The conflicting policy of requiring banks to hold more equity through capital requirements, while simultaneously encouraging them to hold more debt through the tax system, significantly complicates and distorts the functioning of the financial system. The NID provides a useful example of one way to level the debt-equity playing field and potentially establish a more resilient financial system.

Chapters 2 and 3 investigate the potential for equity-based financing for microenterprises in developing countries. Access to finance is often listed as one of the most important constraints

on the expansion of informal micro, small and medium enterprises in many low-income countries. Numerous existing studies focus on the role of microcredit as a source of capital; other work complements this by investigating the effect of microsavings and microinsurance. In Chapter 2, I consider a different approach: 'microequity'. Microequity contracts, which involve performance-contingent repayments, have the potential to provide a more flexible form of capital that could more effectively stimulate growth for some microenterprises in developing countries. Microequity contracts may, relative to microcredit contracts, encourage higher risk and higher return investments, by providing a form of implicit insurance to microenterprises that automatically reduces repayment requirements when business conditions are challenging. This is in contrast to microcredit and microsavings products, which often have strict payment schedules, and, in the case of microcredit, relatively high interest rates. The effects could be particularly strong for microenterprise owners whose behavioural characteristics lead them to under-invest in profitable opportunities, such as those with higher levels of risk aversion. Such individuals may be more willing to choose riskier but higher expected-return investments when given the implicit insurance of microequity contracts, which mitigate the risk of losing their own wealth, compared to non-performance-contingent, fixed-repayment debt contracts.

Initially, it was believed that microcredit would be an effective tool for encouraging entrepreneurship and growth of microenterprises. However, several recent studies have suggested that microloans have not had large benefits for most entrepreneurs and that microcredit-funded businesses rarely grow beyond a subsistence level of entrepreneurship. Other studies have shown that cash and capital grants have delivered high and sustained returns to certain kinds of microenterprise, and that small changes to microcredit contract structure, such as repayment grace periods, can facilitate 'lumpy investment' and have a positive long-term effect on profits. Microequity contracts can be situated at some point on a spectrum between credit and grants, sharing characteristics of both, by providing capital with performance-contingent repayments. In the first part of Chapter 2, I test a microequity contract using an artefactual field experiment with microenterprise owners who were part of a broader field experiment, two-thirds of whom were randomly offered a relatively large amount of financing to purchase an asset for their business. (This was done using an 'equity-like' shared-ownership contract, which is the subject of Chapter 3 of this thesis.) The 'lab-in-field' experiment was designed using a simple theoretical model, in which a utility-maximising agent makes investment decisions in discrete time.

Financial contracts are subsequently introduced to investigate investment behaviour under equity and debt. The model predicts that agents are more likely to choose higher-risk, higher expected-return investment options when financed with performance-contingent-repayment equity contracts, compared to investment decisions taken under a fixed-repayment debt contract. This prediction is stronger for more risk-averse agents. Results from the experiment are consistent with the theoretical predictions; equity-financed microentrepreneurs chose investment options with a higher expected return than under debt financing, with an effect size of 0.40 standard deviations. Heterogeneity analysis with pre-specified variables reveals a treatment effect that is approximately 50% larger for the most risk-averse microenterprise owners, using a survey-based measure of risk aversion. However, while the welfare effects on this population of individuals could be significant, from a policy perspective microfinance institutions may be reluctant to provide such financing if those individuals who take the most risk under equity financing also tend to be those with poorer business management practices, education or cognitive ability. The results presented in the second part of the heterogeneity analysis in Chapter 2 serve to mitigate such concerns; I find no evidence that microenterprise owners with lower business management practices, education or cognitive ability are those for whom equity contracts incentivise the greatest risk-taking relative to debt.

Following on from the positive results in the artefactual field experiment, the second part of Chapter 2 provides some insights for why large microfinance institutions (MFIs) do not typically offer microequity contracts alongside other products in their portfolio. Given the stated objectives of many MFIs to consider borrower welfare as well as profits, it is surprising that no large MFI appears to be implementing microequity contracts, in light of the potential benefits. I report on an attempt by one of the largest MFIs in Pakistan to implement microequity contracts with microenterprise owners in the field. Results from a detailed client survey and a post-survey focus group with senior management indicate the significant challenges of implementing equity-based contracts within a conventional microcredit organisation. While contracts were initially implemented with profit- and loss-sharing, gradually clients and loan officers abandoned the performance-contingent payment features and converged back to a model of fixed-repayment debt contracts. Interviews with senior management and loan officers uncover key reasons for this convergence, which echo results from theoretical work that has investigated the difficulties in implementing performance-contingent contracts, such as equity or sharecrop-

ping. These include costly state verification, adverse selection into income-sharing contracts and moral hazard caused by inappropriately-tailored profit-sharing ratios.

Chapter 3 presents results from a field experiment with the same individuals who participated in the artefactual field experiment in Chapter 2, and is joint work with Faisal Bari and Kashif Malik from the Lahore University of Management Sciences and Simon Quinn from the University of Oxford. We conduct a field experiment in which we offer a relatively large amount of financing to growth-oriented microenterprise owners, using a shared-ownership contract. We focus on shared equity in a single asset, as a proof of concept for shared equity more generally, and to investigate demand for such products. We find high take-up rates for our shared-ownership product in general, and a strong preference for a more flexible repayment schedule among microenterprise owners. Analysis of heterogenous demand provides some evidence that the preference for flexible contracts is particularly strong among the most risk-averse microenterprise owners. This result is significant when compared to the existing literature that reports a higher take-up of flexible microfinance contracts among the *least* risk-averse, which we suggest is due to the shared-ownership structure of our contracts and their inherent implicit insurance. Overall, results indicate promising evidence for the potential of shared-ownership microfinance contracts to help stimulate investment among growth-oriented microenterprise owners.

In summary, Chapters 2 and 3 provide encouraging results for the potential of equity-based contracts to stimulate the growth of microenterprises in developing countries. However, the challenges arising from costly state verification and moral hazard suggest the need to carefully investigate specific innovations in microfinance contract structure that test one particular feature of equity financing, rather than the assortment of features inherent in traditional equity contracts. This is particularly important in environments characterised by high information asymmetries. In the conclusion, I describe three projects that have recently emerged out of the insights in this thesis, where I collaborate with three distinct sets of researchers. The first is an ongoing field experiment in Kenya, where we partner with one of the largest corporations in the world to help growth-oriented microentrepreneurs finance an asset for their business. We test out a variety of different contracts, including a fixed-repayment debt contract, an index-insurance contract, and an 'equity-like' contract that involves performance-contingent

payments. The unique setting of a route-to-market micro-distribution program allows the implementation of performance-contingent contracts, because there is a credible proxy for microentrepreneurs' performance, thereby mitigating issues of costly state verification. The second project is based in Indonesia, where we work with the largest insurance company in the world to assist them in designing a 'venture-capital-like' investment fund for microenterprises. This builds on the specific insights from Chapter 2 that reveal the challenges to implementing equity-like contracts within a conventional microcredit institution, where loan officers do not have an incentive to finance high-risk, high-reward microenterprises, as they would not share in their upside potential but would be exposed to the greater downside risk. Finally, the third experiment is based in Bangladesh, and investigates an aspect of equity financing that has not been explored in this thesis: the element of mentorship and advice that is often a feature of equity financing from 'business angels' and venture capitalists in developed countries. The mentorship plus equity dimension could be a particularly successful one, given that many business training programs have yielded limited, short-term benefits for business practices of microentrepreneurs, with little impact on sales or profits. We hypothesise that entrepreneurial mentorship could be more effective when mentors are incentivised directly by the productivity of their mentees, or, in other words, when they have 'skin in the game'.

Chapter 1

Cost of Equity Financing and Capital Structure: Evidence from a Policy Change in Belgium

Abstract Most corporate tax systems discriminate between debt and equity financing by allowing firms to reduce their taxable income through a deduction based on the amount they pay to their debt-holders, while payments to equity-holders are taxed. The 2007-2008 global financial crisis and subsequent European sovereign debt crisis have reignited the debate about the bias towards debt financing and the impact of leverage on individual firms and the wider economy. In this paper I investigate the impact of a policy change in Belgium, which provides a unique setting to test the effect of a lower cost of equity financing for firms. In 2006 the Belgian government introduced the Notional Interest Deduction (NID), which mitigated the classical tax discrimination between debt and equity financing by allowing firms to reduce their taxable income by an amount based on the equity in their capital structure. I find that this policy led to significantly lower leverage ratios, with the effect being greater for larger firms, as would have been expected given the relative incentives that the policy created for large firms. Results are robust to the use of different measures of leverage, and to the use of various controls for potentially confounding factors. Analysis of heterogeneous treatment effects reveals a significantly greater increase in equity ratios for firms that were most exposed to risk in the pre-NID period. This provides promising evidence for the impact of 'Allowance for Corporate Equity' (ACE) systems. By providing a more flexible form of capital, equity financing has the potential to more effectively encourage high-potential-growth firms to undertake riskier but higher expected-return investments by providing them with the implicit insurance of performance-contingent payments. More broadly, financial systems that are based predominantly on fixed-repayment obligation debt financing can be more fragile. The NID provides a useful example of one way to build a more resilient financial system.

1.1 Introduction: Levelling the debt-equity playing field

The majority of corporate tax systems discriminate between debt and equity financing by allowing firms to reduce their taxable income through a deduction based on the amount they pay to their debt-holders, while payments to equity-holders are taxed. The 2007-2008 global financial crisis and subsequent European sovereign debt crisis have reignited the debate about the bias towards debt financing and the impact of leverage on individual firms and the wider economy. For example, the Mirrlees Review argues that this system of corporate taxation discourages business investment and exposes firms to greater risk of bankruptcy,[1] whilst the LSE Growth Commission finds that it distorts long-term investment incentives,[2] and The Economist magazine recently described it as a "senseless subsidy that wins the title of the world's worst economic distortion".[3] Mayer, Micossi, Onado, Pagano, and Polo (2018) argue that the conflicting policy of requiring banks to hold more equity through capital requirements, while simultaneously encouraging them to hold more debt through the tax system, distorts, complicates and undermines the functioning of the corporate and financial system. Kolev, Barbiero, Popov, Brutscher, and Wolski (2018) investigate debt overhang and investment misallocation in Europe during the recent financial crisis. They find that the firms with higher levels of leverage in the pre-crisis period were those that reduced their investment the most after the crisis, and that this effect was particularly strong for firms that faced the greatest growth opportunities.

In this paper, I investigate the impact of a policy reform that sought to equalise the tax treatment of equity and debt, which provides a unique setting to test the effect of a lower cost of equity financing for firms. In 2006 the Belgian government introduced the Notional Interest Deduction (NID), which is an 'Allowance for Corporate Equity' (ACE) system. The NID mitigated the classical tax discrimination between debt and equity financing by allowing firms to reduce their taxable income by a notional interest charge, based on the amount of equity in their capital structure. One of the main motivations for the NID was a European Commission ruling that was related to a previous tax policy, rather than domestic conditions; as such, the NID provides plausibly exogenous time-series variation in the cost of equity financing for Belgian firms. I use a difference-in-difference methodology to estimate the effect of the NID on the capital structure of Belgian firms by comparing outcomes before and after the NID policy.

[1] See Mirrlees, Adam, Besley, Blundell, Bond, Chote, Gammie, P. Johnson, Myles, and Poterba (2010).
[2] See Aghion, Besley, Brown, Caselli, Lambert, Lomax, Pissarides, Stern, and Van Reenen (2013).
[3] See The Economist (2015).

The effect of the NID is expected to be most significant for large firms, who faced the greatest incentives to reduce their leverage in the post-policy period. I test for differential effects between small and large firms, which controls for some of the effects of domestic time trends and partially mitigates the concern that there may be trends in the leverage ratio for reasons other than the NID. I find that the NID was associated with significantly lower leverage ratios for Belgian firms, with the effect being greater for larger firms, as would have been expected given the relative incentives that the policy created for large firms. Results are robust to the use of different measures of leverage, inclusion of a number of covariates that have been shown in the literature to be important determinants of capital structure decisions (using both their baseline pre-NID values as well as their pre-NID trends), and including pre-NID trends in the outcome variable itself. Results are also robust to adding French firms as an additional control, given the geographic and cultural proximity to Belgian firms, and the fact that they are relatively integrated economically and exposed to similar shocks. In the final section of the empirical analysis, I investigate heterogeneous treatment effects along an important dimension of heterogeneity: risk exposure. As a proxy for risk exposure, I calculate the coefficient of variation of sales for firms, using both a sector-specific and a firm-specific measure. Using both measures, I find a significantly greater increase in equity ratios for firms that were most exposed to risk in the pre-NID period. This provides promising evidence for the impact of 'Allowance for Corporate Equity' (ACE) systems: by providing a more flexible form of capital, equity financing has the potential to more effectively encourage high-potential-growth firms to undertake riskier but higher expected-return investments by providing them with the implicit insurance of performance-contingent payments. More broadly, financial systems that are based predominantly on fixed-repayment obligation debt financing can be more fragile. The NID provides a useful example of one way to successfully build a more resilient financial system.

I contribute to the large academic literature investigating firms' choice of leverage ratio, beginning with the classic 'capital structure irrelevance principle' of Modigliani and Miller (1958), which states that in an efficient market without frictions, the value of a firm is unaffected by whether it finances its assets with debt or equity.[4] Departing from these strong assumptions,

[4] According to the capital structure irrelevance principle, firm value is determined by earning power and asset riskiness, not by how those assets are financed; the optimal capital structure is the one that supports this real side of the business (operations and investments).

the 'pecking order theory' of capital structure captures the impact of asymmetric information,[5] and the agency cost theory investigates conflicts between various groups that have a claim on the resources of the firm.[6] These influential theories make key predictions about the importance of firm profitability, tangibility and liquidity ratios on capital structure decisions, and I use all of these variables as baseline controls in the robustness section of my analysis (both their pre-NID average values and their pre-NID trends). The most relevant theory for the empirical strategy is the 'trade-off theory', which captures the impact of taxes and bankruptcy costs, and leads to the main prediction that I test in the empirical section: as firms' choice of capital structure is expected to respond to tax incentives, leverage ratios should decrease following the introduction of NID, in particular for those firms that faced the greatest incentives to do so (large Belgian firms).[7] There is an extensive empirical literature that examines the effect of taxes on financing decisions of firms.[8] However, many studies suffer from endogeneity problems and only use cross-sectional variation in tax rates. Moreover, it is very difficult to find tax reforms that lead to large variations in tax incentives, and most studies use the Compustat database of publicly listed firms. In this paper, I examine the impact of a tax reform that generated large changes in the tax treatment of equity and variation at the firm level, and whose implementation was triggered by a European Commission ruling rather than domestic fiscal considerations. Further, I use data from a large database that contains information for small and medium enterprises (SMEs), which represent more than 99% of all businesses in the Euro-

[5]See Myers (1984); Myers and Majluf (1984). Managers are assumed to have private information about the characteristics of the firm's investment opportunities and income streams. A firm's choice of capital structure conveys private information to capital markets or mitigates adverse selection effects. The authors show that, if investors are less informed than managers about the value of the firm's assets, then equity may be mis-priced by the market. The pecking order theory postulates that, given this cost of external financing that increases with asymmetric information, there exists a hierarchy of financing sources: firms prefer to finance with internal funds first, and then debt, which is less mis-priced than equity because its value is less sensitive to the private information about the firm's assets and investment opportunities.

[6]The theory states that capital structure is chosen to mitigate conflicts of interest among various groups that have a claim on the resources of the firm (Fama and Miller, 1972; Jensen and Meckling, 1976). Conflicts between shareholders and managers can be mitigated by having a larger amount of debt, which commits the firm to pay out cash that could otherwise be spent by managers in ways that primarily benefit themselves. The agency benefit of debt financing then needs to be balanced against the agency cost, known as the 'asset substitution effect', which is caused by conflicts between debt-holders and equity-holders. Firms that are highly leveraged have a greater incentive to take overly risky investment decisions that maximise value for shareholders, whose payoff is asymmetric, as they implicitly own a call option on the assets of the firm.

[7]According to the trade-off theory, firms decide on their optimal capital structure by comparing the tax advantages of debt to its costs, in particular the cost of financial distress (Kraus and Litzenberger, 1973; Miller, 1977; Myers, 1984).

[8]See Graham (2003); Berk and DeMarzo (2007). MacKie-Mason (1990) shows evidence of substantial tax effects on the choice between issuing debt or equity. Graham (1996) finds a positive relationship between tax rates and leverage ratios. Similarly, Rajan and Zingales (1995) show that tax rates significantly affected financing decisions in a number of countries.

pean Union, and provide 85% of all new jobs.[9]

The importance of SMEs in many economies has led to government policies that aim to address financing constraints for small businesses. For example, the EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) has a budget of €2.3 billion. However, in reality the median surviving SME experiences very little growth, with a small proportion of SMEs experiencing very rapid growth and creating many jobs. It is becoming increasingly evident that it is extremely difficult to predict ex-ante which firms will successfully grow (Nanda, 2016). As such, it has been argued that policymakers should, rather than attempting to "pick winners" and finance them explicitly or implicitly (through loan guarantees),[10] create an 'enabling environment' for investors and entrepreneurs that can facilitate the growth of high-potential firms by setting the conditions for efficient trial-and-error experimentation (Kerr, Nanda, and Rhodes-Kropf, 2014). Equity financing, by providing a more flexible form of capital, can better allow for such experimentation and can lead to a more growth-enhancing form of 'creative destruction' (Aghion, Akcigit, and Howitt, 2014; Brown and Petersen, 2010). Such experimentation and high-growth-potential will often be accompanied by increased volatility and uncertainty, and equity financing – through performance-contingent repayments – can provide the implicit insurance necessary for many firms to experiment with high-risk, high-potential growth investments. One of the main contributions of this paper is in its analysis of heterogeneous treatment effects, where I show that the greatest increase in equity ratios in the post-NID period was among the most risk-exposed firms. If the highest potential growth sectors also have the highest risk, then the result that the most risk-exposed firms increased their equity ratios by the greatest amount is a positive additional outcome of the NID policy. A closer look at some of the sectors that are defined as 'most risk-exposed' based on the coefficient of variation measure that I use reveals a number of high-potential-growth sectors, including computer- and software- related services, research and development services, business and management consulting services, as well as a number of other high-potential-growth service sectors.

[9] See Gagliardi, Muller, Glossop, Caliandro, Fritsch, Brtkova, Bohn, Klitou, Avigdor, Marzocchi, et al. (2013).

[10] Credit guarantee schemes have become very popular in the European Union and other countries (Beck, Klapper, and Mendoza, 2010; Gozzi and Schmukler, 2015). See Nanda (2016) for a discussion of US Small Business Administration loan subsidies, and Lelarge, Sraer, and Thesmar (2010) and Lerner and Schoar (2010) for discussions about a French loan guarantee program.

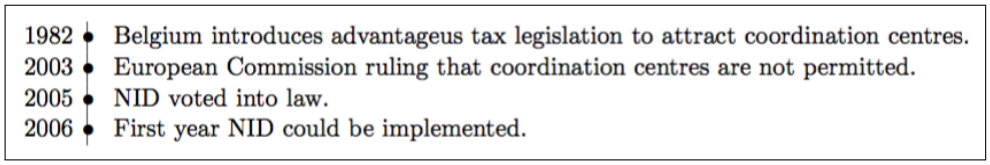
Other studies have investigated the impact of the NID on the capital structure of Belgian firms, with mixed results. Van Campenhout and Van Caneghem (2013), using a sample of 614 firms and data up to 2007, do not find any effect of the NID on the leverage of SMEs. Conversely, Kestens, Van Cauwenberge, and Christiaens (2012) use data from 4,474 small firms up to 2008 and a simulation procedure for marginal tax rates and find that the NID led to lower leverage ratios. Princen (2012), using a sample of 3,332 Belgian firms and 17,100 French firms and data up to 2007, argues that the NID did lead to Belgian firms reducing their leverage relative to French firms. Panier, Pérez-González, and Villanueva (2013) also find a significant effect of the NID on equity ratios of Belgian firms, using data up to 2009 from five countries. Other studies focus on the effect of NID on banks, which are not included in my sample. Célérier, Kick, and Ongena (2018) investigate the effect on banks and find that Belgian banks that were based in Germany extended more credit locally when compared to other banks in Germany that were not affected by the NID. Schepens (2016) finds that the NID led to an increase in equity ratios for Belgian banks.

Compared to the majority of these studies, the dataset I use contains more firms (over 350,000 firm-year observations). These data cover a ten-year period up to 2013, which goes beyond the aforementioned (non-bank) studies and allows me to measure longer-term effects of the NID on capital structure, in particular during the period of the global financial crisis and European sovereign debt crisis. My results are consistent with those found in Princen (2012) and Panier, Pérez-González, and Villanueva (2013), but not with those in Van Campenhout and Van Caneghem (2013), which may be due to having a larger and more recent dataset (the analysis in Section 1.4 reveals a gradual increase in equity ratios in the post-policy years, rather than a sharp increase immediately after implementation of the NID). As mentioned, a distinct contribution of this paper is in the heterogeneity analysis that reveals a significantly larger increase in equity ratios for the most risk-exposed treatment firms, which has important policy implications for ACE systems to create an enabling environment for higher-risk, high-potential-growth firms. The remainder of the paper proceeds as follows. Section 1.2 describes the institutional background to the introduction of the NID, Section 1.3 describes the dataset, Section 1.4 presents results and Section 1.5 concludes.

1.2 The Notional Interest Deduction

The Notional Interest Deduction (NID) was implemented in Belgium from 2006. Figure 1.1 provides a timeline of key events. There were three stated motivations for the law: (i) to improve solvency and create more strongly capitalised firms; (ii) to reduce the tax discrimination between debt and equity; and (iii) most importantly for the identification strategy in this paper, the main reason for the introduction of the NID was to offer an alternative to the special tax regime that had previously existed for 'coordination centres' in Belgium.[11] Coordination centres are companies belonging to multinational groups, which provide financial, accounting and administrative services on behalf of their multinational group. From 1982 to 2003, these coordination centres had benefitted from advantageous tax legislation that had sought to attract the investment of multinational corporations to Belgium. A European Commission ruling in 2003 stated that coordination centres contravened European Union rules on state aid by providing tax benefits to multinationals that were not available to all Belgian firms. Many coordination centres were largely equity-financed. The potential loss of these treasury centres led the tax authorities and business community to design an 'Allowance for Corporate Equity' (ACE) system, which was implemented in the form of the NID. Since this policy was primarily triggered by the European Commission's ruling and not by domestic conditions, it provides exogenous variation in the cost of equity financing for Belgian firms.

Figure 1.1: TIMELINE



In most corporate tax systems, there is a discrimination between debt and equity financing. Firms are typically able to reduce their taxable income by an amount based on the interest payments they make to their debt-holders, while no such deductibility exists for dividend payments to equity-holders. ACE systems seek to mitigate this discrimination by combining interest payment deductibility with a deduction based on the amount of equity a company has in its capital structure. The amount of the deduction is calculated as the adjusted book value of shareholder's equity, multiplied by a given ACE rate. The ACE system is based on the concept

[11] See Panier, Pérez-González, and Villanueva (2013); Zangari et al. (2014); Célérier, Kick, and Ongena (2018).

of a neutral 'pure profits' tax that does not affect the investment decisions of the firm, because it obtains revenues in a non-distorting manner, due to the neutral taxation of capital income (Boadway and Bruce, 1984; Devereux and Freeman, 1991). ACE systems have been strongly promoted by the Mirrlees Review and by the Institute for Fiscal Studies as a way of achieving tax neutrality between debt and equity financing.[12] A number of countries have introduced tax reforms that included features of an ACE system, however analysis of the impact of these reforms has been difficult.[13] Many of these ACE systems were implemented in a restricted form and most countries discontinued the reforms after only a short period. Further, there is a lack of large datasets and in many cases implementation took place at the same time as a number of other changes in tax policy (Chen, Lee, and Mintz, 2002; Klemm, 2007).

The NID allows Belgian firms to reduce their taxable profit by an amount that is equal to the product of the firm's adjusted book value of equity and the average rate on 10-year Belgian Government Bonds. The simplicity of the NID calculation is a very desirable property, given that the effects of tax reforms can be greatly attenuated with complex tax systems.[14] For example, if the rate on the 10-year Belgian Government Bond was 3%, then a firm with €100,000 in equity would be able to reduce its taxable income by €3,000.[15] All firms incorporated in Belgium are eligible for the NID, which became effective in 2006. There were two major provisions included in the NID that differentially affected small firms, which are defined as those having fewer than 100 employees and not exceeding more than one of the following three thresholds: (i) total assets of €3.65 million; (ii) revenue of €7.3 million; and (iii) 50 employees. Although small firms were actually provided with an additional 0.5% NID deduction, two reforms that were implemented at the same time as the NID made it less attractive for small firms to increase their equity (Panier, Pérez-González, and Villanueva, 2013; Van Campenhout and Van Caneghem, 2013). The first reform was the elimination of a tax that had incentivised the use of equity financing before the NID. This had provided a tax credit to firms that had increased

[12] See Mirrlees, Adam, Besley, Blundell, Bond, Chote, Gammie, P. Johnson, Myles, and Poterba (2010); Gammie (1991).

[13] In Europe, ACE systems were implemented in Croatia (1994-2000), Austria (2000-2004) and Italy (1997-2003).

[14] See Chetty, Looney, and Kroft (2009); Abeler and Jäger (2015).

[15] If the rate of return on equity for this company is less than or equal to 3%, then it would face a zero corporate tax rate. A higher rate of return on equity would only be subject to corporate tax at a rate equal to the excess of its return over and above the NID rate of 3% in this example, thereby reducing its effective corporate tax rate.The statutory tax rate for large firms in Belgium is relatively high, at 33.99%. SMEs benefit from a progressive tax rate: 24.98% on income up to €25,000, 31.93% on income between €25,000 and €90,000, and 35.53% on income between €90,000 and €322,500.

their equity capital above the maximum that it had reached in the previous three years. The credit was for 7.5% of the amount of the equity increase, up to a maximum of €19,850. The second reform was the discontinuation of the Untaxed Investment Reserve (UIR) program, which allowed firms to reduce their taxable income by an amount equal to the value of their investments that were funded with retained earnings, by an amount up to €18,750 per year. These two reforms led to relatively weaker incentives for small firms to increase their equity capital following the introduction of NID. Given the combined amount of these allowances is €38,600, and assuming an NID rate of 3%, firms with equity values of €1.29 million or above would benefit from increasing their equity ratios through the NID. Assuming an equity ratio of 35% – the median pre-policy equity ratio for the sample of Belgian firms used in this paper – this implies that firms with total assets of €3.7 million or above would benefit from increasing their equity capital. Given these different incentives for small and large Belgian firms, in the empirical strategy in Section 1.4 I use a difference-in-difference estimator and time-series variation in the cost of equity financing to estimate the effect of the NID on leverage ratios, by testing for differential effects between small and large firms. This controls for some of the effects of domestic time trends in Belgium, and partially mitigates the concern that there may be trends in the leverage ratio that are due to reasons other than NID, which would bias estimates of the NID's effect. As a further empirical strategy, in the robustness analysis in Section 1.4.3 I add French firms as an additional control. French firms are geographically and culturally close to Belgian firms, and their relative economic integration implies that they are exposed to similar shocks and trends.

1.3 Data

The dataset consists of annual firm-level data for Belgian and French firms between 2003 and 2013, extracted from Bureau van Dijk's Orbis database, which provides financial information on nearly 150 million companies worldwide with an emphasis on private firms.[16] Orbis combines company account information from a number of different sources, which is then presented in a standardised format. The primary source of the Belgian data is standardised annual accounts from the National Bank of Belgium (NBB). All firms in Belgium, both privately and publicly owned, are required to file accounts with the NBB, where they must report the total value of their assets, equity and non-equity liabilities, as well as operating and net income. Failure to

[16]The data was extracted in 2014, and 2004 was the earliest year available.

report or misreporting financial statements is a criminal offence that would result in substantial fines by the NBB, as well as possible penalties under civil law (Panier, Pérez-González, and Villanueva, 2013). The Belgian firm-level data are therefore likely to be of very high quality. The coverage of the French data is also very comprehensive, given that all firms in France must file standardised financial accounts to the authorities. I use data for all limited liability corporations that were active and had data available for at least one year in the two years prior to implementation of the NID (2004 and 2005).[17] The balanced nature of the panel raises the possibility of survivorship bias. However, under reasonable assumptions, this would imply that the difference-in-difference coefficient estimated in Section 1.4.2 is actually a lower bound to the true effect. Specifically, if one assumes that firm death is more likely among small firms than large firms, then having a balanced panel excludes proportionately more small firms. It is not unreasonable to assume that the average firm that went bankrupt and disappeared from the panel was more likely to have experienced negative profits and retained earnings. Since equity in the balance sheet is defined as the sum of paid-in capital and retained earnings, this implies that such dying firms would have experienced lower equity ratios, and if their decline had also been preceded by an increase in leverage and possible financial distress, that would provide another reason for their trajectory to have been of higher debt ratios and lower equity ratios. Therefore, if one assumes that firms missing from the balanced panel are more likely to have been small and have been experiencing a negative performance trajectory before their death, had they been included in the sample then the estimated coefficient in the difference-in-difference specification would be even larger than what is calculated here, because those missing firms would have resulted in the overall sample of small firms having a lower increase in equity ratios from pre- to post-NID, which would amplify the relative increase in equity ratios of large firms.

Table 1.1 presents summary statistics for all firms, separated by country and size category. The sample contains 169,950 and 199,590 firm-year observations for Belgium and France respectively. The median asset value for Belgian and French firms is very similar, at €1.268 and €1.247

[17] I exclude all non-profit entities, sole traders and partnerships, as well as subsidiaries of larger groups, since their capital structure may be a function of strategic decisions and financial management considerations at the group level (Bolton and Scharfstein, 1998; Chang and Hong, 2000; Dewaelheyns and Van Hulle, 2006; Rajan, Servaes, and Zingales, 2000; J. Stein, 1997). I also exclude firms whose assets were below €1,000,000 in all ten years of the dataset, since their capital structure decisions may reflect household leverage considerations. Firms in heavily regulated industries or those with unique legislation such as agriculture, finance or utilities are also excluded. Following Princen (2012), I account for outliers by excluding firms that have ratios less than 0% or greater than 100% of total assets.

million respectively. Figure 1.2 illustrates the similarity in terms of the distribution of firm size. Mean equity ratios are lower for Belgian firms (42.9%) compared to French firms (45.7%). The average age of Belgian and French firms is similar (24.5 and 24.0 years respectively). Tangibility ratios are higher for Belgian firms (34.8%) compared to French firms (13.1%), while profitability ratios are lower (6.2% compared to 10.1%), as are cash ratios (18.6% and 25.3% respectively).

Table 1.1: SUMMARY STATISTICS

	(1)	(2)	(3)	(4)	(5)	(6)
	Mean/Median	Mean/Median	Mean/Median	Mean/Median	Mean/Median	Mean/Median
Total assets	2118.3	1611.5	11290.4	2466.7	1559.7	19396.3
	1268.5	1218.9	7468.4	1247.5	1203.5	7266.0
Log(Assets)	7.2	7.1	9.0	7.2	7.1	9.0
	7.1	7.1	8.9	7.1	7.1	8.9
Equity ratio	42.9	42.9	42.4	45.7	45.8	44.0
	38.6	38.7	37.0	44.3	44.5	41.6
L/T debt ratio	15.9	16.2	9.7	6.4	6.4	6.0
	8.3	8.8	2.4	0.7	0.7	0.6
Age	24.5	24.2	31.0	24.0	23.6	31.5
	22.0	22.0	27.0	21.0	21.0	29.0
Tangibility ratio	34.8	35.3	24.1	13.1	12.9	17.5
	28.5	29.2	15.1	6.4	6.4	7.3
Profitability ratio	6.2	6.2	4.7	10.1	10.3	6.3
	3.7	3.8	2.4	7.6	7.8	4.6
Cash ratio	18.6	18.8	14.8	25.3	25.6	19.7
	10.1	10.4	5.9	19.4	19.9	11.8
Observations	169,950	161,050	8,900	199,590	189,440	10,150
Sub-sample	BEL:All	BEL:Small	BEL:Large	FRA:All	FRA:Small	FRA:Large

Note: Firm size is measured in €000's. All ratios are expressed as a percentage. Asset tangibility is the ratio of net fixed assets to total assets. Profitability, defined as the return on total assets, is profits before taxes divided by total assets. The cash ratio (liquidity ratio) equals cash and cash equivalents divided by total assets.

Table 1.2 summarises the sectoral composition of the sample. The Belgian and French samples are relatively similar in terms of proportion of firms in mining (less than 0.5%), construction (16-20%), retail trade (13-16%), and manufacturing (15-16%). Belgium has a larger proportion of firms in wholesale trade (30% compared to 18%), while France has a larger proportion of firms in services (34% compared to 21%), which is consistent with the lower average asset tangibility of French firms seen in Table 1.1.

Figure 1.2: DISTRIBUTION OF LOG ASSETS

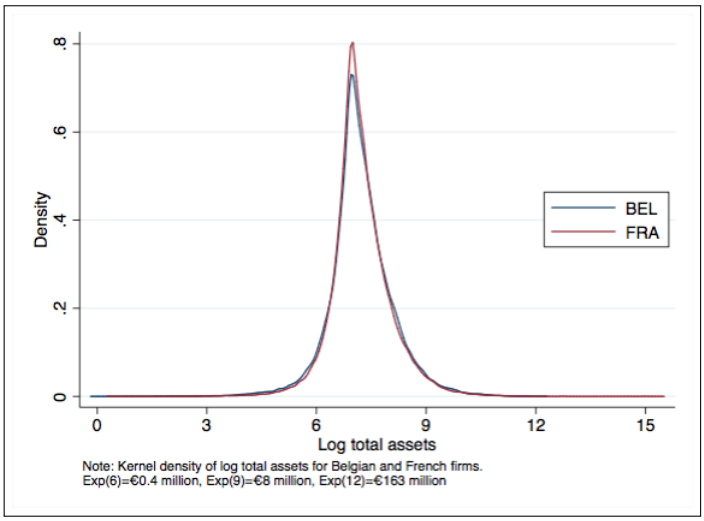


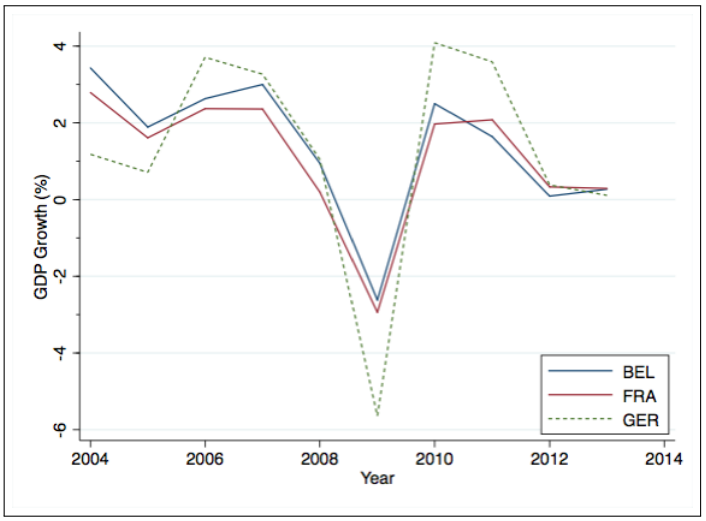
Table 1.2: SECTORAL COMPOSITION

	(1)	(2)	(3)	(4)	(5)	(6)
	Mean	Mean	Mean	Mean	Mean	Mean
Mining	0.002	0.002	0.002	0.005	0.004	0.013
Construction	0.201	0.206	0.120	0.163	0.165	0.135
Manufacturing	0.155	0.149	0.265	0.146	0.143	0.198
Wholesale trade	0.300	0.292	0.434	0.184	0.180	0.260
Retail trade	0.134	0.140	0.038	0.162	0.166	0.086
Services	0.206	0.210	0.139	0.340	0.342	0.308
Observations	169,950	161,050	8,900	199,590	189,440	10,150
Sub-sample	BEL:All	BEL:Small	BEL:Large	FRA:All	FRA:Small	FRA:Large

Note: All values are expressed as a proportion. Columns (1)-(3) present summary statistics for all Belgian firms, with columns (4)-(6) presenting the equivalent statistics for French firms. Large firms are defined as those with an asset value greater than €4 million in the pre-NID period, which is a cut-off based on the relative incentives the NID created for large firms of that size, as described in Section 1.2.

In Section 1.4.2 the empirical analysis includes only Belgian firms, while in Section 1.4.3 French firms are also included as controls. While the summary statistics point to many similarities between Belgian and French firms, there are also some differences. While this does not invalidate the assumptions required for identification of the difference-in-difference estimator, validity does require that firms in Belgium and France are subject to common trends around the introduction of the NID. Figure 1.3 illustrates the high correlation between the growth rate in gross domestic product (GDP) for Belgium and France (with data for Germany also included for comparison), and provides some evidence that the two countries have closely linked economies where firms may be subject to similar economic shocks.

Figure 1.3: GDP GROWTH FOR BELGIUM, FRANCE AND GERMANY

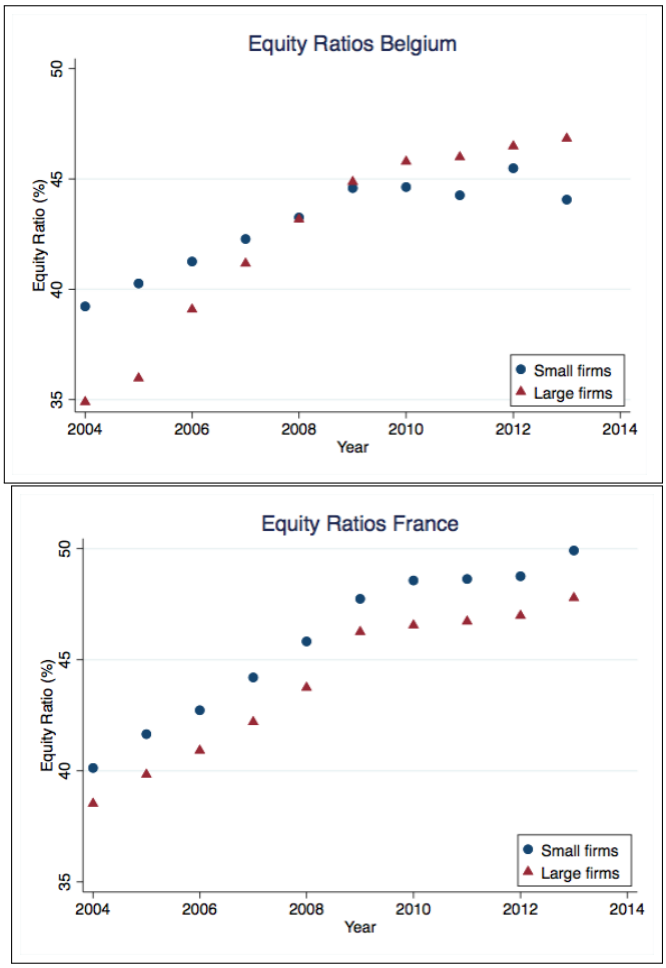


1.4 Results

1.4.1 NID and leverage ratios: Graphical analysis

Figure 1.4 illustrates the main result graphically. There is a sharp increase in equity ratios for large Belgian firms, compared to small firms, in the years following the introduction of the NID. In contrast, equity ratios for large French firms exhibit a very similar trend to those for small firms throughout the 10-year period. Visual observation of Figure 1.4 suggests that the parallel trends assumption that is necessary for validity of the difference-in-difference estimator does not seem to be violated. In the robustness analysis of Section 1.4.3, I add as covariates firm-specific pre-NID trends for firm size, profitability, tangibility, and liquidity ratios, as well as trends in the outcomes variables themselves. The purpose of adding these covariates is to allow for heterogeneity in firms' growth trajectories for a number of key variables that may be important determinants of the outcome variable, as well as the pre-NID trend in the outcome variable itself (Quinn, 2012). I find that all results, which reveal a decrease in leverage for large Belgian firms in the post-NID period, are robust to the inclusion of pre-NID trends (and to the separate and combined inclusion of baseline values of the covariates, as described in Section 1.4.3).

Figure 1.4: EVOLUTION OF EQUITY RATIOS IN BELGIUM AND FRANCE



1.4.2 NID and leverage ratios: Main regression analysis

In this section, I use time-series variation in the cost of equity financing to estimate the effect of the NID on the capital structure of Belgian firms, by comparing outcomes before and after the 'treatment' of the NID policy. As mentioned in Section 1.2, the effect of the NID is expected to be most pronounced for large firms, who faced the greatest incentives to reduce their leverage in the post-policy period. Testing for differential effects between small and large firms controls for some of the effects of domestic time trends in Belgium, and partially mitigates the concern that there may be trends in the leverage ratio that are due to reasons other than NID, which would bias estimates of the NID's effect. I estimate the following model:

$$y_{it} = \beta_0 + \beta_1 Post + \beta_2 Large + \beta_3 Post * Large + \varepsilon_{it} \tag{1.1}$$

where y_{it} is the leverage ratio of firm i at time t, $Post$ is an indicator variable for the post-NID period (2006 onwards), and $Large$ is an indicator variable for firms with total assets above €4 million in the pre-NID period, which is a cut-off based on the relative incentives the NID created for firms of that size, as described in Section 1.2. As a robustness check, all the empirical analysis from Section 1.4 is repeated with alternative cut-off levels (€3 million, €5 million, €6 million, and €7 million); results are very similar, and are provided in the appendix for cut-offs of €3 million and €5 million.[18] I also estimate an equation that includes indicator variables for each post-treatment year, as an alternative to assuming a constant treatment effect.

Results are presented in Table 1.3. The dependent variable in columns (1)-(4) is the equity capital of the firm as a proportion of its total assets. In columns (5)-(8), the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (9)-(12) it is short-term debt, similarly defined. All columns present results from ordinary least squares regressions (OLS), with the exception of columns (2), (6) and (10), which contain results from fixed-effects estimations (with results being almost identical to those from the OLS regressions for each of the three measures of leverage). In columns (3), (7) and (11), the analysis is done separately for small firms, where the leverage ratio is regressed on individual year dummies; in columns (4), (8) and (12) a similar analysis is done for large firms (the remaining columns pool together all Belgian firms, representing 169,950 firm-year observations). Standard errors are clustered at the firm level. The coefficients on $Post$ and $Post * Large$ in columns (1) and (2) reveal that the post-NID period was associated with equity ratios that were 4.0 percentage points higher for small Belgian firms, and 8.8 percentage points higher for large Belgian firms, with both coefficients statistically significant at the 1% level. Columns (3) and (4) illustrate the greater effect for large firms, gradually increasing in each year of the post-policy period. Turning to the long-term debt ratio, columns (5) and (6) show that the post-NID period was associated with a lower long-term debt ratio of 0.9 percentage points for small firms, and 2.1 percentage points lower for large firms; columns (7) and (8) illustrate a gradually increasing (negative) effect for every post-policy year. Finally, columns (9) and (10) reveal a similar result for the short-term debt ratio: small firms had a 3.4 percentage point lower short-term debt ratio in the post-policy period, and large firms' short-term debt ratio was 6.7 percentage points lower; results in columns (11) and (12) illustrate the increasing effect in every post-policy year.

[18] Increasing the threshold for the definition of a large firm does lead to a slightly greater effect for all results; results for higher cut-offs are available on request.

In summary, all results are economically large and statistically significant at the 1% level, confirming that the post-NID period was associated with a lower leverage ratio for Belgian firms, with the effect significantly more pronounced for large firms.

Table 1.3: NID AND LEVERAGE RATIOS: ANALYSIS WITHOUT COVARIATES.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Equity	Equity	Equity	Equity	LTDebt	LTDebt	LTDebt	LTDebt	STDebt	STDebt	STDebt	STDebt
Post * Large	4.8***	4.8***			-1.2***	-1.2***			-3.3***	-3.3***		
	(0.517)	(0.517)			(0.347)	(0.347)			(0.531)	(0.531)		
Post	4.0***	4.0***			-0.9***	-0.9***			-3.4***	-3.4***		
	(0.125)	(0.125)			(0.109)	(0.109)			(0.117)	(0.117)		
Large	-4.3***				-5.6***				9.5***			
	(0.919)				(0.547)				(0.943)			
2006			1.5***	3.7***			-0.3***	-1.0***			-1.2***	-2.8***
			(0.093)	(0.342)			(0.081)	(0.231)			(0.094)	(0.367)
2007			2.5***	5.7***			-0.4***	-1.4***			-2.2***	-4.4***
			(0.117)	(0.442)			(0.103)	(0.305)			(0.115)	(0.477)
2008			3.5***	7.7***			-0.4***	-1.6***			-3.3***	-6.2***
			(0.134)	(0.543)			(0.119)	(0.343)			(0.130)	(0.562)
2009			4.8***	9.4***			-0.6***	-1.8***			-4.6***	-7.8***
			(0.148)	(0.592)			(0.129)	(0.380)			(0.141)	(0.599)
2010			4.9***	10.4***			-1.0***	-2.4***			-4.3***	-8.1***
			(0.159)	(0.628)			(0.137)	(0.416)			(0.150)	(0.641)
2011			4.5***	10.6***			-1.1***	-2.5***			-3.8***	-8.0***
			(0.168)	(0.658)			(0.144)	(0.442)			(0.158)	(0.680)
2012			5.7***	11.1***			-1.4***	-2.9***			-4.8***	-8.0***
			(0.176)	(0.695)			(0.148)	(0.446)			(0.165)	(0.701)
2013			4.3***	11.4***			-1.8***	-3.2***			-2.9***	-8.0***
			(0.191)	(0.719)			(0.152)	(0.462)			(0.181)	(0.737)
Constant	39.7***	39.5***	39.7***	35.4***	16.9***	16.6***	16.9***	11.4***	41.0***	41.5***	41.0***	50.5***
	(0.196)	(0.097)	(0.196)	(0.899)	(0.149)	(0.084)	(0.149)	(0.527)	(0.182)	(0.091)	(0.182)	(0.927)
Observations	169950	169950	161050	8900	169950	169950	161050	8900	169950	169950	161050	8900
Sub-sample	All	All	Small	Large	All	All	Small	Large	All	All	Small	Large
Fixed effects	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No

Note: The dependent variable in columns (1)-(4) is the equity capital of the firm as a proportion of its total assets. In columns (5)-(8) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (9)-(12) it is short-term debt, similarly defined. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

1.4.3 Robustness Analysis

In this section, I demonstrate the robustness of results from Section 1.4.2 to alternative specifications that include a list of potentially important covariates, using both their baseline pre-NID values as well as their pre-NID trends, including pre-NID trends in the outcome variable, and adding all French firms as an additional robustness check. Table 1.4 presents these results.

Table 1.4: NID AND LEVERAGE RATIOS: ADDING BASELINE COVARIATES, PRE-NID TRENDS AND FRENCH FIRMS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt
Post * BEL * Large	6.3***	5.8***	-4.7***	-4.6***	-1.5**	-1.2	4.2***	4.2***	-4.6***	-4.5***	1.3*	1.3*
	(0.816)	(0.810)	(0.433)	(0.425)	(0.750)	(0.745)	(0.795)	(0.786)	(0.391)	(0.393)	(0.743)	(0.731)
Post * BEL	5.2***	5.1***	-1.1***	-1.1***	-4.3***	-4.2***	-1.9***	-2.4***	-2.4***	-2.3***	1.2***	2.0***
	(0.136)	(0.136)	(0.111)	(0.112)	(0.130)	(0.130)	(0.159)	(0.170)	(0.125)	(0.132)	(0.151)	(0.162)
BEL							1.4***	6.4***	6.6***	11.1***	-3.5***	-8.7***
							(0.242)	(0.317)	(0.147)	(0.224)	(0.239)	(0.317)
Log assets	-3.0***	-2.8***	0.9***	0.8***	1.9***	1.9***	-2.2***	-2.3***	0.6***	0.7***	0.8***	0.7***
	(0.186)	(0.188)	(0.114)	(0.116)	(0.171)	(0.172)	(0.133)	(0.133)	(0.065)	(0.065)	(0.126)	(0.124)
Age	0.5***	0.5***	-0.3***	-0.3***	-0.3***	-0.2***	0.4***	0.4***	-0.2***	-0.2***	-0.1***	-0.2***
	(0.015)	(0.015)	(0.009)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.005)	(0.005)	(0.008)	(0.008)
Profitability (baseline)	0.4***	0.4***	-0.1***	-0.1***	-0.3***	-0.3***	0.3***	0.3***	-0.0***	-0.1***	-0.2***	-0.2***
	(0.030)	(0.024)	(0.011)	(0.010)	(0.022)	(0.019)	(0.012)	(0.012)	(0.005)	(0.005)	(0.010)	(0.010)
Profitability (trend)		0.0		-0.0		0.0	-0.0***	-0.0***	0.0*	0.0	0.0	0.0**
		(0.020)		(0.010)		(0.016)	(0.013)	(0.013)	(0.005)	(0.005)	(0.011)	(0.010)
Tangibility (baseline)	0.1***	0.1***	0.3***	0.3***	-0.4***	-0.4***	0.0***	0.0***	0.2***	0.2***	-0.3***	-0.3***
	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
Tangibility (trend)		-0.0***		0.1***		-0.1***	0.0	0.0	0.1***	0.1***	-0.1***	-0.1***
		(0.016)		(0.015)		(0.016)	(0.014)	(0.014)	(0.010)	(0.010)	(0.012)	(0.012)
Cash (baseline)	0.5***	0.5***	-0.1***	-0.1***	-0.4***	-0.4***	0.3***	0.3***	-0.1***	-0.1***	-0.3***	-0.3***
	(0.012)	(0.011)	(0.005)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.003)	(0.003)	(0.006)	(0.006)
Cash (trend)		0.0**		0.0***		-0.1***	0.2***	0.2***	-0.0***	-0.0***	-0.1***	-0.1***
		(0.017)		(0.010)		(0.016)	(0.015)	(0.015)	(0.004)	(0.004)	(0.010)	(0.010)
Log assets (trend)		-6.0***		3.0***		2.5***	-3.4***	-3.3***	1.0***	1.4***	3.4***	2.7***
		(0.710)		(0.395)		(0.554)	(0.467)	(0.462)	(0.211)	(0.213)	(0.387)	(0.373)
Equity (trend)		0.1***					0.1***	0.1***				
		(0.022)					(0.014)	(0.014)				
LTDebt (trend)				0.1***					0.1***	0.1***		
				(0.017)					(0.008)	(0.008)		
STDebt (trend)						0.1***					0.1***	0.1***
						(0.014)					(0.010)	(0.009)
GDP								-0.7***		-0.6***		0.3***
								(0.042)		(0.039)		(0.045)
Tax 1								1.1***		-0.1**		-1.6***
								(0.069)		(0.052)		(0.071)
Tax 2								0.2***		0.2***		-0.1***
								(0.010)		(0.010)		(0.012)
Constant	33.9***	33.3***	10.4***	10.6***	55.3***	55.6***	35.8***	21.4***	4.2***	23.5***	59.3***	71.4***
	(1.377)	(1.382)	(0.846)	(0.862)	(1.246)	(1.255)	(0.951)	(2.718)	(0.473)	(1.882)	(0.892)	(2.715)
Observations	166840	162550	166840	162550	166840	162550	357090	356930	357090	356930	357090	356930
R-squared	0.23	0.24	0.23	0.24	0.22	0.23	0.19	0.21	0.26	0.28	0.17	0.21
Industry dummies	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes
Year dummies	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sub-sample	BEL	BEL	BEL	BEL	BEL	BEL	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA

Note: The dependent variable in columns (1),(2),(7) and (8) is the equity capital of the firm as a proportion of its total assets. In columns (3),(4),(9) and (10) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (5),(6),(11) and (12) it is short-term debt, similarly defined. *Post* is an indicator variable for the post-NID period. 'Baseline' refers to the pre-NID average value of covariates, and 'trend' is the pre-NID trend in those covariates. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

In columns (1), (3) and (5), the analysis is conducted for all Belgian firms, with the inclusion of a number of baseline covariates that represent potentially important determinants of capital structure decisions, as found in the theoretical and empirical literature described in Section 1.1. I use the firm-level average value for each of these variables in the pre-NID period. The conditional correlations from the coefficients on these baseline covariates across all specifications in Table 1.4 are significant and consistent with the theoretical predictions discussed in Section 1.1, which serves as a useful consistency check for the quality of the data. Profitability is predicted to be negatively related to leverage; more profitable firms are expected to have more internally generated funds, which they would be expected to prefer to use on average, when compared to external funds that may be mis-priced due to asymmetric information.[19] The coefficient on profitability across all specifications in Table 1.4 is consistent with this, showing a statistically significant conditional correlation that is positive with equity ratios and negative with both debt ratios. Leverage is expected to be positively related to asset tangibility, due to the lower expected costs of financial distress associated with firms that have more tangible assets, and the resulting greater ability to access debt financing.[20] However, a negative relationship is predicted between short-term leverage and asset tangibility due to the desire of firms to match the maturity of debt and collateral.[21] Results in all specifications of Table 1.4 confirm both predictions; there is a positive and significant relationship between asset tangibility and the long-term debt ratio, and a significant negative correlation with the short-term debt ratio. The third ratio that is included in column (1) is the cash ratio (liquidity ratio), which is also predicted to be an important determinant of capital structure; however, there are conflicting theoretical predictions for the effect of liquidity on leverage.[22] Age is also predicted to be an important determinant of leverage; older firms are expected to borrow less, since they have had more time to accumulate funds (and will therefore have higher equity ratios, since equity consists of shareholder capital plus retained earnings). Results in Table 1.4 are consistent with this, showing a statistically significant conditional correlation that reveals older firms having higher

[19] See Myers (1984); Myers and Majluf (1984).

[20] See Hall, Hutchinson, and Michaelas (2004); Rajan and Zingales (1995).

[21] See Michaelas, Chittenden, and Poutziouris (1999); Sogorb-Mira (2005); Degryse, Goeij, and Kappert (2012); Van Campenhout and Van Caneghem (2013).

[22] Liquidity may influence the financial structure of firms due to reasons related to the costs of financial distress; the expected costs of financial distress are relatively lower for liquid firms, which may lead to them being more leveraged, according to the trade-off theory of capital structure. In contrast, the pecking-order theory predicts a negative relationship between liquidity and leverage, since having liquid assets enables a firm to undertake investment opportunities without needing external financing. Results in Table 1.4 provide strong evidence in favour of the pecking order theory; all three measures of leverage reveal a statistically significant negative relationship with the liquidity ratio.

equity ratios and lower long-term and short-term debt ratios. In general, these conditional correlations are consistent with the existing literature, which serves as a useful consistency check for the data. Most importantly, the addition of these baseline covariates in columns (1), (3) and (5) does not change the overall results seen from Table 1.3; the post-NID period was associated with lower leverage ratios for all Belgian firms, with a bigger effect for large firms, even controlling for all these baseline covariates.

In columns (2), (4) and (6), pre-NID trends are also added as covariates, defined as the firm-level change in profit ratio, tangibility ratio, liquidity ratio and log assets in the two years prior to the NID, in order to allow for heterogeneity in firms' growth trajectories for a number of key variables that may be important determinants of the outcome. I also add as covariates the pre-NID trends for the outcome variables themselves. The effect of adding pre-NID trends as covariates is a slight reduction in the effect of NID on leverage for large Belgian firms, with the coefficient on equity decreasing from 6.3 in column (1) to 5.8 in column (2) (both statistically significant at the 1% level), changing from -4.7% in column (3) to -4.6% in column (4) for the long-term debt ratio (again, both statistically significant at the 1% level), and from -1.5% to -1.2% for the short-term debt ratio in columns (5) and (6) respectively (with the coefficient on the short-term debt ratio no longer statistically significant in column (6)).

In columns (7) - (12), the analysis is extended to include all French firms as controls. Key to the identification of the difference-in-difference estimator is the geographical proximity and economic integration of Belgian and French firms, as they are exposed to similar shocks and influences from trends, which allows for French firms to be used as a credible control group (Princen, 2012; Panier, Pérez-González, and Villanueva, 2013). In columns (7) - (12), I use year indicator variables to control for common trends for both French and Belgian firms, as well as an indicator variable for Belgian firms to control for permanent differences across Belgian and French firms. The effect of the inclusion of all French firms in columns (7) - (12), representing a total of 356,930 firm-year observations, is a slight further reduction in the effect of the NID on the leverage of large Belgian firms, yet the main results remain. Columns (7), (9) and (11) include the full set of covariates previously described (both pre-NID baseline levels as well as trends) for all firms, while columns (8), (10) and (12) also include as covariates GDP, corporate income tax rates, personal income tax rates (which are relevant for firm owners) and two-digit

SIC industry dummies.[23] The coefficient on $Post * BEL * Large$ shows a 4.2 percentage point greater equity ratio for large Belgian firms in the post-NID period, in both columns (7) and (8) (both statistically significant at the 1% level). Columns (9) and (10) reveal a 4.5 and 4.6 percentage point lower long-term debt ratio for large Belgian firms in the post-NID period respectively (both statistically significant at the 1% level). While results for equity and long-term debt ratios are relatively stable with the addition of French firm as controls, with coefficients remaining qualitatively similar, there is a change in effect for the short-term debt ratio, as can be seen in columns (11) and (12); the coefficient on $Post * BEL * Large$ reveals a 1.3 percentage point *increase* in the short-term debt ratio for large Belgian firms in the post-NID period. Although the coefficient is only statistically significant at the 10% level, a comparison with the 4.5 percentage point decrease in the long-term debt ratio may indicate some substitution out of long-term debt into some short-term debt. Nonetheless, in general, results from the robustness analysis in this section confirm the findings of Section 1.4.2; there was an economically meaningful and statistically significant decrease in leverage ratios for large Belgian firms in the post-NID period, as reflected in higher equity and lower long-term debt ratios (with some suggestive evidence of substitution from long-term into short-term debt).

1.4.4 Heterogeneity analysis: Risk exposure

Having shown an economically meaningful, statistically significant and robust average effect of the NID on leverage ratios of large Belgian firms, this section explores heterogeneous treatment effects. In particular, I investigate the effect on firms who had the highest exposure to risk in their operations, as measured by their coefficient of variation of sales in the pre-NID period. Results reveal that the most risk-exposed large Belgian firms increased their equity ratios and decreased their short-term debt ratios significantly more than all other firms, both in Belgium and France. Results are robust to the use of two different measures of risk exposure, and using specifications with and without baseline covariates. I estimate the following model:

[23]GDP growth is expected to be positively related to leverage, since it proxies for the positive growth opportunities of a company and their investment requirements, implying that they should accumulate more external financing through debt by the pecking order theory (Frank and Goyal, 2003). Estimated coefficients in Table 1.4 are broadly consistent with this. However, results from coefficients on tax variables show no consistent pattern, which may be explained by the fact that there is very little time variation in many of the tax variables; for example, the corporate income tax rate in Belgium did not change for ten years, and the personal income tax rate only changed once after 8 years. Similarly, there is little variation in the corporate income tax rate in France. Further, these are all top rate tax rates, which may not reflect marginal tax rates for individual firms, since most of the sample consists of small firms.

$$y_{it} = \beta_1 + \beta_2 Post + \beta_3 Risk + \beta_4 Post * Risk + \boldsymbol{\beta}_5 \boldsymbol{X}_{it} + \varepsilon_{it} \tag{1.2}$$

where $Risk$ is an indicator variable that equals 1 for firms with above-median coefficient of variation of sales in the pre-NID period, and $\boldsymbol{X}_{it}$ is a matrix of all covariates used in Section 1.4.3. I use two different measures of risk exposure: (i) the coefficient of variation of sales for all other firms in the same sector (using two-digit SIC codes); and (ii) a measure that uses each firm's own sales to calculate a firm-specific coefficient of variation. The coefficient of interest is β_4, which represents the change in leverage in the post-NID period for the most risk-exposed firms. Results are presented in Tables 1.5 and 1.9. In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is short-term debt. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and for small french firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include all covariates used in Section 1.4.3.

Beginning with Table 1.5, columns (1) and (2) reveal that equity ratios of the most risk-exposed large Belgian firms increased significantly in the post-NID period, with an economically meaningful coefficient of 3.1 percentage points in the model without any covariates and 3.0 percentage points in the saturated model (both statistically significant at the 1% level). In comparison, the effect for the most risk-exposed small Belgian firms in columns (3) and (4) is much smaller (0.6 percentage points, significant at the 5% level). A formal cross-equation test confirms that the coefficient on $Post * Risk$ for large Belgian firms is significantly greater than for small Belgian firms (p-value for the cross-equation tests of column (1) vs column (3) and column (2) vs column (4): 0.091 and 0.072, respectively). This greater effect for large Belgian firms is even more pronounced when compared to the most risk-exposed small and large French firms, which actually experienced a *decrease* in their equity ratios in the post-NID period (-3.4 percentage points and -1.1 percentage points respectively). Cross-equation tests confirm this greater effect for large Belgian firms, significant at the 1% level for both the model with small and large French firms, and models with and without covariates. In summary, there is strong evidence that the most risk-exposed large Belgian firms significantly increased their equity ratios in the post-NID period, compared to all other firms.

Table 1.5: HETEROGENEITY ANALYSIS: RISK EXPOSURE (SECTOR-LEVEL COEFFICIENT OF VARIATION OF SALES).

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	3.1***	3.0***	0.6**	0.6**	-3.3***	-3.4***	-1.1***	-1.1***
	(1.063)	(1.053)	(0.250)	(0.242)	(0.784)	(0.768)	(0.199)	(0.201)
Risk	-9.1***	-4.1**	-1.0**	-0.1	-3.7**	-0.8	1.4***	1.4***
	(1.849)	(1.723)	(0.392)	(0.333)	(1.562)	(1.539)	(0.314)	(0.289)
Post	6.6***	6.7***	3.7***	5.0***	7.7***	8.1***	6.7***	6.9***
	(0.875)	(0.864)	(0.180)	(0.188)	(0.614)	(0.624)	(0.140)	(0.153)
Constant	41.6***	35.6***	40.3***	34.4***	41.1***	60.7***	40.2***	31.5***
	(1.483)	(8.912)	(0.283)	(1.481)	(1.149)	(8.962)	(0.213)	(1.349)
Observations	8890	8550	161030	153970	10150	9990	189430	184540
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.091	0.072	0.001	0.000	0.005	0.001

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-4.8***	-4.7***	-0.8***	-0.9***	0.6	0.9	-0.5***	-0.4**
	(1.052)	(1.032)	(0.234)	(0.233)	(0.793)	(0.782)	(0.187)	(0.188)
Risk	13.5***	5.2***	3.9***	1.7***	10.4***	3.8**	4.6***	3.2***
	(1.855)	(1.628)	(0.362)	(0.309)	(1.555)	(1.552)	(0.308)	(0.299)
Post	-3.4***	-3.5***	-3.0***	-3.7***	-5.0***	-5.3***	-4.7***	-4.4***
	(0.830)	(0.812)	(0.166)	(0.177)	(0.610)	(0.625)	(0.127)	(0.142)
Constant	41.4***	56.6***	38.9***	54.6***	42.4***	47.6***	46.7***	64.7***
	(1.469)	(8.667)	(0.250)	(1.338)	(1.124)	(8.221)	(0.207)	(1.353)
Observations	8890	8550	161030	153970	10150	9990	189430	184540
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.009	0.003	0.005	0.001	0.005	0.001

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	1.1	1.0	0.2	0.3	-0.0	-0.1	-0.5***	-0.6***
	(0.760)	(0.762)	(0.218)	(0.219)	(0.479)	(0.470)	(0.123)	(0.123)
Risk	-3.2***	0.1	-3.0***	-1.9***	-2.1***	-0.2	-3.1***	-2.0***
	(1.176)	(1.033)	(0.298)	(0.247)	(0.604)	(0.520)	(0.140)	(0.137)
Post	-2.8***	-2.9***	-1.0***	-1.5***	1.9***	1.9***	1.9***	1.7***
	(0.675)	(0.687)	(0.161)	(0.166)	(0.391)	(0.380)	(0.096)	(0.099)
Constant	13.4***	3.0	18.5***	10.7***	5.6***	-1.6	6.5***	4.5***
	(1.016)	(4.142)	(0.223)	(0.936)	(0.526)	(3.067)	(0.115)	(0.556)
Observations	8890	8550	161030	153970	10150	9990	189430	184540
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.366	0.338	0.314	0.214	0.101	0.046

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is the short-term debt ratio. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals 1 for firms with above-median risk exposure in the pre-NID period, using the sector-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

A similar pattern is revealed in regressions of the short-term debt ratio in panel (b), which reveal a 4.7-4.8 percentage point decrease in the short-term debt ratio for the most risk-exposed large Belgian firms, compared to a smaller 0.8-0.9 percentage point decrease for the most risk-exposed small Belgian firms, an insignificant 0.6-0.9 percentage point *increase* for large French firms, and a 0.4-0.5 percentage point decrease for small French firms. Cross-equation tests confirm the significance of this larger effect for the most risk-exposed Belgian firms compared to all other firms, in models with and without covariates, significant at the 1% level in all cross-equation tests. While panels (a) and (b) present evidence for a significantly larger decrease in leverage for large Belgian firms, results for the long-term debt ratio in panel (c) do not reveal any significant change in the post-NID period, with the majority of coefficients close to zero, and the majority of cross-equation tests failing to reject coefficient equality.

Table 1.9 repeats the heterogeneity analysis using the firm-specific measure of risk exposure.[24] Despite the two risk exposure measures being quite different (the correlation coefficient between them is only 0.0628 for the median-split variable and 0.0644 for the raw measure), results are qualitatively similar and statistically significant using cross-equation tests, confirming that the most risk-exposed large Belgian firms significantly increased their equity ratios in the post-NID period, compared to all other firms. Once again, the results are large and robust for the equity ratio and short-term debt ratio in columns (a) and (b) respectively, while coefficients in the long-term debt specification are close to zero for all sets of firms, and insignificantly different from one another. The magnitude of the coefficients in Table 1.9 is also quite similar to Table 1.5, with an increase in the equity ratio of large Belgian firms of just over 4 percentage points, and a 5 percentage point lower long-term debt ratio. Moreover, formal cross-equation tests shown in Table 1.5 reveal that the effect of lower leverage for the most risk-exposed large Belgian firms in the post-NID period is significantly bigger than the size of the effect for small Belgian firms and all French firms.

[24] This measure calculates the coefficient of variation of sales using each individual firm's pre-NID sales data, for firms whose sales data is available.

Table 1.9: HETEROGENEITY ANALYSIS: RISK EXPOSURE (FIRM-LEVEL COEFFICIENT OF VARIATION OF SALES).

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	4.4***	4.2***	0.9*	1.6***	1.1	1.1	1.4***	1.6***
	(1.247)	(1.252)	(0.524)	(0.509)	(0.800)	(0.790)	(0.199)	(0.202)
Risk	-11.7***	-3.7**	-5.0***	-3.4***	-4.2***	-1.5	-3.6***	-2.9***
	(2.071)	(1.631)	(0.830)	(0.704)	(1.593)	(1.442)	(0.310)	(0.295)
Post	6.9***	7.1***	4.0***	5.3***	5.4***	5.9***	5.5***	5.7***
	(0.705)	(0.706)	(0.372)	(0.377)	(0.486)	(0.501)	(0.131)	(0.140)
Constant	38.7***	32.8***	39.8***	39.9***	40.6***	57.5***	42.4***	33.6***
	(1.442)	(9.770)	(0.625)	(2.952)	(0.974)	(8.998)	(0.218)	(1.365)
Observations	5860	5730	34960	33320	10030	9880	187460	182820
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.051	0.064	0.120	0.076	0.078	0.051

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-5.3***	-4.9***	-1.1**	-1.6***	-1.4*	-1.3	-1.7***	-1.5***
	(1.257)	(1.264)	(0.505)	(0.515)	(0.813)	(0.808)	(0.185)	(0.189)
Risk	13.3***	3.9**	4.6***	3.0***	4.3***	0.9	5.1***	3.8***
	(2.120)	(1.605)	(0.823)	(0.682)	(1.621)	(1.455)	(0.305)	(0.305)
Post	-5.1***	-5.2***	-3.5***	-4.4***	-4.1***	-4.3***	-4.2***	-3.9***
	(0.638)	(0.650)	(0.346)	(0.366)	(0.479)	(0.493)	(0.118)	(0.128)
Constant	49.2***	63.4***	42.3***	53.1***	46.4***	53.0***	46.6***	64.7***
	(1.397)	(9.632)	(0.588)	(2.860)	(0.991)	(8.249)	(0.209)	(1.358)
Observations	5860	5730	34960	33320	10030	9880	187460	182820
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.020	0.016	0.070	0.035	0.035	0.009

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	0.5	0.2	0.2	0.0	0.2	-0.1	-0.5***	-0.6***
	(0.724)	(0.705)	(0.442)	(0.444)	(0.483)	(0.474)	(0.125)	(0.126)
Risk	-1.0	0.3	0.1	-0.2	-0.5	0.3	-0.6***	-0.3*
	(1.021)	(0.790)	(0.630)	(0.514)	(0.592)	(0.524)	(0.146)	(0.143)
Post	-1.9***	-1.9***	-0.5*	-0.9***	1.8***	1.8***	1.9***	1.7***
	(0.478)	(0.484)	(0.321)	(0.323)	(0.301)	(0.287)	(0.089)	(0.090)
Constant	9.3***	0.8	15.9***	7.6***	4.7***	-2.2	5.4***	3.8***
	(0.754)	(3.418)	(0.460)	(1.910)	(0.407)	(3.029)	(0.105)	(0.567)
Observations	5860	5730	34960	33320	10030	9880	187460	182820
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.698	0.801	0.722	0.707	0.232	0.198

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is the short-term debt ratio. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals one for firms with above-median risk exposure in the pre-NID period, using the firm-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

One possible explanation for lack of effect on long-term debt ratios in the heterogeneity analysis may relate to the difficulty in changing long-term debt levels, compared to short-term debt. This could be due to lower liquidity in the secondary market for long-term liabilities and the fact that more frequent short-term debt maturities allow an easier restructuring of the capital structure via short-term liabilities, compared to longer-term obligations that may not mature for a long time. However, this rationale is difficult to reconcile with the findings in the main analysis that, on average, long-term debt ratios did in fact significantly decrease for large Belgian firms compared to all other firms in the post-NID period. A possible interpretation that reconciles both results could be related to financial constraints. Firms that are more risk-exposed may face larger financing constraints which, combined with the greater illiquidity of long-term debt, may make it harder to adjust their long-term debt levels. Firms suffering from asymmetric information may face greater challenges in long-term debt financing, due to a greater amount of underpricing (Myers and Majluf, 1984). Vermoesen, Deloof, and Laveren (2013) report that Belgian firms with a larger amount of long-term debt on their balance sheet encountered greater difficulties in refinancing their debt during the years of the financial crisis, which coincides with the data period used in this paper. Further, they present evidence that the effect is driven by firms that are ex-ante more likely to be financially constrained. It is well-documented that during financial crises and recessions there is often a "flight to liquidity",[25] whereby investors prefer to shift their portfolio into more liquid short-term debt, which makes it relatively harder to find buyers of long-term debt, especially for companies that are more financially constrained. To investigate whether more risk-exposed firms in my dataset faced greater financial constraints, I use the Rajan-Zingales measure of sector-level financial dependence:[26]

$$\text{Dependence} = \frac{\text{capital expenditures} - \text{cash flow}}{\text{capital expenditures}} \tag{1.3}$$

where dependence refers to dependence on external finance for investment, and cash flow equals the sum of cash flow from operations, decreases in inventories, decreases in receivables and increases in payables. The constructed index has a mean value of 0.21, a median of 0.10, and 25th and 75th percentiles of -0.06 and 0.57 respectively. Section 1.A.3 in the appendix

[25] See Goyenko, Subrahmanyam, and Ukhov (2011).

[26] See Rajan and Zingales (1995). The calculated index levels are based on US firms, and were kindly provided to me by Tong and Wei (2010), since the dataset that I am using does not allow calculation of a firm-specific measure of external finance dependence.

contains details of the external finance dependence index value for each sector, along with the mean coefficient of variation of sales (using both measures of risk exposure). Comparing the level of financial constraints with risk exposure using the sector-level coefficient of variation of sales measure, firms with below-median risk exposure have a median value of the financial dependence index of 0.04, while firms with above-median risk exposure have a significantly higher median value of 0.10. Similarly, when using the firm-level risk exposure measure, firms with below-median risk exposure again have a score of the financial dependence index of 0.04, while those with above-median risk exposure have a score of 0.10. This provides suggestive evidence that greater financial constraints among the most risk-exposed firms may partially explain why the results on heterogeneity show that the most risk-exposed large Belgian firms significantly increased their equity ratios and decreased their short-term debt ratios, yet no effect was found on their long-term debt levels.

1.5 Conclusion

In this paper I investigate the impact of the Notional Interest Deduction (NID) in Belgium, which is an 'Allowance for Corporate Equity' (ACE) system. The NID mitigated the classical tax discrimination between debt and equity financing by allowing firms to reduce their taxable income through an amount that is based on the level of equity in their capital structure. I find that this policy led to significantly lower leverage ratios for Belgian firms, with the effect being greater for larger firms, as would have been expected given the relative incentives that the policy created for large firms. Results are robust to the use of different measures of leverage, inclusion of a number of potentially important covariates (using both their baseline pre-NID values as well as their pre-NID trends), including pre-NID trends in the outcome variable itself, and adding all French firms as an additional control.

Analysis of heterogeneous effects reveals that the most risk-exposed large Belgian firms increased their equity ratios and decreased their short-term debt ratios significantly more than all other firms, both in Belgium and France, and using two different measures of risk exposure. This provides evidence of a positive impact of the NID policy on increasing equity ratios of the most risk-exposed firms. Section 1.A.3 in the appendix reveals that two of the most risk-exposed sectors in the dataset are 'business services' and 'engineering, accounting, research,

management, and related services'.[27] These categories include a number of sub-sectors that are normally associated with high potential growth, including computer- and software- related services, research and development services, business and management consulting services, as well as a number of other high-potential-growth service sectors. This provides promising evidence for the ability of ACE-type systems to increase the capital buffer of riskier but high-potential-growth firms and sectors.

There is a large academic literature that analyses the consequences of high leverage. Myers (1977) develops a theory of 'debt overhang', whereby firms with excessive debt forego valuable investment opportunities. Andrade and Kaplan (1998) find that high leverage was the primary cause of financial distress in a sample of firms that were involved in highly leveraged transactions, and find that poor firm performance and poor industry performance played much smaller roles. Importantly, all of the firms in their sample had positive operating income in the years that they became financially distressed and in fact had an operating margin greater than the median for their respective industries. Since these firms appeared healthy apart from their high leverage, they argue that these firms experienced 'financial not economic distress'. They find that a number of these firms were forced to substantially cut capital expenditures, with many selling assets at depressed prices.[28] Kolev, Barbiero, Popov, Brutscher, and Wolski (2018) investigate debt overhang and investment misallocation in Europe during the recent financial crisis. They find that firms with higher levels of leverage in the pre-crisis period reduced their investment the most significantly afterwards, and that this effect was particularly strong for firms that faced the greatest growth opportunities. My paper complements this literature and aims to contribute to the wider discussion on how to reduce leverage in the financial system, such as The Basel Committee on Banking Supervision's objective to create a more resilient financial system by setting a minimum 'capital conservation buffer' for banks and limiting leverage ratios.

Results in this paper do not dismiss the importance of debt, which serves many useful functions in the economy such as allowing cash-constrained firms to borrow against future profits while not giving up control of their company. However, systematically discriminating against

[27] SIC categories 73 and 87 respectively.

[28] Shleifer and Vishny (2011) analyse the link between debt and distressed asset sales in greater detail. Pulvino (1998) presents evidence that leverage ratios are a key determinant of liquidation value of assets for financially constrained firms.

equity financing, as most corporate tax systems do by subsiding debt, can lead to socially excessive leverage and a more fragile financial system. The conflicting policy of requiring banks to hold more equity through capital requirements, while simultaneously encouraging them to hold more debt through the tax system, significantly complicates and distorts the functioning of the financial system. Equity financing can benefit firms by providing them with a more flexible form of capital that spreads risk more effectively; payments to equity-holders can be reduced in times of financial stress, and equity does not need to be re-financed. In the 2000-2 dot-com stock market crash, total losses have been estimated as $4 trillion, which is twice the estimated $2 trillion loss that banks suffered in the financial crisis of 2007-10, yet there was no credit crunch. "In a crisis, equity bends while debt breaks".[29] In this paper, I find that the NID was successful in encouraging greater equity ratios, with a particularly strong effect for the most risk-exposed firms. Future work might benefit from using more recent data for the firms in this sample and using the 'natural experiment' of the NID as part of an instrumental variable strategy to investigate the effect of higher equity ratios on firms' ability to 'weather the storm' of the European sovereign wealth and financial market crisis that occurred directly at the end of the period in this current dataset.

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[29] The Economist (2015).

Appendices of Chapter 1

1.A Appendix

1.A.1 Robustness: Decreasing the cutoff threshold for large firms to €3 million

Table 1.13: NID AND LEVERAGE RATIOS: ANALYSIS WITHOUT COVARIATES.

	(1) Equity	(2) Equity	(3) Equity	(4) Equity	(5) LTDebt	(6) LTDebt	(7) LTDebt	(8) LTDebt	(9) STDebt	(10) STDebt	(11) STDebt	(12) STDebt
Post * Large	4.1***	4.1***			-1.6***	-1.6***			-2.3***	-2.3***		
	(0.401)	(0.401)			(0.291)	(0.291)			(0.407)	(0.407)		
Post	3.9***	3.9***			-0.8***	-0.8***			-3.4***	-3.4***		
	(0.128)	(0.128)			(0.111)	(0.111)			(0.120)	(0.120)		
Large	-3.5***				-4.7***				8.0***			
	(0.712)				(0.447)				(0.723)			
2006			1.5***	3.3***			-0.3***	-0.9***			-1.2***	-2.4***
			(0.095)	(0.263)			(0.083)	(0.197)			(0.096)	(0.287)
2007			2.5***	5.2***			-0.3***	-1.5***			-2.2***	-3.7***
			(0.120)	(0.333)			(0.106)	(0.245)			(0.118)	(0.357)
2008			3.4***	7.0***			-0.3**	-1.8***			-3.3***	-5.4***
			(0.137)	(0.406)			(0.122)	(0.275)			(0.133)	(0.425)
2009			4.7***	8.7***			-0.5***	-2.1***			-4.6***	-6.8***
			(0.151)	(0.450)			(0.133)	(0.304)			(0.144)	(0.455)
2010			4.8***	9.4***			-0.9***	-2.7***			-4.3***	-6.9***
			(0.163)	(0.475)			(0.140)	(0.330)			(0.154)	(0.480)
2011			4.4***	9.5***			-1.0***	-2.9***			-3.8***	-6.6***
			(0.171)	(0.502)			(0.147)	(0.353)			(0.162)	(0.507)
2012			5.6***	10.3***			-1.3***	-3.1***			-4.7***	-7.1***
			(0.180)	(0.533)			(0.151)	(0.360)			(0.168)	(0.531)
2013			4.2***	10.1***			-1.7***	-3.6***			-2.9***	-6.4***
			(0.195)	(0.571)			(0.155)	(0.372)			(0.184)	(0.574)
Constant	39.8***	39.5***	39.8***	36.3***	17.0***	16.6***	17.0***	12.3***	40.8***	41.5***	40.8***	48.8***
	(0.199)	(0.097)	(0.199)	(0.684)	(0.152)	(0.084)	(0.152)	(0.420)	(0.185)	(0.091)	(0.185)	(0.700)
Observations	169950	169950	155490	14460	169950	169950	155490	14460	169950	169950	155490	14460
Sub-sample	All	All	Small	Large	All	All	Small	Large	All	All	Small	Large
Fixed effects	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No

The dependent variable in columns (1)-(4) is the equity capital of the firm as a proportion of its total assets. In columns (5)-(8) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (9)-(12) it is short-term debt, similarly defined. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.14: NID AND LEVERAGE RATIOS: ADDING BASELINE COVARIATES, PRE-NID TRENDS AND FRENCH FIRMS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt
Post * BEL * Large	5.8***	5.3***	-4.8***	-4.5***	-0.9	-0.7	3.8***	3.7***	-4.4***	-4.3***	1.5***	1.6***
	(0.646)	(0.645)	(0.361)	(0.358)	(0.585)	(0.585)	(0.631)	(0.623)	(0.326)	(0.328)	(0.581)	(0.572)
Post * BEL	5.1***	5.0***	-1.0***	-1.0***	-4.3***	-4.2***	-2.0***	-2.5***	-2.3***	-2.2***	1.2***	1.9***
	(0.138)	(0.138)	(0.113)	(0.113)	(0.132)	(0.132)	(0.163)	(0.173)	(0.127)	(0.134)	(0.154)	(0.165)
BEL							1.4***	6.4***	6.6***	11.1***	-3.5***	-8.7***
							(0.242)	(0.317)	(0.147)	(0.224)	(0.239)	(0.317)
Log assets	-3.2***	-3.0***	1.1***	1.0***	1.9***	1.8***	-2.3***	-2.3***	0.6***	0.7***	0.7***	0.6***
	(0.187)	(0.189)	(0.115)	(0.117)	(0.171)	(0.173)	(0.134)	(0.134)	(0.065)	(0.065)	(0.127)	(0.125)
Age	0.5***	0.5***	-0.3***	-0.2***	-0.3***	-0.2***	0.4***	0.4***	-0.2***	-0.2***	-0.1***	-0.2***
	(0.015)	(0.015)	(0.009)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.005)	(0.005)	(0.008)	(0.008)
Profitability (baseline)	0.4***	0.4***	-0.1***	-0.1***	-0.3***	-0.3***	0.3***	0.3***	-0.0***	-0.1***	-0.2***	-0.2***
	(0.030)	(0.024)	(0.011)	(0.010)	(0.022)	(0.019)	(0.012)	(0.012)	(0.005)	(0.005)	(0.010)	(0.010)
Profitability (trend)		0.0		-0.0		0.0	-0.0***	-0.0***	0.0*	0.0	0.0	0.0**
		(0.020)		(0.010)		(0.016)	(0.013)	(0.013)	(0.005)	(0.005)	(0.011)	(0.010)
Tangibility (baseline)	0.1***	0.1***	0.3***	0.3***	-0.4***	-0.4***	0.0***	0.0***	0.2***	0.2***	-0.3***	-0.3***
	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
Tangibility (trend)		-0.0***		0.1***		-0.1***	0.0	0.0	0.1***	0.1***	-0.1***	-0.1***
		(0.016)		(0.015)		(0.016)	(0.014)	(0.014)	(0.010)	(0.010)	(0.012)	(0.012)
Cash (baseline)	0.5***	0.5***	-0.1***	-0.1***	-0.4***	-0.4***	0.3***	0.3***	-0.1***	-0.1***	-0.3***	-0.3***
	(0.012)	(0.011)	(0.005)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.003)	(0.003)	(0.006)	(0.006)
Cash (trend)		0.0**		0.0***		-0.1***	0.2***	0.2***	-0.0***	-0.0***	-0.1***	-0.1***
		(0.017)		(0.010)		(0.016)	(0.015)	(0.015)	(0.004)	(0.004)	(0.010)	(0.010)
Log assets (trend)		-6.0***		3.0***		2.5***	-3.4***	-3.3***	1.0***	1.4***	3.4***	2.7***
		(0.710)		(0.395)		(0.554)	(0.466)	(0.462)	(0.211)	(0.213)	(0.387)	(0.373)
Equity (trend)		0.1***					0.1***	0.1***				
		(0.022)					(0.014)	(0.014)				
LTDebt (trend)				0.1***					0.1***	0.1***		
				(0.016)					(0.008)	(0.008)		
STDebt (trend)						0.1***					0.1***	0.1***
						(0.014)					(0.010)	(0.009)
GDP								-0.7***		-0.6***		0.2***
								(0.042)		(0.038)		(0.045)
Tax 1								1.1***		-0.1**		-1.6***
								(0.069)		(0.052)		(0.071)
Tax 2								0.2***		0.2***		-0.1***
								(0.010)		(0.010)		(0.012)
Constant	35.1***	34.4***	9.1***	9.5***	55.5***	55.8***	36.1***	22.2***	3.7***	22.6***	59.6***	71.6***
	(1.385)	(1.392)	(0.852)	(0.870)	(1.250)	(1.261)	(0.956)	(2.699)	(0.473)	(1.875)	(0.896)	(2.701)
Observations	166840	162550	166840	162550	166840	162550	357090	356930	357090	356930	357090	356930
R-squared	0.23	0.24	0.23	0.24	0.22	0.23	0.19	0.21	0.27	0.28	0.17	0.21
Industry dummies	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes
Year dummies	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sub-sample	BEL	BEL	BEL	BEL	BEL	BEL	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA

The dependent variable in columns (1),(2),(7) and (8) is the equity capital of the firm as a proportion of its total assets. In columns (3),(4),(9) and (10) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (5),(6),(11) and (12) it is short-term debt, similarly defined. *Post* is an indicator variable for the post-NID period. *'Baseline'* refers to the pre-NID average value of covariates, and *'trend'* is the pre-NID trend in those covariates. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.15: HETEROGENEITY ANALYSIS: RISK EXPOSURE (SECTOR-LEVEL COEFFICIENT OF VARIATION OF SALES).

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	2.6***	2.4***	0.5*	0.6**	-2.6***	-2.8***	-1.1***	-1.1***
	(0.790)	(0.785)	(0.255)	(0.247)	(0.623)	(0.607)	(0.203)	(0.205)
Risk	-6.9***	-3.2**	-0.9**	0.0	-2.3*	0.0	1.5***	1.4***
	(1.383)	(1.286)	(0.399)	(0.338)	(1.216)	(1.184)	(0.318)	(0.293)
Post	6.2***	6.5***	3.6***	5.1***	7.5***	8.0***	6.6***	6.9***
	(0.635)	(0.633)	(0.184)	(0.192)	(0.488)	(0.493)	(0.142)	(0.157)
Constant	40.7***	38.4***	40.3***	35.7***	41.1***	57.8***	40.2***	31.7***
	(1.074)	(6.888)	(0.288)	(1.532)	(0.883)	(6.880)	(0.216)	(1.390)
Observations	14450	13990	155470	148530	16350	16100	183230	178430
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.091	0.072	0.001	0.000	0.005	0.001

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-4.0***	-3.8***	-0.7***	-0.8***	-0.2	0.2	-0.5**	-0.4**
	(0.787)	(0.780)	(0.239)	(0.238)	(0.601)	(0.589)	(0.191)	(0.192)
Risk	10.2***	3.3***	3.8***	1.7***	10.1***	4.6***	4.5***	3.1***
	(1.394)	(1.222)	(0.367)	(0.314)	(1.198)	(1.203)	(0.311)	(0.303)
Post	-3.1***	-3.4***	-3.0***	-3.7***	-4.5***	-4.8***	-4.8***	-4.4***
	(0.612)	(0.612)	(0.169)	(0.181)	(0.456)	(0.465)	(0.129)	(0.146)
Constant	42.3***	51.3***	38.8***	55.3***	42.2***	42.9***	46.8***	64.9***
	(1.076)	(6.594)	(0.253)	(1.377)	(0.850)	(6.409)	(0.210)	(1.401)
Observations	14450	13990	155470	148530	16350	16100	183230	178430
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.009	0.003	0.005	0.001	0.005	0.001

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	0.9	0.9	0.2	0.2	-0.3	-0.3	-0.5***	-0.6***
	(0.592)	(0.597)	(0.224)	(0.223)	(0.384)	(0.381)	(0.125)	(0.126)
Risk	-2.9***	0.3	-3.0***	-2.0***	-2.7***	-1.0***	-3.1***	-2.0***
	(0.906)	(0.786)	(0.304)	(0.252)	(0.456)	(0.395)	(0.143)	(0.140)
Post	-2.9***	-3.0***	-0.9***	-1.6***	2.1***	2.1***	1.8***	1.6***
	(0.511)	(0.521)	(0.164)	(0.169)	(0.306)	(0.303)	(0.098)	(0.101)
Constant	14.1***	7.2**	18.6***	8.9***	6.0***	2.8	6.5***	4.2***
	(0.762)	(3.376)	(0.227)	(0.979)	(0.397)	(2.463)	(0.117)	(0.581)
Observations	14450	13990	155470	148530	16350	16100	183230	178430
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.366	0.338	0.314	0.214	0.101	0.046

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is short-term debt. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals 1 for firms with above-median risk exposure in the pre-NID period, using the sector-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.19: HETEROGENEITY ANALYSIS: RISK EXPOSURE (FIRM-LEVEL COEFFICIENT OF VARIATION OF SALES).

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	3.6***	3.5***	1.0*	1.7***	1.5**	1.5**	1.4***	1.6***
	(1.087)	(1.093)	(0.538)	(0.521)	(0.640)	(0.627)	(0.202)	(0.206)
Risk	-10.8***	-3.2**	-4.9***	-3.5***	-4.5***	-2.5**	-3.6***	-2.9***
	(1.767)	(1.455)	(0.857)	(0.721)	(1.230)	(1.110)	(0.314)	(0.299)
Post	7.0***	7.2***	3.7***	5.2***	5.5***	6.0***	5.5***	5.7***
	(0.663)	(0.675)	(0.381)	(0.386)	(0.386)	(0.393)	(0.134)	(0.143)
Constant	38.3***	30.0***	40.0***	41.6***	41.4***	56.2***	42.4***	33.7***
	(1.226)	(8.531)	(0.648)	(3.035)	(0.770)	(6.939)	(0.221)	(1.407)
Observations	7690	7500	33130	31550	16140	15910	181350	176790
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.051	0.064	0.120	0.076	0.078	0.051

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-4.6***	-4.4***	-1.1**	-1.5***	-1.9***	-1.8***	-1.7***	-1.5***
	(1.086)	(1.092)	(0.520)	(0.531)	(0.622)	(0.613)	(0.188)	(0.193)
Risk	12.3***	4.2***	4.6***	3.0***	5.1***	2.3**	5.0***	3.7***
	(1.832)	(1.449)	(0.842)	(0.698)	(1.244)	(1.134)	(0.308)	(0.309)
Post	-5.1***	-5.2***	-3.4***	-4.2***	-3.7***	-4.0***	-4.2***	-4.0***
	(0.591)	(0.608)	(0.357)	(0.377)	(0.360)	(0.369)	(0.121)	(0.132)
Constant	49.3***	61.9***	41.8***	54.8***	45.7***	46.8***	46.7***	65.1***
	(1.205)	(8.295)	(0.605)	(2.965)	(0.769)	(6.472)	(0.211)	(1.404)
Observations	7690	7500	33130	31550	16140	15910	181350	176790
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.020	0.016	0.070	0.035	0.035	0.009

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	0.7	0.5	0.1	-0.1	0.3	0.2	-0.5***	-0.7***
	(0.634)	(0.626)	(0.461)	(0.460)	(0.395)	(0.393)	(0.127)	(0.128)
Risk	-1.2	-0.7	0.1	0.0	-0.8*	-0.1	-0.5***	-0.2*
	(0.933)	(0.770)	(0.652)	(0.531)	(0.451)	(0.397)	(0.149)	(0.147)
Post	-2.0***	-2.0***	-0.4	-0.9***	1.8***	1.8***	1.9***	1.7***
	(0.433)	(0.440)	(0.336)	(0.335)	(0.240)	(0.234)	(0.091)	(0.093)
Constant	10.0***	6.8*	16.1***	4.7**	4.9***	2.2	5.4***	3.3***
	(0.699)	(3.547)	(0.477)	(2.029)	(0.315)	(2.453)	(0.108)	(0.593)
Observations	7690	7500	33130	31550	16140	15910	181350	176790
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.698	0.801	0.722	0.707	0.232	0.198

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is short-term debt. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals 1 for firms with above-median risk exposure in the pre-NID period, using the firm-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

1.A.2 Robustness: Increasing the cutoff threshold for large firms to €5 million

Table 1.23: NID AND LEVERAGE RATIOS: ANALYSIS WITHOUT COVARIATES

	(1) Equity	(2) Equity	(3) Equity	(4) Equity	(5) LTDebt	(6) LTDebt	(7) LTDebt	(8) LTDebt	(9) STDebt	(10) STDebt	(11) STDebt	(12) STDebt
Post * Large	5.5***	5.5***			-1.4***	-1.4***			-3.8***	-3.8***		
	(0.642)	(0.642)			(0.415)	(0.415)			(0.655)	(0.655)		
Post	4.0***	4.0***			-0.9***	-0.9***			-3.4***	-3.4***		
	(0.123)	(0.123)			(0.107)	(0.107)			(0.116)	(0.116)		
Large	-5.6***				-5.8***				10.9***			
	(1.103)				(0.654)				(1.147)			
2006			1.5***	3.8***			-0.3***	-1.2***			-1.3***	-2.7***
			(0.091)	(0.432)			(0.080)	(0.291)			(0.093)	(0.453)
2007			2.6***	6.1***			-0.4***	-1.4***			-2.2***	-4.7***
			(0.115)	(0.555)			(0.102)	(0.376)			(0.114)	(0.601)
2008			3.6***	8.5***			-0.4***	-1.8***			-3.3***	-6.9***
			(0.133)	(0.680)			(0.117)	(0.424)			(0.129)	(0.702)
2009			4.9***	10.3***			-0.6***	-1.9***			-4.6***	-8.6***
			(0.146)	(0.743)			(0.128)	(0.469)			(0.139)	(0.744)
2010			4.9***	11.5***			-1.0***	-2.5***			-4.3***	-9.0***
			(0.157)	(0.789)			(0.135)	(0.509)			(0.149)	(0.804)
2011			4.6***	11.6***			-1.1***	-2.8***			-3.9***	-8.8***
			(0.166)	(0.820)			(0.142)	(0.533)			(0.157)	(0.847)
2012			5.8***	12.0***			-1.4***	-3.2***			-4.8***	-8.6***
			(0.175)	(0.839)			(0.146)	(0.527)			(0.163)	(0.840)
2013			4.4***	12.1***			-1.8***	-3.5***			-3.0***	-8.4***
			(0.189)	(0.896)			(0.150)	(0.550)			(0.179)	(0.897)
Constant	39.7***	39.5***	39.7***	34.1***	16.8***	16.6***	16.8***	11.1***	41.1***	41.5***	41.1***	52.0***
	(0.194)	(0.097)	(0.194)	(1.088)	(0.147)	(0.084)	(0.147)	(0.638)	(0.181)	(0.091)	(0.181)	(1.134)
Observations	169950	169950	163810	6140	169950	169950	163810	6140	169950	169950	163810	6140
Sub-sample	All	All	Small	Large	All	All	Small	Large	All	All	Small	Large
Fixed effects	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No

The dependent variable in columns (1)-(4) is the equity capital of the firm as a proportion of its total assets. In columns (5)-(8) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (9)-(12) it is short-term debt, similarly defined. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.24: NID AND LEVERAGE RATIOS: ADDING BASELINE COVARIATES, PRE-NID TRENDS AND FRENCH FIRMS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt	Equity	Equity	LTDebt	LTDebt	STDebt	STDebt
Post * BEL * Large	6.6***	6.2***	-4.8***	-4.6***	-1.9**	-1.7**	4.5***	4.5***	-4.6***	-4.6***	1.2	1.3
	(0.966)	(0.961)	(0.501)	(0.492)	(0.891)	(0.888)	(0.946)	(0.939)	(0.459)	(0.460)	(0.889)	(0.881)
Post * BEL	5.2***	5.2***	-1.1***	-1.1***	-4.3***	-4.3***	-1.8***	-2.4***	-2.5***	-2.4***	1.2***	2.0***
	(0.135)	(0.135)	(0.111)	(0.111)	(0.129)	(0.129)	(0.157)	(0.168)	(0.124)	(0.131)	(0.149)	(0.160)
BEL							1.4***	6.4***	6.6***	11.1***	-3.5***	-8.7***
							(0.242)	(0.317)	(0.147)	(0.224)	(0.239)	(0.317)
Log assets	-2.9***	-2.8***	0.8***	0.7***	1.9***	1.9***	-2.2***	-2.2***	0.5***	0.6***	0.8***	0.7***
	(0.187)	(0.189)	(0.113)	(0.115)	(0.172)	(0.173)	(0.133)	(0.133)	(0.065)	(0.065)	(0.126)	(0.124)
Age	0.5***	0.5***	-0.3***	-0.3***	-0.3***	-0.2***	0.4***	0.4***	-0.2***	-0.2***	-0.1***	-0.2***
	(0.015)	(0.015)	(0.009)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.005)	(0.005)	(0.008)	(0.008)
Profitability (baseline)	0.4***	0.4***	-0.1***	-0.1***	-0.3***	-0.3***	0.3***	0.3***	-0.0***	-0.1***	-0.2***	-0.2***
	(0.030)	(0.024)	(0.011)	(0.010)	(0.022)	(0.019)	(0.012)	(0.012)	(0.005)	(0.005)	(0.010)	(0.010)
Profitability (trend)		0.0		-0.0		0.0	-0.0***	-0.0***	0.0*	0.0	0.0	0.0**
		(0.020)		(0.010)		(0.016)	(0.013)	(0.013)	(0.005)	(0.005)	(0.011)	(0.010)
Tangibility (baseline)	0.1***	0.1***	0.3***	0.3***	-0.4***	-0.4***	0.0***	0.0***	0.2***	0.2***	-0.3***	-0.3***
	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
Tangibility (trend)		-0.1***		0.1***		-0.1***	0.0	0.0	0.1***	0.1***	-0.1***	-0.1***
		(0.016)		(0.015)		(0.016)	(0.014)	(0.014)	(0.010)	(0.010)	(0.012)	(0.012)
Cash (baseline)	0.5***	0.5***	-0.1***	-0.1***	-0.4***	-0.4***	0.3***	0.3***	-0.1***	-0.1***	-0.3***	-0.3***
	(0.011)	(0.011)	(0.005)	(0.005)	(0.010)	(0.010)	(0.007)	(0.007)	(0.003)	(0.003)	(0.006)	(0.006)
Cash (trend)		0.0**		0.0***		-0.1***	0.2***	0.2***	-0.0***	-0.0***	-0.1***	-0.1***
		(0.017)		(0.010)		(0.016)	(0.015)	(0.015)	(0.004)	(0.004)	(0.010)	(0.010)
Log assets (trend)		-6.1***		3.1***		2.5***	-3.4***	-3.3***	1.1***	1.5***	3.4***	2.7***
		(0.710)		(0.395)		(0.554)	(0.467)	(0.462)	(0.211)	(0.213)	(0.386)	(0.373)
Equity (trend)		0.1***					0.1***	0.1***				
		(0.022)					(0.014)	(0.014)				
LTDebt (trend)				0.1***					0.1***	0.1***		
				(0.017)					(0.008)	(0.008)		
STDebt (trend)						0.1***					0.1***	0.1***
						(0.014)					(0.010)	(0.009)
GDP								-0.7***		-0.6***		0.3***
								(0.042)		(0.039)		(0.045)
Tax 1								1.1***		-0.1**		-1.6***
								(0.069)		(0.052)		(0.071)
Tax 2								0.2***		0.2***		-0.1***
								(0.010)		(0.010)		(0.012)
Constant	33.0***	32.6***	11.1***	11.4***	55.3***	55.5***	35.5***	20.8***	4.5***	24.0***	59.1***	71.3***
	(1.382)	(1.384)	(0.839)	(0.853)	(1.247)	(1.256)	(0.951)	(2.740)	(0.472)	(1.893)	(0.891)	(2.734)
Observations	166840	162550	166840	162550	166840	162550	357090	356930	357090	356930	357090	356930
R-squared	0.23	0.24	0.23	0.24	0.22	0.23	0.19	0.21	0.26	0.28	0.17	0.21
Industry dummies	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes
Year dummies	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Sub-sample	BEL	BEL	BEL	BEL	BEL	BEL	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA	BEL,FRA

The dependent variable in columns (1),(2),(7) and (8) is the equity capital of the firm as a proportion of its total assets. In columns (3),(4),(9) and (10) the dependent variable is the long-term debt stock of the firm as a proportion of total assets, and in columns (5),(6),(11) and (12) it is short-term debt, similarly defined. *Post* is an indicator variable for the post-NID period. *'Baseline'* refers to the pre-NID average value of covariates, and *'trend'* is the pre-NID trend in those covariates. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.25: HETEROGENEITY ANALYSIS: RISK EXPOSURE (SECTOR-LEVEL COEFFICIENT OF VARIATION OF SALES)

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	4.3***	3.9***	0.6**	0.6**	-3.0***	-3.1***	-1.1***	-1.1***
	(1.334)	(1.340)	(0.247)	(0.240)	(0.943)	(0.912)	(0.197)	(0.199)
Risk	-9.8***	-5.0**	-1.1***	-0.1	-6.2***	-2.9	1.4***	1.5***
	(2.251)	(2.113)	(0.389)	(0.331)	(1.914)	(1.886)	(0.312)	(0.287)
Post	6.5***	6.9***	3.7***	5.0***	7.5***	7.8***	6.7***	7.0***
	(1.101)	(1.116)	(0.179)	(0.186)	(0.753)	(0.746)	(0.139)	(0.152)
Constant	40.9***	43.7***	40.3***	33.3***	41.9***	65.3***	40.2***	31.4***
	(1.822)	(11.076)	(0.281)	(1.462)	(1.431)	(10.817)	(0.212)	(1.323)
Observations	6130	5890	163790	156630	6930	6810	192650	187720
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.091	0.072	0.001	0.000	0.005	0.001

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-6.0***	-5.8***	-0.8***	-0.9***	0.2	0.6	-0.5**	-0.4**
	(1.308)	(1.306)	(0.232)	(0.231)	(1.002)	(0.977)	(0.185)	(0.186)
Risk	15.2***	7.0***	4.0***	1.7***	12.3***	5.5***	4.7***	3.1***
	(2.279)	(2.043)	(0.359)	(0.308)	(1.899)	(1.894)	(0.306)	(0.297)
Post	-3.1***	-3.3***	-3.0***	-3.7***	-4.8***	-5.1***	-4.7***	-4.4***
	(1.039)	(1.054)	(0.165)	(0.175)	(0.770)	(0.771)	(0.126)	(0.140)
Constant	41.6***	51.0***	39.0***	54.5***	41.5***	44.2***	46.6***	64.6***
	(1.829)	(10.907)	(0.248)	(1.319)	(1.387)	(9.731)	(0.206)	(1.317)
Observations	6130	5890	163790	156630	6930	6810	192650	187720
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.009	0.003	0.005	0.001	0.005	0.001

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	1.1	1.2	0.2	0.3	0.4	0.2	-0.5***	-0.6***
	(0.915)	(0.903)	(0.216)	(0.217)	(0.582)	(0.566)	(0.122)	(0.122)
Risk	-3.9***	-0.4	-3.0***	-1.9***	-2.2***	-0.2	-3.1***	-2.0***
	(1.449)	(1.277)	(0.295)	(0.245)	(0.800)	(0.671)	(0.139)	(0.135)
Post	-3.0***	-3.2***	-1.0***	-1.4***	1.7***	1.8***	1.9***	1.7***
	(0.807)	(0.807)	(0.160)	(0.165)	(0.467)	(0.450)	(0.095)	(0.098)
Constant	13.6***	-0.7	18.4***	11.8***	5.7***	-1.7	6.5***	4.8***
	(1.268)	(4.560)	(0.221)	(0.910)	(0.719)	(3.765)	(0.113)	(0.548)
Observations	6130	5890	163790	156630	6930	6810	192650	187720
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.366	0.338	0.314	0.214	0.101	0.046

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is short-term debt. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals 1 for firms with above-median risk exposure in the pre-NID period, using the sector-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Table 1.29: HETEROGENEITY ANALYSIS: RISK EXPOSURE (FIRM-LEVEL COEFFICIENT OF VARIATION OF SALES)

(a) DEPENDENT VARIABLE: EQUITY RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	5.4***	5.1***	0.9*	1.5***	2.3**	2.1**	1.4***	1.6***
	(1.467)	(1.464)	(0.511)	(0.499)	(0.962)	(0.944)	(0.197)	(0.201)
Risk	-14.3***	-4.9***	-4.9***	-3.1***	-6.0***	-3.5**	-3.6***	-2.9***
	(2.295)	(1.806)	(0.816)	(0.693)	(1.935)	(1.737)	(0.308)	(0.294)
Post	7.3***	7.5***	4.0***	5.1***	4.9***	5.3***	5.5***	5.7***
	(0.832)	(0.832)	(0.360)	(0.367)	(0.548)	(0.574)	(0.130)	(0.138)
Constant	38.4***	37.3***	39.8***	35.4***	40.7***	61.7***	42.4***	33.5***
	(1.648)	(11.245)	(0.611)	(2.862)	(1.203)	(10.945)	(0.216)	(1.342)
Observations	4520	4410	36300	34640	6840	6730	190650	185970
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.051	0.064	0.120	0.076	0.078	0.051

(b) DEPENDENT VARIABLE: SHORT-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	-5.9***	-5.5***	-1.2**	-1.6***	-2.5**	-2.2**	-1.7***	-1.5***
	(1.508)	(1.510)	(0.492)	(0.502)	(1.014)	(1.001)	(0.183)	(0.187)
Risk	15.5***	4.8***	4.7***	2.9***	6.1***	2.3	5.0***	3.7***
	(2.383)	(1.826)	(0.809)	(0.670)	(1.975)	(1.749)	(0.303)	(0.303)
Post	-5.5***	-5.6***	-3.5***	-4.2***	-3.6***	-3.9***	-4.2***	-4.0***
	(0.748)	(0.759)	(0.335)	(0.354)	(0.600)	(0.619)	(0.117)	(0.127)
Constant	49.8***	60.7***	42.5***	55.4***	45.9***	50.5***	46.6***	64.5***
	(1.616)	(11.366)	(0.575)	(2.739)	(1.221)	(9.837)	(0.207)	(1.326)
Observations	4520	4410	36300	34640	6840	6730	190650	185970
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.020	0.016	0.070	0.035	0.035	0.009

(c) DEPENDENT VARIABLE: LONG-TERM DEBT RATIO

	(1) BEL:Large	(2) BEL:Large	(3) BEL:Small	(4) BEL:Small	(5) FRA:Large	(6) FRA:Large	(7) FRA:Small	(8) FRA:Small
Post * Risk	0.2	-0.0	0.2	0.1	-0.0	-0.3	-0.4***	-0.6***
	(0.779)	(0.742)	(0.430)	(0.433)	(0.569)	(0.550)	(0.123)	(0.124)
Risk	-0.7	0.3	0.0	-0.3	-0.6	0.6	-0.5***	-0.3*
	(1.118)	(0.885)	(0.614)	(0.499)	(0.759)	(0.647)	(0.144)	(0.142)
Post	-1.8***	-1.9***	-0.6*	-0.8***	1.9***	2.0***	1.9***	1.8***
	(0.549)	(0.551)	(0.310)	(0.313)	(0.394)	(0.371)	(0.087)	(0.089)
Constant	8.9***	-2.6	15.7***	9.4***	4.8***	-2.7	5.3***	4.1***
	(0.843)	(3.647)	(0.447)	(1.789)	(0.555)	(3.663)	(0.104)	(0.560)
Observations	4520	4410	36300	34640	6840	6730	190650	185970
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Cross-equation test			0.698	0.801	0.722	0.707	0.232	0.198

In panel (a), the dependent variable is the equity ratio, in panel (b) it is the long-term debt ratio, and in panel (c) it is short-term debt. Columns (1) and (2) show results using only the sub-sample of large Belgian firms, with results for small Belgian firms in columns (3) and (4), for large French firms in columns (5) and (6), and small French firms in columns (7) and (8). Columns (1), (3), (5) and (7) present the simplest specification, with no additional covariates, while columns (2), (4), (6) and (8) include the full set of covariates from the most saturated model in Section 1.4.3. $Risk$ is an indicator variable that equals 1 for firms with above-median risk exposure in the pre-NID period, using the firm-level coefficient of variation of sales. Standard errors are clustered at the firm level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

1.A.3 Summary data for risk exposure and financial dependence

SECTORS WITH ABOVE-MEDIAN RISK EXPOSURE (COEFFICIENT OF VARIATION OF SALES)

SIC	Detail	Sector-level Risk Exposure	Firm-level Risk Exposure	External Finance Dependency Index
87	Engineering & Management Services	6.61	0.19	0.10
57	Furniture & Homefurnishings Stores	3.60	0.10	0.20
76	Miscellaneous Repair Services	3.12	0.14	3.84
28	Chemical & Allied Products	2.83	0.14	0.30
73	Business Services	2.61	0.18	-0.80
50	Wholesale Trade D Durable Goods	2.55	0.13	0.57
78	Motion Pictures	2.44	0.34	0.00
37	Transportation Equipment	2.16	0.13	0.14
51	Wholesale Trade D Nondurable Goods	2.04	0.16	-0.05
16	Heavy Construction, Except Building	2.04	0.15	-0.08
39	Miscellaneous Manufacturing Industries	2.00	0.13	1.29
20	Food & Kindred Products	1.98	0.10	-0.25
22	Textile Mill Products	1.87	0.13	0.30
34	Fabricated Metal Products	1.86	0.11	0.06
26	Paper & Allied Products	1.74	0.08	-0.25
27	Printing & Publishing	1.74	0.14	-0.75

SECTORS WITH BELOW-MEDIAN RISK EXPOSURE (COEFFICIENT OF VARIATION OF SALES)

SIC	Detail	Sector-level Risk Exposure	Firm-level Risk Exposure	External Finance Dependency Index
33	Primary Metal Industries	1.68	0.12	0.30
29	Petroleum & Coal Products	1.68	0.10	-0.15
36	Electronic & Other Electric Equipment	1.68	0.16	-0.03
56	Apparel & Accessory Stores	1.64	0.12	0.04
32	Stone, Clay, & Glass Products	1.58	0.10	0.04
25	Furniture & Fixtures	1.54	0.11	-0.40
35	Industrial Machinery & Equipment	1.50	0.14	0.11
15	General Building Contractors	1.46	0.32	2.77
38	Instruments & Related Products	1.40	0.09	0.01
14	Nonmetallic Minerals, Except Fuels	1.39	0.13	0.14
59	Miscellaneous Retail	1.37	0.11	0.04
30	Rubber & Miscellaneous Plastics Product	1.34	0.11	-0.60
58	Eating & Drinking Places	1.32	0.10	-0.06
79	Amusement & Recreation Services	1.28	0.17	-0.67
31	Leather & Leather Products	1.16	0.07	-1.46
55	Automative Dealers & Service Stations	1.16	0.12	0.89
81	Legal Services	1.14	0.12	.
70	Hotels & Other Lodging Places	1.14	0.11	-0.54
52	Building Materials & Gardening Supplies	1.13	0.10	0.31
72	Personal Services	1.11	0.12	-0.40
24	Lumber & Wood Products	1.10	0.10	-0.14
75	Auto Repair, Services, & Parking	1.10	0.12	-1.75
54	Food Stores	1.09	0.09	-0.07
53	General Merchandise Stores	1.09	0.08	0.34
23	Apparel & Other Textile Products	0.95	0.14	0.18
17	Special Trade Contractors	0.94	0.14	0.58
80	Health Services	0.93	0.08	-0.22
82	Educational Services	0.90	0.15	-1.56
83	Social Services	0.67	0.11	-1.21
12	Coal Mining	0.60	0.05	-0.17
84	Museums, Botanical, Zoological Gardens	0.60	0.10	.
21	Tobacco Products	0.34	0.07	-2.19

Chapter 2

Microequity for Microenterprises: Evidence from an Artefactual Field Experiment and Survey in Pakistan

Abstract Access to finance is often listed as one of the most important constraints on the expansion of small firms in low-income countries. However, several recent studies reveal that most microcredit-funded businesses rarely grow beyond subsistence-level entrepreneurship. Other evidence shows that cash and capital grants have delivered high returns to some microenterprises, and that small changes to contract structure can have a long-term effect on investment and profits. In this paper, I investigate the potential of 'microequity' contracts, which can be viewed as lying at some point on a spectrum between credit and grants, and provide a more flexible form of capital with performance-contingent repayments and a greater sharing of risk and reward. I present results from work with two of the largest microfinance institutions in Pakistan to investigate the effects of microequity contracts on microenterprises. In the first part of the paper, I describe an artefactual field experiment, designed using a simple model of investment choice under different financial contracts. This is tested with microenterprise owners who are part of a related field experiment that provides them with shared-ownership financing to expand their business. Results reveal that equity-financed microenterprise owners chose investment options with a greater expected profit than those under debt financing, with heterogeneity analysis suggesting a larger effect for more risk-averse individuals. Given the potential benefits, in the second part of the paper I present results from a field survey to provide insights on the reasons why most microfinance institutions do not actually offer microequity products. Results reveal the practical implementation challenges related to costly state verification, adverse selection into income-sharing contracts and moral hazard caused by inappropriately-tailored profit-sharing ratios.

2.1 Introduction

Access to finance is often listed as one of the most important constraints on the expansion of informal micro, small and medium enterprises in many low-income countries.[1] Many existing studies focus on the role of microcredit as a source of capital; other work complements this by considering the potential effect of microsavings and microinsurance. In this paper, I consider a different approach: 'microequity'. Microequity contracts, which involve performance-contingent repayments, have the potential to provide a more flexible form of capital that could more effectively stimulate growth for *some* microenterprise in developing countries. Microequity contracts may, relative to microcredit contracts, encourage higher risk and higher return investments, by providing a form of implicit insurance to microenterprises that automatically reduces repayment requirements when business conditions are challenging. This is in comparison to microcredit and microsavings products, which often have strict payment schedules (and, in the case of microcredit, relatively high interest rates). The effects could be particularly strong for microenterprise owners whose behavioural characteristics lead them to under-invest in profitable opportunities, such as those with higher levels of risk aversion. Such individuals may be more willing to choose riskier but higher expected-return investments when provided with the implicit insurance of microequity contracts, which mitigate the risk of losing their own wealth, compared to non-performance-contingent, fixed-repayment debt contracts. Microequity contracts also have the potential to serve hundreds of millions of low-income microentrepreneurs from the world's population of 1.6 billion Muslims, many of whom remain unbanked both by microcredit and microsavings products because of the religious prohibition on interest.

Initially, it was believed that microcredit would be an effective tool for encouraging entrepreneurship and growth of microenterprises. However, several recent studies have suggested that microloans have not had large benefits for most entrepreneurs and that microcredit-funded businesses rarely grow beyond a subsistence level of entrepreneurship. Banerjee, Karlan, and Zinman (2015) report on seven randomised evaluations of microcredit, using a variety of sampling, data collection, experimental design, and econometric strategies to identify causal effects

[1] See Ayyagari, Beck, and Demirguc-Kunt (2007); Beck, Demirgüç-Kunt, and Martinez Peria (2008); P. Stein, Ardic, and Hommes (2013).

of expanded access to microcredit on borrowers or communities.[2] They consistently find no transformative impact from microcredit. In particular, take-up rates were unexpectedly low, investments rarely resulted in increased profits, and none of the studies found a significant impact on average household income. Among several recommendations, Banerjee, Karlan, and Zinman (2015) identify the following key challenges for the next generation of microfinance studies: (i) investigating how innovations to microfinance contract structure can improve take-up rates and effectiveness; (ii) addressing the limited evidence on repeat borrowers; and (iii) broadening our understanding of non-credit microfinance activities. In this paper, I aim to contribute to these objectives by investigating the viability of microequity contracts, which provide a more flexible form of capital with performance-contingent repayments and a greater sharing of risk and reward, using an artefactual field experiment and a field survey with two of the largest microfinance institutions in Pakistan.

Standard microcredit contracts are often characterised by high interest rates and immediate repayment requirements. While the majority of the results from the literature on microcredit have showed little effect from standard microcredit products on the growth of microenterprises, recent evidence reveals that small changes to contract structure, such as repayment grace periods, can have a long-term effect on profits and facilitation of lumpy investment.[3] Further, cash and capital grants have delivered high and sustained returns to at least some kinds of microenterprise.[4] Microequity contracts can be viewed as lying at some point on a spectrum between credit and grants, sharing characteristics of both, by providing capital with performance-contingent repayments.

This paper draws on the work of Fischer (2013), who uses theory and a 'lab-in-field' experiment to investigate the possibility that the structure of many existing microfinance contracts discourages risky but high-expected-return investments, with a particular focus on the difference between individual- and joint-liability microcredit contracts on risk-sharing and informal transfers between pairs of individuals who have been issued a loan. He also investigates the

[2]See Augsburg, De Haas, Harmgart, and Meghir (2015); Tarozzi, Desai, and K. Johnson (2015); Duflo, Banerjee, Glennerster, and Kinnan (2013); Angelucci, Karlan, and Zinman (2015); Attanasio, Augsburg, De Haas, Fitzsimons, and Harmgart (2015); Crépon, Devoto, Duflo, and Parienté (2015); Karlan and Zinman (2011). Meager (2018) jointly estimates the average effect and the heterogeneity in effects across these seven studies using a Bayesian hierarchial model, and finds support for the conclusion that the average effect on household outcomes is close to zero, while there is some evidence of a positive effect for households with previous business experience.

[3]See Field, Pande, Papp, and Rigol (2013); Battaglia, Gulesci, and Madestam (2017); Barboni (2017).

[4]See De Mel, McKenzie, and Woodruff (2008); Fafchamps, McKenzie, Quinn, and Woodruff (2014).

effect of a quasi-equity contract, in which partners who are given a loan also have profit- and loss-sharing enforced on them, and finds that this contract led to increased risk-taking and expected returns relative to all other contracts (both individual- and joint-liability debt contracts), and actually produced the lowest default rates.[5]

There are over 1.6 billion Muslims in the world, representing nearly a quarter of the global population. The religious prohibition on usury (*'riba'*) means that many Muslim microentrepreneurs remain unbanked both by microcredit and microsaving products.[6] An equity-based product, though not restricted to any one particular religion or group, has the potential to meet the demands of hundreds of millions of poor Muslims, many of whom reject conventional loan products on religious grounds.[7] Research from the Islamic Development Bank reports that in the six countries with the largest Muslim populations (Indonesia, India, Pakistan, Bangladesh, Egypt and Nigeria) the number of people living on less than $2 per day far exceeds half a billion.[8] Financial exclusion rates in India are as high as 80% for Muslims, compared to 20% for non-Muslims.[9] Recent reports by the World Bank and IMF discuss the benefits of risk-sharing products and call for innovations in equity-based contracts for micro-, small- and medium-sized enterprises.[10]

In the first part of the paper, I test a microequity contract using an artefactual field experiment, with microenterprise owners who were part of a broader field experiment, two-thirds of whom were randomly offered a relatively large amount of financing to purchase an asset for their business (using an 'equity-like', shared-ownership contract). The sample consists of growth-oriented microenterprise owners who had successfully graduated from previous loan cycles, reaching the upper limit of borrowing of $450 from Akhuwat, one of the largest microfinance institutions in Pakistan, and who had expressed an interest in expanding their business

[5]The major differences between this paper and Fischer (2013) are that Fischer's equity-like contract is itself a hybrid of a debt and equity contract that was implemented with participants in pairs, with the primary aim of studying informal risk sharing and transfers between these pairs of individuals. Other major differences include the characteristics of the sample: Fischer uses only females with relatively low incomes, and it is not clear how many of them were managing a business. In my context, all participants were growth-oriented microenterprise owners who had successfully graduated from previous loan cycles, reaching the upper limit of borrowing of $450, and had entered into an experiment that provided them with financing up to the value of $1,800 to expand their business with the purchase of a fixed asset using a shared-ownership contract.

[6]See El-Gamal, El-Komi, Karlan, and Osman (2014).

[7]See Nimrah, Michael, and Xavier (2008).

[8]See Obaidullah and Khan (2008).

[9]See El-Komi and Croson (2013).

[10]See World Bank (2012); Kammer, Norat, Pinon, Prasad, Towe, and Zeidane (2015).

by purchasing a fixed asset up to the value of $1,800. As such, this experiment has greater external validity compared to most 'lab-in-the-field' studies because all participants are actual microenterprise owners making an important investment decision for their business. The experiment was designed based on a simple theoretical model, in which a utility-maximising agent makes investment decisions in discrete time. Financial contracts are then introduced to investigate investment behaviour under equity and debt. The model predicts that agents are more likely to choose higher-risk, higher expected-return investment options when financed with performance-contingent-repayment equity contracts, compared to investment decisions taken under a fixed-repayment debt contract. This prediction is stronger for more risk-averse agents. I demonstrate the robustness of these predictions to changes in the parameters of the model, which is then tested using the artefactual field experiment with microenterprise owners. Results from the experiment reveal that equity-financed microentrepreneurs chose investment options with a higher expected return than under debt financing, with an effect size of 0.40 standard deviations. Heterogeneity analysis with pre-specified variables reveals a treatment effect that is approximately 50% larger for the most risk-averse microenterprise owners, using a survey-based measure of risk aversion. Such individuals may under-invest in profitable opportunities due to their aversion to risk and losses; microequity contracts have the potential to stimulate profitable but more risky investment choices for this group of individuals through the implicit insurance inherent in performance-contingent repayments. However, while the welfare effects on this population of individuals could be significant, from a policy perspective microfinance institutions may not wish to provide such financing if those individuals who take the most risk under equity financing also tend to be those with the worst business management practices, education or cognitive ability. The results presented in the second part of the heterogeneity analysis help to mitigate such concerns: I find no evidence that microenterprise owners with lower business management practices, education or cognitive ability are those for whom equity contracts incentivise the greatest risk-taking relative to debt.

Following on from the positive results in the artefactual field experiment, the second part of the paper provides some insights for why large microfinance institutions (MFIs) do not typically offer microequity contracts alongside other products in their portfolios. Given the stated objectives of many microfinance institutions to consider borrower welfare as well as profits, it seems surprising that no large microfinance institution appears to be implementing microe-

quity contracts, given the potential benefits, in particular for individuals whose risk aversion may lead them to under-invest, and given the evidence that those individuals are not characterised by the lowest levels of business management practices, education or cognitive ability. To investigate this, I report on an attempt by the National Rural Support Program (NRSP), another one of the largest microfinance institutions in Pakistan, to implement microequity contracts with microenterprise owners in the field. Results from a detailed client survey and a post-survey focus group with senior management reveal the significant challenges of implementing equity-based contracts within a conventional microcredit organisation. I find that, while contracts were initially implemented with profit- and loss-sharing, gradually clients and loan officers abandoned the performance-contingent payment features and converged back to a model of fixed-repayment debt contracts. Interviews with senior management and loan officers uncover key reasons for this convergence, which echo results from theoretical work that has investigated the difficulties in implementing performance-contingent contracts, such as equity or sharecropping, due to costly state verification, adverse selection and moral hazard.[11]

The second part of this paper reveals two major insights. First, from the supply-side, the main challenge of implementing equity-like contracts was related to the organisational structure of a conventional microfinance institution: specifically, how loan officers are incentivised. Loan officers in the study reported that they were familiar with disbursing a relatively high volume of loans and focusing the majority of their efforts on maximising the repayment rate of their loan portfolio, based on which they are paid a bonus.[12] Loan officers did not have much incentive to finance higher-return, higher-risk microentrepreneurs by providing them with a product that contained possible loss-sharing, especially because the loan officer would not themselves benefit from the upside portion of the entrepreneur's payment. Further, loan officers reported that it took much added effort to monitor microenterprises and their profits and losses, on which they had to calculate shared payments. These results provide some support for the theoretical result of Townsend (1979), who shows that under costly state verification the optimal financing mechanism is a standard debt contract, rather than performance-linked contracts that require the capital provider to monitor the microenterprise.

[11] See Townsend (1979); Stiglitz and Weiss (1981).

[12] Note that this could also lead to an incentive to re-finance the loan of a client who is performing poorly, rather than investigating whether their business is worthy of being re-financed.

The second major insight relates to the incentives of microfinance clients themselves in the implementation of profit-sharing contracts. Results from the survey and interviews illustrate that many microenterprise owners had serious objections to the profit-sharing rule used in the contracts when they were originally implemented. A common sharing rule of 20-80 was applied by the MFI – where the microenterprise shared 20% of its monthly profits – but this led to the most profitable microentrepreneurs having to share too much of their profits and thus the equity product, ironically, appeared to them to be very 'inequitable'. Once again, it was beyond the remit and incentives of loan officers to spend a large amount of time auditing the accounts of the microenterprise and carefully tailoring the sharing ratio based on expected profits and losses of the business after the capital injection. Over time, loan officers and clients mutually agreed to remove the performance-contingent aspect of the contracts, which converged to a fixed repayment schedule. Had NRSP maintained performance-contingent contracts alongside fixed-repayment contracts, a serious problem of adverse selection may have developed, with the most profitable microenterprises deciding to re-negotiate to a debt contract, and the least profitable ones remaining on performance-contingent contracts. Hence, the decision taken by NRSP management to revert all contracts back to a standard fixed repayment schedule appears to have been appropriate. This decision to move back to debt-like contracts also appears prudent in light of the potential adverse consequences of moral hazard. Since a 20-80 sharing ratio was considered inappropriate by some of the more profitable businesses, in that they were obliged to share too much of their profits, had NRSP not renegotiated the contract then it could have created negative incentives for those microenterprises stuck on 'unfair' sharing ratios. This may have encouraged them either to exert less effort – for instance if they equated their marginal disutility of effort with their share of their marginal product rather than total marginal product – or to simply understate their profits, which would be difficult to detect due to costly state verification.

Intriguingly, NRSP branch managers also observed that, even though the contracts originally maintained a 'downside option' that did allow for loss-sharing ex-ante, in practice no entrepreneurs ever exercised this loss-sharing option. This was due to a fear that if they did not meet their expected payment every month, it would adversely affect their standing with the bank, which may hinder their ability to borrow in the future. Therefore, fears regarding reputation and dynamic incentives actually led to microenterprise owners not exercising their

loss-sharing option, even when NRSP had explicitly allowed it. In summary, these findings from the survey of NRSP clients suggest that it is very challenging to implement equity-based contracts within a conventional microcredit organisation. The major constraints relate to the incentives of microcredit loan officers and those of clients, as discussed in earlier theoretical work on optimal financial contracts in the presence of asymmetric information and costly state verification. These are compounded by the related problems of adverse selection (the most profitable microenterprises selecting out of equity contracts) and moral hazard (distortionary effects caused by inappropriately chosen income-sharing ratios).

Nevertheless, given the positive results from the artefactual field experiment, and the eagerness of some of the largest microfinance institutions in the world such as NRSP and Akhuwat to implement microequity contracts, there appears to be some potential for establishing alternative 'venture capital-like' funding models. Insights from this paper suggest that these would need to be operated separately from the conventional operations of a microcredit institution, with the aim of providing risk-sharing capital for promising growth-oriented microentrepreneurs. In Section 2.6, I discuss the potential design of such a financing model, links to the broader literature on entrepreneurial finance and venture capital, and some examples of recents attempts to innovate in this direction.

The remainder of the paper proceeds as follows. In Section 2.2, I outline the simple model that was used to design the artefactual field experiment, which is described in Section 2.3, and for which results are presented in Section 2.4. Section 2.5 presents results from the field survey of NRSP clients, and Section 2.6 concludes.

2.2 A simple model of contract structure and investment choice

2.2.1 General setup

In this section, I outline a simple model in which an agent makes a series of investment decisions in discrete time. I describe the general setup of the model, how financial contracts are introduced (debt and equity), and the model's predictions for the behaviour of agents under the financial contract 'treatments'. The model forecasts that agents are more likely to choose investment options with a higher expected return (and higher risk) when financed with the

equity contract, compared to the debt contract. This prediction is stronger for more risk-averse agents. I demonstrate the robustness of these predictions to changes in the structure of the model. This model is then used to design the experiment that is outlined in Section 2.3, which is implemented with microenterprise owners who are part of a large field experiment, in order to test the effect of financial contracts on investment choice.

In the model, the agent begins the game with initial wealth w_1, and makes an investment choice in each decision round. There are T decision rounds; in each round the agent chooses from a set of j investment options, with each investment option having: (i) a good outcome g_j; and (ii) a bad outcome b_j. The bad outcome always has a payoff of zero ($b_j = 0$), while the good outcome has some positive payoff ($g_j > 0$). Each outcome is equally likely. I define a payoff matrix with each row corresponding to one of the j investment options pairs (b_j, g_j). Each of the j investment options also has an associated cost, c_j. The agent chooses investment options that maximise their expected utility, subject to the constraint that their current wealth is sufficient to pay for the chosen investment option. The agent is assumed to have a constant relative risk aversion (CRRA) utility function over wealth w_t:

$$u(w_T) = \frac{w_T^{1-r} - 1}{1 - r} \tag{2.1}$$

where r is the coefficient of relative risk aversion (CRRA) (and $u(w_t) = \ln w_t$ if $r = 1$). Backward induction is used to solve the model for the optimal decisions of the agent. I begin by defining a 'wealth grid' at the terminal period T, with $[w_{T,1}, w_{T,2}, ..., w_{T,MAX}]$ representing gradually increasing values on the discretised state space for wealth, and $w_{T,MAX}$ the maximum possible wealth at T.[13] Similarly, wealth grids are created for all periods $t = 1, 2, ..., T-1$. A 'value grid' is then created for each period t, where each point on the value grid represents the utility from the corresponding point on the wealth grid at time t, based on the utility function in equation 2.1: $[u(w_{t,1}), u(w_{t,2}), ..., u(w_{t,max})]$. This therefore represents a discrete choice dynamic programming problem with wealth w_t as the state variable and the investment decision as the choice variable. The objective is to fill in each of these value grids, starting from the last period, and working back one period at a time. The model is solved by backward induction; in the final

[13] Calculated as the number of previous rounds ($T - 1$) multiplied by the maximum payoff from the set of j investment options (g_j).

period T, the agent chooses the investment option that maximises their expected utility. This optimal choice of investment option is computed for every possible starting wealth level on the $T-1$ wealth grid, which leads to a vector of optimal investment choices, for each possible wealth level w_{T-1}. This is then repeated for the $T-2$ wealth grid, and so on, until period $t=1$. This provides an optimal solution grid for each agent, based on their CRRA parameter r. Having solved the model backwards, it is then possible to 'simulate forwards' in order to generate predictions for investment choices made by agents with different levels of risk aversion, which is outlined in Sections 2.2.3 and 2.2.4.

2.2.2 Adding financial contracts

Each game is played under a different financial contract environment, described below, which affects the amount of capital with which the agent begins and the terminal payoffs at the end of the game. These different environments correspond to the 'treatment arms' in the experiment described in Section 2.3:

Control Treatment (CT): The control treatment is the baseline scenario, upon which different financial contract treatments are added. In the general setup, an agent begins period $t=1$ with initial capital w_1. The agent can then choose any of the affordable j investment options; in period $t=1$, they can afford any investment option with cost $c_j \leq w_1$. The agent selects the optimal investment option and pays the cost. The outcome of the investment option is then realised, with the agent carrying forward to the next round their initial wealth w_1, minus the cost of the investment option that they chose c_j, plus the payoff from the investment option that they chose (b_j or g_j, with equal likelihood). The game proceeds in the same manner for T rounds, after which it ends and the agent keeps whatever wealth is remaining.

Debt Treatment (DT): In the debt dreatment, the agent begins with the same initial capital w_1 as in the control treatment, but they also receive an additional amount of capital k in the form of a zero-interest loan (the debt contract with which the microenterprise owners in the experiment are most familiar).[14] At the end of the T rounds, the loan of k must be repaid in full. The main purpose of the debt treatment is that it mimics 'external financing' that is required by the agent

[14]The MFI partner in this artefactual field experiment and the larger field experiment, Akhuwat, predominantly lends at zero interest.

to invest in higher expected-return investment options, which also cost more, and which the agent cannot afford when their initial wealth level is w_1 (as in the control treatment).

Equity Treatment, 50-50 Sharing (ET1): In the first equity treatment, the agent also begins with w_1 and an additional amount of capital k. However, the additional capital k is now given in the form of equity-based financing. The equity capital does not have a fixed repayment obligation at the end of the game, which is the requirement of the loan in debt treatment. Instead, there is a requirement to share all the wealth that is left at the end of the game in a 50-50 ratio (the agent keeps 50% of the remaining wealth, and shares 50%; this includes the initial wealth w_1 that they were given as starting capital).

Equity Treatment, 75-25 Sharing (ET2): The second equity treatment is identical to ET1, except that the sharing ratio at the end of the game is 75-25 (the agent keeps 75% and shares 25%).

For the financial contract treatments, an adjustment to the terminal wealth is made at the end of the game to meet all payment requirements (repaying the loan for the debt treatment, or sharing the required amount for the equity treatments). Equation 2.2 nests the different financial contracts:

$$Y_{T+1} = W_{T+1} - \delta.k - \alpha.\gamma.W_{T+1} \tag{2.2}$$

where Y_{T+1} is the total final payoff for the agent, $\delta \in \{0, 1\}$ is an indicator variable for the debt contract DT, $\gamma \in \{0, 1\}$ is an indicator variable for the equity contract ET and $\alpha \in \{0.5, 0.25\}$ controls the sharing ratio for ET. For example, when $\delta = 0$, $\gamma = 1$ and $\alpha = 0.25$ the 75-25 sharing equity contract (ET2) is activated.

2.2.3 Model predictions

To summarise the setup of the model, the objective for agents is to select investment options to maximise their expected utility from wealth, subject to the constraint that they must have sufficient wealth to choose the investment options (with the additional financial contract treatments relaxing the budget constraint by providing external capital at the start of the game). Agents

are assumed to know the full structure of the game, including the fixed number of rounds and investment options, that each investment option is equally likely, and the terms of the debt and equity contracts. In terms of heterogeneity of preferences, all agents are assumed to be expected utility maximisers, but they vary in their coefficient of relative risk aversion. The solution method is backward induction.

Thus far, the model has been outlined in general terms. Section 2.2.2 describes results from simulations that demonstrate the robustness of the final model predictions to a changing of the values of the key model parameters. The result of the analysis, and extensive testing of the game in the field, is a final preferred structure for the game, which is used in the design and implementation of the final experiment described in Section 2.3:

(i) Two rounds in the game;

(ii) Initial capital w_1 of 200 and external capital k of 500;

(iii) Five investment options (monotonically increasing in risk-return, as illustrated in Figure 2.1).

Figure 2.1: INVESTMENT OPTIONS

Investment Option	Cost	Bad Payoff	Good Payoff	Expected Payoff	Net Expected Return
1	0	0	100	50	50
2	100	0	400	200	100
3	200	0	700	350	150
4	300	0	1000	500	200
5	400	0	1300	650	250

Note: Each row represents one of the five possible investment options, along with the cost of each option and the payoff in each of the two possible states. The expected payoff and the expected payoff net of cost are also displayed, but were not shown to the participant in the final activity.

The final model predictions can be summarised as:

Hypothesis 1. *In general, agents take more risk under equity financing.*

Hypothesis 2. *More risk-averse agents take more risk under equity financing.*

Figure 2.2 illustrates the optimal solution grid for the model under the preferred game structure. Each row represents the optimal investment choice, as solved for in the model, for different values of the CRRA parameter of the agent. CT, DT, ET1 and ET2 refer to the four different

treatments. Each entry is a number between 1 and 5, representing the choice between the five investment options listed in Figure 2.1. For each treatment, there are three columns, which represent:

(i) The optimal investment choice in round 1;

(ii) The optimal investment choice in round 2, if the *bad* outcome occurred in round 1;

(iii) The optimal investment choice in round 2, if the *good* outcome occurred in round 1.

Figure 2.2: MODEL SOLUTION GRID

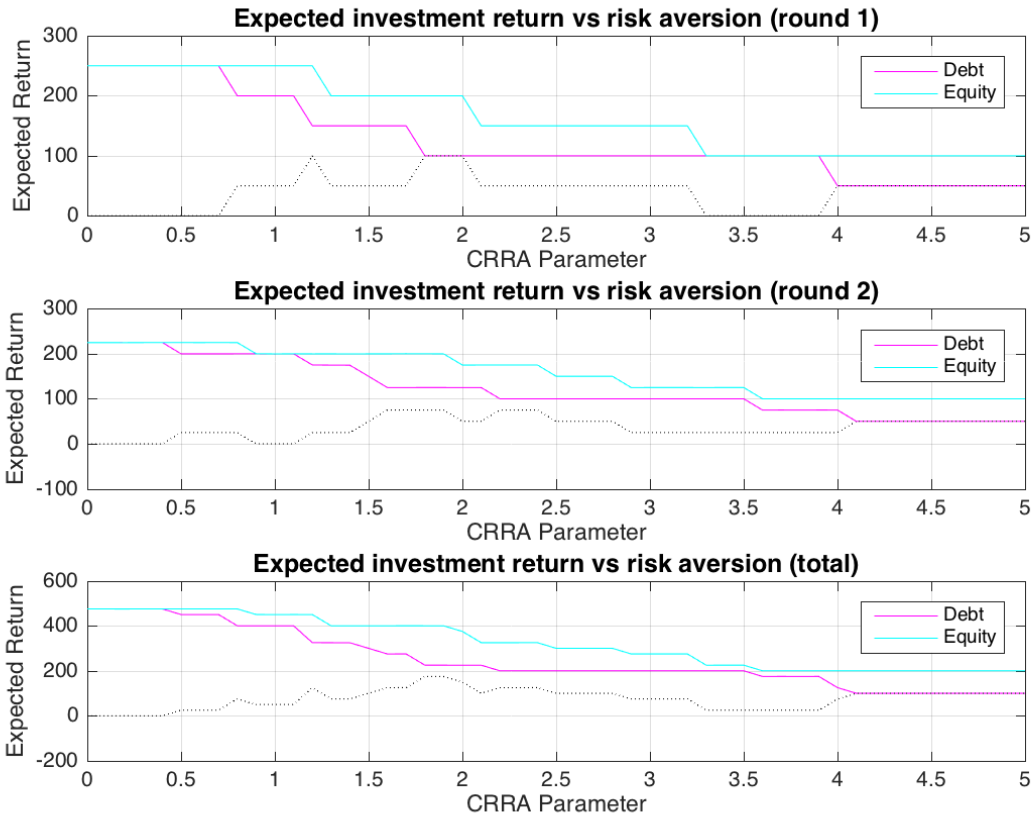
	CT	CT	CT	DT	DT	DT	ET1	ET1	ET1	ET2	ET2	ET2
CRRA	1	2_b	2_g	1	2_b	2_g	1	2_b	2_g	1	2_b	2_g
0.0	3	1	5	5	4	5	5	4	5	5	4	5
0.1	3	1	5	5	4	5	5	4	5	5	4	5
0.2	3	1	5	5	4	5	5	4	5	5	4	5
0.3	3	1	5	5	4	5	5	4	5	5	4	5
0.4	3	1	5	5	4	5	5	4	5	5	4	5
0.5	3	1	5	5	4	5	5	4	5	5	4	5
0.6	3	1	5	5	4	5	5	4	5	5	4	5
0.7	3	1	5	5	4	5	5	4	5	5	4	5
0.8	3	1	5	4	4	5	5	4	5	5	4	5
0.9	3	1	5	4	3	5	5	4	5	5	4	5
1.0	3	1	5	4	3	5	5	4	5	5	4	5
1.1	2	2	4	4	3	5	5	4	5	5	4	5
1.2	2	2	4	3	3	4	5	4	5	5	4	5
1.3	2	2	4	3	3	4	5	4	5	5	4	5
1.4	2	2	3	3	2	4	5	4	5	4	4	5
1.5	2	2	3	3	2	4	5	4	5	4	4	5
1.7	2	2	3	3	2	4	5	4	5	4	3	5
2.0	2	2	3	2	2	3	4	4	5	3	3	4
2.5	2	2	2	2	2	2	3	3	4	3	2	3
3.0	2	2	2	2	2	2	3	3	3	2	2	3
3.5	2	2	2	2	1	2	3	2	3	2	2	2
4.0	1	1	1	1	1	1	2	2	2	2	2	2

Note: Each number represents the optimal investment choice for an agent with a given coefficient of relative risk aversion (CRRA) and under a given treatment environment.

As can be seen in Figure 2.2, the optimal solution implies greater risk-taking in the equity treatments, ET1 and ET2, than the debt treatment DT. This is reflected in Figure 2.3, which illustrates results from simulations of the model, pooling together the two equity treatments. Each point represents the coefficient from a regression of the expected return of the investment options chosen by an agent with a given CRRA parameter on treatment indicator variables (an OLS regression without a constant). The top two panels illustrate simulated results for the investment decisions made in the first round and second round respectively, with the bottom panel displaying the sum of the two decision rounds. In each round, it can be observed that a risk-neutral agent takes the same amount of risk under both debt and equity contracts, but

for agents with CRRA parameters above 0.5 there is relatively less risk-taking under debt contracts. The gap between risk-taking under equity and debt is largest in the intermediate range of illustrated CRRA parameters, while the effect for the most risk-averse people is relatively smaller but still positive in the direction of greater risk-taking under equity.

Figure 2.3: SIMULATED RESULTS



Note: The grey dotted line plots the risk-taking under equity minus risk-taking under debt. Simulations were done in MATLAB with a simulated sample of size 300 and 300 simulations, with regressions being run for each simulated dataset. Results are also stable and similar for a lower number of simulations and smaller sample size.

2.2.4 Robustness simulations

Tables 2.15 - 2.23 of the appendix illustrate results from a number of simulations, which reveal the robustness of the model's predictions to changes in key parameters. Each simulation is done with results compared to the 'baseline' specification that was implemented in the final

experiment: two decision rounds, five investment options to choose from each round, starting capital of 200 and additional capital of 500 for the financing contracts.

Number of decision rounds: Table 2.15 presents simulated results when the number of decision rounds in the game is changed from two to three, five, seven and ten. Results are qualitatively the same, and based on logistical reasons and a desire not to over-burden participants, the final design included only two rounds.

Number of investment options: Table 2.17 illustrates results using three, seven and ten investment options respectively. Again, predictions do not qualitatively change. Based on piloting, it was decided that five investment options provided the optimal trade-off between client comprehension and offering sufficient variation in choices.

Initial wealth level: In Table 2.19, the initial level of starting capital w_1 was sequentially increased. While results reveal the same pattern of equity-financed agents taking more risk than debt-financed agents, with the effect positive for more risk-averse agents (before tailing off for the most risk-averse agents), the CRRA region in which the effect is largest shifts to the right as the initial wealth level is increased. This is an intuitive result, given that the assumed utility function exhibits constant relative risk aversion (CRRA), which implies decreasing absolute risk aversion (DARA), such that an agent who experienced an increase in wealth should increase their absolute level of risk-taking. Although not illustrated in Table 2.19, when comparing risk-taking for each of the two treatment contracts relative to the control group, who do not get access to the additional capital of 500, it can be seen that the effect is smaller as the initial wealth level is increased. Again, this is quite an intuitive result, as less 'value' is added by the external capital treatments when the agent begins in a wealthier state. Nonetheless, the overall effect of greater risk-taking under equity than debt persists, with the difference increasing in risk aversion up to a certain CRRA coefficient where it begins to decrease but remains positive.

Amount of external capital: Table 2.21 illustrates simulated results for different values of the external capital amount k. Results remain qualitatively similar, although the effect size when the external capital amount is smallest decreases, as would be expected. It should be noted that there are potentially large differences in the welfare implications of the two financial contracts. For example, if the external capital amount is very low, the equity contracts begin to look rather

'unequal', since agents are provided with very little capital yet they are required to share a large amount of the firm's value at the end of the game.

Finally, Table 2.23 presents simulations of the terminal wealth at the end of the game for the two treatments. Results show that the equity contracts are not unambiguously 'better' than the debt contracts in terms of expected terminal wealth; in particular, for risk-neutral agents and those with a CRRA coefficient up to 0.5, expected terminal wealth is the same under both debt and equity contracts. For higher levels of risk aversion, equity-financed entrepreneurs do end with higher terminal wealth, as would be expected given the observed greater risk-taking.

2.3 Experimental implementation

In this section, I describe the setup of the artefactual field experiment, which was designed to test the predictions of the model set out in Section 2.2, and to coincide with a broader field experiment conducted with growth-oriented clients from one of the fastest growing microfinance institutions in Pakistan to help them finance business expansion. Akhuwat is based in Lahore and operates in 775 branches across Pakistan, with over 930,000 active borrowers and an outstanding loan portfolio of PKR 15.6 billion (approximately USD 135 million).[15] The sample consisted of microenterprise owners who had successfully completed at least one loan cycle with Akhuwat, and who had expressed an interest in expanding their business by purchasing a fixed asset. Individuals were invited to a half-day workshop, where a baseline survey was conducted and the new shared-ownership microfinance contract was explained to them (after this session, two-thirds of participants were randomly offered this new contract to finance an asset for their business, up to the value of $1,800). During the workshop, and after the baseline survey, enumerators conducted a detailed session of behavioural games, with the microequity game, based on the model in Section 2.2, as the main activity.

2.3.1 Summary statistics for microenterprise owners

Table 2.1 presents summary statistics for the microenterprise owners who participated in the study. 90% were male, with an average age of 38 and seven years of formal education. 84% were married, and the average household size was six, of which two people were typically earning

[15] Information is correct as of 03 April 2018.

some form of income. 62% of participants were themselves the head of the household, with a further 22% as the son or daughter of the household head, and 8% as the husband or wife of the head. In terms of business characteristics, the mean number of businesses in the household was 1.2, with a median of 1. The average number of years of experience in that business was 9.6. The mean number of employees was 1.1, with a median of 0. Average monthly business profits were approximately US$ 253, with a median of $217, and average total fixed assets were $1,175 (median $395). Average monthly household income from all sources was $560 (median $350), and average monthly household expenditure was $218 (median $185). The most popular business sector was rickshaw driving (20%), followed by clothing and footwear production (10%), food and drink sales (8%), and retail trade in the form of fabric and garment sales (6%). As a comparison to two of the most prominent studies on microenterprises, average microenterprise profits in De Mel, McKenzie, and Woodruff (2008) were 3,850 Sri Lankan Rupees (approximately $25 at current market rates) and 125 Ghanaian Cedis ($27) in Fafchamps, McKenzie, Quinn, and Woodruff (2014). The average microenterprise owner in this current study is larger in terms of business profits than the two most prominent microenterprise-focused studies, which is unsurprising given that the wider field experiment targets growth-oriented microenterprise owners who had successfully completed previous loans and were looking to finance an asset for business expansion up to the value of $1,800. The seven microcredit field experiments summarised in Banerjee, Karlan, and Zinman (2015) contained a mixture of microenterprise-targeted products and ones with no restrictions. The most relevant comparisons would be Tarozzi, Desai, and K. Johnson (2015), who worked with a microenterprise-targeted loan product in Ethiopia with an approximate value of $500, Karlan and Zinman (2011), who offered approximately $220 to microenterprises in the Philippines, and Angelucci, Karlan, and Zinman (2015), who offered approximately $450 to Mexican microenterprises.

Table 2.1: AKHUWAT SAMPLE: SUMMARY STATISTICS

	Mean	SD	10th Pctile	Median	90th Pctile	Obs.
Gender	0.1	0.3	0.0	0.0	0.0	718
Age	38.0	10.3	26.0	37.0	52.0	718
Education	7.4	3.7	0.0	8.0	12.0	718
Married	0.8	0.4	0.0	1.0	1.0	718
Household size	6.3	2.8	4.0	6.0	9.0	718
Household earners	2.0	1.2	1.0	2.0	4.0	718
Number of businesses	1.2	0.6	1.0	1.0	2.0	718
Business experience	9.6	8.1	2.0	7.0	20.0	718
Number of employees	1.1	3.1	0.0	0.0	3.0	718
Monthly profits	25,327.7	18,005.6	7,500.0	21,666.7	48,333.3	718
Total fixed assets	117,513.5	310,687.7	0.0	39,500.0	250,000.0	718
Household Income	55,967.2	73,649.0	0.0	35,000.0	120,000.0	718
Household Expenditure	21,785.4	17,266.5	9,500.0	18,450.0	36,000.0	718

2.3.2 Eliciting risk preferences and loss aversion

Microenterprise owners who had expressed an interest in expanding their business with a fixed asset were invited to a half-day workshop, where a baseline survey was conducted. Prior to the microequity game, behavioural games were conducted to measure risk preferences and loss aversion, in order to provide measures for the analysis of heterogeneous treatment effects.

The first measure of risk aversion was survey-based, in which each respondent was asked the following four questions:[16]

(i) *"How would you rate your willingness to take risks in financial matters?"*;

(ii) *"How would you rate your willingness to take risks in your occupation?"*;

(iii) *"How would you rate your willingness to take risks when it comes to having faith in other people?"*;

(iv) *"How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks?"*.

The questions were adapted from Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner (2011), who used a large sample to show that responses to the survey-based measure were a reliable predictor of actual risky behaviour in incentivised risk preference elicitation activities. The authors argue that relatively simple survey-based measures, compared to often quite complex

[16]Responses were given on a scale of 1 to 10, with 0 representing 'risk-averse' and 10 for 'fully prepared to take risks'.

paid lottery experiments, are easy to use, cheap to administer, and deliver a behaviourally valid measure of risk attitudes, which maps onto actual choices in risk preference elicitation activities with real monetary consequences.

I complemented the survey-based measure of risk aversion with an incentive-compatible measure, using a method that provided the best trade-off between comprehension and quality of data for this population of microenterprise owners, as discovered through extensive piloting.[17] The final incentivised risk preference elicitation activity can be characterised as a 'certainty-equivalent method'.[18] Respondents were posed a series of 30 questions, where they were required to choose between a certain amount of money or an uncertain investment option, which had two possible outcomes: (i) a 'bad' outcome, with a payoff of zero; or (ii) a 'good' outcome, with a payoff of PKR 1,000 ($9).

In the risk preference elicitation activity, there were three sets of ten questions. Each of the three sets had a different probability of a good outcome and bad outcome, which was illustrated using four coloured balls. In the first set of 10 questions, participants were shown a bowl that contained four balls: one green and three white. This reflected a probability of the good outcome of 25% (winning PKR 1,000) and 75% for the bad outcome (receiving nothing). Participants were also shown a sheet to graphically illustrate the possible outcomes for the uncertain option. Participants were asked to choose between the uncertain investment option (which had an expected value of PKR 250, although no mention of expected values was made to participants) and a certain payment of money. For example, in the first question, they were presented with a certain payment of zero versus the uncertain option.[19] In the second question,

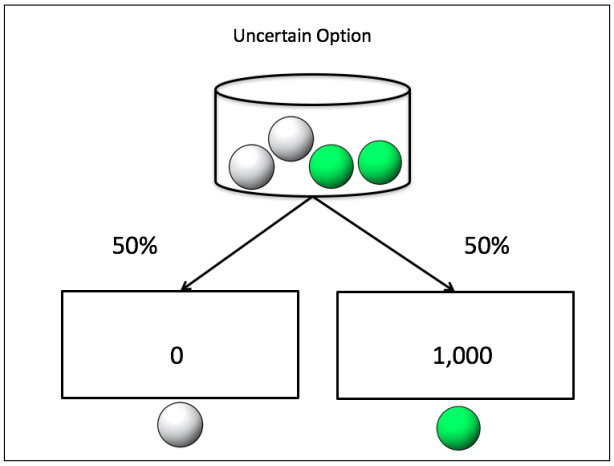
[17] I previously tested the well-known Ordered Lottery Selection design, which was developed by Binswanger (1981) and used by many authors, such as Fischer (2013), but decided against it for two main reasons that are explained in more depth in Harrison and Elisabet Rutström (2008): (i) probabilities are restricted to 0.5, which does not allow one to make inferences about probability weighting, which plays a major role in alternatives to Expected Utility Theory, such as rank-dependent utility models; and (ii) the use of a certain amount for the first investment choice may frame the investment choices in a way that makes them 'sign-dependent', such that the certain payment provides a clear reference point from which participants may identify gains and losses. I also tested other more sophisticated risk preference elicitation methods, such as the well-known Multiple Price List (MPL) design of Holt and Laury (2002), where subjects were presented with a choice between two binary lotteries, and the probabilities on each lottery were varied for different decisions. Based on piloting, I considered this risk elicitation method to be too complicated for the population at hand, which would have resulted in a large portion of the data needing to be discarded due to a lack of participant comprehension.

[18] I adapted the measures used by Barr and Packard (2002) and Vieider, Lefebvre, Bouchouicha, Chmura, Hakimov, Krawczyk, and Martinsson (2015).

[19] This was essentially a test of comprehension, since no-one was expected to accept a certain payment of zero versus an uncertain option with a non-zero expected value and a minimum payoff of zero.

participants were offered a certain payment of PKR 100 or the uncertain option. The response recorded by enumerators, who explained the activities carefully and conducted a number of practice rounds with participants to test understanding, was either a '1' (if the participant selected the certain payment for that question) or a '0' (if the participant took the risk of the uncertain investment option). As such, for this first set of 10 questions, each participant finished with a score between 0 and 10, with a higher number indicating a higher level of risk aversion (choosing the certain payment more often). Most participants would be expected to initially choose the uncertain investment option (compared to a certain payment of zero) but, at the point of a sufficiently high certain payment being offered, would switch to choosing the certain investment option. After switching, they would then be expected to accept all greater amounts for the certain payment rather than the uncertain investment option. While participants were in principle allowed to make 'multiple switches', which means switching back to preferring the uncertain option compared to a greater certain payment, this would be a clear sign of lack of comprehension of the activity.[20]

Figure 2.4: DEMONSTRATING THE UNCERTAIN INVESTMENT OPTION



In the second set of 10 questions, the mix of balls was changed to two green and two white, reflecting an equal probability of the good or bad outcome. The same set of 10 questions was then

[20]Collected data reveal that there was relatively little multiple switching (less than 3%), which likely reflects many practice rounds and careful explanation, as well as the participants knowing that their inputted data was being monitored on a regular basis. Sessions were conducted in a large hall in and under the monitoring of up to three research assistants and one of the principal investigators on the project. The data was collected using tablets and uploaded to SurveyCTO immediately after each survey. A project manager was then able to download and check the data to monitor collection and detect errors, which addressed by directly contacting the responsible enumerator.

asked: *"Do you prefer x for certain or the uncertain investment option?"*, where x increased from 0 to 1,000 in increments of 100, with real money being used for display purposes. In the third set of 10 questions, the mix of balls became three green balls and one white ball, reflecting a probability of the good outcome of 75%. At the end of the activity, it was possible to construct a risk aversion index with a number between 0 and 30 for each respondent, with higher numbers reflecting greater risk aversion.[21] Before the activities were conducted, some non-inentivised questions to check the cognitive ability of participants were also asked.[22]

Having elicited risk preferences using two separate measures, the final activity elicited possible loss aversion.[23] Individuals were presented with a series of investment decisions, which they could either accept or reject. Each was a binary equal-probability lottery, with the 'good' payoff being a positive value of PKR 1,000, and the bad payoff being some negative number x. x started at a low number (- PKR 100) and the individual had to decide whether they would accept or reject a binary lottery that either paid PKR 1,000 or led to a loss of PKR 100. If a loss was incurred in the activity, then the amount of loss would be taken from the individual's participation fee of PKR 1,000; as such, it was a 'real' loss that was being considered. The next question required the participant to accept or reject a binary lottery that either paid PKR 1,000 or led to a loss of PKR 200. A rejection was coded as '1' and an acceptance as '0'. 10 such questions were asked, with the loss amount increasing by PKR 100 each time. In the end, each individual had a score between 0 and 10, which indicated how many of the 10 investment options they rejected, and provided an incentive-compatible measure of loss aversion for the microenterprise owner.

Before conducting all activities, participants were informed that, at the end of the behavioural games session, one of the incentivised activities would be selected for payment by physically drawing a ball from a bag. Within the selected activity, balls would be drawn to select the one final question that would be used for payment. As such, participants were required to answer all questions attentively, because any question could have been selected. This method also allowed the use of payment amounts that were relatively large, with the average payment being approximately three times as large as median daily business profits for microenterprises in the

[21] The purpose of varying the probability of a good outcome was to allow for testing of non-linear probability weighting in future work.

[22] These included number recall exercises, simple calculations and questions to test understanding of probabilities when drawing balls from a bag, which was the format used to explain probabilities throughout the activities.

[23] I adapted the measure used by Bartling, Fehr, and Herz (2014).

sample. From a methodological perspective, Charness, Gneezy, and Halladay (2016) show that paying for only a (randomly selected) subset of all activities is at least as effective as paying for all of them, and can actually be more effective in terms of helping to avoid wealth effects and hedging within the behavioural games session. Further, compared to most other 'lab experiments', which have been criticised as not accurately reflecting behaviour in the field for a number of reasons including 'small stakes' and unrepresentative student samples,[24] the experiment in this paper uses a highly relevant population. These individuals were all growth-oriented microenterprise owners who were taking part in a large field experiment that randomly offered two-thirds of them a large amount of financing for a fixed asset; therefore, concerns about attentiveness are significantly reduced and payment amounts are relatively large.[25]

2.3.3 Basic structure of the microequity game

Following the risk preference elicitation activity, the microequity game was conducted. Before learning the structure of the game, participants were carefully introduced to the concept of the game using a vignette. This described the story of an entrepreneur who was starting a new business, which would then be closed after a period of two years due to their need to migrate to another city. The entrepreneur in this vignette began with some amount of wealth, and had the possibility of obtaining additional financing through external capital, either in the form of: (i) a zero-interest loan, to be paid at the end of the two years; or (ii) equity capital, which required a 50-50 or 25-75 sharing of all that was left in the business at the end of the two years. A number of example scenarios for the value of the firm at the end of the two years were described, as well as an illustration and calculation of the required payments under the different financial contracts. Finally, participants were tested on their understanding of the contracts, using similar examples but with different numbers for the value of the firm at the end of the two years (specifically, one scenario where the firm was very profitable, and one scenario where it was not profitable); participants were then asked to calculate the required payment under the different contracts.

Following the introduction to the concept of raising external capital in the form of debt or equity, and how one calculated the terminal payoffs at the liquidation of the firm (which was

[24] See Levitt and List (2007).

[25] The average payment amount was approximately $20.

analogous to the terminal payment at the end of the proceeding microequity game), participants were introduced to the final microequity game activity. As mentioned, the microequity game was designed to match the structure of the model described in Section 2.2:

(i) Two decision rounds: in each round, one of the five different investment options had to be chosen, conditional on it being affordable; participants were only allowed to use money provided to them in the game;[26]

(ii) Starting capital of 200 for the control treatment (CT);

(iii) Additional capital of 500 for the debt treatment (DT), to be repaid at the end of the second round;

(iv) Additional capital of 500 for the equity treatment (ET), which required sharing of all money remaining at the end of the second round using a 50-50 or 25-75 split.

2.3.4 Strategy method

I used a strategy method to elicit second-round investment decisions, rather than having participants choose an investment option for round 1 and then actually drawing a ball from a bag to determine the outcome (after which they would have had to make their second round decision). As well as providing twice as much second-round information,[27] the strategy method mitigated undesirable behaviour whereby a person who chose a number that led to a good outcome would perceive something 'lucky' about that number and continue to choose it in the second round, regardless of their underlying preference over the risk and return of the different options.[28] Participants were initially asked to make their choice of investment in round one from one of the five investment options illustrated in Figure 2.5. Participants were informed that each investment option had a cost, and once that cost had been paid, each investment had

[26]The microequity game, as well as all behavioural games, used real monetary notes for both demonstration purposes and the final decisions. Piloting suggested that the use of paper tokens reduced the seriousness with which participants viewed the activity. Further, all numerical values corresponded to actual amounts in Pakistani Rupees (PKR), to avoid confusion mapping from game units to real units. As mentioned, the procedure of only paying out for one activity at the end of the workshop allows for the use of relatively large payment amounts for each activity.

[27]If one used the actual realisation of first-round outcomes to frame the second-round decision, one counterfactual second round decision would never be observed.

[28]Such behaviour was indeed observed among some participants during piloting.

an equally-likely good or bad outcome, as demonstrated using Figure 2.6. Participants were then asked the following two questions:

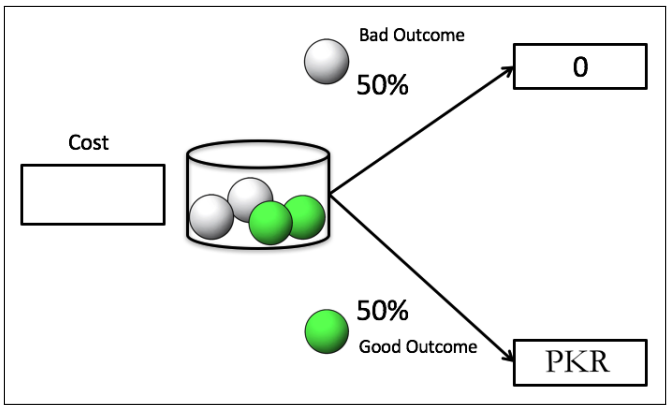
(i) *"If the bad outcome occurs from the investment choice you just chose for the first round, which investment option would you then choose in the second round?"*;

(ii) *"What about if the good outcome occurs from the investment choice you just chose for the first round; which investment option would you then choose in the second round?"*.

Figure 2.5: SET OF INVESTMENT OPTIONS

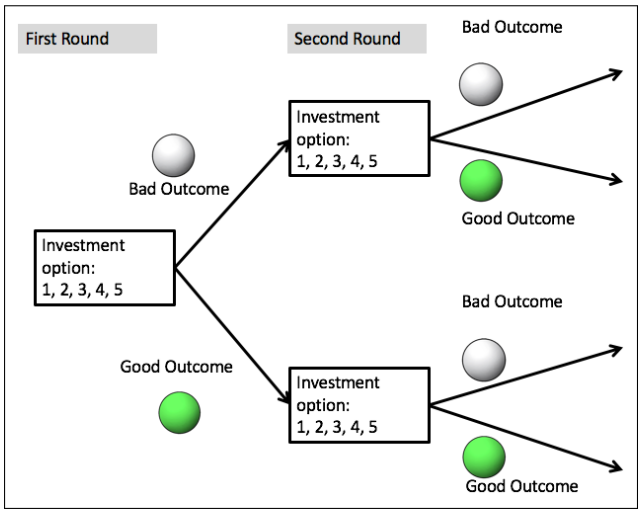
			
Investment Option	Cost	Bad Outcome	Good Outcome
1	0	0	100
2	-100	0	400
3	-200	0	700
4	-300	0	1000
5	-400	0	1300

Figure 2.6: OUTCOME OF AN INVESTMENT OPTION



Enumerators spent a considerable amount of time explaining the structure of the game to participants, and a number of practice rounds were conducted to test understanding before the final decisions. Figure 2.7 illustrates the tree diagram that was used to explain the structure of the entire game to participants.

Figure 2.7: GAME STRUCTURE



2.3.5 Randomisation of financial contract treatments

After completing a demonstration round with participants, where they practised the game under each treatment, the final activity was conducted. To mitigate learning effects, the order in which the participants played the three financial contract treatments was randomised.[29] It is important to note that, when communicating with participants, the word 'treatment' was never used, nor were the words 'debt' or 'equity'; instead the more neutral words 'loan contract' and 'sharing contract' were used (in the local language). The purpose of the experiment was to study the effect of the contractual structure on investment behaviour, rather than any effect driven by using those possibly emotive terms. However, all participants had previously taken a loan from Akhuwat and successfully repaid it, and therefore it is much less likely that they would have had an aversion to debt contracts.

2.4 Experimental results

In this section, I present results from the artefactual field experiment, which took place between December 2016 and February 2018. The main outcome variable, empirical specifications, and variables for heterogeneity analysis were pre-specified at the American Economic Association's RCT Registry.[30] The sample consists of 2,872 observations from 718 unique microenterprise

[29] In order to reduce confusion from switching from equity to debt and then back to equity, the two equity treatments always appeared next to each other, although the order in which the two equity treatments appeared was also randomised.

[30] See https://www.socialscienceregistry.org/trials/2224.

owners, representing one decision per respondent for each of the four treatment groups (CT, DT, ET1, ET2). Decisions under the two equity contracts are pooled into one treatment indicator (ET) in the subsequent analysis.

2.4.1 Main result: Greater risk-taking under equity contract

Table 2.2 presents results using the following simple specification:

$$y_i = \beta_0 + \beta_1 DT_i + \beta_2 ET_i + \varepsilon_i \tag{2.3}$$

where y_i is the expected return of the investment options chosen by individual i in round 1, DT_i is an indicator variable that equals one for all investment decisions made under the debt treatment, and ET_i is the equivalent indicator variable for the equity treatments. Standard errors are clustered at the individual level. β_0 represents the average expected return of investments chosen by individuals in the control group, whilst β_1 and β_2 represent the additional risk taken by debt-financed and equity-financed individuals relative to the control group, respectively. The main hypothesis I test is $H_0 : \beta_1 = \beta_2$. Table 2.2 presents the main result of the experiment. Equity-financed microenterprise owners chose investment options with an expected return of 185, compared to an expected return of 173 under the debt contract. This represents an effect size of 0.40 standard deviations of the control group's distribution of investment choices, where the average expected return was 109, and is statistically significant at the 1% level. In Section 2.4.4, I present evidence that this overall result is robust to a number of alternative specifications, including using the outcomes of second-round decisions. Further, in Tables 2.3 - 2.9, where heterogeneous treatment analysis using a set of pre-specified variables is presented, the average expected return under equity is greater than under debt in every sub-group.[31] Heterogeneity analysis is conducted by estimating equation 2.3 separately for each quantile of the particular heterogeneity variable, as well as estimating the combined specification:

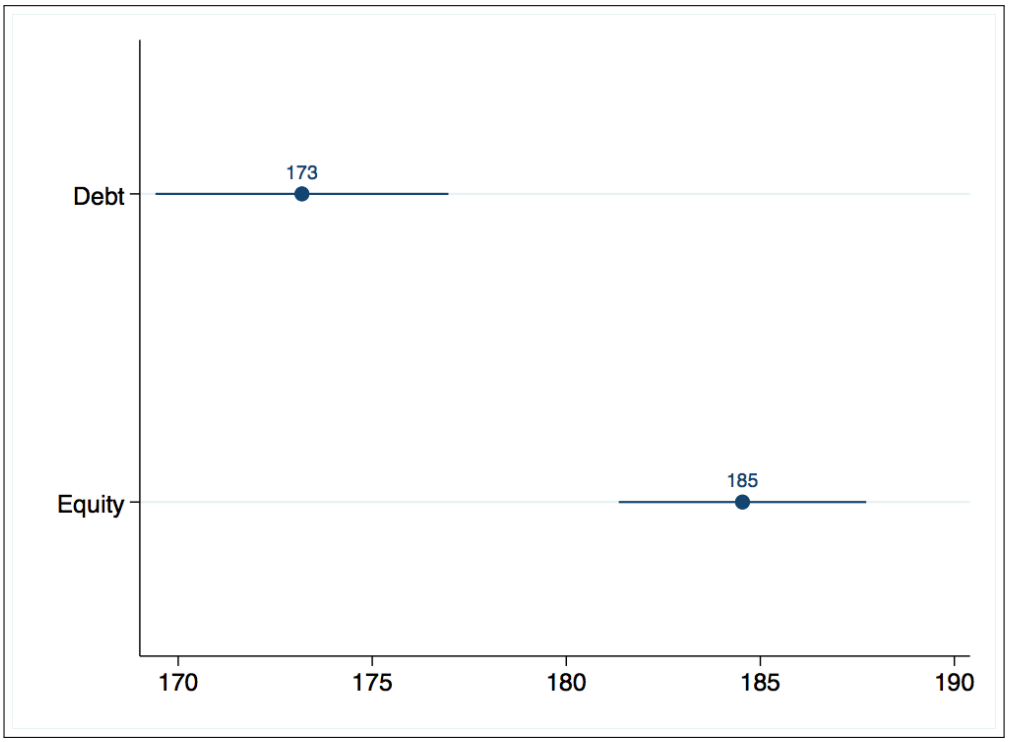
$$y_i = \beta_0 + \beta_1 DT_i + \beta_2 ET_i + \beta_3 HighX_i + \beta_4 DT_i * HighX_i + \beta_5 ET_i * HighX_i + \varepsilon_i \tag{2.4}$$

where $HighX_i$ indicates whether the individual has a higher value of the particular heterogeneity variable being considered (X_i), using both a median split as well as terciles. A test for the equivalence of β_4 and β_5 indicates whether individuals with higher values of X_i are differentially affected by the equity and debt treatments.

[31] While all variables used in the heterogeneity analysis were pre-specified, the fact that they were trichotomised was not specified. In each of Tables 2.3 - 2.9, I provide results using both a median split and terciles for the heterogeneity variable.

Table 2.2: OVERALL EFFECTS

	(1) Expected return	(2) Expected return	(3) Expected return
ET	76***	76***	76***
	(2.00)	(2.00)	(2.00)
DT	64***	64***	64***
	(2.32)	(2.32)	(2.32)
Order effect			2
			(2.96)
Constant	109***	109***	108***
	(1.07)	(1.44)	(1.83)
Observations	2872	2872	2872
R-squared	0.26	0.46	0.26
ET vs DT (Percent)	6.6	6.6	6.6
ET vs DT (Standard deviation)	0.40	0.40	0.40
Test: ET = DT (p-value)	0.00	0.00	0.00



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. DT and ET represent indicator variables for the debt and equity contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the result graphically, with each point representing the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

2.4.2 Heterogeneous treatment effects: Risk aversion and loss aversion

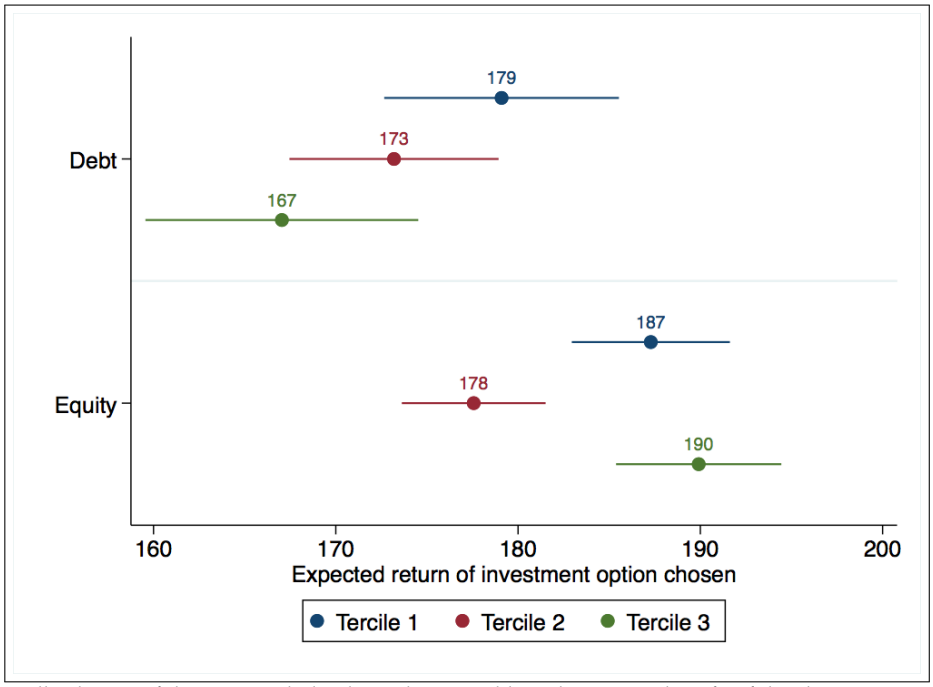
The purpose of the first section of heterogeneity analysis, presented in Tables 2.3 - 2.5, is to investigate potential mechanisms through which the structure of contracts may affect investment behaviour. In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the respective heterogeneity variable, while columns (5) and (6) present results from the sub-sample with below- and above-median values respectively. Columns (4) and (7) present results from the combined specification. DT and ET are indicator variables for the debt and equity contracts respectively, with the reported coefficient estimate indicating the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). In the bottom panel of each table, results are presented graphically, with each point illustrating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Risk aversion

Entrepreneurs who are more risk-averse may take relatively greater risk when financed with an equity contract, where there is an insurance-like element through the explicit sharing of losses, compared to when they are financed with a fixed-repayment debt contract. Tables 2.3 and 2.4 display regressions and graphical analysis using the two different measures of risk aversion. Column (1) of Table 2.3 presents results for the least risk-averse entrepreneurs (the most 'risk-tolerant'), with column (2) showing results for those with an intermediate level of risk aversion, and column (3) for the most risk-averse, using the survey-based measure. In all three specifications, the expected return of investment options chosen under equity is greater than that under debt, mirroring the overall results described in Section 2.4.1. The magnitude of the difference between risk-taking under equity compared to debt increases for the most risk-averse microenterprise owners. Specifically, for the most risk-averse tercile, risk taken under equity is 0.80 standard deviations greater than risk taken under debt, with the effect statistically significant at the 1% level. This compares to a difference of 0.29 and 0.15 standard deviations for the first two terciles of risk aversion respectively, using this survey-based measure. A similar result can be seen in the median split analysis of columns (4) and (5), with an effect size of 0.29 standard deviations for those with below-median risk aversion and 0.51 standard deviations

Table 2.3: HETEROGENEITY ANALYSIS: RISK PREFERENCES (SURVEY-BASED MEASURE)

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	74***	68***	87***	74***	70***	82***	70***
	(3.60)	(3.12)	(3.61)	(3.60)	(2.83)	(2.78)	(2.83)
DT	66***	64***	64***	66***	62***	67***	62***
	(4.11)	(3.55)	(4.45)	(4.11)	(3.18)	(3.37)	(3.18)
Tercile 2				-4			
				(2.44)			
ET * Tercile 2				-6			
				(4.76)			
DT * Tercile 2				-2			
				(5.43)			
Tercile 3				-10***			
				(2.71)			
ET * Tercile 3				13**			
				(5.10)			
DT * Tercile 3				-2			
				(6.06)			
Median							-8***
							(2.13)
ET * Median							12***
							(3.97)
DT * Median							6
							(4.64)
Constant	113***	110***	103***	113***	113***	105***	113***
	(1.74)	(1.71)	(2.07)	(1.74)	(1.40)	(1.60)	(1.40)
Observations	928	1052	892	2872	1500	1372	2872
R-squared	0.26	0.25	0.29	0.27	0.24	0.29	0.27
ETvsDT (Percent)	4.6	2.5	13.7		4.8	8.5	
ETvsDT (Standard deviation)	0.29	0.15	0.80		0.29	0.51	
Test: ET=DT (p-value)	0.005	0.117	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.347			
Test: ET*Terc3=DT*Terc3 (p-value)				0.003			
Test: ET*Med=DT*Med (p-value)							0.103



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

for those with above-median risk aversion (both statistically significant at the 1% level). The joint specification in column (4), which includes all individuals, confirms that the equity treatment differentially affected the most risk-averse individuals ($p-$value for the test of equivalence between $ET_i * Tercile3$ and $DT_i * Tercile3$ is 0.003). The joint specification in column (7), using the median split, reveals a marginally insignificant differential effect ($p-$value of 0.103).

Turning to the incentivised measure of risk aversion, Table 2.4 reveals that the most risk-tolerant tercile took on average 0.37 standard deviations more risk under equity compared to debt, and that this magnitude increases for those with intermediate risk aversion, with an effect size of 0.49 standard deviations. For those who were most risk-averse in the incentivised risk aversion activity, the effect size decreases back down to 0.33 standard deviations. The median-split analysis of columns (4) and (5) reveals an effect size of 0.36 standard deviations for those with below-median risk aversion and 0.43 standard deviations for those with above-median risk aversion (both statistically significant at the 1% level). One possible reason that the largest effect size is seen with the top tercile of risk aversion for the survey-based measure, whereas for the incentivised measure it was seen for those with an intermediate level of risk aversion, is that those who are defined as 'most risk-averse' using the incentivised measure are displaying quite an 'extreme' form of risk aversion, compared to those who are self-reporting as risk-averse in the survey-based measure. The two measures of risk aversion are significantly correlated, but the correlation coefficient is 0.267 for the raw measure and only 0.222 for the trichotomised measure (both statistically significant at the 1% level), and thus the 'most risk-averse' group defined by the two different measures could be quite distinct. Investigating the choices made by those in the top tercile of the incentivised measure confirms the rather extreme level of risk aversion; the average person in the top tercile of risk aversion rejected all 30 offers of the risky investment option, even when the certain payment offered was only PKR 100 (compared to an average expected return of the risky investment option of PKR 500, and even when the expected return of the risky option was increased to PKR 750). As a comparison, the most risk-tolerant tercile on average only rejected 11 of the risky investment options, and accepted 19 of them. It could be argued that this result for the most risk-averse tercile may be due to a cultural 'gambling aversion', given the Pakistani conservative Muslim context, yet all these participants who displayed extreme risk aversion were willing to make risky decisions in the microequity game. There were also no reports of any of the microenterprise owners refusing

Table 2.4: HETEROGENEITY ANALYSIS: RISK PREFERENCES (INCENTIVISED MEASURE)

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	67***	84***	77***	67***	69***	82***	69***
	(3.47)	(3.30)	(3.51)	(3.47)	(2.81)	(2.80)	(2.81)
DT	56***	70***	67***	56***	59***	70***	59***
	(4.15)	(3.97)	(3.85)	(4.15)	(3.34)	(3.19)	(3.34)
Tercile 2				-6**			
				(2.52)			
ET * Tercile 2				18***			
				(4.78)			
DT * Tercile 2				14**			
				(5.75)			
Tercile 3				-12***			
				(2.61)			
ET * Tercile 3				10**			
				(4.93)			
DT * Tercile 3				12**			
				(5.66)			
Median							-10***
							(2.10)
ET * Median							13***
							(3.97)
DT * Median							11**
							(4.62)
Constant	115***	109***	103***	115***	114***	104***	114***
	(1.81)	(1.76)	(1.89)	(1.81)	(1.43)	(1.54)	(1.43)
Observations	972	916	984	2872	1396	1476	2872
R-squared	0.21	0.33	0.26	0.27	0.24	0.29	0.27
ETvsDT (Percent)	6.2	7.9	5.6		5.9	7.1	
ETvsDT (Standard deviation)	0.37	0.49	0.33		0.36	0.43	
Test: ET=DT (p-value)	0.001	0.000	0.002		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.463			
Test: ET*Terc3=DT*Terc3 (p-value)				0.812			
Test: ET*Med=DT*Med (p-value)							0.565

Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

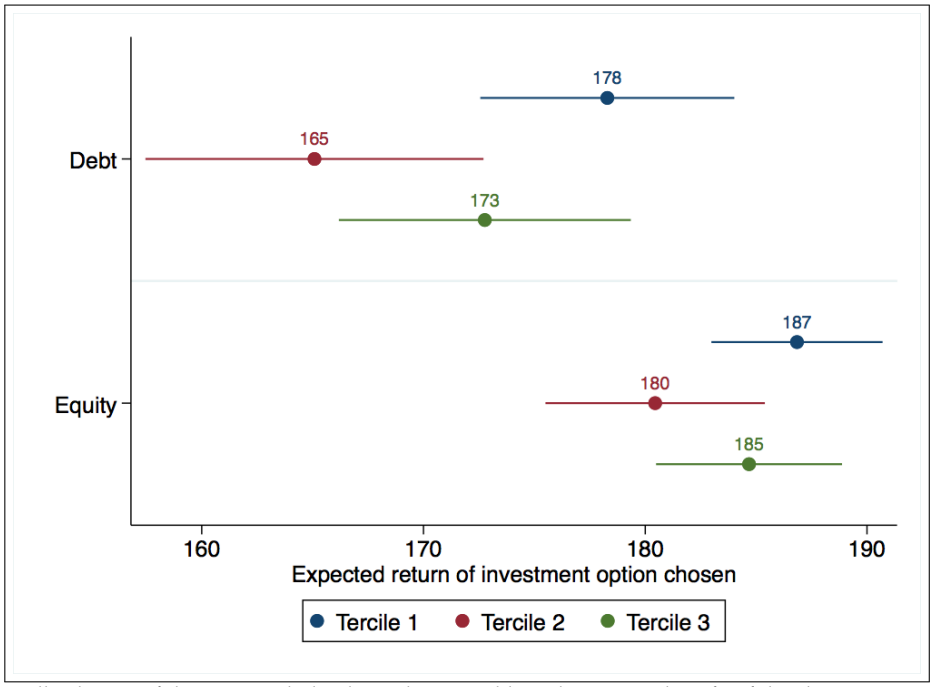
to participate, so it appears that this behaviour does in fact reflect an extreme form of risk aversion. Referring back to the model predictions in Section 2.2, the effect of equity contracts on risk-taking was expected to be most significant for those with greater risk aversion, while tailing off for those who were most risk-averse, and results in this section are broadly consistent with that prediction. However, the combined specifications in columns (4) and (7) do not reveal a significant differential effect of equity and debt when testing for equality of the interaction terms, using either terciles or the median split.

Loss aversion

Entrepreneurs who are more loss-averse may take relatively less risk when financed by the debt contract, compared to the equity contract, because of the prospect of defaulting on their debt contract and having money deducted from the fixed participation fee that they are guaranteed for attending the workshop. Loss-averse agents may be more willing to choose a higher expected return but riskier investment option when provided with the implicit insurance of the equity contract, which mitigates the risk that they would lose some of their own wealth, compared to the unlimited-liability debt contract. Table 2.5 presents regression and graphical analysis of results using the incentivised measure of loss aversion. Column (1) presents results for the least loss-averse entrepreneurs, with column (2) containing results for those with an intermediate level of loss aversion, and column (3) for the most loss-averse. In all specifications, the expected return of investment options chosen under equity is greater than that under debt. For the least loss-averse group, risk taken under equity is 0.30 standard deviations greater than risk taken under debt, with the difference statistically significant at the 1% level. For those with an intermediate level of loss aversion, risk taken under equity is 0.54 standard deviations greater than risk taken under debt, and significant at the 1% level. Finally, for the most loss-averse group, the effect size is smaller, at 0.42 standard deviations, significant at the 1% level, and mirroring the results for the incentivised risk aversion measure in Table 2.4. The median split analysis of columns (4) and (5) reveals an effect size of 0.32 standard deviations for those with below-median loss aversion and 0.49 standard deviations for those with above-median loss aversion. However, none of the differential effects are significant when analysing the equality of the interacted terms in the combined specification in columns (4) and (7).

Table 2.5: HETEROGENEITY ANALYSIS: LOSS AVERSION

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	73***	72***	82***	73***	72***	81***	72***
	(3.24)	(3.69)	(3.40)	(3.24)	(2.72)	(2.93)	(2.72)
DT	64***	57***	70***	64***	63***	66***	63***
	(3.66)	(4.46)	(3.97)	(3.66)	(3.13)	(3.45)	(3.13)
Tercile 2				-6**			
				(2.66)			
ET * Tercile 2				-1			
				(4.91)			
DT * Tercile 2				-7			
				(5.78)			
Tercile 3				-11***			
				(2.46)			
ET * Tercile 3				9*			
				(4.70)			
DT * Tercile 3				6			
				(5.40)			
Median							-9***
							(2.14)
ET * Median							9**
							(3.99)
DT * Median							4
							(4.65)
Constant	114***	108***	103***	114***	113***	103***	113***
	(1.58)	(2.13)	(1.88)	(1.58)	(1.38)	(1.63)	(1.38)
Observations	1216	716	940	2872	1604	1268	2872
R-squared	0.25	0.24	0.30	0.27	0.25	0.28	0.27
ETvsDT (Percent)	4.8	9.3	6.9		5.2	8.3	
ETvsDT (Standard deviation)	0.30	0.54	0.42		0.32	0.49	
Test: ET=DT (p-value)	0.001	0.000	0.001		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.141			
Test: ET*Terc3=DT*Terc3 (p-value)				0.448			
Test: ET*Med=DT*Med (p-value)							0.196



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Analysing the behaviour of the most loss-averse microenterprise owners (the top tercile of loss aversion) sheds light on why the effect is smaller relative to those with an intermediate amount of loss aversion, as was clear in the analysis of the most risk-averse tercile in the incentivised risk measure. Individuals in the most loss-averse tercile made an average of 9 rejection decisions, meaning that they rejected investment options that involved either winning PKR 1,000 with probability 0.5 or losing PKR 200 with probability 0.5 (an expected value of 400), and 8 other similar investment options that led to winning PKR 1,000 or losing amounts greater than PKR 200 (in increments of PKR 100). As a comparison, the least loss-averse individuals only rejected 4 of the 10 investment options. Therefore, those in the most loss-averse tercile could be considered to have quite an 'extreme' amount of loss aversion, as was the case with those in the top tercile of the incentivised risk aversion activity; in fact, the correlation between responses in the incentivised loss aversion activity and the incentivised risk preference elicitation activity is actually higher than that between the two risk preference activities (a correlation of 0.302 in the raw data, and 0.319 for the trichotomised measure, both statistically significant at the 1% level). However, as mentioned, the differential effects are insignificant when comparing the interacted terms in the combined models for both the incentivised risk measure and loss aversion, so results are interpreted with caution.

2.4.3 Heterogeneous effects: Management practices and education

The purpose of the first section of heterogeneity analysis was to explore heterogeneous treatment effects by variables that illustrate potential mechanisms through which the structure of contracts may affect investment behaviour. Results in Section 2.4.2 provide suggestive evidence that more risk-averse individuals chose investment options with a greater expected return under equity financing than under debt financing, using the survey-based measure of risk aversion. While there could be positive welfare effects in stimulating profitable investments for individuals whose behavioural characteristics lead them to relatively under-invest, from a policy perspective MFIs may not wish to provide such financing if those individuals have the worst business management practices, and the lowest education and cognitive ability. In this section I conduct a similar heterogeneity analysis for those variables, and confirm that such a concern is unfounded; there is no evidence that the microenterprise owners with the lowest business management practices, education or cognitive ability are those for whom equity contracts are incentivising the greatest risk-taking relative to debt.

Management practices

From a policy perspective, it is important to understand what the treatment effect is for microenterprise owners with better management practices, for example record-keeping and a clear separation of business and household finances. Equity financing, which requires accurate reporting of performance for the purposes of profit- and loss-sharing, is less viable for individuals who do not keep records of their assets, incomes and expenses, or who frequently combine business and household accounts. If individuals with better management practices take more risk under equity financing, this provides promising evidence for the potential impact of an equity-based product in the field. A recent literature has highlighted the importance of business management practices for the performance of firms in developed countries (Bloom and Van Reenen, 2010). McKenzie and Woodruff (2016) develop a set of questions that have been adapted for microenterprises in a developing country setting, which I used to measure business management practices for the participants in my sample. The questions covered the following areas:

(i) Marketing (whether the firm advertises, attempts to attract customers with a special offer, and if it solicits customer feedback on what other products they would like it to sell);

(ii) Record-keeping (whether the firm records its sales and purchases, if it has calculated the cost and profit margin of its main products, and whether it has a written budget);

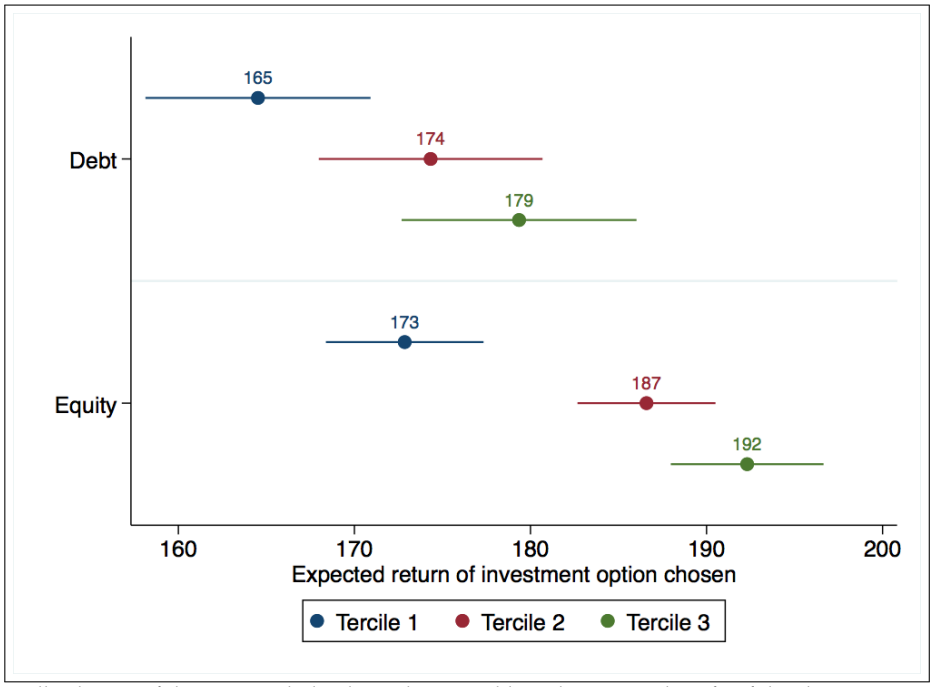
(iii) Financial planning (whether the firm has a sales target, and if it keeps a balance sheet and profit and loss statement);

(iv) Buying and stock control (whether it frequently runs out of stock, and if it attempts to negotiate with suppliers).

I aggregated all positive responses into a business management practices index. Results in Table 2.6 reveal that, as with all previous specifications, average risk-taking is greater under equity than debt for each sub-group. It can also be observed that the size of the effect is greater for those with higher management practices; those in the lowest tercile of management practices take 0.29 standard deviations greater risk under equity (significant at the 5% level), with an effect size of 0.43 standard deviations for those with intermediate management practices and 0.45 standard deviations for the highest management practices group (both significant at the 1% level). A similar result is reflected in the median-split analysis (0.33 and 0.46 standard

Table 2.6: HETEROGENEITY ANALYSIS: BUSINESS MANAGEMENT PRACTICES

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	62***	79***	84***	62***	70***	81***	70***
	(3.70)	(3.18)	(3.41)	(3.70)	(2.87)	(2.76)	(2.87)
DT	54***	66***	71***	54***	61***	68***	61***
	(4.00)	(3.74)	(4.19)	(4.00)	(3.14)	(3.39)	(3.14)
Tercile 2				-3			
				(2.71)			
ET * Tercile 2				17***			
				(4.88)			
DT * Tercile 2				13**			
				(5.48)			
Tercile 3				-3			
				(2.69)			
ET * Tercile 3				22***			
				(5.03)			
DT * Tercile 3				17***			
				(5.80)			
Median							-3
							(2.14)
ET * Median							11***
							(3.98)
DT * Median							7
							(4.62)
Constant	111***	108***	108***	111***	110***	108***	110***
	(2.04)	(1.78)	(1.76)	(2.04)	(1.54)	(1.48)	(1.54)
Observations	840	1044	988	2872	1412	1460	2872
R-squared	0.21	0.29	0.29	0.27	0.25	0.28	0.27
ETvsDT (Percent)	5.1	7.0	7.2		5.6	7.5	
ETvsDT (Standard deviation)	0.29	0.43	0.45		0.33	0.46	
Test: ET=DT (p-value)	0.010	0.000	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.395			
Test: ET*Terc3=DT*Terc3 (p-value)				0.305			
Test: ET*Med=DT*Med (p-value)							0.329



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

deviation effect sizes for those with below-median and above-median management practices respectively, with both effects significant at the 1% level). However, the differential effects are insignificant when comparing the interacted terms in the combined model in columns (4) and (7).

Education and cognitive ability

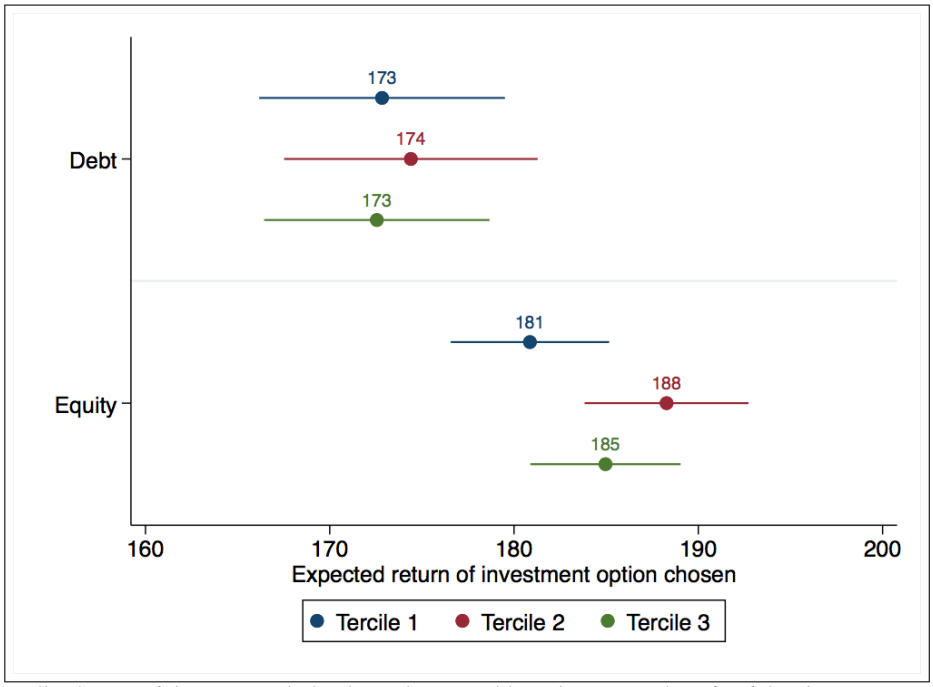
Equity contracts may be relatively unfamiliar to many participants and need more cognitive processing than simple fixed-repayment debt contracts, since they require individuals to calculate income-sharing payments of 25%, 50% and 75%. Individuals with lower cognitive ability may struggle with such calculations. While the education variable was simply measured as the highest completed level of formal education, cognitive ability was measured using a set of number recall activities and addition, subtraction and division questions, with scores aggregated into an index.

Tables 2.7 and 2.8 suggest that the largest effect of equity financing was amongst those with the highest education and cognitive ability respectively. Individuals in the lowest tercile of education took 0.28 standard deviations greater risk under equity, with an effect size of 0.48 and 0.43 standard deviations for those with intermediate and the highest levels of education respectively. Similar evidence is provided using scores from a mathematical test that was administered with all participants during the workshop, with an effect size of 0.30 standard deviations for the lowest tercile of maths score, and 0.45 and 0.42 standard deviations for those with intermediate and the highest maths scores respectively, with the effects statistically significant in all specifications. However, as with the management practices score, the differential effects are insignificant when comparing the interacted terms in the combined model in columns (4) and (7).

Overall, results from this section of heterogeneity analysis are encouraging from a policy perspective since there is no evidence that the overall result of greater risk raking under equity is being driven by microenterprise owners with the lowest business management practices, education or cognitive ability, particularly because these are the individuals who an MFI would be least likely to offer equity-based contracts (which require clear record keeping, a separation of household and business accounts, and making non-standard calculations for profit shares).

Table 2.7: HETEROGENEITY ANALYSIS: YEARS OF EDUCATION

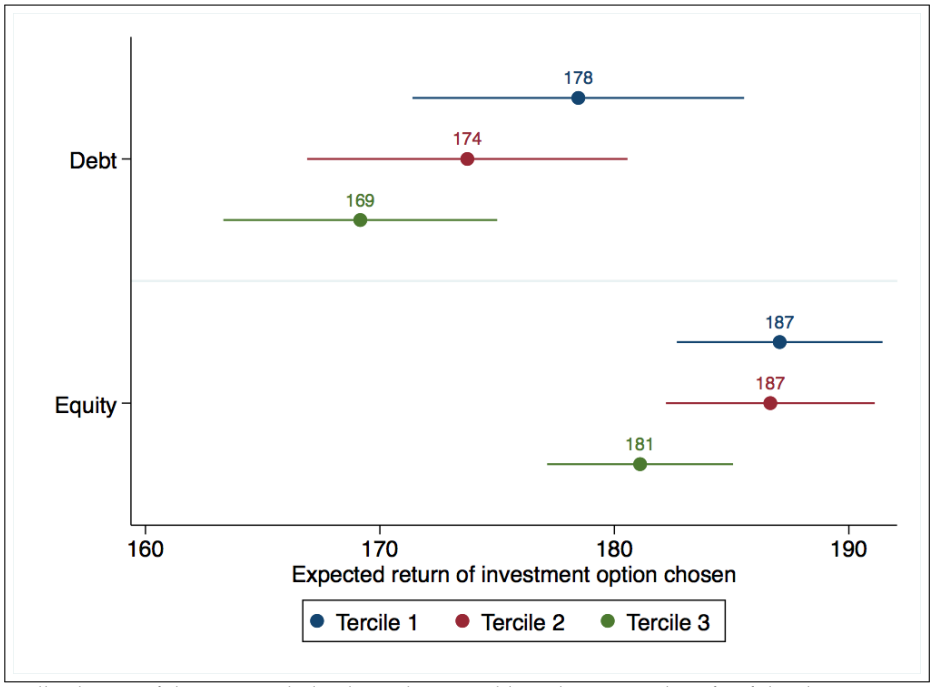
	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	72***	80***	76***	72***	76***	76***	76***
	(3.41)	(3.49)	(3.44)	(3.41)	(2.55)	(3.19)	(2.55)
DT	64***	66***	63***	64***	65***	63***	65***
	(3.95)	(4.18)	(3.90)	(3.95)	(2.98)	(3.67)	(2.98)
Tercile 2				-1			
				(2.60)			
ET * Tercile 2				8			
				(4.88)			
DT * Tercile 2				2			
				(5.76)			
Tercile 3				1			
				(2.61)			
ET * Tercile 3				3			
				(4.84)			
DT * Tercile 3				-1			
				(5.56)			
Median							0
							(2.18)
ET * Median							-0
							(4.08)
DT * Median							-2
							(4.72)
Constant	109***	108***	109***	109***	109***	109***	109***
	(1.85)	(1.83)	(1.85)	(1.85)	(1.38)	(1.69)	(1.38)
Observations	972	836	1064	2872	1628	1244	2872
R-squared	0.24	0.30	0.26	0.26	0.27	0.26	0.26
ETvsDT (Percent)	4.6	8.0	7.2		6.0	7.3	
ETvsDT (Standard deviation)	0.28	0.48	0.43		0.36	0.44	
Test: ET=DT (p-value)	0.015	0.000	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.206			
Test: ET*Terc3=DT*Terc3 (p-value)				0.338			
Test: ET*Med=DT*Med (p-value)							0.581



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Table 2.8: HETEROGENEITY ANALYSIS: MATHEMATICAL CALCULATIONS EXERCISE

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	82***	79***	69***	82***	79***	73***	79***
	(3.48)	(3.48)	(3.31)	(3.48)	(2.93)	(2.72)	(2.93)
DT	73***	66***	57***	73***	69***	61***	69***
	(4.26)	(4.11)	(3.66)	(4.26)	(3.44)	(3.12)	(3.44)
Tercile 2				2			
				(2.65)			
ET * Tercile 2				-2			
				(4.92)			
DT * Tercile 2				-7			
				(5.92)			
Tercile 3				7***			
				(2.62)			
ET * Tercile 3				-13***			
				(4.80)			
DT * Tercile 3				-16***			
				(5.62)			
Median							4*
							(2.15)
ET * Median							-6
							(4.00)
DT * Median							-8*
							(4.65)
Constant	105***	107***	112***	105***	106***	111***	106***
	(1.93)	(1.82)	(1.77)	(1.93)	(1.61)	(1.43)	(1.61)
Observations	780	944	1148	2872	1268	1604	2872
R-squared	0.32	0.27	0.22	0.27	0.28	0.25	0.26
ETvsDT (Percent)	4.8	7.4	7.1		5.8	7.2	
ETvsDT (Standard deviation)	0.30	0.45	0.42		0.35	0.43	
Test: ET=DT (p-value)	0.028	0.000	0.000		0.001	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.401			
Test: ET*Terc3=DT*Terc3 (p-value)				0.481			
Test: ET*Med=DT*Med (p-value)							0.582



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Trust

The final pre-specified variable for heterogeneity analysis is trust. Trust is potentially quite important in the comparison between equity contracts, which involve sharing of profits and losses, and fixed-repayment debt contracts. Since individuals who are less trusting may be less inclined to choose equity financing in the field, understanding the treatment effect for more trusting individuals is important from a policy perspective. Trust was measured using a series of questions from the General Social Survey (GSS).[32] Table 2.9, as with all previous tables, shows greater risk-taking under equity compared to debt, for all terciles. The magnitude of the effect is 0.27 standard deviations for the least trusting, 0.42 standard deviations for those with an intermediate level of trust, and 0.52 standard deviations for the most trusting, however the differential effects are marginally insignificant when comparing the interacted terms in the combined model.

2.4.4 Robustness checks

As seen in Table 2.2 and the subsequent heterogeneity analysis of Tables 2.3-2.9, risk-taking under equity was greater than that under debt, with the effect evident in every sub-group used in the heterogeneity analysis. While this provides strong evidence for the effects, in this section I present further robustness checks by investigating second-round decisions and order effects.

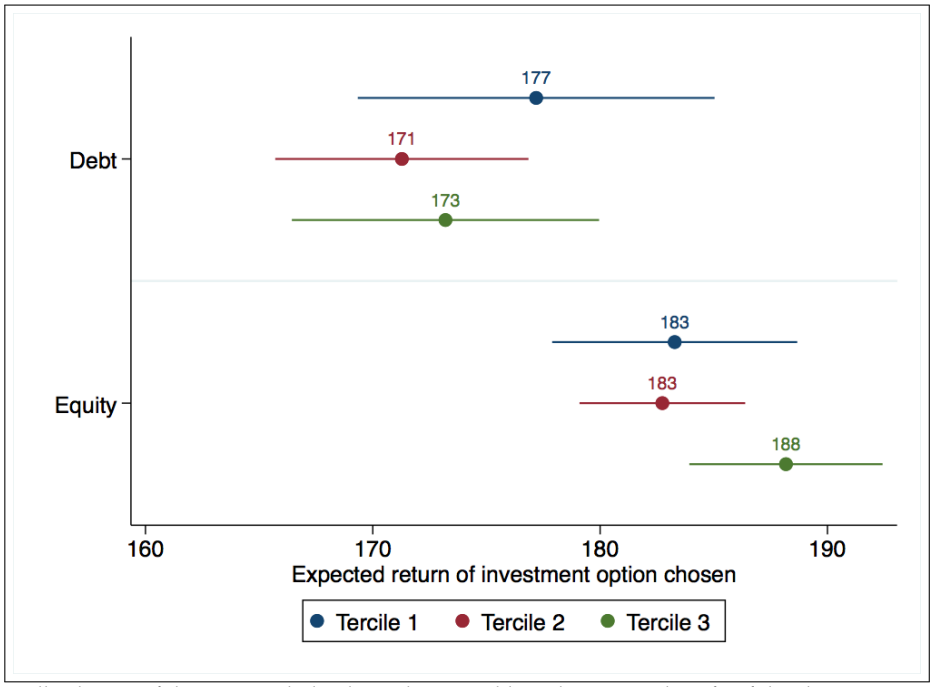
Second-round decisions

Table 2.10 illustrates results for the investment options chosen in the second decision round, using the strategy method described in Section 2.3.4. In columns (1) and (2) the analysis is done for second-round decisions conditional on a bad outcome occurring in the first round, and in columns (3) and (4) the analysis is done conditional on a good outcome having occurred in the first round. Columns (1) and (3) present results from specifications with simple treatment dummies and a dummy for basic order effects, while columns (2) and (4) include dummies that fully control for the endogeneity that is inherent in columns (1) and (3). Decisions in the second round are endogenous to the previous investment decision made by participants, which in this setting can be fully controlled for by including dummies for the decision made in the first round.

[32] As used by Giné, Jakiela, Karlan, and Morduch (2010).

Table 2.9: HETEROGENEITY ANALYSIS: TRUST

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	77***	72***	78***	77***	75***	76***	75***
	(3.33)	(3.53)	(3.52)	(3.33)	(2.94)	(2.73)	(2.94)
DT	70***	60***	63***	70***	67***	62***	67***
	(3.69)	(4.28)	(4.06)	(3.69)	(3.32)	(3.23)	(3.32)
Tercile 2				6**			
				(2.53)			
ET * Tercile 2				-5			
				(4.85)			
DT * Tercile 2				-10*			
				(5.65)			
Tercile 3				5*			
				(2.65)			
ET * Tercile 3				1			
				(4.85)			
DT * Tercile 3				-7			
				(5.49)			
Median							5**
							(2.14)
ET * Median							1
							(4.01)
DT * Median							-5
							(4.63)
Constant	105***	111***	110***	105***	106***	111***	106***
	(1.78)	(1.80)	(1.96)	(1.78)	(1.56)	(1.46)	(1.56)
Observations	1036	948	888	2872	1336	1536	2872
R-squared	0.28	0.23	0.28	0.26	0.27	0.26	0.27
ETvsDT (Percent)	4.4	7.0	8.6		4.9	8.0	
ETvsDT (Standard deviation)	0.27	0.42	0.52		0.30	0.48	
Test: ET=DT (p-value)	0.007	0.000	0.000		0.001	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.320			
Test: ET*Terc3=DT*Terc3 (p-value)				0.104			
Test: ET*Med=DT*Med (p-value)							0.157



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Column (1) reveals that in the second round, conditional on a bad outcome occurring in the first round, risk-taking under equity was 0.40 standard deviations greater than risk-taking under debt, with the difference statistically significant at the 1% level. Inclusion of dummies for endogenous selection does not significantly change the outcome; column (2) shows that equity-financed microenterprise owners took 0.29 standard deviations greater risk than those who were debt-financed, with the effect still statistically significant at the 1% level.

Table 2.10: SECOND-ROUND DECISIONS

	(1)	(2)	(3)	(4)
	R2 | R1bad	R2 | R1bad	R2 | R1good	R2 | R1good
Constant	77***	44***	176***	110***
	(1.51)	(4.89)	(2.80)	(6.17)
DT	65***	52***	24***	-14***
	(2.00)	(2.57)	(2.27)	(3.09)
ET	75***	59***	32***	-13***
	(1.81)	(2.56)	(1.99)	(3.08)
Order	0	0	1	-1
	(2.31)	(2.03)	(3.70)	(2.62)
R1:Inv2		37***		65***
		(5.04)		(6.47)
R1:Inv3		37***		94***
		(5.18)		(6.82)
R1:Inv4		64***		125***
		(5.59)		(6.93)
R1:Inv5		60***		148***
		(5.46)		(6.50)
Observations	2872	2872	2872	2872
R-squared	0.34	0.41	0.05	0.37
ET vs DT (Percent)	7.2	7.7	3.9	0.6
ET vs DT (Standard deviation)	0.40	0.29	0.14	0.01
Test: ET = DT (p-value)	0.00	0.00	0.00	0.71

Note: The dependent variable is the expected profit of the chosen investment option in the second round, conditional on the outcome of the first-round choice. Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

While column (3) also reveals greater risk-taking under equity in the second decision round conditional on a good outcome occurring in the first round, with an effect size of 0.14 standard deviations (significant at the 1% level), inclusion of dummies for first-round decisions leads to this effect almost completely disappearing (to 0.01 standard deviations, statistically indistinguishable from zero). In fact, inclusion of the first-round dummies reveals that the co-

efficients on the debt and equity treatments are actually negative and of similar magnitude, implying less risk-taking relative to the control group. This could indicate an income effect, whereby entrepreneurs who were externally financed, by either debt or equity, are implicitly being taxed on their gains, with some portion being returned either as a loan repayment or an equity sharing amount, whereas the control group accrue the full additional benefits of the positive investment outcomes.

Order effects

As described in Section 2.3, the experiment used a within-subject design, where each microenterprise owner made investment decisions under all treatments, with the order of the financing treatments randomised. Column (1) of Table 2.11 presents regression analysis with the same simple controls for order effects as in previous regressions, as well as the addition of interaction terms between the order and treatments, where 'Order' is an indicator variable for whether debt (randomly) appeared as the first treatment. Column (2) illustrates the analysis for only those observations where debt was randomly revealed first, and column (3) displays results when equity appeared first. Risk-taking under equity is significantly greater than risk-taking under debt, regardless of whether debt or equity appear first, although there is some difference in magnitude. Column (3) reveals that when equity appeared first, risk-taking under equity was greater by 0.53 standard deviations, significant at the 1% level. The effect decreases to 0.25 standard deviations greater risk-taking under equity when debt appears first, but is still highly significant (p-value 0.010). As can be seen in columns (2) and (3), risk-taking under equity is at approximately the same level regardless of whether debt or equity appear first in the order, however risk-taking under debt is lower when it appears after equity. One possible interpretation is that, having experienced the risk-sharing contract, individuals are subsequently less likely to take risk under debt as they have learned about the insurance-like benefits of the equity contract, which are absent from a fixed-repayment loan contract. Nonetheless, as mentioned, risk-taking under equity is still significantly greater than risk-taking under debt, even when debt appears first.

Table 2.11: ORDER EFFECTS

	(1) ExpRet	(2) ExpRet	(3) ExpRet
Constant	109***	108***	109***
	(1.49)	(1.54)	(1.49)
DT	59***	70***	59***
	(3.16)	(3.38)	(3.17)
ET	75***	77***	75***
	(2.78)	(2.89)	(2.78)
Order	-1		
	(2.14)		
DT:Ord1	10**		
	(4.63)		
ET:Ord1	2		
	(4.01)		
Observations	2872	1412	1460
R-squared	0.27	0.28	0.25
ET vs DT (Percent)		4.1	9.1
ET vs DT (Standard deviation)		0.25	0.53
Test: ET = DT (p-value)		0.0101	0.0000

Note: The dependent variable is the expected profit of the chosen investment option. Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Robustness: Predicting risk-taking with a simple machine learning algorithm

In this section, I use a simple machine learning technique as a robustness check for the heterogeneity analysis of Sections 2.4.2 and 2.4.3. Specifically, the Least Absolute Shrinkage and Selection Operator (LASSO) is employed (Belloni, Chernozhukov, and Hansen, 2014). The LASSO estimator (and other high-dimensional model selection methods) can be a useful forecasting tool when there are a large number of potentially informative covariates. For a simple model:

$$y_i = \sum_{j=1}^{p} \beta_j x_{ij} + u_i$$

LASSO coefficients are chosen to minimise the sum of squared residuals plus a penalty term that penalises the size of the model through the sum of absolute values of the coefficients:

$$\widehat{\beta} = \arg\min_{b} \sum_{i=1}^{n} \left(y_i - \sum_{j=1}^{p} x_{ij} b_j \right)^2 + \lambda \sum_{j=1}^{p} |b_j| \gamma_j$$

where λ is a penalty parameter and γ_j are penalty loadings. One issue with this estimator is that non-zero coefficients that are part of the solution to the LASSO problem tend to be biased towards zero. The Post-LASSO estimator first applies LASSO to determine which variables can be dropped from the standpoint of prediction, and then estimates coefficients on the remaining variables using ordinary least squares. Table 2.12 presents results from LASSO estimation. In column (1), all variables that were used for the purposes of heterogeneity analysis in Sections 2.4.2 and 2.4.3 are included in their trichotomised form. Column (2) includes a number of other potentially important business and household characteristics: respondent literacy, household net income (total household income minus total expenditure), net wealth (value of all assets plus savings minus loans), business profits, and business assets (fixed assets plus current assets).

Unsurprisingly, LASSO estimation identifies the two most important variables for predicting the outcome variable of expected return of investment chosen as the debt and equity treatment indicator variables, DT and ET. Column (1) also identifies risk aversion and loss aversion as important variables for predicting risk-taking, independently of their interaction with the treatment variables. Both coefficients are negative, indicating that more risk- and more loss-averse microenterprise owners chose investment options with a lower expected return and risk, on average. Results also confirm the findings of Section 2.4.2: more risk-averse individuals chose investment options with a higher expected return when financed with the equity contract, as indicated by the selection of the interaction between ET and the two different measures of risk aversion in the LASSO estimation (specifically, the third tercile of risk aversion for the survey-based measure, and the second tercile of risk aversion for the incentivised measure). In contrast, LASSO dropped the interaction between DT and both risk aversion measures. Further, in column (1), the LASSO specification also selected the interaction between ET and the top two terciles of management practices, as well as the top tercile of the trust measure, with a positive coefficient indicating greatest risk-taking when individuals with the highest management practices and the highest level of trust are equity-financed. The only debt-interacted variable selected is the interaction between DT and the top tercile of management practices.

Table 2.12: LASSO ANALYSIS

	(1) ExpRet	(2) ExpRet
ET	59.05***	52.44***
	(3.548)	(3.901)
DT	61.09***	58.93***
	(3.080)	(3.253)
Risk (incentivised) tericle 3	-7.68***	-8.52***
	(2.245)	(2.240)
Loss aversion tericle 2	-6.80***	
	(2.252)	
ET * Risk (incentivised) tercile 2	1.57	-0.07
	(3.130)	(3.111)
ET * Risk (survey-based) tercile 3	8.73***	8.64***
	(3.009)	(3.005)
ET * Management practices tercile 2	13.71***	11.84***
	(3.436)	(3.438)
ET * Management practices tercile 3	19.25***	12.48***
	(3.484)	(3.681)
DT * Management practices tercile 3	9.67**	6.42
	(4.083)	(4.160)
ET * Trust tercile 3	5.89**	5.82**
	(2.973)	(2.958)
Household net income tercile 3		-8.38***
		(2.091)
DT * total household wealth tercile 3		9.85**
		(4.195)
ET * total household wealth tercile 2		9.03***
		(3.360)
ET * total household wealth tercile 3		11.72***
		(3.516)
ET * total business assets tercile 3		10.09***
		(3.133)
Constant	113.10***	114.45***
	(2.160)	(2.204)
Observations	2872	2872
R-squared	0.28	0.29

Note: Column (1) presents results from a Post-LASSO estimation using all variables that were used for heterogeneity analysis in Sections 2.4.2 and 2.4.3, in their trichotomised form. The dependent variable is the expected profit of the chosen investment option. Column (2) includes respondent literacy, household net income, household net wealth (total savings minus total loans), business profits and business assets. The LASSO code was taken from Belloni, Chernozhukov, and Hansen (2014), with the following inputs: `lassoShooting Takeup 'variables', lasiter(0)`, where `'variables'` represents all explanatory variables entered into the analysis. Standard errors from a simple OLS regression using the set of variables identified by the LASSO estimation are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Results in column (2), when including a number of other business and household characteristics, reveal the robustness of the findings in the top panel; the LASSO estimator continues to select the interaction between equity financing and risk aversion, management practices and trust as important variables in predicting the outcome variable. Further, a number of other variables that capture business size and household net wealth are also found to be important determinants of risk-taking when interacted with both treatment variables (with the majority of the selected variables being those interacted with the equity financing indicator). As discussed by Mullainathan and Spiess (2017), the purpose of LASSO and other machine learning algorithms is prediction and not parameter estimation, so one should be cautious in providing too much interpretation to these results. The purpose of this section was to provide an additional robustness check, which confirms the importance of risk aversion and business management practices when interacted with equity financing. However, the fact that loss aversion was dropped by the LASSO estimator does not indicate that loss aversion is not an important factor; it could simply be that risk aversion is more accurately measured than loss aversion in the behavioural games activities, which would not be surprising, given that there were many more questions dedicated to measuring risk preferences.

2.5 Implementing microequity contracts in the field

Results in Section 2.4 reveal that equity contracts led to greater risk-taking compared to debt-based contracts, with suggestive evidence that the effect was stronger for more risk-averse entrepreneurs, who might ordinarily under-invest. Further, the second part of the heterogeneity analysis provides evidence that mitigates adverse-selection-type concerns that those microenterprise owners who are most encouraged to take more risk with equity financing might be those with the worst business management practices, education and cognitive ability, which has important implications for the viability of implementing equity contracts in the field. Given the positive results, it is important to investigate why we do not typically observe MFIs implementing microequity contracts in the field. The majority of microcredit contracts have a very rigid structure, and – although there are recent researcher-led efforts to introduce more flexible microcredit contracts – to my knowledge there is no organisation that is implementing performance-contingent-repayment contracts with microenterprises on any meaningfully large scale. Theoretical work suggests that equity contracts are non-optimal relative to debt due to costly state verification (Townsend, 1979) and moral hazard (Stiglitz and Weiss, 1981),

although those results only hold for a risk-neutral agent and a fixed-repayment contract may be sub-optimal for a risk-averse agent. Given many MFIs' stated objectives to prioritise borrower welfare as well as profits, it is peculiar that no large MFI is implementing microequity contracts, given the potential benefits discussed in the artefactual field experiment in this paper, in particular for individuals whose behavioural characteristics such as risk aversion may lead them to under-invest. In this section, I provide some evidence that sheds light on some of the most important constraints to implementing microequity contracts in the field, using a survey that I designed to investigate a microequity program that had been initiated by one of the largest microfinance institutions in Pakistan, the National Rural Support Programme (NRSP).[33]

NRSP is the largest rural support programme in Pakistan, with a presence in 64 districts across all four provinces, and currently working with 3 million poor households. In September 2014, NRSP launched a microequity program that aimed to help skilled apprentices start their own business by providing them with equity-like capital. As of August 2015, 1,250 individuals had been provided with financing as part of this program, in five major districts across Punjab and Islamabad.[34] I generated a stratified random sample from the population of 1,250 clients, based on the following variables: (i) gender; (ii) business type (trade, manufacturing or services); (iii) district; and (iv) age of entrepreneur (using a median-split). This generated 60 distinct blocks, from which a random sample of 248 individuals was drawn.[35]

2.5.1 Summary statistics

Tables 2.13 and 2.14 present summary statistics. 90% of clients were male, with a mean age of 33. The average years of education was eight, and 95% of clients could read Urdu. 73% of clients were married, and the average household size was approximately seven. 96% of respondents were managing a business, with 88% of them only running one business (79% owned that business themselves). On average, they had seven years of experience in the sector to which their business related (either managing a business, or as an apprentice). 81% of businesses were initially set up by the respondent. 61% of businesses had no other employees, with 20% having

[33] I learned about this program in the course of fieldwork for the artefactual field experiment; the program had started before my activities with Akhuwat and I was invited by the CEO of NRSP to conduct a survey to evaluate the implementation of these microequity contracts in the field.

[34] In Attock, Chakwal, ICT, Jhelum, and Mandi Bahauddin.

[35] All surveys were then conducted by enumerators at the microenterprise's location of business.

one additional employee and 12% having two additional employees. Only 2% of respondents had any other form of wage employment.

Table 2.13: NRSP SAMPLE: SUMMARY STATISTICS

	count	mean	sd	min	max
Gender	248	0.10	0.31	0.00	1.00
Age	248	33.09	9.10	19.00	70.00
Education	248	8.16	3.19	0.00	14.00
Reads Urdu	248	0.95	0.42	0.00	2.00
Married	248	0.73	0.44	0.00	1.00
HH Size	248	6.88	3.37	2.00	32.00

In terms of sectoral composition, the most common business sectors were: (i) trade and retail shops; (ii) hairdressers and beauty parlours; (iii) tailors; (iv) food outlets; and (v) vehicle repair shops. Figure 2.11 in the appendix illustrates business performance. The average microenterprise had mean monthly sales of PKR 81,000 (approximately $810) over the previous three months, with a median of $360, and mean monthly profits of $178 (median $136), which is not too dissimilar to the microenterprise clients of Akhuwat who took part in the artefactual field experiment.

Figure 2.12 in the appendix shows that 68% of microenterprise owners were previously apprentices, which is unsurprising given that the program specifically aimed to help skilled but capital-constrained apprentices start a business. The mean number of years of experience as an apprentice was three. In terms of reasons for taking the financing product, approximately half of microentrepreneurs stated the purchase of assets or equipment for the business as one of the reasons, with 40% stating the purchase of raw materials. The amount of financing received as part of the program was $500 in 97% of cases, which is the first indication that the product, as it

Table 2.14: NRSP SAMPLE: BUSINESS ACTIVITIES

	count	mean	sd	min	max
Manage a business?	248	0.96	0.19	0.00	1.00
Numbers of businesses managed	239	1.15	0.42	1.00	3.00
Own the business?	248	0.79	0.41	0.00	1.00
Number of years of experience (in sector)	239	6.57	6.70	0.00	50.00
Started the business from scratch?	248	0.81	0.39	0.00	1.00
Number of employees in the business	238	0.70	1.11	0.00	6.00
Own the land on which the business operates?	239	0.26	0.44	0.00	1.00
Have any form of other wage employment?	248	0.02	0.15	0.00	1.00

was implemented, appeared very similar to that of a conventional microcredit portfolio. Given the heterogeneity in business sector and business performance observed in Figure 2.11, some variation in financing amount might have been expected.

2.5.2 NRSP contract structure

The main purpose of the survey was to investigate the structure of the contracts that were intended to be implemented as 'microequity', as described by clients who were provided with financing. Figures 2.8, 2.9 and 2.10 illustrate the results. It is clear that NRSP had started implementing the product as an equity-based contract, for which there was a pre-agreed profit- and loss-sharing ratio of 20-80 (with the entrepreneur sharing 20% of their monthly profits with NRSP, and keeping 80% for themselves). As observed in Figure 2.8, when asked what the 'profit-sharing ratio' was between them and NRSP, 50% of respondents answered "80-20", which reflects the actual profit- and loss-sharing ratio with which the program started. Over 30% of respondents, however, stated that they did not know the profit-sharing ratio; post-survey follow-up conversations with enumerators suggested a lack of comprehension of this question. In hindsight, this reflects many entrepreneurs' inability to understand a question about sharing ratios when the way in which the product was being implemented at the time of the survey very much resembled a conventional fixed-repayment debt product. The next graph in Figure 2.8 again provides evidence that the way the contracts were being implemented in the field at the time of the survey mirrored a conventional debt contract with one set of standard terms and conditions implemented by all NRSP field staff. Here, it is clear that the repayment payment frequency was monthly for all entrepreneurs. While this is not sufficient evidence in itself that the product being offered was not equity-like, *some* variation in payment frequency might have been expected if a true equity-like product was being implemented.

The next two questions were the most significant in the survey; if what was being implemented was truly an equity-like product with performance-contingent payments, then one would expect some correlation between microenterprise business outcomes and actual payments made to NRSP. The following questions were asked:

(i) *"Think about the current contract that you have with NRSP. If you have zero profits in a given period that you usually make payments, how much do you have to pay to NRSP?"*;

(ii) *"Think about the current contract that you have with NRSP. If you have very big profits in a given period, how much do you have to pay to NRSP?"*.

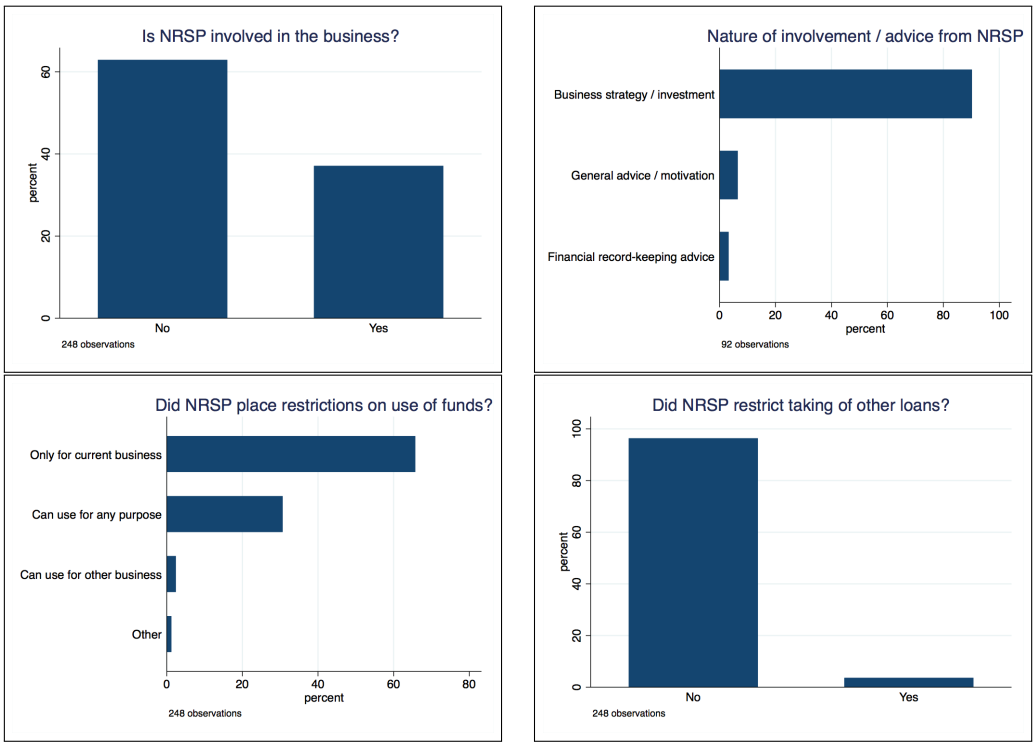
Figure 2.8: CONTRACT STRUCTURE QUESTIONS 1

The results, illustrated in the third and fourth graphs in Figure 2.8, are very clear; in 85% of cases, the respondent stated that there was no profit- or loss-sharing involved in their relationship with NRSP: when their business profits were low, their repayments stayed the same, and when their business profits were high, their repayments again remained constant. This provides conclusive evidence that what was being implemented in the field was not equity-like in the sense of containing performance-contingent repayments.

Another common feature of equity contracts is active involvement by the capital provider in the business. The first and second panels in Figure 2.9 illustrate that 37% of microenterprise owners said that NRSP was involved in their business, with most people citing some sort of 'business / investment strategy' as the form of advice. To further explore the extent of the involvement of NRSP, the next two questions were posed: *"Does the financing place any restrictions on the type of business for which you can use the money?"*, and *"Does the financing place any restrictions on you taking other loans in your business?"*. As can be seen in the third and fourth

panels of Figure 2.9, 65% of respondents stated that they *were* restricted to using the money for their current business, while 31% asserted that they could spend the money for any other uses (which is rather surprising, given that the program was solely intended for business financing). 96% of respondents stated that NRSP did not place any restrictions on them taking other loans in their business. This is likely to be a standard practice with conventional loans, but it may be a cause for concern when providing actual equity-like financing. Specifically, if providing a loss-sharing product, the hierarchy of claims on the cash-flows of the firm is important (with debt typically having seniority and equity representing the residual claimant), so an MFI offering equity-like financing might be advised to place restrictions on the amount of debt that the microentrepreneur takes on.

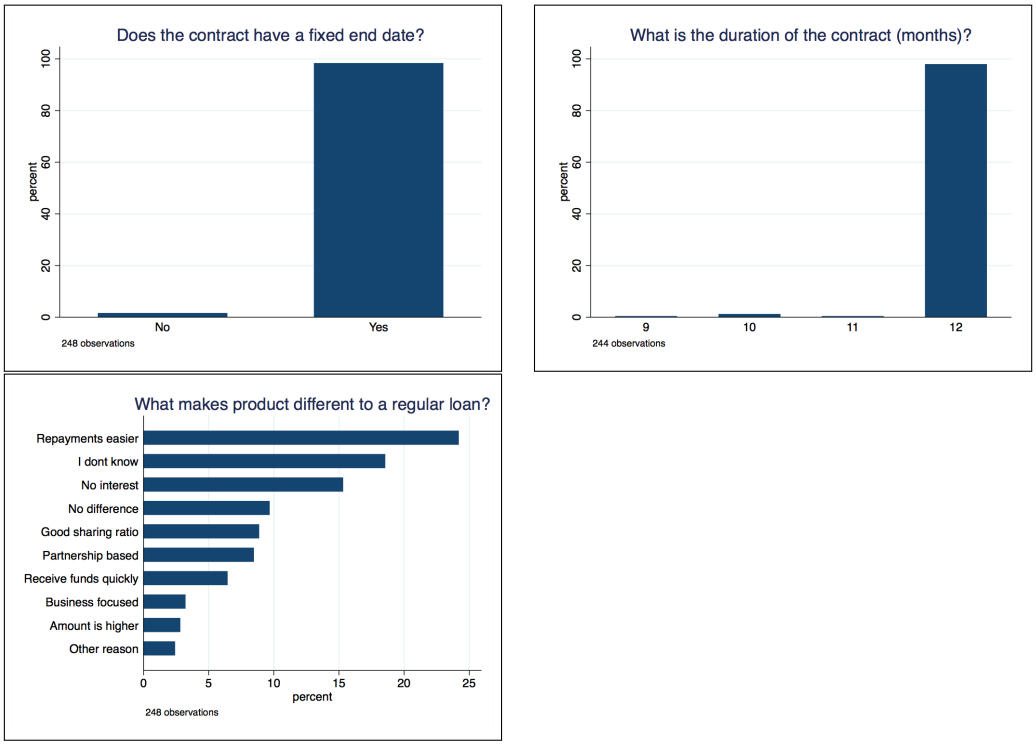
Figure 2.9: CONTRACT STRUCTURE QUESTIONS 2



Finally, the first and second panels in Figure 2.10 illustrate that almost all contracts were implemented with a fixed end date of 12 months, much like the conventional NRSP loan product. The third panel illustrates the response to the question, *"In what ways is this product different from a normal loan?"*. There were many positive reasons given; approximately 30% stated that the payment terms were preferable, and nearly 10% thought that it was more 'partnership-based'. 15% said that it was unique because it was not interest-based; this is a surprising result, since

the product very much resembled a conventional interest-based product, which is NRSP's standard product. This response may reflect that the program did in fact start with an equity-based product, and initially used Islamic legal terms such as '*Musharakah*', which means joint participation in Arabic and is commonly used to describe equity financing. This likely also reflects the desire of many clients to use non-interest-based products. In summary, this section of questions provides conclusive evidence that the contracts, as they were being implemented in the field, did not contain any loss-sharing or profit-sharing features, and that NRSP was not exercising any control rights in the operational or financial management of the firm.

Figure 2.10: CONTRACT STRUCTURE QUESTIONS 3



2.5.3 Discussion

Results from Section 2.5.2 reveal that, at the time of the survey, the contracts were not implemented in any meaningfully distinct way from a conventional fixed-repayment, fixed-duration, microcredit contract. Presentation of results and a detailed focus group with senior managers and field officers revealed interesting reasons for which these contracts, which had in fact

started with performance-contingent repayments, converged to a standard debt structure. Results relate to many of the themes that arise in earlier theoretical work on sharecropping and income-sharing contracts, which suggest the optimality of a standard debt contract in the presence of information asymmetries and costly state verification.[36]

I presented results from the survey to NRSP's CEO, senior management and regional managers, with a detailed focus-group-style discussion taking place over the course of three hours. There are two major insights arising out of post-survey reflections and accounts from managers and field officers. First, from the supply side, one valuable lesson is the difficulty in implementing equity-like contracts within the structure of a conventional microcredit organisation. Loan officers did not have much incentive to finance higher-return, higher-risk microenterprise owners by providing them with an unfamiliar product that required greater monitoring effort and contained loss-sharing, especially because the loan officer would not themselves benefit from the upside portion of the profit- and loss-sharing arrangement (i.e. they had no 'skin in the game'). Further, loan officers reported that it was very time-consuming to calculate profit- and loss-sharing amounts, since many microenterprises did not keep adequate income statements, thereby requiring the loan officer to essentially create these. Even when records were kept, they were often paper-based and took much time to process for calculating performance-contingent payments, which reinforces the idea that in a world of costly state verification, a non-performance-contingent contract may be optimal.

The second key lesson arising out of post-survey interviews was from the perspective of clients. Results indicate that many clients had serious objections to the sharing rule used in the contracts when they were originally implemented with profit- and loss-sharing. A common sharing rule led to the most profitable entrepreneurs having to share too much of their profits and thus the equity product, ironically, appearing to be very 'inequitable' to them. The post-survey focus group with NRSP management revealed that gradually this led to loan officers and clients mutually agreeing to remove the performance-contingent aspect of the contracts, which eventually converged to a fixed-repayment structure, albeit on much more lenient terms than a conventional microcredit contract. Had NRSP maintained performance-contingent contracts alongside fixed-repayment contracts, adverse selection may have become a serious issue, with

[36] See Townsend (1979); Stiglitz and Weiss (1981).

the most profitable microenterprises deciding to re-negotiate to a debt contract, and the least profitable ones remaining on performance-contingent contracts. Hence, the decision taken by NRSP management to revert all contracts back to a standard fixed repayment schedule appears to have been appropriate. This decision to move back to debt-like contracts also appears prudent in light of the potential adverse consequences of moral hazard. Since a 20-80 sharing ratio was considered inappropriate by some of the more profitable businesses, in that they were obliged to share too much of their profits, had NRSP not renegotiated the contract then it could have created negative incentives for those microenterprises stuck on 'unfair' sharing ratios. This may have encouraged them either to exert less effort – for instance if they equated their marginal disutility of effort with their share of their marginal product rather than total marginal product – or to simply understate their profits, which would be difficult to detect due to costly state verification.

Intriguingly, NRSP branch managers also observed that, even though the contracts originally maintained a 'downside option' that did allow for loss-sharing ex-ante, in practice no entrepreneurs ever exercised this loss-sharing option. This was due to a fear that if they did not meet their expected payment every month, it would adversely affect their standing with the bank, which may hinder their ability to borrow in the future. Therefore, fears regarding reputation and dynamic incentives actually led to microenterprise owners not exercising their loss-sharing option, even when NRSP had explicitly allowed it. In summary, these findings from the survey of NRSP clients suggest that it is very challenging to implement equity-based contracts within a conventional microcredit organisation. The major constraints relate to the incentives of microcredit loan officers and those of clients, as discussed in earlier theoretical work on optimal financial contracts in the presence of asymmetric information and costly state verification. These are compounded by the related problems of adverse selection (the most profitable microenterprises selecting out of equity contracts) and moral hazard (distortionary effects caused by inappropriately chosen profit-sharing ratios).

2.6 Conclusion

Access to finance is frequently listed as one of the most important constraints on the expansion of small firms in low-income countries. Many existing studies focus on the role of microcredit as a source of capital; other work complements this by considering the potential effect of microsavings and microinsurance. In this paper, I investigate the effect of 'microequity' contracts, which provide capital using a performance-contingent repayment schedule that allows a greater sharing of risk and reward between capital provider and microenterprise. In the first part of the paper, I describe the implementation of an artefactual field experiment, designed using a simple model of investment choice under different financial contracts, and tested with microenterprise owners who are part of a large field experiment that provides them with a graduated loan to expand their business with a fixed asset. Results reveal that equity-financed microentrepreneurs chose investment options with a greater expected return and risk than under debt financing, with heterogeneity analysis providing suggestive evidence of a larger effect for more risk-averse microenterprise owners. In the second part of the paper, I explore the question of why microequity contracts do not appear to be part of the current portfolio of products offered by most microfinance institutions, considering the significant potential benefits identified in the first part of the paper. To shed some light on this question, I report on an attempt by one of the largest microfinance institutions in Pakistan to implement equity-based microfinance contracts with microenterprise owners in the field. Results from a detailed client survey and a post-survey focus group with senior management point to the significant challenges of implementing equity-based contracts within a conventional microcredit organisation, with the major challenges relating both to the incentives for microcredit loan officers as well as costly state verification, adverse selection and moral hazard.

Nevertheless, given the positive results in the first part of the paper, and the willingness of some large MFIs such as Akhuwat and NRSP to implement microequity contracts, there appears to be some potential for establishing alternative 'venture capital-like' funding models. Insights from this paper suggest that this would need to be operated separately from the conventional operations of a microcredit institution, with the aim of providing risk-sharing capital for promising growth-oriented microentrepreneurs. In the entrepreneurial finance literature, it is well-established that venture capital firms can add value beyond that of traditional financial

intermediaries, including monitoring, support, control, and the professionalisation of firms.[37] One of the key insights from NRSP's experiment with a microequity product was that the common sharing ratio that was applied to all entrepreneurs was inappropriate, and led to some entrepreneurs sharing a very large amount of profit; if such income-sharing contracts are to be provided, then there is clearly a need for more specialised investment officers who understand the dynamics of the firms and industries being financed and what a reasonable sharing ratio would be, given the typical margins and income volatility in that sector. Venture capital firms are also able to diversify risk simultaneously in a number of firms, whereas a conventional loan-based organisation typically does not operate with such a 'portfolio perspective' and rather seeks to prevent default on each individual loan disbursed, which is unrealistic if one seeks to finance higher-risk, higher-return entrepreneurs. As a way of screening high-potential firms through a graduated finance model, venture capital firms often 'stage' their investment expenditure in each enterprise, initially giving smaller amounts of finance and increasing this based on the attainment of certain targets, which has a number of benefits such as the reduction of agency risks induced by one-sided asymmetric information.[38] While one concern with attempting to implement such a venture-capital-type model in developing countries is the lack of exit option via a liquid stock market, Hellmann (2006) reports that there are actually more venture capital exits by acquisition than by initial public offering (IPO), and in many developing countries there may be the potential for a future exit by selling to various possible buyers, include social investment funds.

An important issue to consider when attempting to address the lack of growth of many microenterprises in developing countries is the identification of growth-oriented entrepreneurs. A useful distinction to make is between 'subsistence entrepreneurs' and 'transformational entrepreneurs', who vary in their economic objectives, skills, and role in the economy. Subsistence entrepreneurs become entrepreneurs as a means of providing subsistence income, whereas transformational entrepreneurs aim to grow their firms and provide jobs and income for others. Most of the financial infrastructure built to reach the poor in developing countries is based on MFIs, like Akhuwat and NRSP, who have succeeded in rapidly expanding and effectively managing the operational challenges with a 'retail-like' approach of providing a high volume of standardised loan products with relatively rigid repayment terms. Although there is now

[37] See Hellmann and Puri (2002); Bottazzi, Da Rin, and Hellmann (2008).
[38] See Sahlman (1990); Gompers (1995); Neher (1999).

strong evidence that such products have not led to large effects on the growth of entrepreneurs or household income, they have proven to be important tools that help poor individuals manage negative income shocks and smooth consumption. Nonetheless, it is clear that MFIs are not best-placed to support growth-oriented transformational entrepreneurs. Schoar (2010) argues that to achieve a more effective flow of capital to transformational entrepreneurs in developing countries, there is a requirement for organisations that effectively foster the selection and financing of such entrepreneurs. She discusses emerging markets such as Brazil, India, and China, where there has been a rapid emergence of venture capital funds that support the top end of entrepreneurs. However, most small firms still rely on bank lending, so innovations to provide more risk-sharing products are much-needed.

Apart from organisational set-up and microenterprise screening methods, one of the major remaining challenges in providing equity-like financing is that of costly state verification. Progress in financial technology, such as electronic point-of-sale systems and mobile banking, may help mitigate the cost of monitoring business performance, and permit innovative models with performance-contingent repayments. Revenue-sharing models may be a particularly fruitful avenue to investigate such contracts, as they avoid the often complicated process of identifying business expenses in order to calculate profits. It is conceivable that costly state verification can be dramatically reduced for firm revenues, whereas it may remain difficult to verify microenterprise profits due to the challenge of measuring and monitoring business expenses directly attributable to sales in a particular period (for the purpose of calculating that period's profits), especially given that many microenterprises face highly volatile incomes, do not keep good business records, and mix business and household finances. While it may be possible that technological advances can also help monitor expenses, for example using radio frequency identification (RFID) tags for inventory management to measure flow of inventories, recent work highlights the significant challenges in implementing the currently available 'off-the-shelf' inventory management devices with microenterprises.[39] A revenue-based financing model avoids the complication of accurately attributing expenses, and it is relatively straightforward to monitor sales using an electronic point-of-sale system.[40] For example, the financial technology firm iZettle, which is one of the fastest growing fintech companies in Europe, pro-

[39] See De Mel, Herath, McKenzie, and Pathak (2016).

[40] Of course, one needs to design mechanisms that consider the incentives to hide sales from such systems, if repayments are only linked to sales registered on the system.

vides payments systems and point of sales terminals for small businesses to record, manage and analyse sales. iZettle recently introduced a financing product with performance-contingent repayments that are taken directly taken out of the business' sales.[41]

In this spirit of innovative microenterprise financing models, Allianz, the largest insurance company in the world, recently launched a microequity project that aims to establish such a venture-capital-like investment fund for microenterprises in Indonesia.[42] The model involves an initial selection phase of entrepreneurs, who were given uncollateralised loans, after which their repayment behaviour is used as a screening device to evaluate them for 'graduation' to the next phase. This next phase is a mentoring phase, where they receive access to a personal mentor and a larger amount of financing. Some entrepreneurs are then expected to move into the business professionalisation stage, where Allianz proposes to officially register the business and take a formal equity share, with a view to exiting the investment in the future by selling their stake to an investor, which could potentially be a social impact investor. The Allianz model has been designed in a venture-capital-like manner, with the expectation that less than 1% of entrepreneurs would graduate to the formalisation stage.

The mentorship plus equity dimension could be a particularly successful one, given that many business training programs have yielded limited, short-term benefits for business practices of microentrepreneurs, with little impact on sales or profits (McKenzie and Woodruff, 2013). Moreover, there is recent evidence that tailored and intensive programs can have a positive impact.[43] At the extreme end of the personalisation spectrum is personalised mentoring, for which some positive results have been found.[44] Entrepreneurial mentorship could be more effective when mentors are incentivised directly by the productivity of their mentees (i.e. when they have 'skin in the game'). Microequity provided through such a venture-capital-like organisation has the potential to provide a flexible alternative to traditional forms of microcredit, which more effectively aligns the incentives of entrepreneurs and the capital provider, who would have a stronger incentive to help the entrepreneur reap the benefits of better management practices. Such innovative models merit further empirical and theoretical research.

[41] iZettle processes their sales through its card payments system. www.mobiletransaction.org/loans-small-businesses-izettle-advance/.

[42] www.allianz.com/en/sustainability/media-2016/AllianzSE-EmergingConsumersReport2016.

[43] See Drexler, Fischer, and Schoar (2014); Chandy, Anderson-McDonald, and Zia (2016).

[44] See Brooks, Donovan, and T. Johnson (2016).

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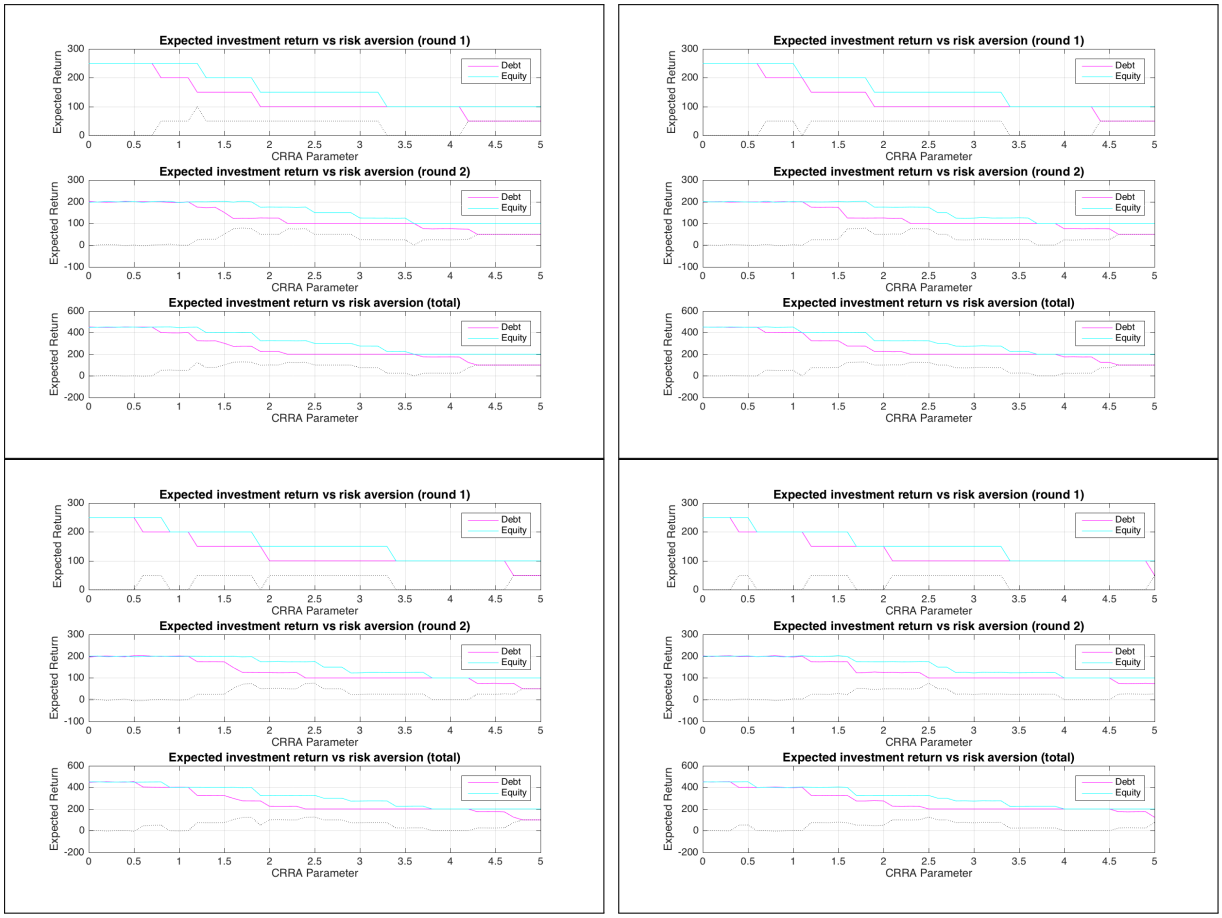
Appendices of Chapter 2

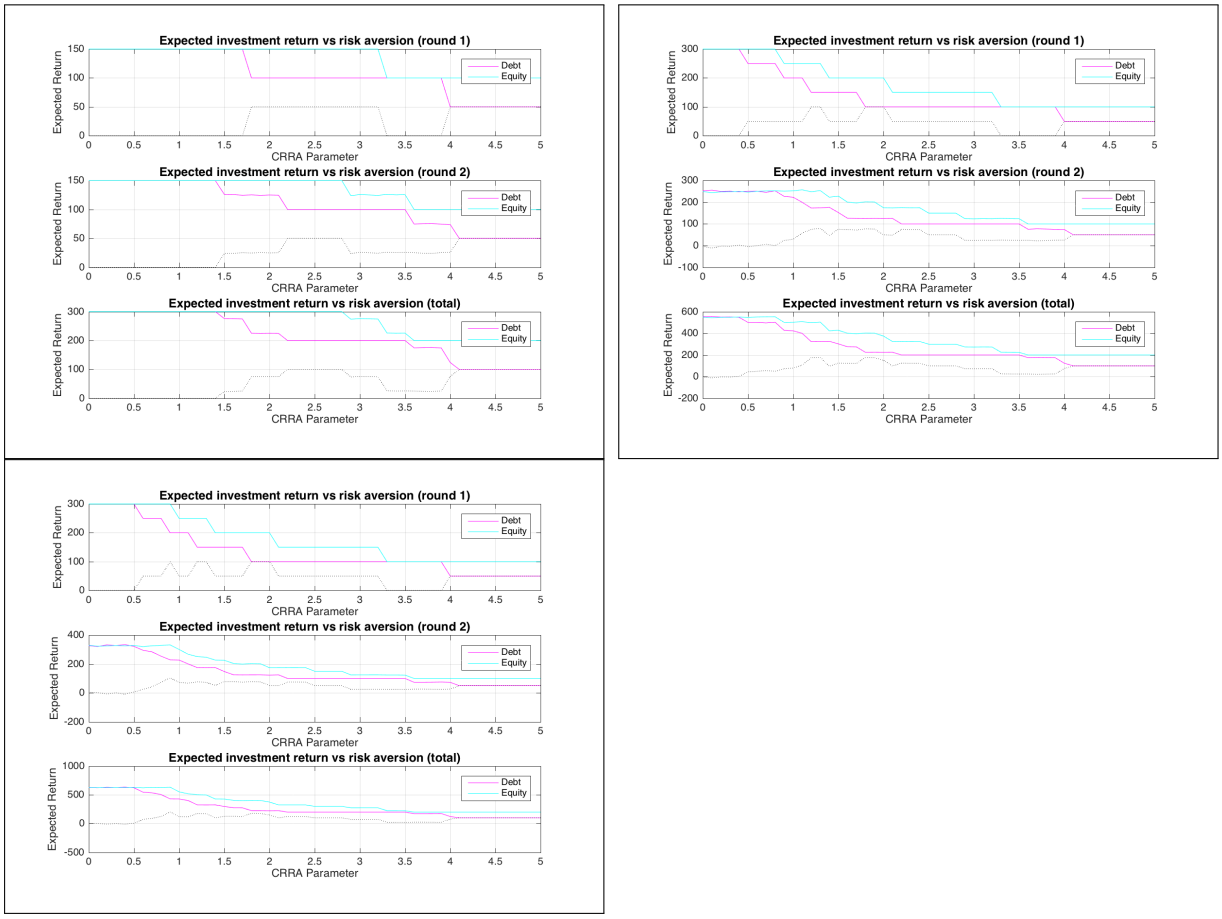
2.A Appendix

Table 2.15: SIMULATIONS: CHANGING THE NUMBER OF GAME ROUNDS



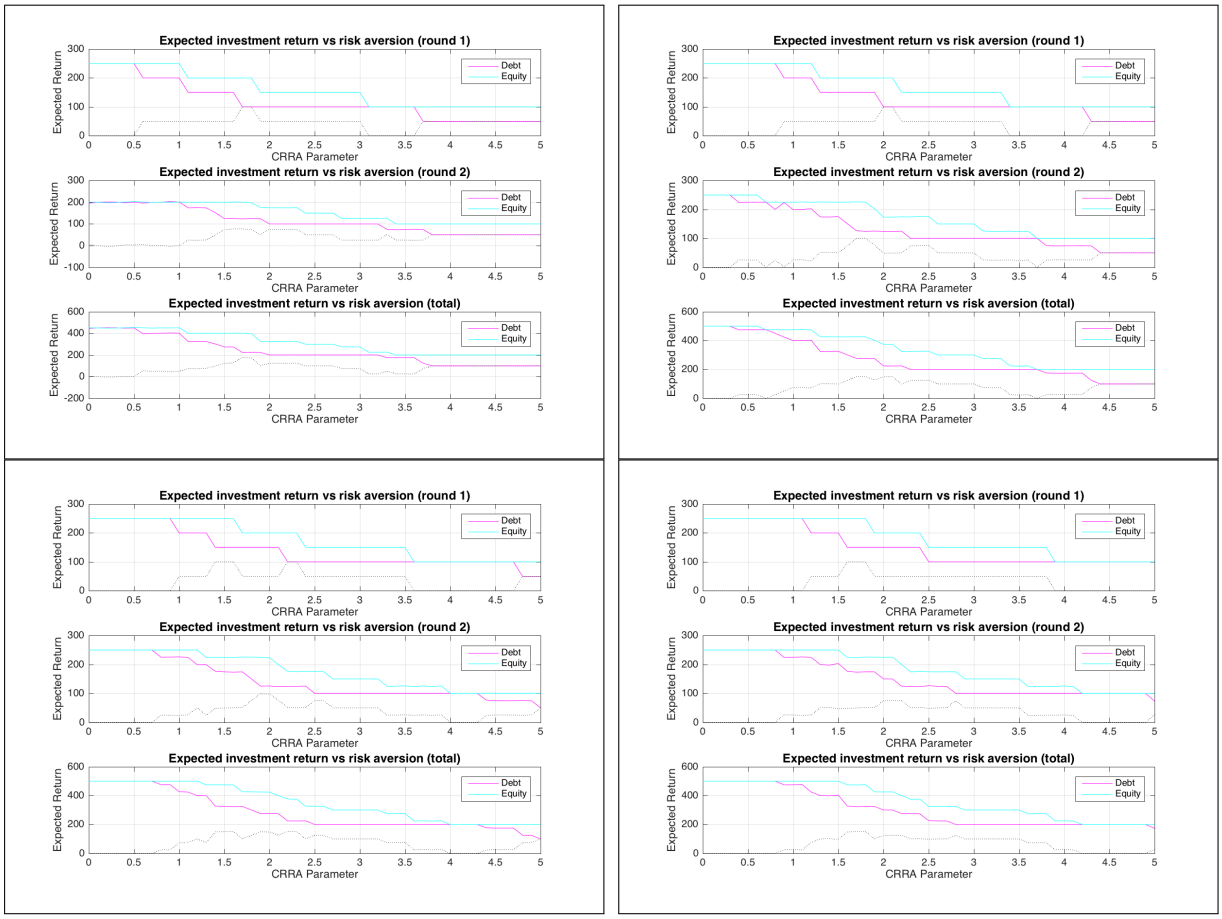
This figure presents results from simulations with a different number of investment rounds in the game: (beginning in the top-left panel, going clockwise): 3, 5, 7 and 10 rounds.

Table 2.17: SIMULATIONS: CHANGING THE NUMBER OF INVESTMENT OPTIONS



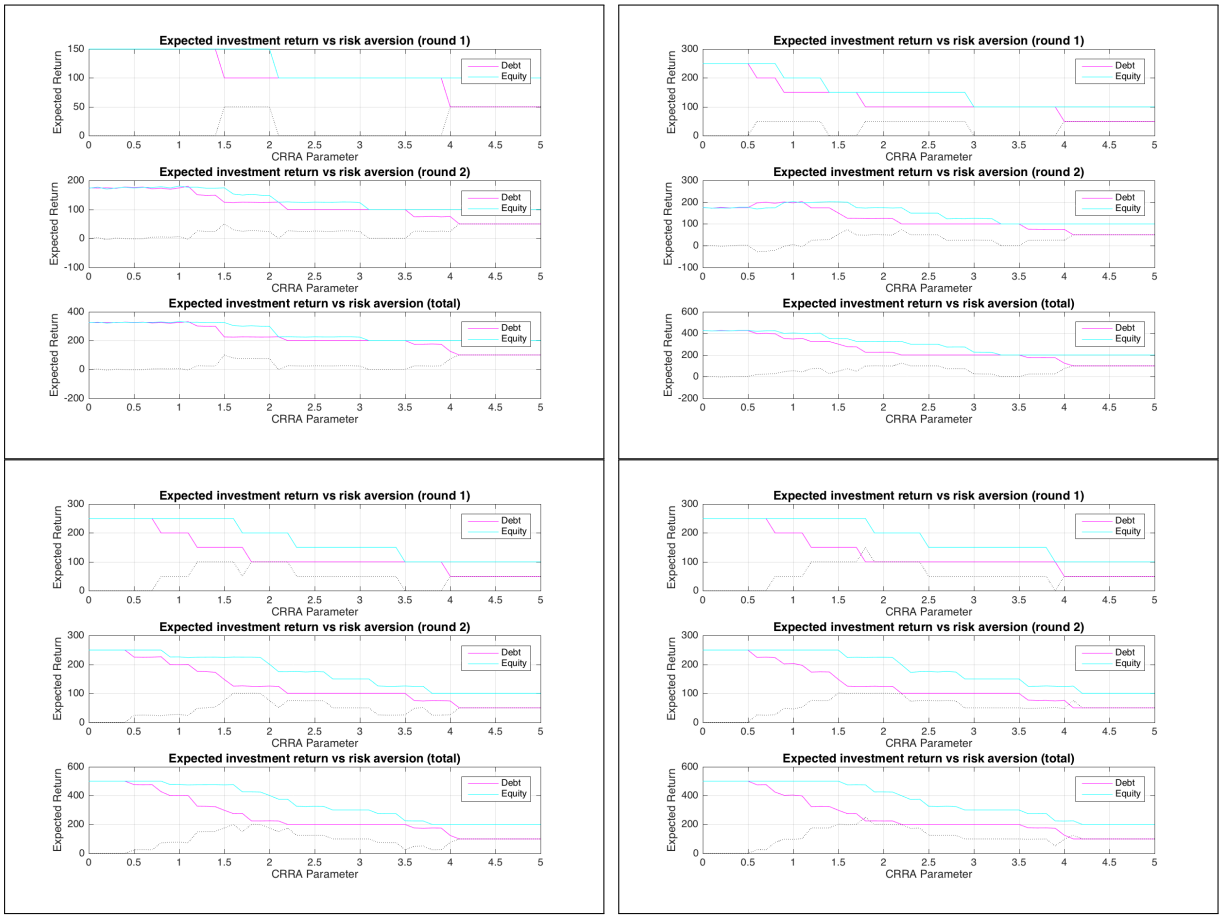
This figure presents results from simulations with a different number of investment options per round: (beginning in the top-left panel, going clockwise): 3, 7 and 10 investment options.

Table 2.19: SIMULATIONS: CHANGING THE INITIAL WEALTH LEVEL IN THE GAME



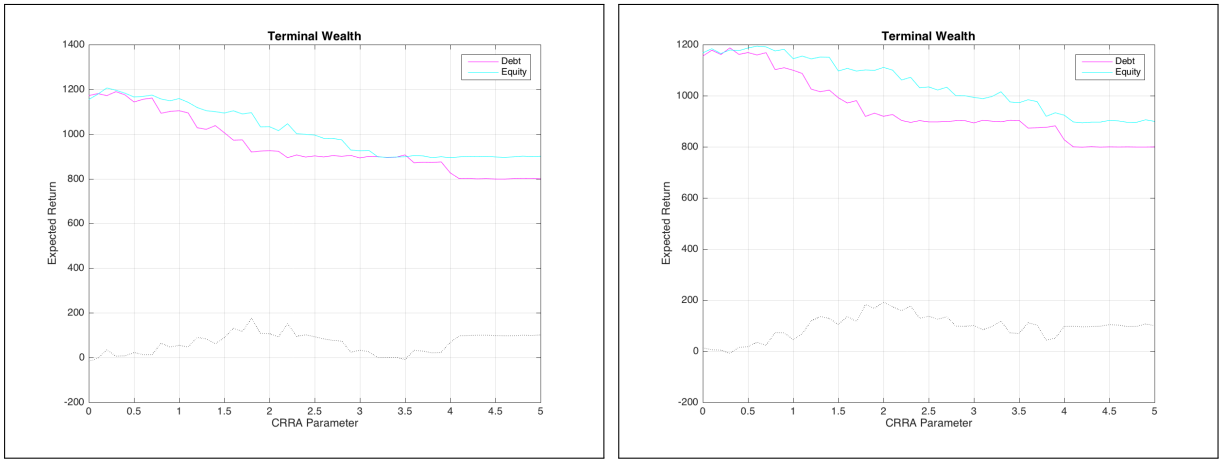
This figure presents results from simulations with a different starting amount of investment wealth in the first round of the game: (beginning in the top-left panel, going clockwise): 100, 300, 500, and 700.

Table 2.21: SIMULATIONS: CHANGING THE FINANCING AMOUNT



This figure presents results from simulations with a different capital amount for the financing contracts: (beginning in the top-left panel, going clockwise): 100, 300, 700, and 1,000.

Table 2.23: SIMULATION: TERMINAL WEALTH AT THE END OF THE GAME.



This figure presents results for the terminal wealth for agents at the end of the game. The left panel represents the 50-50 equity contract, and the right panel the 25-75 equity contract.

Figure 2.11: BUSINESS PERFORMANCE METRICS

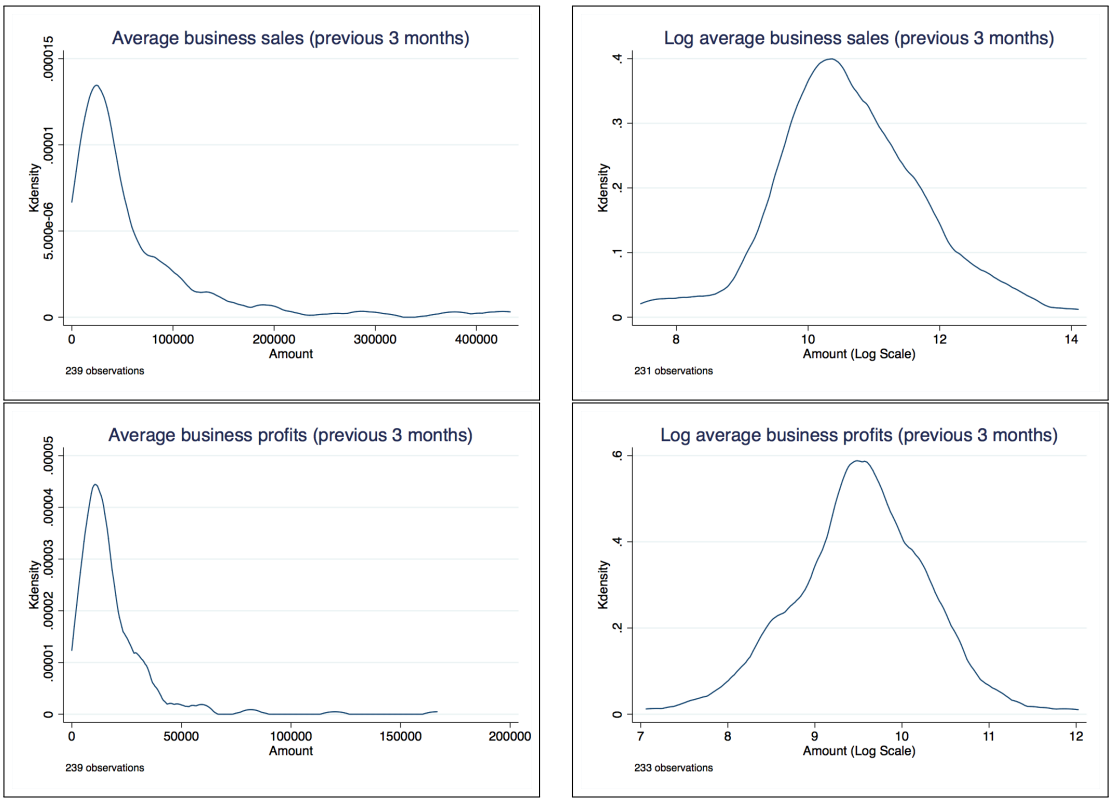
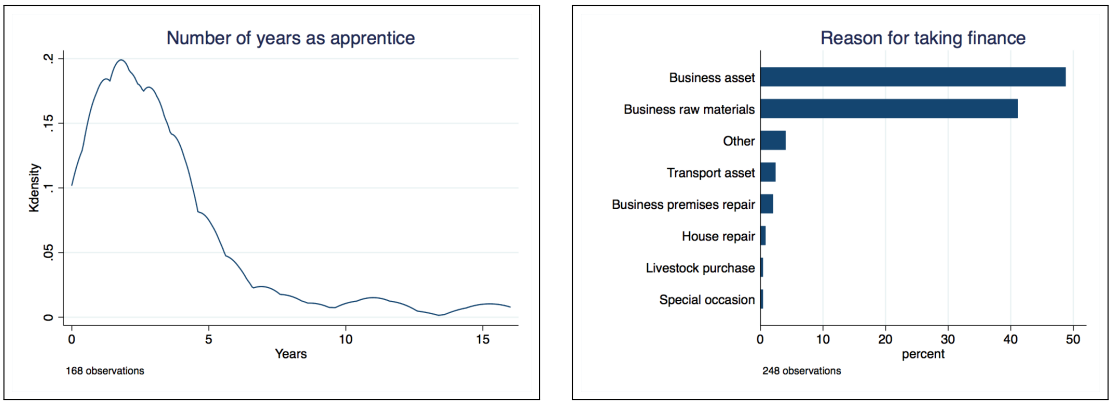


Figure 2.12: BACKGROUND OF APPRENTICES AND HOW THE FUNDS WERE USED



Chapter 3

Shared-ownership Microfinance: A Field Experiment in Pakistan

Abstract Shared equity and asset-based financing are two of the most important sources of investment capital for small and medium enterprises around the world, however microenterprises in developing countries typically only have access to rigid debt-based contracts, which may not be the optimal contract structure to support higher-risk, higher-reward investments. In this paper, we conduct a field experiment in which we offer a relatively large amount of financing to growth-oriented microenterprise owners, using a shared-ownership contract. We focus on shared equity in a single asset, as a proof of concept for shared equity more generally, and to investigate demand for such products. We find high take-up rates for our shared-ownership product, and a strong preference for a more flexible repayment schedule among microenterprise owners, especially those who are more risk-averse. The result on risk aversion is striking when compared to the existing literature that finds a higher take-up of flexible microfinance contracts among the least risk-averse, which we suggest is due to the shared-ownership structure of our contracts and the implicit insurance inherent within them. Overall, results provide promising evidence for the potential of shared-ownership microfinance contracts to help stimulate investment among growth-oriented microenterprise owners.

3.1 A field experiment on shared-ownership microfinance

Asset-based financing is one of the most important sources of capital investment for small and medium enterprises around the world, providing funding amounts that would not otherwise be possible on unsecured terms, and offering lower credit risk for lenders through the collateralisation of assets.[1] In lease-based contracts, lessors often retain ownership of the asset, which further facilitates provision of funding for firms to whom it would usually be too risky to lend large amounts. Shared equity financing is a common feature of many developed countries, from small 'business angel' investor groups to large venture capital firms, providing a more flexible source of finance that shares risk and reward with growth-oriented firms. However, despite the prevalence of asset-based and shared equity finance in many countries, to date microfinance has provided a prominent exception. Microenterprise owners typically only have access to debt-based contracts with a rigid repayment structure, which may not be the optimal contract structure to support growth-oriented microenterprises seeking to significantly expand their operations with a potentially profitable but risky investment. While equity-based contracts, which involve a greater sharing of risk and reward between capital provider and capital user, have the potential to more effectively support such growth, to our knowledge most microfinance institutions have been reluctant to share ownership of financed assets. Anecdotal evidence suggests several reasons for this, the most prominent of which are high costs of screening potential clients, the need to monitor business performance, and misalignment in the incentives for loan officers (Meki, 2018). The objective of most microcredit loan officers is to maintain a high repayment rate on their portfolio, which often leads to a desire for lower-risk clients who are more likely to repay their loans, rather than growth-oriented microenterprises that make investments with a greater expected return but also greater risk.

In this paper, we conduct a field experiment in which we offer a relatively large amount of financing to growth-oriented microenterprise owners, using a shared-ownership contract. We focus on shared equity in a single asset, as a proof of concept for shared equity more generally,

[1] A report by the European Investment Fund highlights the growing importance of asset-based financing for European SMEs since the 2007-2008 global financial crisis, particularly in light of a changing regulatory landscape that has made it more difficult to provide unsecured lending to SMEs (Kraemer-Eis and Lang, 2014).

and to investigate demand for such products. We work with Akhuwat, a large microfinance institution (MFI) in Pakistan, and sample from their graduated borrowers who have successfully completed previous loan cycles and reached the upper limit of borrowing (approximately $450), and who expressed an interest in expanding their business through the purchase of a fixed asset. We design an asset-based microfinance contract that provides them with a financing amount of up to $1,800. We offer two variants of the contract, both using a shared-ownership structure and having a duration of 18 months: (i) a fixed-repayment contract where microenterprise owners are obliged to purchase Akhuwat's ownership share each month using a linear repayment schedule that results in them fully owning the asset at the end of the 18 months; and (ii) a flexible-repayment contract that has only half of the monthly obligation to purchase Akhuwat's share and allows clients to repurchase a larger share at any time. In both contracts, clients are required to pay rent based on Akhuwat's proportional ownership share of the asset at the start of each month, using an annual rental rate of 12%. Clients who were randomly assigned to our control group were eligible for a zero-interest loan of up to $450, which sets a high bar against which to test the demand for our shared-ownership contracts.

We find high take-up rates for our shared-ownership product: 55% of microenterprise owners who were offered the fixed-repayment contract took up an asset. Further, we use a strategy method to randomly offer a subset of clients the option to take the flexible-repayment contract rather than the fixed-repayment contract. We find a high demand for flexibility: specifically, 79% of clients who were offered the flexible-repayment contract over the fixed-repayment contract accepted it. Further analysis of heterogenous demand reveals that the preference for flexible contracts is particularly strong among the most risk-averse microenterprise owners, as measured using incentivised behavioural games before the experiment. We also find similar but weaker results using a non-incentivised measure of risk preferences. Although actual take-up rates of our product were quite high, stated take-up was even higher: approximately 95% of microenterprise owners stated that they would take the contracts. However, a number of them did not complete the process that required them to initially purchase 10% of the value of the asset. In light of this, we use a simple Bayesian approach to further investigate the underlying structure of demand for our product, by classifying individuals into different 'types' based on

their preference over contracts (fixed, flexible or simple zero-interest cash loan) and whether they were of the type that completed the process and provided the required 10% payment. This allows us to estimate the proportion of the population that falls into each of our defined types, and investigating demand specifically for the types that microfinance institutions would most likely consider offering such products to: those who follow the contract procedure to its completion and pay the required 10%. We find that demand for the flexible-repayment contract is particularly high among this group of individuals, which provides encouraging evidence for the benefit of more flexible contracts. However, when investigating what proportion of this type of client would prefer to take no contract rather than the fixed contract if the fixed contract alone were offered to them, we find that this is very low. This suggests that in our population there is no evidence for a large number of unbanked microenterprise owners who would only take financing if offered flexible contracts. Overall, our results offer promising evidence for the potential of shared-ownership microfinance contracts, which allow microfinance institutions to finance relatively large amounts for microenterprise capital investment, in a more secure manner. Our findings also point to microenterprise owners' desire for flexibility, although this desire is not so substantial that they would prefer no contract over a fixed-repayment contract.

Our paper contributes to several distinct strands of the microfinance literature. The first wave of rigorous microcredit evaluations found that, despite much initial excitement about its potential, microcredit does not, on average, have transformational effects. Results showed relatively low take-up, some (unprofitable) business investment, and no substantial increases in income or other key outcomes (Banerjee, Karlan, and Zinman, 2015; Augsburg, De Haas, Harmgart, and Meghir, 2015; Tarozzi, Desai, and K. Johnson, 2015; Duflo, Banerjee, Glennerster, and Kinnan, 2013; Angelucci, Karlan, and Zinman, 2015; Attanasio, Augsburg, De Haas, Fitzsimons, and Harmgart, 2015; Crépon, Devoto, Duflo, and Parienté, 2015; Karlan and Zinman, 2011). This contrasts with evidence of sustained high returns to capital in some firms that were given assets or cash as grants (De Mel, McKenzie, and Woodruff, 2008; Fafchamps, McKenzie, Quinn, and Woodruff, 2014). Our project builds on this evidence by attempting to identify growth-oriented microenterprises by sampling from existing microfinance borrowers who have successfully completed previous loans, have reached the upper limit on borrowing, and who have

expressed a desire to expand their businesses with a significantly higher financing amount. As such, our work also relates to a recent literature that investigates different methods for identifying high-potential-growth entrepreneurs. McKenzie and Sansone (2017) compare the relative performance of machine learning approaches and an expert panel of judges in predicting successful entrepreneurs from a business plan competition in Nigeria, and identify an overall predictive power that is very low for all approaches. Similarly, Fafchamps and Woodruff (2016) find that an expert panel in a business plan competition in Ghana had very little predictive power for microenterprise growth. In contrast, for a sample of subsistence-level entrepreneurs in India, Hussam, Rigol, and Roth (2017) report that it is possible to use community-based information to predict which microentrepreneurs would have higher average returns to capital. The selection criteria in our paper are relatively 'light-touch', in that we select microenterprise owners on the basis of having successfully graduated from borrowing smaller amounts and repaying them, and do not use subjective measures such as decision committees or behavioural or psychometric tests.

We also contribute to the second wave of microfinance studies, which examines the impact of contractual innovations on microenterprises. Field, Pande, Papp, and Rigol (2013) work with the classic group-based microcredit contract, which typically features immediate repayment requirements, and find that a two-month grace period led to an increase in short-run business investment and long-run profits, but also higher default rates. Battaglia, Gulesci, and Madestam (2017) extend this idea by implementing a contract with two grace periods that can be exercised at any time, using a sample of both microenterprises as well as larger SMEs. They observe that clients value flexibility, and that take-up of the more flexible contract is higher among the least risk-averse microentrepreneurs and those with higher baseline profits and education. They also find that more flexible contracts led to higher microenterprise assets and revenues, but no increase in profits, and no major effects on the sample of SMEs. Barboni (2017) conducts a lab-in-the-field experiment with Indian microentrepreneurs and shows that higher-revenue borrowers are more likely to select into flexible contracts, especially when there is a higher price for the flexible contract. She also observes that more risk-averse borrowers prefer the fixed-repayment contract. Barboni and Agarwal (2018) implement a microfinance contract with two

grace periods, reporting that more disciplined and more forward-looking borrowers prefer the flexible contract, with some evidence of greater take-up of the flexible contract among the least risk-averse borrowers. Our paper relates to these studies of more flexible microcredit as one of our two contracts has a more flexible repayment schedule, which could be perceived as a series of grace periods combined with early-repayment options. The major difference in our work is the shared-ownership nature of the product, which involves risk-sharing in an asset. In the case of default, our repossession mechanism requires the asset to be sold and proceeds disbursed in proportion to the prevailing ownership shares, which provides an element of risk-sharing and implicit insurance that may be particularly valued by more risk-averse microenterprise owners. Indeed, our finding that take-up of the flexible contract was actually *higher* for more risk-averse borrowers stands in stark contrast to the aforementioned studies that used conventional debt-based contracts – often with a group-based structure, which may further discourage risk-taking[2] – and found that take-up was higher for *less* risk-averse borrowers. We suggest that this could be due to the unique shared-ownership nature of our product, which could incentivise more risk-averse individuals to invest. Our other finding of clients valuing flexibility is consistent with the aforementioned studies, although as mentioned we find no evidence that there is a large pool of unbanked microfinance borrowers who would only take financing if it were offered as a flexible contract. Our work is also related to Jack, Kremer, De Laat, and Suri (2016), who collaborate with a Kenyan dairy cooperative and observe significantly higher take-up of a loan product that replaces high down-payments and joint-liability with asset collateralisation, using a rainwater harvest tank. Our product has some similarities, in its asset-based nature, but differs in the shared-ownership structure. The authors also speculate that prospect theory could explain the high take-up of the asset-collateralised loan; loss-averse agents may prefer to take loans where the asset itself is used as collateral, rather than using some of their existing assets or relationships as collateral, which risks a loss to their endowment. Although we do find some suggestive pattern of higher take-up for the most loss-averse microenterprise own-

[2]Joint-liability may lead to excessive risk mitigation through monitoring by peers, who do not share in the upside of riskier but more profitable investments but do suffer the negative consequences (Fischer, 2013). Czura (2015) shows that peer punishment in borrower groups can be excessive in that it arises not only in response to misbehaviour by an individual but also when that individual suffers observable negative income shocks. Other studies have reported microcredit institutions using drastic social measures to enforce loan repayment, such as public shaming, verbal harassment and confiscation of household assets (Montgomery, 1996; Rahman, 1999; Karim, 2008).

ers who were offered the flexible contract, compared to those offered the fixed contract, results are not statistically significant.

There are over 1.6 billion Muslims in the world, and research from the Islamic Development Bank reports that in the six countries with the largest Muslim populations (Indonesia, India, Pakistan, Bangladesh, Egypt and Nigeria) the number of people living on less than $2 per day far exceeds half a billion (Obaidullah and Khan, 2008). Many Muslim microentrepreneurs remain unbanked by conventional microcredit and microsavings products due to the religious prohibition on usury. An equity-based product, though not restricted to any one particular religion or group, has the potential to meet the demands of hundreds of millions of poor Muslims. Recent reports by the World Bank and IMF discuss the benefits of risk-sharing products and call for innovations in equity-based contracts for micro-, small- and medium-sized enterprises.[3] While we designed our products to be consistent with Islamic law, the declining-balance partnership agreement we used has strong resonance with Western legal traditions, dating back at least to the ancient Roman law of *hypotheca*. It is also important to note that, when communicating with participants, we were careful not to use religious language or Arabic terminology, and instead used the local terms for joint ownership and rent.

Shared-ownership microfinance contracts have the potential to more effectively stimulate microenterprise growth, both for individuals in Muslim-majority countries, as well as more generally for risk-averse microenterprise owners, who may increase their investment in higher-risk, higher-return opportunities when provided with the implicit insurance of shared-ownership. This particularly applies to contracts that involve more flexible repayments, which allow a better alignment with microenterprise performance.[4] Recent research also highlights an alternative view of microfinance, in particular when related to demand for a 'lumpy asset' and the 'savings-like' properties inherent in borrowing. Bauer, Chytilová, and Morduch (2012)

[3]See World Bank (2012); Kammer, Norat, Pinon, Prasad, Towe, and Zeidane (2015).

[4]Fischer (2013) shows that a combination of borrowing plus equity-like profit and loss sharing can lead to greater risk-taking by microfinance borrowers, and Meki (2018) also finds that equity-like contracts led to greater risk-taking by microenterprise owners in a lab-in-field setting, in particular for the most risk-averse individuals. Burchardi, Gulesci, Lerva, and Sulaiman (2017) find that sharecroppers who were given a larger share of their cultivated output increased their investments and production.

draw a link between the propensity to take microcredit and disciplining measures that can increase savings. Afzal, d'Adda, Fafchamps, Quinn, and Said (2015) suggest that the distinction between microlending and microsaving is largely illusory, and use a product modelled on a rotating savings and credit association (ROSCA) to offer both credit and saving contracts to subjects. They report that people often accept both credit and saving contracts, and rationalise the behaviour with a model of individuals with a desire for lump-sum investment and facing savings constraints. Our work resonates with this because the product we offer is restricted to the purchase of a business fixed asset, and our results indicate higher demand for the flexible contract, which contains more 'savings-like' elements by allowing microenterprise owners to save any large windfalls and to make extra repayments into their contract to increase their ownership share of the asset. More generally, our product serves as a proof of concept for 'equity-like' contracts; had we been unsuccessful in implementing a contract where the MFI and client shared ownership in just one asset, it would imply a low likelihood of success for implementing shared-ownership in a whole microenterprise, without the assistance of strong monitoring technology. Our results provide encouraging evidence for the potential for shared equity contracts for microenterprises, which warrants further research on 'equity-like' contractual innovations with the aim of stimulating microenterprise growth through risk-sharing.

The remainder of the paper is structured as follows. Section 3.2 outlines the study context and experimental design, with data described in Section 3.3 and results presented in Section 3.4. Section 3.5 concludes.

3.2 Experimental design

3.2.1 Study context

This study was conducted with clients of Akhuwat, one of the fastest growing microfinance institutions in Pakistan. Akhuwat is based in Lahore and operates in 775 branches across the country, with over 930,000 active borrowers and an outstanding loan portfolio of PKR 15.6 billion (approximately $135 million).[5] We sampled from microenterprises that had passed the

[5]Information is correct as of 03 April 2018.

relatively simple screening process of Akhuwat, by having 'graduated' from being small-scale borrowers to financing larger amounts. This is an ideal sample for any field experiment of shared-ownership microfinance, which is not intended as a form of welfare support for struggling entrepreneurs. Beyond the field experiment, the long-term viability of any such product will rely upon an MFI already having screened a sample of firms that are considered to be trustworthy and profitable.

The sample consisted of microenterprise owners who had successfully completed at least one loan cycle with Akhuwat, had reached the maximum permitted borrowing amount (approximately $450), and had expressed an interest in expanding their business by purchasing a fixed asset. Eligible clients were invited to a workshop, where they completed a comprehensive survey, which included questions asking about individual and household characteristics, household finances (loans, savings, incomes, and expenditures), business income, expenditures and assets, business management practices, and a variety of questions on decision-making and trust. Following the survey, all microenterprise owners participated in a set of detailed behavioural games, designed to measure risk preferences, loss aversion, time preferences, and cognitive ability. There were two risk preference elicitation activities; the first was a survey-based measure, using a series of questions that sought to gauge respondents' risk-taking in their occupation, financial matters, and faith in others.[6] The second measure of risk preferences was incentivised, where respondents were posed a series of 30 questions that required them to choose between a certain amount of money or an uncertain investment option, which had two possible outcomes: (i) a 'bad' outcome, with a payoff of zero; or (ii) a 'good' outcome, with a payoff of PKR 1,000.[7] In the loss aversion activity, respondents were offered a series of binary-outcome investment choices that involved a large positive outcome or a (gradually increasing) negative outcome, which they could accept or reject. If they accepted the invest-

[6]Specifically, the questions were: *(i) "How would you rate your willingness to take risks in financial matters?"; (ii) "How would you rate your willingness to take risks in your occupation?"; (iii) "How would you rate your willingness to take risks when it comes to having faith in other people?"; and (iv) "How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks?"*. Responses were given on a scale of 1 to 10, with 0 representing 'risk-averse' and 10 representing 'fully prepared to take risks'. The questions were adapted from Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner (2011), have been used by other researchers in a number of settings and have demonstrated a reasonably strong correlation with incentivised measures of risk preferences.

[7]We adapted the measures used by Barr and Packard (2002) and Vieider, Lefebvre, Bouchouicha, Chmura, Hakimov, Krawczyk, and Martinsson (2015).

ments and the loss aversion activity was chosen for payment at the end of the workshop,[8] then a realised loss would be taken out of their guaranteed workshop participation fee; as such, this represented a potential real loss.[9] In the time-preference elicitation activity, individuals were offered a series of choices between an amount of money paid on the same day as the workshop or (gradually increasing) amounts of money one month from the workshop.[10] For all incentivised measures, a simple index was created for the number of decisions made (for example, the number of rejections of the risky investments, indicating risk aversion or loss aversion, or the number of rejections of future payment amounts, indicating a preference for money today). This index was then employed for the heterogeneity analysis in Section 3.4.3, using a median-split of the index, as well as terciles from trichotomisation. Further details of the behavioural games and elicitation methods are provided in Meki (2018), who uses the same participants and behavioural games data to investigate the effect of equity financing on investment behaviour in a 'lab-in-field' setting. The heterogeneity analysis conducted in our paper employs the same set of variables that were pre-specified by Meki (2018).[11]

3.2.2 Contract structure

We implemented two types of shared-ownership contract. Both were 18-month contracts that allowed clients to finance the purchase of a fixed asset up to the value of PKR 200,000 (approximately $1,800). The client was obligated to initially purchase 10% of the asset, with Akhuwat purchasing the remaining 90%. The difference in the contracts was in how clients were required to purchase Akhuwat's share:

(1) Fixed-repayment contract: The client was required to purchase 5% of Akhuwat's owner-

[8] Before conducting all activities, participants were informed that, at the end of the behavioural games session, one of the incentivised activities would be selected for payment by physically drawing a ball from a bag. Within the selected activity, balls would be drawn to select the one final question that would be used for payment. As such, participants were required to answer all questions attentively, because any question could have been selected. This method also allowed the use of payment amounts that were relatively large, with the average payment being approximately three times as large as median daily business profits for microenterprises in the sample. From a methodological perspective, Charness, Gneezy, and Halladay (2016) show that paying for only a (randomly selected) subset of all activities is at least as effective as paying for all of them, and can actually be more effective in terms of helping to avoid wealth effects and hedging within the behavioural games session.

[9] We adapted the loss aversion measure used by Bartling, Fehr, and Herz (2014).

[10] The time-preference activity was also conducted using a 'far frame', where money was offered one month forward versus two months forward.

[11] See https://www.socialscienceregistry.org/trials/2224.

ship share each month. At the end of the 18 months, the client would fully own the asset.

(2) Flexible-repayment contract: The client was only obliged to purchase 2.5% of Akhuwat's ownership share each month. The client also had the option to pay *more* than what was required in any given month. If the client purchased all of Akhuwat's share before the 18-month period was over, the contract would terminate. If the client had not fully purchased Akhuwat's share at the end of 18 months, the asset would be sold in the market and proceeds disbursed in proportion to the ownership shares at time of sale (reflecting the shared-ownership structure).

Both contracts were designed to be consistent with locally accepted financial norms. The contract structure was that of *'diminishing musharakah'*, which is a declining-balance partnership agreement that is commonly used to finance the purchase of an asset where both parties share the risk and returns. This type of arrangement combines two distinct Islamic legal contracts under one product: a partnership contract (*'musharakah'*) and a rental contract (*'ijarah'*). This type of contract also has strong resonance with Western legal traditions, dating back at least to the ancient Roman law of *hypotheca*. It is important to note that, when communicating with participants, neither the Arabic words nor any terms with religious connotations were used; instead the local equivalents for joint ownership (*'shirakat'*) and rent (*'kirayah'*) were employed.

Since the asset is solely used by the client, clients are also obliged to make monthly rental payments based on the proportional ownership of the asset at the start of the month. The rental amount was based on a nominal annual rate of 12%. Table 3.1 provides an example of the required payment structure under the fixed-repayment contract for an asset costing PKR 100,000, where the client has paid PKR 10,000 to initially purchase 10% of the asset. A nominal annual rental rate of 12% implies monthly rent of 1% of the asset's value, which is PKR 1,000. The final rental payment due at the end of the first month is PKR 900, reflecting the fact that Akhuwat initially owns 90% of the asset. In addition to the rent, the client is also obliged to purchase 5% of Akhuwat's ownership share each month, based on the initial asset value of PKR 100,000, which implies an amount of PKR 5,000. At the start of the second month, Akhuwat's ownership share is 85%, and a reduced rent of PKR 850 is required at the end of the month, as well as the

regular requirement of PKR 5,000 to purchase 5% of Akhuwat's share. The contract continues in this manner until the 18th month, when the client purchases the final 5% of Akhuwat's ownership share, and the contract ends. Over the 18-month duration of the contract, total rental payments are PKR 8,550, which is 9.5% of the initial financing amount of PKR 90,000.

Table 3.1: CONTRACT STRUCTURE: FIXED-REPAYMENT CONTRACT

MONTH	AKHUWAT OWNERSHIP	PAYMENT		TOTAL PAYMENT
		RENT	OWNERSHIP	
1	90.0%	900	5,000	5,900
2	85.0%	850	5,000	5,850
3	80.0%	800	5,000	5,800
4	75.0%	750	5,000	5,750
5	70.0%	700	5,000	5,700
6	65.0%	650	5,000	5,650
7	60.0%	600	5,000	5,600
8	55.0%	550	5,000	5,550
9	50.0%	500	5,000	5,500
10	45.0%	450	5,000	5,450
11	40.0%	400	5,000	5,400
12	35.0%	350	5,000	5,350
13	30.0%	300	5,000	5,300
14	25.0%	250	5,000	5,250
15	20.0%	200	5,000	5,200
16	15.0%	150	5,000	5,150
17	10.0%	100	5,000	5,100
18	5.0%	50	5,000	5,050
TOTAL		8,550	90,000	98,550

Table 3.2 provides two examples for the required payment structure under the flexible-repayment contract, again using an initial asset value of PKR 100,000. The first example illustrates the absolute minimum repayment requirement for the client, which is PKR 2,500 per month. Since Akhuwat's ownership share decreases more gradually than it does under the fixed-repayment contract, the cumulative rental payments to Akhuwat are 45% higher in the flexible-repayment contract. The second example presents a case where the client repays PKR 10,000 every month, which results in a more rapidly decreasing ownership share for Akhuwat (and lower rental payments), and the contract ending at the end of the ninth month.

The default procedure for both contracts is identical, and reflects the shared-ownership nature of the contracts. This contrasts with the majority of asset-based financing arrangements, where a default often results in a repossession of the asset and its sale, with the financier claiming all proceeds up to the outstanding amount owed in the contracts, and the residual amount being given to the client.[12] The way our contracts are implemented reflects risk-sharing in the asset. Specifically, if a client misses a payment, they are given a one-month grace period. If they still do not pay, this triggers a default procedure whereby the asset would be repossessed and sold in the market. Proceeds would then be disbursed proportional to the ownership shares at the time of the default, reflecting the shared-ownership structure.

Table 3.2: CONTRACT STRUCTURE: FLEXIBLE-REPAYMENT CONTRACT

MONTH	PAYMENT EXAMPLE 1				PAYMENT EXAMPLE 2			
	AKHUWAT OWNERSHIP	RENT	SHARE	TOTAL	AKHUWAT OWNERSHIP	RENT	SHARE	TOTAL
1	90.0%	900	2,500	3,400	90.0%	900	10,000	10,900
2	87.5%	875	2,500	3,375	80.0%	800	10,000	10,800
3	85.0%	850	2,500	3,350	70.0%	700	10,000	10,700
4	82.0%	825	2,500	3,325	60.0%	600	10,000	10,600
5	80.0%	800	2,500	3,300	50.0%	500	10,000	10,500
6	77.5%	775	2,500	3,275	40.0%	400	10,000	10,400
7	75.0%	750	2,500	3,250	30.0%	300	10,000	10,300
8	72.5%	725	2,500	3,225	20.0%	200	10,000	10,200
9	70.0%	700	2,500	3,200	10.0%	100	10,000	10,100
10	67.5%	675	2,500	3,175	·	·	·	·
11	65.0%	650	2,500	3,150	·	·	·	·
12	62.5%	625	2,500	3,125	·	·	·	·
13	60.0%	600	2,500	3,100	·	·	·	·
14	57.5%	575	2,500	3,075	·	·	·	·
15	55.0%	550	2,500	3,050	·	·	·	·
16	52.5%	525	2,500	3,025	·	·	·	·
17	50.0%	500	2,500	3,000	·	·	·	·
18	47.5%	475	2,500	2,975	·	·	·	·
TOTAL		12,375	45,000	57,375		4,500	90,000	94,500

[12]Such an arrangement may incentivise 'fire sales' of assets, since the incentive for the financier is to recover their owed amount, which may result in the asset being sold far below market price, as the financier would not directly benefit from a higher sale price.

3.2.3 Contract offers: Strategy method

During the workshops, after clients had completed their surveys and behavioural games, the fixed-repayment contract was described to them using a vignette and example calculations.[13] The flexible-repayment contract was not demonstrated, based on insights from an earlier pilot that some microenterprise owners found it slightly overwhelming to be introduced to the relatively unfamiliar concepts of joint ownership and a changing rental amount as well as the flexible repayment option in the same session. By only initially explaining the fixed-repayment contract, clients were gradually introduced to the idea of shared-ownership and rent calculations based on ownership shares. All participants were subsequently given a one-page information sheet and allowed a few days to consider the contract and discuss it with their families, before a visit to their home to elicit their decision on whether they would take the fixed-repayment contract if it was offered to them. Clients were informed that contract offers would be made randomly, and that those not offered contracts would still be eligible for a zero-interest loan of PKR 50,000 ($450) from Akhuwat.

Following the collection of workshop data, and before the visits were conducted, all clients were randomised into three different groups: (i) a control group, who had access to the interest-free loan of PKR 50,000; (ii) a group that were only offered the fixed-repayment contract (T1); and (iii) a group that were offered the flexible-repayment contract (T2), which would subsequently be explained to them. Randomisation was stratified on microenterprise type, performance and gender, using matched sextuplets:

(i) First, the sample was split into three groups: (a) rickshaw drivers (this was a very popular asset, and the business dynamics of rickshaw drivers are sufficiently unique to warrant stratification); (b) males in all non-rickshaw sectors; and (c) females in non-rickshaw sectors;

(ii) Within each of the three groups, individuals were ordered by the three-month average of their business profits, as collected in the survey;

[13] See the appendix for details of the vignette.

(iii) Groups of matched sextuplets were then formed, with two individuals being randomly allocated into the three treatment groups in each sextuplet.

Forming matched sextuplets is consistent with the recommendation by Athey and Imbens (2017), who suggest stratifying as much as possible so that each stratum contains at least two treated and two control units. They argue that although using paired designs has some benefits in terms of expected precision, these tend to be small, and do not outweigh the significant costs.

Once all participants were allocated their treatment status, they were individually visited by Akhuwat field officers and research assistants, who were given a tablet computer, with a pre-programmed survey form that contained the treatment status of all participants tagged by a unique ID. Field officers were not informed of the treatment status of the client that they were visiting. They were required to ask all clients the following question: *"If the computer selects you for the contract that we explained to you at the workshop, would you take it?"*. Participants were reminded that this was a binding decision, as was explained to them at the workshop, and that their randomly generated treatment status would only be revealed after they had made the decision. As such, we obtained a 'yes' or 'no' from each participant for whether they would take the fixed-repayment contract if it was offered to them.

After entering participants' responses into tablets, the final treatment status was revealed. Individuals randomised into the control group were informed that they would not be offered the contract, but that they would be eligible for the zero-interest loan of PKR 50,000 from Akhuwat. Individuals who were randomised into T1 were either told that they would not receive the contract (if they pre-committed to reject the fixed-repayment contract) or that they would receive it (if they originally accepted it), and that contract signing and asset procurement would begin in due course. Individuals who were randomised into T2 were notified that there was a new contract that the field officer would explain to them. The new contract was framed as similar to the fixed-repayment contract, but with the added optionality that they would only be required to make a 2.5% ownership payment every month, compared to the required 5% monthly ownership payment for the fixed-repayment contract (which nests the flexible-repayment contract).

All other aspects of the contract were identical.[14] Individuals were then given a one-page document with a simple summary of the structure of the flexible-repayment contract, with diagrams and tables to illustrate the repayment schedule. Participants were informed that they would be visited after a few days to take their decision on whether they would accept the flexible-repayment contract. As such, we used the same explanation, waiting period, visit and decision elicitation procedure as for T1. If individuals decided to reject the flexible contract in their follow-up visit, we reverted back to the decision they initially made when offered the fixed-repayment contract; if they pre-committed to reject it, they were given no contract, but if they had accepted it, they would immediately start with the process of contract signing and asset disbursement under the fixed-repayment contract.

3.3 Data

3.3.1 Summary statistics for microenterprise owners

Table 3.3 presents summary statistics for the 757 microenterprise owners. 92% were male, with an average age of 38 and 7.5 years of formal education. 84% were married, and the average household size was six, of which two people were typically earning some form of income. 67% of participants were themselves the head of the household, with a further 19% as the son or daughter of the household head, and 7% as the husband or wife of the head. In terms of business characteristics, the mean number of businesses in the household was 1.2, with a median of 1. On average, microenterprise owners had 9.6 years of experience in their current business, with a median of 7 years. The mean number of employees was 1.1, with a median of 0. Average monthly business profits were approximately US$ 255 (median $223), and the average value of total fixed assets for the business was $1,141 (median $380). Average monthly household income from all sources was $579 (median $380), and average monthly household expenditure was $216 (median $183). The most popular business sector was rickshaw driving (20%), followed by clothing and footwear production (11%), food and drink sales (10%), and retail trade in the form of fabric and garment sales (7%). As a comparison to two of the most

[14] This design feature is similar to the ex-post waivers implemented by Karlan and Zinman (2009), who use it to distinguish between moral hazard and adverse selection in the context of conventional microcredit interest rates.

prominent studies on microenterprises, average microenterprise profits in De Mel, McKenzie, and Woodruff (2008) were 3,850 Sri Lankan Rupees (approximately $25 at current market rates) and 125 Ghanaian Cedis ($27) in Fafchamps, McKenzie, Quinn, and Woodruff (2014). The average microenterprise owner in our sample is larger in terms of business profits than in these two studies, which is unsurprising given that the target population was growth-oriented microenterprise owners who had successfully completed previous loans and were seeking to expand by purchasing an asset up to the value of $1,800. The seven microcredit field experiments summarised in Banerjee, Karlan, and Zinman (2015) contained a mixture of microenterprise-targeted products and ones with no restrictions. The most relevant comparisons would be Tarozzi, Desai, and K. Johnson (2015), who worked with a microenterprise-targeted loan product in Ethiopia with an approximate value of $500, Karlan and Zinman (2011), who offered approximately $220 to microenterprises in the Philippines, and Angelucci, Karlan, and Zinman (2015), who offered approximately $450 to Mexican microenterprises.

Table 3.3: SUMMARY STATISTICS

	Mean	SD	10th Pctile	Median	90th Pctile	Observations
Gender	0.1	0.3	0.0	0.0	0.0	757
Age	37.9	10.2	25.0	37.0	51.0	757
Education	7.5	3.7	0.0	8.0	12.0	757
Married	0.8	0.4	0.0	1.0	1.0	757
Household size	6.3	2.8	4.0	6.0	9.0	757
Household earners	2.0	1.1	1.0	2.0	4.0	757
Number of businesses	1.2	0.6	1.0	1.0	2.0	757
Business experience	9.6	8.1	2.0	7.0	20.0	757
Number of employees	1.1	3.0	0.0	0.0	3.0	757
Monthly profits	25,525.9	17,896.5	7,666.7	22,333.3	48,333.3	757
Total fixed assets	114,125.8	303,643.3	0.0	38,000.0	245,000.0	757
Household Income	57,864.5	74,724.1	0.0	38,000.0	120,000.0	757
Household Expenditure	21,644.2	16,901.2	9,500.0	18,300.0	35,700.0	757

3.3.2 Randomisation balance

Table 3.4 presents a series of regressions that test for balance across control and treatment groups, for a range of outcomes. Each of the baseline variables was regressed on indicator variables for being assigned to the first or second treatment groups ($T1$ and $T2$ respectively), with the mean for the control group reported at the bottom of the table. We also control for strata fixed effects and use robust standard errors. P-values are reported for a joint test of whether the

coefficients on the two treatment indicators jointly equal zero. Panel (a) reveals that the sample is balanced across both treatment groups and the control group for gender, age, and marital status of microenterprise owners, as well as for household size, the number of earners in the household, and total household income, expenditure, savings and loans. Panel (b) shows that the sample is also balanced in terms of the number of businesses in the household, the years of business experience of the microenterprise owners, the number of employees in the business, business sales, profits, fixed assets, current assets and household assets. Finally, panel (c) reveals that the sample is balanced across the behavioural measures of risk preferences (using the incentivised measure), time preferences, business management practices, trust, mathematical test score and literacy. There is imbalance in the survey-based measure of risk preferences and the educational level of microenterprise owners, as well as in the loss aversion measure (significant at the 10% level), although the coefficient sizes are quite small relative to the mean of the control group. Further, a cross-equation test of joint equality of coefficients across all the specifications fails to reject the null that they are all equal to zero ($p = 0.124$).

3.3.3 Chosen assets

Figure 3.1 illustrates the distribution of chosen assets for the 278 microenterprise owners who were offered one of the treatment contracts and accepted it. In both contracts, microenterprise owners were permitted to purchase up to three assets up to a total value of PKR 200,000 ($1,800). The most popular assets financed were rickshaws (28%), followed by sewing machines (17%), manufacturing or welding machines (14%), other transportation assets (10%), and cameras (9%). The remaining assets comprised other machines for light manufacturing, food production machines, computers, photocopiers and printers. Table 3.17 in the appendix presents results from a series of regressions that investigate the relationship between contract assignment and the value and type of asset chosen by microenterprise owners. The average value of asset financed for those assigned to T1 was PKR 154,850, while those assigned to T2 chose assets with an average value of PKR 161,795 ($p = 0.184$ for a test of the difference). The remaining columns show that across all asset types, there is no significant difference by treatment assignment in the proportion of microenterprise owners who chose that asset.

Table 3.4: BALANCE CHECK

(a) HOUSEHOLD CHARACTERISTICS

	(1) Gender	(2) Age	(3) Married	(4) HH size	(5) HH earners	(6) HH income	(7) HH expend	(8) HH savings	(9) HH loans
T1	-0.00	0.80	0.05*	0.31	-0.02	2964.40	1363.57	4378.91	-719.87
	(0.0)	(0.8)	(0.0)	(0.2)	(0.1)	(4200.7)	(1371.0)	(10254.3)	(1151.7)
T2	0.00	1.41	0.04	0.34*	0.13	5243.57	825.42	13207.66	640.01
	(0.0)	(0.9)	(0.0)	(0.2)	(0.1)	(5162.2)	(1018.0)	(10508.4)	(1224.6)
Control mean	0.06	37.1	0.81	6.1	1.9	54,228	20,608	47,184	5,398
Observations	757	757	757	757	757	757	757	757	757
Test:T1=T2=0 (p-value)	0.741	0.273	0.243	0.200	0.217	0.538	0.516	0.454	0.474

(b) BUSINESS CHARACTERISTICS

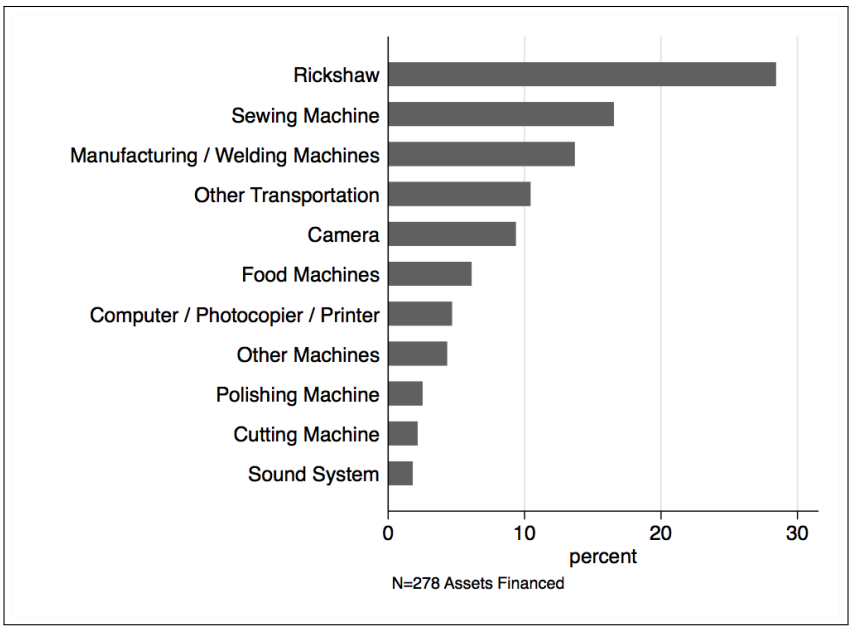
	(1) Biz number	(2) Biz years	(3) Biz employees	(4) Biz sales	(5) Biz profits	(6) Fixed assets	(7) Current assets	(8) HH assets
T1	-0.1	0.5	-0.5*	4794.1	676.7	13042.6	4442.2	-45664.2
	(0.047)	(0.616)	(0.265)	(6421.184)	(700.511)	(28301.298)	(9549.462)	(36434.293)
T2	0.0	0.4	-0.3	-471.6	-91.2	-8001.3	-2821.3	-694.6
	(0.050)	(0.688)	(0.270)	(6160.678)	(648.149)	(20790.408)	(9105.519)	(41458.724)
Control mean	1.2	9.3	1.4	76,845	24,875	110,326	73,307	408,882.2
Observations	757	757	757	757	757	757	757	757
Test:T1=T2=0 (p-value)	0.401	0.680	0.152	0.695	0.484	0.677	0.738	0.332

(c) OTHER VARIABLES

	(1) Risk (incentive)	(2) Risk (survey)	(3) Loss	(4) Time preferences	(5) Management	(6) Trust	(7) Math	(8) Education	(9) Literacy
T1	0.8	1.0	0.5**	-0.0	0.1	0.4	-0.1	-0.5*	-0.1
	(0.738)	(0.610)	(0.215)	(0.407)	(0.507)	(0.225)	(0.205)	(0.290)	(0.109)
T2	0.8	-1.1*	0.1	-0.4	0.1	0.1	0.1	0.2	0.1
	(0.729)	(0.635)	(0.217)	(0.391)	(0.499)	(0.229)	(0.206)	(0.297)	(0.114)
Control mean	21.1	22.4	5.9	4.5	6.4	-0.9	6.2	7.6	2.2
Observations	757	757	757	757	757	757	757	757	757
Test:T1=T2=0 (p-value)	0.462	0.005	0.062	0.580	0.953	0.249	0.755	0.030	0.130

Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10.

Figure 3.1: ASSETS FINANCED



3.4 Results

3.4.1 Identification strategy

Our basic identification strategy involves a linear probability model, in which we regress an indicator variable for whether the individual took an asset (from any contract) upon indicator variables for whether (s)he was assigned to the first or second treatment groups ($T1_i$ and $T2_i$ respectively):

$$y_{is} = \beta_1 \cdot T1_i + \beta_2 \cdot T2_i + \gamma_s + \varepsilon_{is}. \tag{3.1}$$

We also control for randomisation strata fixed effects (γ_s) and use robust standard errors.

3.4.2 Contract take-up

Table 3.8 presents overall take-up results. Of the 254 microenterprise owners who were assigned to the control group, 95% stated that they would take the fixed-repayment contract if they were offered it. This compares to a stated take-up of 92% for the 257 people assigned to T1 and 93% for the 246 individuals who were assigned to T2. A test of joint equality fails to reject the null hypothesis that stated take-up of the fixed-repayment contract is the same across all three treatment groups (p-value of 0.245). Individuals who rejected the contract cited a variety of reasons, the three most popular being: (i) the individual changing their mind, without giving any further details (six people); (ii) the individual securing a job or changing their employment activities (five people); and (iii) a desire for current assets (inventory or cash) rather than a fixed asset (five people). The third row of Table 3.8 shows that 79% of individuals assigned to T2 stated a preference for the flexible-repayment contract over the fixed-repayment contract. As mentioned in Section 3.2.3, individuals who were assigned to T2 were permitted to revert back to their original decision on the fixed-repayment contract, as declining the offer of the flexible-repayment contract did not disqualify them from the obtaining asset financing. As such, we identify a high demand for flexible-repayment contracts among our sample. Of those who rejected the flexible-repayment contract for the fixed-repayment contract, the most popular reason given was that the fixed repayments were easier to understand and manage (35

people).

Table 3.8: RESULTS: TAKE-UP

	NUMBER	FIXED		FLEXIBLE	
		STATED	ACTUAL	STATED	ACTUAL
CONTROL	254	95%	0%	·	·
TREATMENT 1	257	92%	52%	·	·
TREATMENT 2	246	93%	9%	79%	50%
TOTAL	757				

Focusing on final contract outcomes, while 92% of microenterprise owners who were assigned to T1 stated that they would accept the contract, the final percentage who paid the initial 10% required to buy the asset and finalise the contract was only 52%. A similar pattern of actual take-up being lower than stated take-up was observed for individuals who were assigned to T2; 50% took financing under the flexible-repayment contract, compared to stated take-up of 79% (and 9% took financing under the fixed-repayment contract i.e. those who were offered the flexible contract but preferred the fixed contract). In Section 3.4.4 we explicitly account for this difference between stated and actual take-up by conducting a Bayesian analysis of the underlying structure of contract demand, focusing on the type of individuals who do make the initial 10% payment. From a policy perspective, our microfinance partner and other microfinance institutions would be most attracted to the type of individuals who successfully complete the entire contract procedure, so specifically analysing the preference for flexible compared to fixed contracts among these individuals is vital. Nonetheless, overall take-up results reveal a strong demand for flexible-repayment microfinance contracts.

3.4.3 Regression results

Risk aversion

Tables 3.9 and 3.10 present results from analysis of heterogeneous take-up by risk preferences, using the incentivised and survey-based measures of risk aversion respectively (as elicited in the behavioural games described in Section 3.2). In all regressions, the dependent variable is an indicator for whether the microenterprise owner ended up with an asset (from any contract). Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of risk aversion, while columns (4) and (5) display results from the sub-sample with below- and above-median values of risk aversion. T1 and T2 are indicator variables for whether the microenterprise owner was assigned to the fixed-repayment or flexible-repayment group respectively. In the bottom panel of each table, results are presented graphically, with 90% confidence intervals shown around each point estimate. Overall, results provide evidence that the most risk-averse microenterprise owners had higher take-up when offered the flexible contract.

Beginning with Table 3.9, column (1) shows that the average take-up rate for the least risk-averse individuals (most 'risk-tolerant') who were assigned to the flexible-repayment contract (T2) is statistically indistinguishable from take-up for those assigned to the fixed-repayment contract (T1) (both equalling 57%). Column (2), which illustrates results for individuals with an intermediate level of risk aversion, reveals a higher but not statistically different take-up rate for individuals assigned to the flexible contract compared to the fixed contract (57% vs 56%; $p = 0.966$ for a test of the difference). For the most risk-averse individuals (those in the uppermost tercile), column (3) reveals a significantly greater take-up rate for individuals assigned to the flexible contract compared to those assigned to the fixed contract (71% vs 47%; $p = 0.001$). A similar pattern is observed in columns (4) and (5), using a median-split analysis. Individuals with above-median risk aversion had a take-up rate of 65% when assigned to the flexible contract, compared to a take-up rate of 47% for those with above-median risk aversion who were assigned to the fixed contract, with the difference statistically significant at the 1% level ($p = 0.001$). In contrast, for individuals with below-median risk aversion, take-up when assigned to the fixed contract is statistically indistinguishable from take-up when assigned to

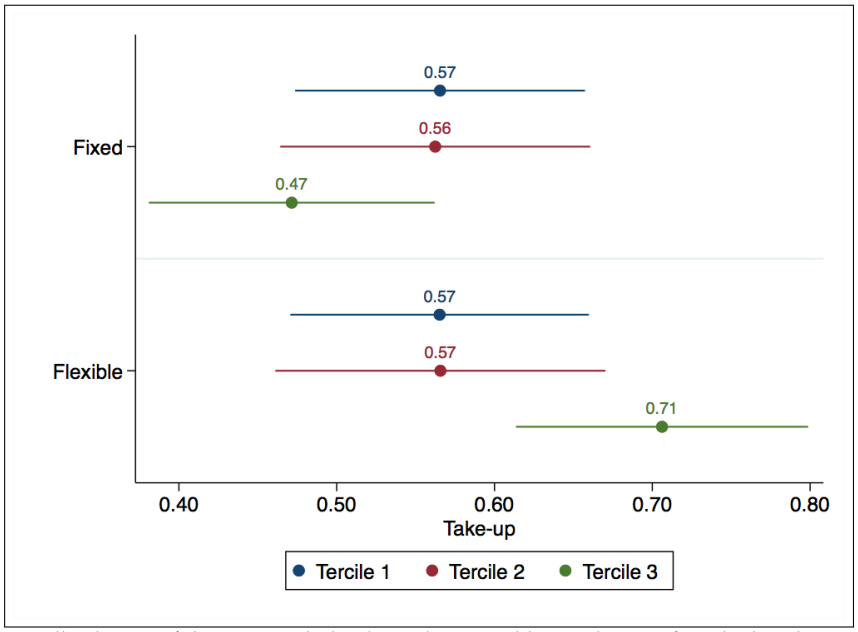
the flexible contract (59% vs 51%; $p = 0.143$). The graph in the bottom panel of Table 3.9 illustrates the striking result that, for individuals assigned to the fixed-repayment contract, average take-up is lower as risk aversion increases; in contrast, for individuals assigned to the flexible-repayment contract, average take-up actually *increases* for the most risk averse. The bottom of the regression table also reports p-values from cross-equation tests of the joint hypothesis that the difference in take-up between individuals assigned to the fixed and flexible contracts is significantly larger *across* the quantiles of risk aversion, using a pooled regression model.[15] Comparing the difference in take-up for individuals assigned to T1 to those assigned to T2, across the highest and lowest terciles of risk aversion, $p = 0.001$, confirming that the contrast in take-up between those assigned to the fixed and flexible contracts is significantly larger for the most risk-averse microenterprise owners compared to the most risk-tolerant ones. The cross-equation test using the median-split confirms the overall result that take-up is higher for the most risk-averse individuals when assigned to the flexible contract ($p = 0.003$).

Table 3.10 provides similar evidence using the survey-based measure of risk aversion, although the results are less statistically significant and not significant in cross-equation tests. Beginning with columns (1) and (2), average take-up for the least risk-averse and those with an intermediate level of risk aversion who were assigned to the flexible contract is statistically indistinguishable from take-up for those assigned to the fixed contract (54% vs 56%, $p = 0.826$; and 53% vs 46%, $p = 0.348$, respectively). As in Table 3.9, the difference is large and statistically significant for the most risk-averse individuals, depicted in column (3). Take-up for the most risk-averse individuals when assigned to the flexible contract is 17 percentage points higher than those assigned to the fixed contract (70% vs 53%), with $p = 0.006$ for a test of the difference. There is no statistically significant difference when using the median-split analysis in columns (4) and (5). Overall, results using the survey-based measure of risk aversion provide some suggestive evidence that the most risk-averse individuals had a higher take-up rate when offered the more flexible contract, broadly consistent with the findings using the incentivised measure.

[15]The pooled regression model for the median-split analysis includes the treatment indicator variables T1 and T2 and their interaction with indicator variables for below- and above-median risk aversion, as well as the non-interacted indicator for above-median risk aversion. Similarly, the model for analysis of the trichotomised measure of risk aversion includes the treatment indicators T1 and T2 and their interaction with indicators for the three terciles of risk aversion, as well as the non-interacted indicators for the second and third terciles of risk aversion.

Table 3.9: HETEROGENEITY ANALYSIS: RISK PREFERENCES (INCENTIVISED)

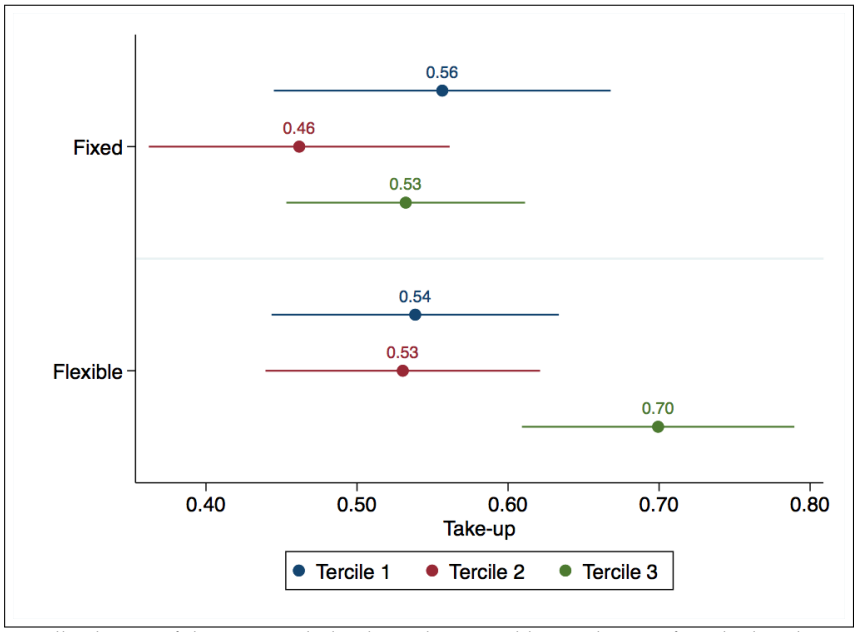
	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.57***	0.56***	0.47***	0.59***	0.47***
	(0.056)	(0.060)	(0.055)	(0.044)	(0.043)
T2	0.57***	0.57***	0.71***	0.51***	0.65***
	(0.058)	(0.064)	(0.056)	(0.045)	(0.044)
Observations	252	232	251	363	372
T2 vs T1	-0	0	23	-8	18
Test: T2 vs T1	0.997	0.966	0.001	0.147	0.001
Test: Tri3 vs Tri1	0.001		0.001		
Test: Tri3 vs Tri2		0.005	0.005		
Test: Tri2 vs Tri1	0.751	0.751			
Test: Med2 vs Med1				0.003	0.003



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Table 3.10: HETEROGENEITY ANALYSIS: RISK PREFERENCES (SURVEY-BASED)

	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.56***	0.46***	0.53***	0.51***	0.53***
	(0.068)	(0.061)	(0.048)	(0.047)	(0.041)
T2	0.54***	0.53***	0.70***	0.56***	0.62***
	(0.058)	(0.055)	(0.055)	(0.044)	(0.045)
Observations	239	255	263	368	389
T2 vs T1	-2	7	17	6	8
Test: T2 vs T1	0.826	0.348	0.006	0.321	0.127
Test: Tri3 vs Tri1	0.231		0.231		
Test: Tri3 vs Tri2		0.467	0.467		
Test: Tri2 vs Tri1	0.619	0.619			
Test: Med2 vs Med1				0.617	0.617



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Loss aversion

Table 3.11 illustrates results from an analysis of heterogeneous demand using the measure of loss aversion elicited in the behavioural games. Column 3 shows that average take-up for the most loss-averse microenterprise owners who were assigned to the flexible contract was 66%, compared to 55% for those who were assigned to the fixed contract, although the difference is not statistically significant ($p = 0.156$). Column 5 reveals that average take-up for individuals with above-median loss aversion who were assigned to the flexible contract was 58%, compared to take-up of 51% for those assigned to the fixed contract, but the difference is not statistically significant ($p = 0.179$).

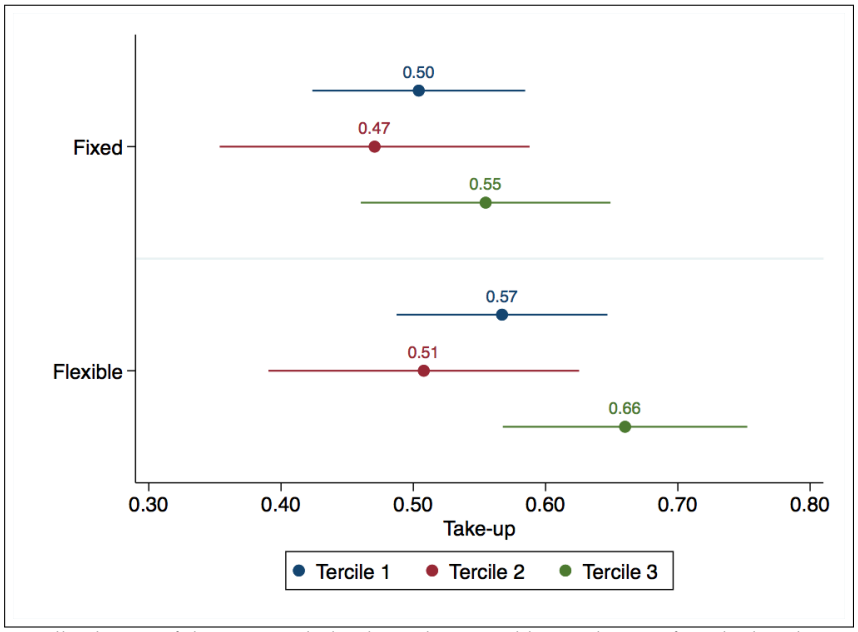
The cross-equation test comparing the difference in take-up when assigned to the flexible contract compared to the fixed contract for individuals with below-median and above-median loss aversion is also statistically insignificant ($p = 0.585$), as it is when comparing take-up for the flexible versus the fixed contract across the second and third tercile of loss aversion ($p = 0.123$) and comparing the third and first terciles ($p = 0.209$). Overall, there appears to be some suggestive pattern of higher take-up for the most loss-averse microenterprise owners who were offered the flexible contract, compared to those offered the fixed contract, but results are not statistically significant.

Cognitive ability, business management practices and trust

Tables 3.18 to 3.22 in the appendix contain results from analysis of heterogeneous demand using the other variables pre-specified in Meki (2018). We do not find evidence of heterogeneous demand by time preferences, but do observe some evidence of greater take-up under the flexible contract for individuals in the middle tercile of both education and mathematical ability, and for those with the highest business management practices index score.

Table 3.11: HETEROGENEITY ANALYSIS: LOSS AVERSION

	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.50***	0.47***	0.55***	0.50***	0.51***
	(0.049)	(0.071)	(0.057)	(0.049)	(0.042)
T2	0.57***	0.51***	0.66***	0.57***	0.58***
	(0.048)	(0.071)	(0.056)	(0.048)	(0.043)
Observations	328	186	238	328	424
T2 vs T1	6	4	11	6	7
Test: T2 vs T1	0.314	0.675	0.156	0.314	0.179
Test: Tri3 vs Tri1	0.209		0.209		
Test: Tri3 vs Tri2		0.123	0.123		
Test: Tri2 vs Tri1	0.673	0.673			
Test: Med2 vs Med1				0.585	0.585



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

The results found on risk aversion suggest a possible mechanism through which flexible shared-ownership microfinance contracts may affect investment behaviour. Specifically, more risk-averse microenterprise owners may increase their investments in higher-risk, higher-return opportunities when provided with the implicit insurance of shared-ownership combined with more flexible repayments, which allow a better alignment with microenterprise performance and reduce the risk of asset loss. While there could be positive welfare effects in stimulating profitable investments for individuals whose behavioural characteristics such as risk aversion ordinarily lead them to relatively under-invest, from a policy perspective MFIs may not wish to provide such financing if those individuals also happen to possess poor business management skills and low cognitive ability. Results from heterogeneity analysis with these variables do not indicate that the microenterprise owners with the lowest business management practices, education or cognitive ability are those for whom more flexible contracts are stimulating the greatest take-up. In fact, as described, there is evidence that take-up under the flexible contract was actually greater for microenterprise owners with the highest business management practices and cognitive ability.

From a policy perspective, it is important to understand what the treatment effect is for microenterprise owners with better management practices, such as record-keeping and a clear separation of business and household finances. Shared-ownership financing, which requires calculation of changing ownership shares and rental amounts, is less viable for individuals with lower cognitive ability, those who do not keep records of their assets, incomes and expenses, or those who frequently combine business and household accounts. If individuals with better management practices and cognitive ability are more likely to select such contracts, as shown in the heterogeneity analysis in the appendix, this provides promising evidence for the viability of such products in the field.

Robustness: Predicting take-up with a simple machine learning algorithm

As a final robustness check, we use a simple machine learning technique to predict take-up based on a large number of potentially informative covariates, including all the previous variables used for heterogeneity analysis, as well as a number of other potentially important business and household characteristics: business profits, business assets (the sum of fixed assets and current assets), household net income (total household income minus total household expenditure), total household assets (the sum of assets, savings and loans), and literacy of the microenterprise owner. We use the Least Absolute Shrinkage and Selection Operator (LASSO) (Belloni, Chernozhukov, and Hansen, 2014). The Post-LASSO estimator (and other high-dimensional model selection methods) can be a useful forecasting tool when there are a large number of potentially informative covariates. The Post-LASSO estimator first applies LASSO to determine which variables can be dropped from the standpoint of prediction, and subsequently estimates coefficients on the remaining variables using ordinary least squares.

Tables 3.12 and 3.13 reveal results from the LASSO analysis. In column (1), all variables that were used for the purposes of heterogeneity analysis in Section 3.4.3 are included in the specification, while column (2) also includes household net income (total household income minus total expenditure), net wealth (value of all assets plus savings minus loans), business profits, and business assets (fixed assets plus current assets). Table 3.12 presents results using a median split analysis, while Table 3.13 displays results from analysis using all variables in their trichotomised form. Coefficient estimates are reported from Post-LASSO estimation using a simple OLS regression on the set of variables selected in the LASSO estimation.

Unsurprisingly, LASSO estimation identifies the two most important variables for predicting the outcome variable of take-up as the two treatment indicator variables, T1 and T2. Results also confirm the main finding in Section 3.4.3 that risk aversion is an important predictor of take-up. Specifically, the LASSO estimator selected the interaction of the incentivised measure of risk aversion and the indicator variable for whether the microenterprise owner was assigned to the flexible-repayment contract, in both Tables 3.12 and 3.13. The result is robust to using

only the behavioural variables in column (1) as well as the inclusion of all other household and business variables in column (2). The strong positive association between take-up and assignment to the flexible contract for the most risk-averse microenterprise owners is robust to using the median-split in Table 3.12 or the tercile analysis in Table 3.13. There is no such relationship for the fixed-repayment contract; the LASSO specification does not retain the interaction between assignment to the fixed-repayment contract and any of the indicator variables for risk aversion. This is true across both the median split analysis and the tercile analysis, and when the analysis is restricted to the behavioural variables as well as when all other variables are included. Apart from this main result, the LASSO estimation also provides some evidence of higher take-up for individuals with the highest education and literacy levels, household wealth, and business size, under both treatment assignments.

As discussed by Mullainathan and Spiess (2017), the purpose of LASSO and other machine learning algorithms is prediction and not parameter estimation, so caution must be exercised not to over-interpret these results. The purpose of this section was to provide an additional robustness check, which confirms the importance of risk aversion when interacted with assignment to the flexible-repayment contract. However, the fact that loss aversion was dropped by the LASSO estimator does not imply that loss aversion is not an important factor; it could simply indicate that risk aversion is more accurately measured than loss aversion in the behavioural games activities, which would not be surprising given that there were many more questions dedicated to measuring risk preferences, added to the fact that there is a strong correlation between the two measures.[16]

[16]The correlation between responses in the incentivised loss aversion activity and the incentivised risk preference elicitation activity is 0.302 in the raw data, and 0.319 for the trichotomised measure (both statistically significant at the 1% level). The two measures of risk aversion are also correlated, but to a lesser extent, with a correlation coefficient of 0.267 for the raw measure and 0.222 for the trichotomised measure (both statistically significant at the 1% level).

Table 3.12: LASSO: MEDIAN SPLIT ANALYSIS

	(1) Take-up	(2) Take-up
T1	0.45***	0.30***
	(0.032)	(0.045)
T2	0.45***	0.36***
	(0.044)	(0.049)
T1 * Education above-median	0.18***	0.15***
	(0.051)	(0.051)
T1 * Biz Assets above-median		0.11**
		(0.052)
T1 * Biz Profits above-median		0.10**
		(0.050)
T1 * HH Wealth above-median		0.13**
		(0.052)
T2 * Risk (incentivised) above-median	0.13**	0.10*
	(0.051)	(0.050)
T2 * Education above-median	0.14***	0.12**
	(0.051)	(0.050)
T2 * HH Wealth above-median		0.22***
		(0.050)
Observations	757	757
R-squared	0.57	0.59

Note: The dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). In column (1), all variables that were used for the purposes of heterogeneity analysis in Section 3.4.3 are included in the specification, while column (2) includes all of the variables for household net income, net wealth, business profits and assets. The LASSO code was taken from Belloni, Chernozhukov, and Hansen (2014), with the following inputs: `lassoShooting Takeup 'variables', lasiter(0)`, where `'variables'` represents all explanatory variables entered into the analysis. Standard errors are from a simple OLS regression using the set of variables identified by the LASSO estimation (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10

Table 3.13: LASSO: TERCILE ANALYSIS

	(1) Take-up	(2) Take-up
T1	0.46***	0.35***
	(0.030)	(0.037)
T2	0.51***	0.38***
	(0.034)	(0.044)
T1 * Education tercile 3	0.19***	0.16***
	(0.053)	(0.053)
T1 * HH Assets tercile 3		0.05
		(0.068)
T1 * Biz Assets tercile 3		0.09
		(0.055)
T1 * Biz Profits tercile 3		0.13**
		(0.053)
T1 * HH Wealth tercile 3		0.08
		(0.066)
T2 * Risk (incentivised) tercile 3	0.10*	0.11**
	(0.054)	(0.053)
T2 * HH Wealth tercile 3		0.14*
		(0.072)
T2 * Math score tercile 2	0.14**	0.12**
	(0.057)	(0.056)
T2 * Household Assets tercile 3		0.11
		(0.072)
T2 * Literacy tercile 3		0.08
		(0.052)
Observations	757	757
R-squared	0.57	0.59

Note: The dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). In column (1), all variables that were used for the purposes of heterogeneity analysis in Section 3.4.3 are included in the specification, while column (2) includes all of the variables for household net income, net wealth, business profits and assets. The LASSO code was taken from Belloni, Chernozhukov, and Hansen (2014), with the following inputs: `lassoShooting Takeup 'variables', lasiter(0),` where `'variables'` represents all explanatory variables entered into the analysis. Standard errors are from a simple OLS regression using the set of variables identified by the LASSO estimation (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10

3.4.4 Bayesian analysis of contract demand

Our regression analysis has revealed high average take-up rates, and tested how those take-up rates vary by baseline covariates. In this section, we explore what these take-up rates imply about the underlying structure of contract demand. We do this using a Bayesian approach, which allows back-and-forth movement between underlying demand and revealed preferences. Table 3.14 defines the seven different demand behaviours that can be identified through this exercise; the goal, in each case, is to estimate the proportion of the underlying population belonging to each behaviour type. In Table 3.15, we show how these different demand types imply the different probabilities of our observed behaviour.[17] It is straightforward to recover estimates of the demand parameters from the observed behaviour, using Maximum Likelihood and conducting inference using a standard MCMC algorithm.[18]

Table 3.14: CONTRACT DEMAND: MAXIMUM LIKELIHOOD ESTIMATES

VARIABLE	DEFINITION
	Proportion of the population...
p_{0xxx}	...who prefer no contract to either T1 or T2
p_{1xx0}	...whose first preference is for T1, but who will not provide the deposit
p_{1xx1}	...whose first preference is for T1, and who will provide the deposit
p_{2010}	...who prefer T2 to no contract, and no contract to T1 — but will not provide the deposit
p_{2011}	...who prefer T2 to no contract, and no contract to T1 — and who will provide the deposit
p_{2100}	...who prefer T2 to T1, and T1 to no contract — but will not provide the deposit
p_{2101}	...who prefer T2 to T1, and T1 to no contract — and who will provide the deposit

In Table 3.16, we report our Maximum Likelihood estimates; that is, we show our estimates of the proportion of the population falling into each of our seven defined types. We find a very high proportion (48.7%) who prefer the flexible contract to the fixed contract, and prefer the fixed contract to no contract, and who are willing and able to provide the deposit. The second

[17] Note that the seven proportions in Table 3.14 could be recovered directly from the proportions reported in Table 3.15 by simple algebraic manipulation. Note further that there would be three separate means of obtaining p_{1xx0}, given that all three treatments involve a preliminary question about willingness to accept the fixed contract. This implies that the system is over-identified; we test this over-identifying restriction as a check for whether the randomisation was balanced on the underlying demand behaviour. This test passes comfortably: see Table 3.16.

[18] Specifically, we use a Metropolis algorithm. We use six chains, each of 20,000 replications (dropping the first 10,000 replications in each case as a burn-in). We use the Potential Scale Reduction Factor of Gelman and Rubin (1992), and verify that our chains converged.

most common group (with 28.8%) hold the same preference ordering, but are not willing or able to provide the deposit. In the bottom row of the table, we test our model against a fully saturated alternative (in effect, we test whether the randomisation was balanced by unobservable product demand); this test passes comfortably.

Table 3.15: CONTRACT DEMAND: RELATIONSHIP BETWEEN DEMAND TYPES AND OBSERVED CHOICES

OBSERVED BEHAVIOUR			PROBABILITY	NUMBER
T1 OR NOTHING?	SWITCH TO T2?	PAY 10%?	OBSERVED	OBSERVED
Control group:				
nothing	·	·	$p_{1xx0} + p_{1xx1} + p_{2100} + p_{2101}$	12
fixed	·	·	$1 - p_{1xx0} + p_{1xx1} + p_{2100} + p_{2101}$	242
Treatment 1 group:				
nothing	·	·	$1 - p_{1xx0} + p_{1xx1} + p_{2100} + p_{2101}$	20
T1	·	no	$p_{1xx0} + p_{2100}$	103
T1	·	yes	$p_{1xx1} + p_{2101}$	134
Treatment 2 group:				
nothing	no	·	p_{0xxx}	12
nothing	yes	no	p_{2010}	4
nothing	yes	yes	p_{2011}	1
T1	no	no	p_{1xx0}	18
T1	no	yes	p_{1xx1}	22
T1	yes	no	p_{2100}	68
T1	yes	yes	p_{2101}	121

Table 3.16: CONTRACT DEMAND: ESTIMATES

PARAMETER	ESTIMATE	90% CONFIDENCE INTERVAL
p_{0xxx}	0.047	(0.032, 0.065)
p_{1xx0}	0.075	(0.050, 0.105)
p_{1xx1}	0.083	(0.055, 0.112)
p_{2010}	0.016	(0.005, 0.028)
p_{2011}	0.004	(0.000, 0.011)
p_{2100}	0.288	(0.250, 0.328)
p_{2101}	0.487	(0.446, 0.531)
Log-likelihood:	-585.2346	
H_0: Balance by type (p-value):	0.176	

These results can be used to obtain a rich characterisation of product demand. For example, one object of particular importance is the proportion of potential clients, those who are willing

and able to accept at least one of the two contracts, who prefer the flexible contract. This is given by the ratio:

$$\frac{p_{2011} + p_{2101}}{p_{1xx1} + p_{2011} + p_{2101}}.$$

We obtain a point estimate for this value of 86%; using the posterior distribution generated by our MCMC algorithm, our 90% confidence interval is $(81\%, 90\%)$. Similarly, a second important object of interest is the proportion of potential clients who would drop out if the flexible contract were not offered. This is given by the ratio:

$$\frac{p_{2011}}{p_{1xx1} + p_{2011} + p_{2101}}.$$

Our point estimate for this proportion is just 1%; the 90% confidence interval is $(0\%, 2\%)$. That is, we estimate that a high proportion of potential clients prefers the flexible contract to the fixed contract, but that a high proportion also prefers the fixed contract to a traditional microcredit arrangement (the zero-interest loan, up to a maximum of PKR 50,000).

This analysis is subsequently extended to explore heterogeneity by risk aversion; we do this by a median split. We find that, of the less risk-averse clients, 78% prefer the flexible contract over the fixed (with a 90% confidence interval of $(69\%, 87\%)$), and 1% would drop out if the flexible contract were not offered (90% confidence interval: $(0\%, 3\%)$). Of the more risk-averse clients, 91% prefer the flexible contract to the fixed contract (90% confidence interval: $(84\%, 95\%)$), and 0% would drop out if the flexible contact were not offered. Both of these differences are statistically significant between above-median and below-median groups. In sum, our Bayesian analysis extends our regression analysis by allowing a disaggregation of underlying demand types. The analysis confirms a high demand for both product types, with a high comparative demand for the flexible repayment contract; this pattern is particularly strong among more risk-averse clients.

3.5 Conclusions

In this paper, we conduct a field experiment to offer a relatively large amount of financing to growth-oriented microenterprise owners, using a shared-ownership contract. We focus on shared equity in a single asset, as a proof of concept for shared equity more generally, and to investigate demand for such products. We find high take-up rates for our shared-ownership product in general, and a strong preference for a more flexible repayment schedule among microenterprise owners. Analysis of heterogenous demand provides some evidence that the preference for flexible contracts is particularly strong among the most risk-averse microenterprise owners. This result is striking when compared to the existing literature that reports a higher take-up of flexible microfinance contracts among the *least* risk-averse, which we suggest is due to the shared-ownership structure of our contracts and the implicit insurance inherent in them that incentivises greater investment among the most risk-averse.

While a substantial demand for flexibility is observed, we do not find evidence of a large number of unbanked microenterprise owners who would only take financing through flexible contracts. In the case of no flexible contracts being offered, we find that most microenterprise owners would still take the fixed-repayment contract, and most of those who reject the fixed-repayment contract are not persuaded to take up even if it is offered in the form of a flexible contract. Overall, results provide promising evidence for the potential of shared-ownership microfinance contracts to help stimulate investment among growth-oriented microenterprise owners. Such contracts allow microfinance institutions to finance relatively large amounts in a more secure manner.

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Appendices of Chapter 3

3.A Appendix

3.A.1 Asset analysis

Table 3.17: ANALYSIS OF FINANCED ASSETS

	(1) AssetValue	(2) Camera	(3) ComputPhotPrint	(4) CuttingMach	(5) FoodMach	(6) ManufWeld
T2	6945.229	0.048	-0.006	0.007	0.032	-0.002
	(5227.421)	(0.031)	(0.028)	(0.007)	(0.029)	(0.040)
Observations	278	278	278	278	278	278
T1 mean	154,850	0.060	0.052	0.007	0.060	0.142

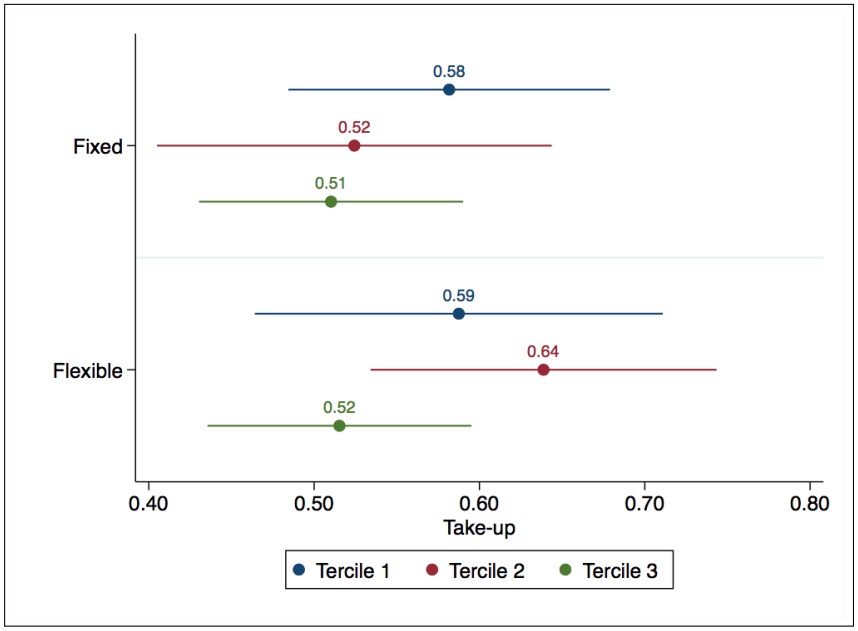
	(1) OtherMach	(2) OtherTransp	(3) PolishMach	(4) Rickshaw	(5) Sewing	(6) Sound
T2	-0.032	-0.042	-0.026	0.001	0.024	-0.005
	(0.022)	(0.031)	(0.018)	(0.036)	(0.041)	(0.013)
Observations	278	278	278	278	278	278
T1 mean	0.052	0.119	0.030	0.276	0.179	0.022

In column (1) of the top panel, the dependent variable is the value of the asset chosen by the microenterprise owner. In all other columns, the dependent variable is a binary indicator for the type of asset purchased. In all specifications, the dependent variable is regressed on an indicator for assignment to T2. Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10.

3.A.2 Additional heterogeneity tests

Table 3.18: HETEROGENEITY ANALYSIS: TIME PREFERENCES

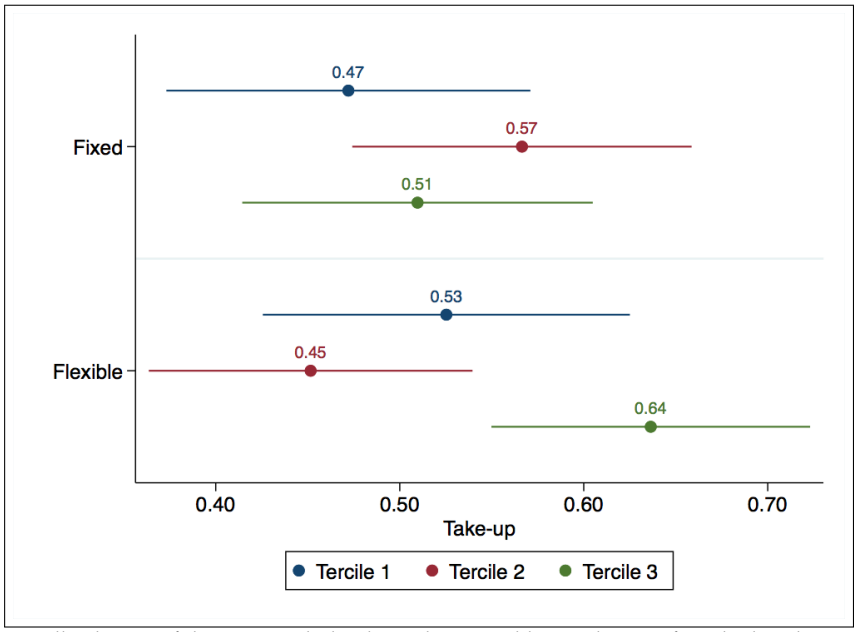
	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.58***	0.52***	0.51***	0.51***	0.52***
	(0.059)	(0.073)	(0.049)	(0.045)	(0.047)
T2	0.59***	0.64***	0.52***	0.58***	0.52***
	(0.075)	(0.064)	(0.049)	(0.046)	(0.046)
Observations	225	184	344	384	369
T2 vs T1	1	11	1	7	0
Test: T2 vs T1	0.946	0.180	0.931	0.217	0.977
Test: Tri3 vs Tri1	0.409		0.409		
Test: Tri3 vs Tri2		0.872	0.872		
Test: Tri2 vs Tri1	0.565	0.565			
Test: Med2 vs Med1				0.315	0.315



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Table 3.19: HETEROGENEITY ANALYSIS: BUSINESS MANAGEMENT PRACTICES

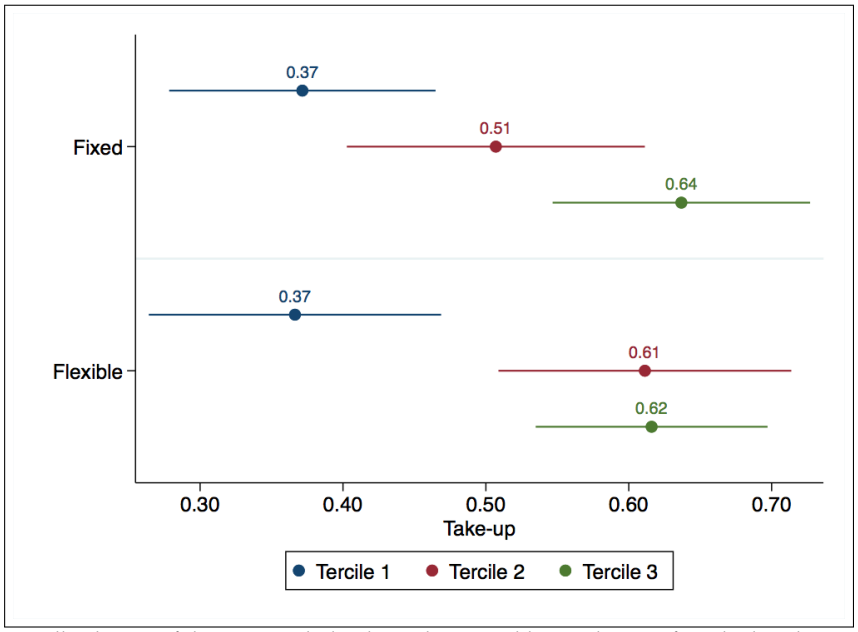
	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.47***	0.57***	0.51***	0.48***	0.54***
	(0.060)	(0.056)	(0.058)	(0.045)	(0.045)
T2	0.53***	0.45***	0.64***	0.50***	0.64***
	(0.061)	(0.053)	(0.053)	(0.045)	(0.043)
Observations	232	266	259	377	380
T2 vs T1	5	-11	13	2	10
Test: T2 vs T1	0.474	0.079	0.068	0.671	0.062
Test: Tri3 vs Tri1	0.952		0.952		
Test: Tri3 vs Tri2		0.074	0.074		
Test: Tri2 vs Tri1	0.098	0.098			
Test: Med2 vs Med1				0.289	0.289



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Table 3.20: HETEROGENEITY ANALYSIS: EDUCATION

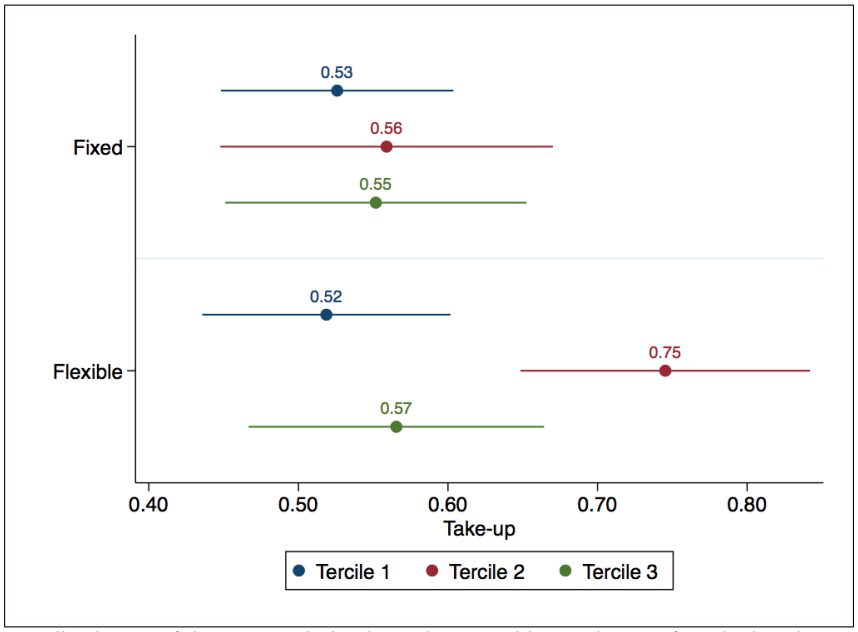
	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.37***	0.51***	0.64***	0.46***	0.62***
	(0.057)	(0.063)	(0.055)	(0.040)	(0.049)
T2	0.37***	0.61***	0.62***	0.49***	0.64***
	(0.062)	(0.062)	(0.049)	(0.045)	(0.045)
Observations	255	219	283	426	331
T2 vs T1	-1	10	-2	3	2
Test: T2 vs T1	0.940	0.219	0.748	0.524	0.731
Test: Tri3 vs Tri1	0.442		0.442		
Test: Tri3 vs Tri2		0.080	0.080		
Test: Tri2 vs Tri1	0.314	0.314			
Test: Med2 vs Med1				0.779	0.779



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Table 3.21: HETEROGENEITY ANALYSIS: MATHS SCORES

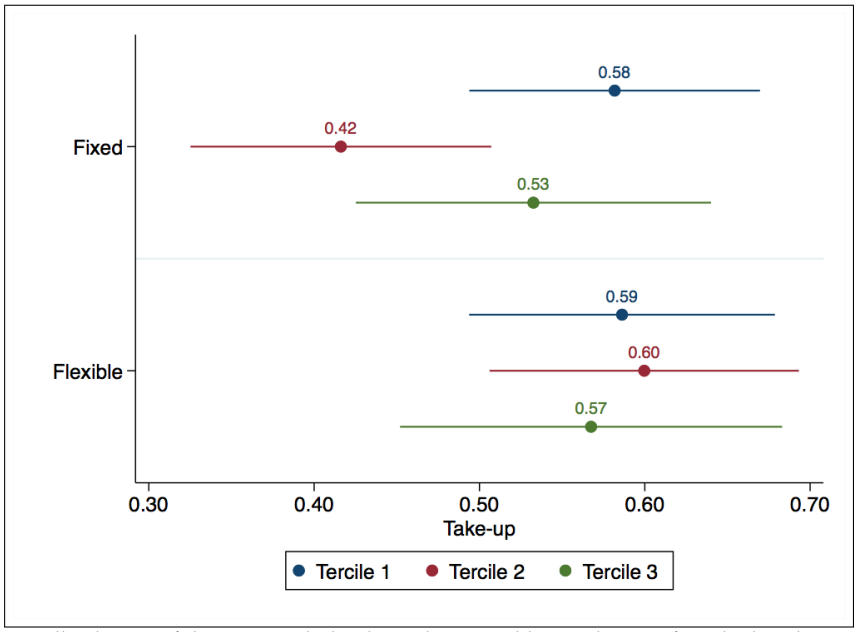
	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.53***	0.56***	0.55***	0.51***	0.56***
	(0.047)	(0.068)	(0.061)	(0.038)	(0.048)
T2	0.52***	0.75***	0.57***	0.53***	0.66***
	(0.050)	(0.059)	(0.060)	(0.042)	(0.049)
Observations	322	209	226	440	317
R-squared	-0.04	-0.07	-0.21	0.05	0.02
T2 vs T1	-1	19	1	2	10
Test: T2 vs T1	0.904	0.017	0.855	0.730	0.115
Test: Tri3 vs Tri1	0.286		0.286		
Test: Tri3 vs Tri2		0.499	0.499		
Test: Tri2 vs Tri1	0.073	0.073			
Test: Med2 vs Med1				0.149	0.149



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

Table 3.22: HETEROGENEITY ANALYSIS: TRUST

	(1) Tercile1	(2) Tercile2	(3) Tercile3	(4) Median1	(5) Median2
T1	0.56***	0.46***	0.53***	0.51***	0.53***
	(0.068)	(0.061)	(0.048)	(0.047)	(0.041)
T2	0.54***	0.53***	0.70***	0.56***	0.62***
	(0.058)	(0.055)	(0.055)	(0.044)	(0.045)
Observations	239	255	263	368	389
T2 vs T1	-2	7	17	6	8
Test: T2 vs T1	0.826	0.348	0.006	0.321	0.127
Test: Tri3 vs Tri1	0.231		0.231		
Test: Tri3 vs Tri2		0.467	0.467		
Test: Tri2 vs Tri1	0.619	0.619			
Test: Med2 vs Med1				0.617	0.617



In all columns of the top panel, the dependent variable is a dummy for whether the microenterprise owner ended up with an asset (from any contract). Randomisation strata fixed effects are controlled for, and standard errors are clustered at the individual level (p-values are reported in parentheses below each coefficient estimate). *** p<0.001, ** p<0.05, * p<0.10. Cross-equation tests are from a pooled model that includes both T1 and T2 interacted with dummies for terciles and above/below median values of the heterogeneity variable, as well as the non-interacted values of the heterogeneity variable, controlling for randomisation strata fixed effects and using robust standard errors. In the bottom panel, 90% confidence intervals are displayed around each point estimate.

3.A.3 Contract explanation script

Introduction

تعارف

In this meeting, we are going to describe a type of contract that Akhuwat would like to offer to some of its selected clients, like you. This contract is designed to help entrepreneurs like you purchase an asset for their business. If you are offered this contract, you are allowed to use the money to buy a large asset for your business, *such as* a sewing machine if you make clothes, or *for example* a rickshaw if you are a rickshaw driver, or *for example* a welding plant if you do welding, or *for example* a molding machine if that is your business. You are not allowed to use it to purchase raw materials or inventories or stock that you then sell to people: for example, if you were a tailor, then you would not be allowed to use the money to buy thread or clothes. The benefit of this new contract is that it allows you to access finance for a larger amount than is currently available from Akhuwat,

اس ملاقات میں ہم آپ کو ایک نئے معاہدے کی تفصیل بیان کرنے جا رہے ہیں جو اخوت آپ جیسے منتخب گاہکوں کو پیش کرنا چاہ رہی ہے۔ اس معاہدے کو یہ سوچ کر ترتیب دیا گیا ہے تا کہ آپ جیسے کاروباری حضرات کی اپنے کاروبار کے لئے ایک اثاثہ خریدنے میں مدد کی جا سکے۔ اگر آپ کو یہ معاہدہ پیش کیا گیا تو آپ کو اس بات کی اجازت ہو گی کہ آپ اس رقم سے اپنے کاروبار کے لئے ایک مستقل اثاثہ خرید لیں۔ مثلاً کپڑے سینے والوں کے لئے سلائی مشین، رکشہ چلانے والوں کے لئے رکشہ، ویلڈنگ کرنے والوں کے لئے ویلڈنگ پلانٹ یا مولڈنگ کا کاروبار کرنے والوں کے لئے مولڈنگ مشین۔ آپ اس رقم سے خام مال نہیں خرید سکتے، اور نہ ہی گاہکوں کو بیچنے کے لئے کوئی سامان لے کر رکھ سکتے ہیں۔ مثال کے طور پر اگر آپ ایک درزی ہیں تو آپ اس رقم سے دھاگہ یا کپڑے نہیں خرید سکتے۔ ان نئے معاہدوں کا فائدہ یہ ہے کہ ان کے ذریعے آپ اخوت سے ایک بڑی رقم لے سکتے ہیں، جب کہ اخوت کے باقی قرضوں میں دی جانی والی رقم کم ہوتی ہے۔

The purpose of this meeting is to describe the contract to you. We would like you to understand how the contract works. We will describe the contract and then we will ask you questions to see if you have understood the contract. Please do not tell us now in this meeting about if you are interested in the contract or not. After the meeting, on another day, an Akhuwat member of staff will visit you to ask if you would be interested in this contract. The purpose of the group meeting is just to explain the contract and check that you have understood how it works. Please feel free to ask us as many questions as you want about the contract. It is very important that you understand how this contracts works: what payments you have to make and what happens if you do not make the payments.

اس ملاقات کا مقصد ہے کہ ہم یہ معاہدہ آپ کو بیان کر سکیں۔ ہم چاہتے ہیں کہ آپ اس معاہدے کو بخوبی سمجھ جائیں۔ ہم یہ معاہدہ بیان کریں گے اور آپ سے سوال پوچھ کر یہ اندازہ لگائیں گے کہ آیا آپ کو معاہدے کی سمجھ آئی ہے کہ نہیں۔ برائے مہربانی اس ملاقات میں ابھی ہمیں یہ نہ بتائیں کہ

آپ معاہدے میں دلچسپی رکھتے ہیں یا نہیں۔ اس ملاقات کے بعد، کسی اور دن، اخوت کے عملے سے کوئی آپ کے گھر آپ سے پوچھنے آئے گا کے آپ اس معاہدے میں دلچسپی رکھتے ہیں یا نہیں۔ یہ اجتماعی ملاقات صرف اس لیے کی جارہی ہے تاکہ آپ کو اس معاہدے کے بارے میں تفصیلی طور پر بتایا جاسکے اور ہمیں اس بات کا یقین ہو جائے کہ آپ کو اس معاہدے کے قوانین سمجھ آچکے ہیں۔ آپ اس معاہدے کے بارے میں ہم سے جتنے مرضی سوال چاہے پوچھ سکتے ہیں۔ یہ بہت اہم ہے کہ آپ مکمل طور پر سمجھ جائیں کہ یہ معاہدہ کس طرح کام کرتا ہے، آپ کو اپنے قرض کی ادائیگی کس طرح کرنی پڑے گی اور ادائیگی نا کرنے کی صورت میں کیا ہو گا۔

Does anybody have any question

کیا آپ میں سے کوئی سوال پوچھنا چاہتا ہے؟

Ali the Tailor

علی-ایک درزی

We will explain how the contract works using the hypothetical story of a business person called Ali. Ali lives and works in Township, Lahore. Ali owns and manages a small tailor business, where he stitches clothes by hand. Ali's business is successful, but he would like to expand his business. Ali thinks that if he buys a sewing machine, his profits will increase a lot. Ali has a small amount of savings, 10,000 Rs, but it is not enough to buy a sewing machine, which costs 100,000 Rs.

ہم یہ معاہدے سمجھانے کے لئے علی نامی ایک کاروباری شخص کی مثال استعمال کریں گے۔ علی لاہور کے علاقے ٹاون شپ میں رہتا اور کاروبار کرتا ہے۔ وہ ہاتھ سے کپڑے سی کر ایک درزی کا کاروبار کرتا ہے۔ اگرچہ علی کا کاروبار اچھا ہے وہ اسے مزید بڑھانا چاہتا ہے۔ علی کا خیال ہے کہ سلائی مشین خریدنے سے اس کے منافع میں بہت اضافہ ہو گا۔ سلائی مشین کی قیمت 100,000 روپیہ ہے مگر علی کے پاس صرف 10,000 روپے ہیں جو سلائی مشین کی خیداری کے لئے کافی نہیں ہیں۔

Akhuwat can help Ali. Ali has 10,000 Rs of savings. The sewing machine costs 100,000 Rs. If Akhuwat contributes 90,000 Rs, then Akhuwat and Ali can buy the asset together. Akhuwat and Ali will then own the asset together. This type of partnership, or joint ownership, is called "shirakat." Akhuwat will own 90% of the sewing machine, and Ali will own 10% of the sewing machine.

اخوت علی کی مدد کر سکتی ہے۔ علی کے پاس 10,000 روپے ہیں سلائی مشین کی قیمت 100,000 روپیہ ہے اگر اخوت 90,000 ملائے، تو علی اور اخوت مل کر سلائی مشین خرید سکتے ہیں۔ اخوت اور علی دونوں اس سلائی مشین کے مالک بن جائیں گے۔ ایسی مشترکہ ملکیت کو "شراکت" کہا جاتا ہے۔ اخوت کے پاس سلائی مشین کی 90 فیصد ملکیت ہو گی اور علی کے پاس 10 فیصد۔

But Akhuwat does not need to use the sewing machine. Ali does need to use the sewing machine, for his business. So Akhuwat and Ali make an agreement. Ali will use the sewing machine for his business, and he will pay rent to Akhuwat every month because he is the only one who will benefit from using it. So Ali will pay Akhuwat rent, or "kirayah." Ali will also be responsible for all daily repairs of the asset, because he is the one that is using it, but if there is a natural disaster then Akhuwat will share in the risk of this with Ali.

لیکن اخوت کو سلائی مشین کی ضرورت نہیں ہے۔ صرف علی کو اپنے کاروبار کے لئے سلائی مشین کی ضرورت ہے۔ تو اس لئے اخوت اور علی آپس میں ایک معاہدہ کرتے ہیں جس کے تحت سلائی مشین کو صرف علی اپنے کاروبار کے لئے استعمال کرے گا اور علی ہر ماہ اس کا کرایہ اخوت کو ادا کرے گا۔ سلائی مشین کی دیکھ بھال کی ساری ذمہ داری علی پر ہو گی، اور وہی مشین کی روزمرہ مرمت پر آنے والے اخراجات کو اکیلا ادا کرے گا۔ لیکن کسی قدرتی آفت کے دوران آنے والے نقصان کو علی اور اخوت مل کر برداشت کریں گے۔

ENUMERATOR: PLEASE BE VERY CAREFUL IN EXPLAINING THE NUMBERS NOW:

The amount of rent that Ali will pay to Akhuwat is based on the percentage of the asset that Akhuwat owns. Imagine that Akhuwat and Ali agree on a rental rate of 1% per month for the sewing machine." 1% of 100,000 Rs is 1,000 Rs. Because Akhuwat owns 90% of the sewing machine, Akhuwat is entitled to 90% of 1,000 Rs, which is 900 Rs. So Ali must pay Akhuwat rent of 900 Rs at the end of the first month.

علی اخوت کو اتنا ہی کرایہ ادا کرے گا جتنی اخوت کی سلائی مشین میں ملکیت ہے۔

۔ فرض کریں کہ اخوت اور علی اس بات پر رضامند ہیں کہ سلائی مشین کا ایک مہینے کا کرایہ ایک فیصد ہے – ایک لاکھ کا 1 فیصد 1000 روپیہ ہے۔ کیونکہ اخوت کے پاس سلائی مشین کی 90 فیصد ملکیت ہے، اخوت کو 1 ہزار روپے کا 90 فیصد کرایہ ملنا چاہیے جو کہ 900 روپیہ ہے۔ چنانچہ علی پہلے مہینے کے آخر میں اخوت کو 900 روپے کا کرایہ ادا کرے گا۔

ENUMERATOR: Illustrate all of this.

Does everybody understand? Does anybody have any questions?

کیاسب کو سمجھ آگئی ہے؟کیاکسی نے کوئی سوال پوچھناہے؟

Reduction of Akhuwat's Ownership Share
اخوت کی ملکیت میں کمی

As mentioned, Akhuwat owns 90% of the sewing machine, and Ali owns 10%. However, this ownership share can change. Ali can purchase some of Akhuwat's ownership share. If Ali gives Akhuwat 5,000 Rs, then he can purchase 5% of Akhuwat's ownership share in the sewing machine. This would increase Ali's ownership share of the asset by 5%, and decrease Akhuwat's share by 5%. Ali's ownership share would increase from 10% before to 15% now, and Akhuwat's ownership share would decrease from 90% before to 85% now.

جیسا کہ ہم پہلے ذکر کیا ہے کہ اخوت کے پاس سلائی مشین کی 90 فیصد ملکیت ہے اور علی کے پاس 10 فیصد۔ تاہم دونوں کی ملکیت کے حصے بدل سکتے ہیں۔ علی اخوت کی ملکیت کا کچھ حصہ خرید سکتا ہے۔ اگر علی اخوت کو 5000 روپے دے تو وہ سلائی مشین میں اخوت کی ملکیت کا 5 فیصد حصہ خرید سکتا ہے۔ اس خریداری سے سلائی مشین میں علی کی ملکیت کا 10 فیصد سے بڑھ کر 15 فیصد ہو جائے گا اور اخوت کی ملکیت کا حصہ 90 فیصد سے گھٹ کر 85 فیصد رہ جائے گا۔

The benefit of this to Ali is that he now pays less rent. Before, when his ownership share of the sewing machine was only 10%, and Akhuwat's ownership share was 90%, Ali had to pay rent on Akhuwat's share of 900 Rs per month. But after he repurchased 5% from Akhuwat's share, Ali now owns 15% of the asset, and Akhuwat owns 85%, so the rent he pays will decrease to 850 Rs per month.

علی کو اس سے یہ فائدہ ہو گا کہ اسے کم کرایہ ادا کرنا پڑے گا۔ پہلے جب علی کے پاس سلائی مشین کی ملکیت میں صرف 10 فیصد حصہ تھا اور اخوت کے پاس 90 فیصد تو علی کو ہر ماہ اخوت کے حصے پر 900 روپے کا کرایہ ادا کرنا پڑتا تھا۔ مگر بعد میں علی نے جب اخوت کے حصے میں سے 5 فیصد حصہ مزید خرید لیا تو علی کے پاس اب 15 فیصد حصہ ملکیت میں آگیا اور اخوت کا حصہ 85 فیصد رہ گیا ہے۔ اس لیے علی کو اب ہر ماہ 850 روپیہ ادا کرنا پڑے گا۔

Does everybody understand? Does anybody have any questions?

کیاسب کو سمجھ آگئی ہے؟کیا کسی نے کوئی سوال پوچھنا ہے؟

We have now explained the basic idea about this new contract that Akhuwat is interested in offering to some of its selected clients, using the example of Ali. The main ideas that we discussed were:

1) Joint-ownership of the sewing machine between Akhuwat and Ali, or 'shiraakat'
2) A payment of rent or "kirayah" from Ali to Akhuwat, because Ali is using the asset and Akhuwat owns some of the sewing machine.
3) A reduction in the amount of rent that Ali has to pay when he repurchases some of Akhuwat's ownership share in the sewing machine.

اب ہم نے اس نئے معاہدہ کے بنیادی تصور کو تفصیل سے بیان کر دیا ہے جو کہ اخوّت اپنے منتخب گاہکوں کو پیش کرنے میں دلچسپی رکھتی ہے۔اب میں معاہدے کی اہم شرائط دہراؤں گا/گی۔

1. اخوّت اور علی کے درمیان سلائی مشین کی مشترکہ ملکیت یا "شراکت"۔
2. علی کی طرف سے اخوّت کو کرایہ کی ادائیگی اس لیے کہ علی اس کو استعمال کر رہا ہے اور اخوّت سلائی مشین کے کچھ حصے کی ملکیت رکھتی ہے۔
3. کرایہ کی رقم جو علی اخوّت کو دیتا ہے، میں کمی، کیونکہ علی اخوّت سے اخوّت کی ملکیت کا کچھ حصہ خرید لیتا ہے۔

We will now describe the contract that Akhuwat is interested in offering to some of its clients, using the same ideas as the example with Ali. Please do not tell us now in this meeting about if you are interested in the contract or not. After the meeting, on another day, an Akhuwat member of staff will visit you to ask if you would be interested in this contract.

اب ہم علی کی مثال کو ہی استعمال کرتے ہوئے ایک معاہدے کے بارے میں بیان کریں گے جو اخوّت اپنے گاہکوں کو پیشکش کرنے میں دلچسپی رکھتی ہے۔برائے مہربانی اس ملاقات میں ابھی ہمیں یہ نہ بتائیں کہ آپ معاہدے میں دلچسپی رکھتے ہیں یا نہیں۔اس ملاقات کے بعد، کسی اور دن، اخوت کے عملے میں سے کوئی آپ کے گھر آپ سے پوچھنے آئے گا کے آپ اس معاہدے میں دلچسپی رکھتے ہیں یا نہیں ۔

Describing the Contract: The Fixed-Repayment Contract

معاہدے کی وضاحت۔مقررہ قسطوں والا معاہدہ

The contract is a “fixed-repayment” contract. We will again illustrate it with the example of Ali the tailor and the sewing machine.

یہ معاہدہ "مقرر شدہ قسطوں" والا معاہدہ ہے۔ ہم دوبارہ علی اور سلائی مشین والی مثال کے ذریعے اس معاہدے کی وضاحت کریں گے۔

In this fixed-repayment contract, Ali and Akhuwat make an agreement for 18 months. The agreement says that, every month, Ali has to buy back 5% of Akhuwat’s ownership share in the sewing machine. That means that Ali has to pay 5,000 Rs to Akhuwat every month, for 18 months. Every time Ali pays 5,000 to Akhuwat, his ownership share of the sewing machine increases by 5%, and Akhuwat’s ownership share decreases by 5%. We can see what this looks like using a table:

پہلے مقررہ قسطوں کی ادائیگی والے معاہدے میں علی اور اخوّت مل کر آپس میں 18 مہینے کا معاہدہ کرتے ہیں۔ اس معاہدے کے مطابق ہر مہینے علی کو اخوّت سے اخوّت کی ملکیت کا 5 فیصد حصہ خریدنا ہو گا۔ اس کا مطلب یہ ہے کہ علی کو اخوّت کو 18 مہینے تک ہر مہینے 5000 روپے ادا کرنا ہوں گے۔ ہر مرتبہ جب علی اخوّت کو یہ 5000 روپے ادا کرتا ہے تو سلائی مشین میں علی کا حصہ 5 فیصد بڑھ جاتا ہے اور اخوّت کا سلائی مشین میں حصہ 5 فیصد ہی سے کم ہو جاتا ہے۔

ہم یہ Table استعمال کرتے ہوئے اس بات کا مشاہدہ کر سکتے ہیں:

Fixed Payment Contract

Start of Month	Akhuwat	Ali
1	90%	10%
2	85%	15%
3	80%	20%
4	75%	25%
5	70%	30%
6	65%	35%

7	60%	40%
8	55%	45%
9	50%	50%
10	45%	55%
11	40%	60%
12	35%	65%
13	30%	70%
14	25%	75%
15	20%	80%
16	15%	85%
17	10%	90%
18	5%	95%
End	0%	0%

ENUMERATOR: Describe, slowly, how Akhuwat's ownership share decreases by 5% every month.

So this "fixed-repayment" agreement between Ali and Akuwat means that Ali must pay 5,000 every month to Akhuwat to purchase Akhuwat's ownership share in the asset. But during those 18 months, the asset will stay with Ali, and he will benefit from it, so he must also pay rent or "kirayah," like we described before. Because the rent payment that Ali pays to Akhuwat every month is dependent upon the ownership share, the rent amount will decrease each month as Akhuwat's ownership share decreases. We can see what this looks like using a table:

لہذا اس "مقررہ ادائیگی" والے معاہدے کا مطلب یہ ہے کہ علی کو اخوّت سے سلائی مشین کا حصہ خریدنے کے لئے ہر مہینے 5000 روپے ادا کرنا ہوں گے۔ لیکن ان 18 مہینوں کے دوران سلائی مشین علی کے پاس رہے گی اور وہ اس کا استعمال بھی کرے گا۔ اس لیے علی اخوّت کو سلائی مشین کا کرایہ بھی ادا کرتا رہے گا۔ معاہدے کے تحت علی ایک ماہ کے دوران کتنا کرایہ اخوت کو دے گا، اس کا انحصار اس بات پر ہے کہ اس ماہ کے دوران مشین میں

علی، اور اخوت کی ملکیت کتنی کتنی ہے۔ جیسے جیسے ہر مہینے اخوّت کی ملکیت کم ہوتی جائے گی، ویسے ویسے جو کرایہ علی اخوّت کو ادا کرے گا وہ بھی کم ہوتا جائے گا۔ ہم یہ Table استعمال کرتے ہوئے اس بات کو سمجھتے ہیں:

Fixed Payment Contract

Start of Month	Ali	Akhuwat	End of Month Rent	End of Month Payment
1	10	90	900	5000
2	15	85	850	5000
3	20	80	800	5000
4	25	75	750	5000
5	30	70	700	5000
6	35	65	650	5000
7	40	60	600	5000
8	45	55	550	5000
9	50	50	500	5000
10	55	45	450	5000
11	60	40	400	5000
12	65	35	350	5000
13	70	30	300	5000
14	75	25	250	5000
15	80	20	200	5000
16	85	15	150	5000
17	90	10	100	5000
18	95	5	50	5000
End	100%	0%	0	0

ENUMERATOR: Describe, slowly, how Ali's rental payment changes as the ownership share changes.

Does everybody understand how this fixed-repayment contract works? Does anybody have any questions?

کیاہر ایک کو سمجھ آگئی ہے کہ یہ "مقررہ ادائیگی" والا معاہدہ کیا ہے؟ کیا کسی کا کوئی سوال ہے؟

Missed Payments

قرض کی غیر ادائیگی

Now we will describe what happens if Ali misses any of the requirement payments in the contract.

اب ہم یہ بتائیں گے کہ معاہدے میں اگر علی نے قرض نہ ادا کیا تو کیا ہو گا۔

If Ali cannot pay any of his required payments, then he has to make the payment in the next month. However, if he still cannot make the payment in the next month, then Ali has to agree that Akhuwat will repossess the sewing machine.

۔اگر ایک ماہ علی قرض اور کرائے کی ادائیگی نہ کر سکا تو اُس کو اگلے مہینے اس کی ادائیگی کرنی ہو گی۔ البتہ اگر وہ اگلے ماہ بھی ان کی ادائیگی نہ کر سکا تو علی کو اس بات پر راضی ہونا ہو گا کہ اخوت اُس سے سلائی مشین واپس لے لے۔

To help in this process - before this contract starts - Akhuwat and Ali will agree to have a "witness" to the contract, who will agree to assist in the process of delivering the sewing machine back to Akhuwat in this situation that we have described. But the "witness" will not have any obligation to make any payment if Ali misses a payment.

اس عمل میں مدد کرنے کیلئے معاہدے کا آغاز کرنے سے پہلے ہی علی اور اخوت اس بات پر اتفاق کریں گے کہ معاہدے کے لئے ایک گواہ رکھا جائے جو رقم کی غیر ادائیگی کی صورت میں سلائی مشین علی سے لے کر اخوت کو دے گا۔ لیکن اگر علی قرض ادا نہیں کرے گا تو گواہ رقم کی ادائیگی کے لئے ذمہ دار نہیں ہو گا

When Akhuwat repossesses the sewing machine, Akhuwat will sell the sewing machine in the market. The proceeds of the sale will be distributed in proportion to the ownership shares. For example, if the sewing machine was sold for 80,000 Rs in the market, and Akhuwat and Ali's ownership share was 50%-50%, then Akhuwat will keep 40,000 Rs and Ali will keep 40,000 Rs. After that, the contract between Ali and Akhuwat will be finished.

علی سے سلائی مشین لینے کے بعد اخوت اس مشین کو بازار میں بیچ دے گی۔ اس فروخت سے آنے والی رقم کو علی اور اخوت میں اُن کی ملکیت کے حساب سے تقسیم کر دیا جائے گا۔ مثال کے طور پر اگر مشین اسی ہزار روپے کی بکتی ہے اور علی اور اخوت دونوں 50،50 فیصد کے مالک ہیں تو اخوت کو چالیس ہزار روپے دیئے جائیں گے اور علی کو بھی چالیس ہزار روپے دیئے جائیں گے۔ اس کے بعد علی اور اخوت کے درمیان معاہدہ ختم ہو جائے گا۔

-

Other

Akhuwat has only a limited number of products that it can offer at the moment. The computer will decide who will be offered the product, using a random process (like drawing lots). We have no influence on the decision of the computer. The computer will decide randomly if you are selected to be offered the contract. Some ,people will not be offered the contract. This will not take place today, but will take place after we have identified the asset that you would like to purchase.

اس وقت اخوت بہت محدود تعداد میں قرضوں کی پیشکش کر سکتی ہے۔ کمپیوٹر قرعہ اندازی کے ذریعے اس بات کا فیصلہ گا کہ کس شخص کو قرض دیا جائے گا﴿مثال کے طور پر: جیسے پرچیاں ڈالی جاتی ہیں﴾۔ کمپیوٹر کے فیصلے پر ہمارا کوئی اختیار نہیں ہے۔ کمپیوٹر قرعہ اندازی کے ذریعے اس بات کا فیصلہ گا کہ آپ ک معاہدہ ملے گا یا نہیں۔ چند لوگوں کو معاہدہ نہیں ملے گا۔ یہ قرعہ اندازی آج نہیں کی جائے گی۔ پہلے ہم یہ معلوم کریں گے کہ آپ کونسا اثاثہ خریدنا چاہتے ہیں۔ اُس کے بعد یہ قرعہ اندازی کی جائے گی۔

Does everybody understand? Does anybody have any questions?

کیا سب کو سمجھ آگئی ہے؟ کیا کسی نے کوئی سوال پوچھنا ہے؟

Conclusion

This thesis has explored the role of equity-based financing for firms, using data from both a developed and developing country. In Chapter 1, I investigated the effect of a policy change in Belgium that mitigated the classical tax discrimination between debt and equity financing, and found that it led to significantly lower leverage ratios, with a greater effect for the most risk-exposed firms. In Chapter 2, I presented results from work with two of the largest microfinance institutions in Pakistan to investigate the effects of 'microequity' contracts on microenterprises. Using an artefactual field experiment, I found that equity-financed microenterprise owners chose investment options with a greater expected profit than those under debt financing, with heterogeneity analysis suggesting a larger effect for more risk-averse individuals. However, the second part of the chapter used a field survey to indicate the practical challenges to implementing such contracts, related to costly state verification, adverse selection into income-sharing contracts and moral hazard caused by inappropriately-tailored profit-sharing ratios. In Chapter 3, I reported on a field experiment where growth-oriented microenterprise owners were offered a shared-ownership contract to finance the purchase of an asset for their business. Results revealed a high demand for the shared-ownership contract, and a strong demand for a more flexible repayment structure, particularly among the most risk-averse microenterprise owners.

The results in this thesis provide promising evidence for the potential of equity-based contracts to stimulate the growth of microenterprises in developing countries. However, the challenges arising from costly state verification and moral hazard suggest the need to carefully investigate specific innovations in microfinance contract structure that test one particular feature of equity financing, rather than the assortment of features inherent in traditional equity contracts. This is particularly important in environments characterised by high information asymmetries. In this conclusion, I describe three separate projects that have recently emerged out of the insights in this thesis.

4.2 Implementing performance-contingent contracts

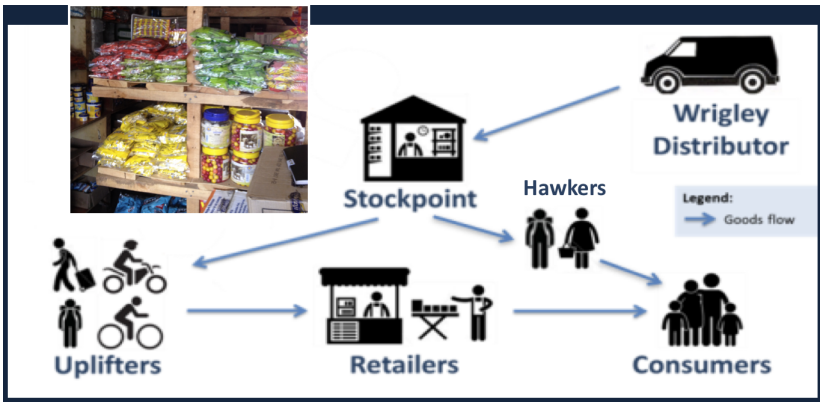
One of the most important market failures that inhibit the implementation of performance-contingent repayment contracts is costly state verification, which is a particularly significant problem in low-income countries, where most small businesses do not keep formal records of assets and income and there is often a mixing of business and household accounts. In this project, which is ongoing joint work with Marcel Fafchamps (Stanford), Franco Cordaro (Mars), and Colin Mayer, Simon Quinn and Kate Roll from the University of Oxford, we operate in a setting where we are able to observe a proxy for the performance of microentrepreneurs, which allows us to design contracts with performance-contingent repayments. We collaborate with one of the largest companies in the world, Mars Corporation, who own Wrigley Kenya. Our sample consists of micro-distributors, many of whom sell their retail products on foot, and who would like to finance the purchase of a bicycle to expand their micro-distribution activities. This setting is common to many 'route-to-market' distribution programs run by large multinational corporations around the world. This project is part of Mars Corporation's 'Mutuality in Business' research program, in collaboration with Said Business School. The project was initiated by Mars' research department, who approached us to design a more 'mutual' contract with its micro-distributors. The concept of mutuality is closely aligned with the idea of risk-sharing in equity contracts, and so we collaborated with Mars to design a number of different microfinance contracts that would help their micro-distributors finance the purchase of a bicycle, with the contracts varying in the extent to which they contain features that are 'debt-like', 'equity-like', and 'insurance-like'.

4.2.1 Study setting

Our setting consists of microentrepreneurs who are part of Wrigley Kenya's route-to-market program. These micro-distributors, who are known as 'Uplifters', purchase chewing gum from stock points that function as small warehouses. Stock points receive deliveries of Wrigley chewing gum, which they sell, alongside various non-Wrigley products. Uplifters purchase chewing gum as well as other products from stock points, before selling it to retailers, who are often small kiosks. The benefits for Uplifters of being part of Wrigley's entrepreneurship program are twofold: (i) they initially purchase the gum at a KES 5 discount per bag of gum (approximately US$ 0.05) to the market price (an up-front margin); and (ii) for every bag, they receive

an end-of-month bonus of KES 7.5 via mobile money (M-Pesa). There is no obligation for Uplifters to exclusively sell gum, but selling Wrigley's product is relatively profitable, and they have a strong incentive to stay in the program.[19] Figure 4.2 illustrates the route-to-market flow diagram for the chewing gum. Many Uplifters do their micro-distribution work by foot; some have bicycles, with a much smaller number using motorcycles. There are currently approximately 700 active Uplifters in Wrigley's program across Kenya.

Figure 4.2: WRIGLEY ROUTE-TO-MARKET FLOW DIAGRAM



Qualitative work with micro-distributors revealed the two major constraints on their business to be 'materials and equipment', which can be interpreted as working capital and assets. Our sample consists of Uplifters who expressed an interest in expanding their business by purchasing a bicycle. Bicycles can lead to significantly greater sales due to an expansion of territory and extra storage capacity; further, many Uplifters, particularly women, have complained of back problems from carrying large bags for their distribution work, so bicycles can also be beneficial from a health perspective. However, bicycles are often prohibitively expensive, costing approximately 10,000 KES ($100) for a mid-market model. We began with a pilot with 29 Uplifters; Table 4.23 presents data for their incomes and days worked, prior to the start of the pilot. The mean number of days worked selling Wrigley products was 11 (median 9), with a mean monthly income from selling Wrigley products of approximately $82 (median $31).

Table 4.23: UPLIFTER SUMMARY STATISTICS (PILOT)

	Mean	SD	10th Pctile	Median	90th Pctile	Obs.
Days worked	10.86	8.92	1.00	9.00	24.00	490
Monthly income	8,248.53	9,445.20	437.50	3,131.25	23,512.50	490

[19]Stock points also sell gum to people other than Wrigley Uplifters, but such sales are not eligible for an up-front discount or end-of-month bonus.

In the pilot, we randomly offered a subset of these Uplifters financing for a bicycle, using three types of contract, which varied in their 'equity-like' and 'debt-like' characteristics, and were labelled with (politically-neutral) colours to facilitate explanation:

(i) **Grey contract**: a 12-month, fixed-repayment debt contract, based on a 15% mark-up of the financed amount;

(ii) **Pink contract**: a 12-month contract that also involved some fixed monthly repayment, as well as a requirement to share 10% of the Uplifter's monthly income;

(iii) **Blue contract**: a flexible-duration contract that has the same repayment structure as the pink contract, but terminates once the cumulative payments reach the total amount due in the grey contract.

All contracts required the Uplifter to pay an initial deposit of 10%. Note that this is different to the initial 10% payment required in the shared-ownership product described in Chapter 3 of this thesis; in the project in Kenya, there is no notion of shared ownership in the asset, which fully belongs to the MFI until the contract ends. The remaining 90% of the bicycle price is financed by our MFI partner, Longitude Finance. For example, assuming a bicycle price of KES 9,275, the Uplifter was required to provide a 10% deposit (KES 928), with the remaining amount (KES 8,348) being financed. For the grey contract, payments are calculated by simply increasing the financing amount by 15% (to KES 9,600), which would need to be paid in equal monthly instalments of KES 800 for 12 months. We did not use compound interest, for ease of explanation. The pink contract also has a fixed-repayment component, which is half of that of the grey contract (KES 400); in addition, Uplifters are required to pay 10% of their Wrigley income per month, which we proxy for using their observable stock purchases, which are measured by Wrigley for the purposes of computing Uplifters' monthly bonuses.[20] The

[20]The design of the contracts, in particular the income-sharing contracts, was done using a simple conceptual framework. We first abstracted from risk and used an accounting exercise to analyse the cash flows of each contract, for (risk-neutral) Uplifters with different levels of income and time-discounting. The net present value (NPV) of each of the contracts was calculated as the sum of the discounted monthly payments over the life of the contract (which was fixed at 12 months for the grey and pink contracts, and adjusted based on cumulative repayment under the blue contract), under a range of incomes and time-discounting, based on actual administrative data and incentivised behavioural games from individuals who took part in our pilot. Results are intuitive and reveal that, beginning with an income of 1,000 and comparing the NPV between the three contracts, the preferred contract in terms of lowest NPV is the pink contract. In general, the two income-sharing contracts are always preferred to the fixed-repayment grey contract for this low level of income. A similar pattern is observed for an income of KES 3,000, which is approximately the median income of Uplifters in the pilot. At an income level of KES 4,000, the NPV of each of the contracts is identical, for all levels of time-discounting; each contract results in a monthly payment of KES 800, and the duration of the blue contract is identical to the grey and pink contracts. As the level of income

blue contract has exactly the same repayment structure as the pink contract, with the exception that it terminates once cumulative payments reach KES 9,600; as such, it can be considered as a hybrid between the more 'debt-like' grey contract and the more 'equity-like' pink contract. We designed the contracts such that an Uplifter with an income of KES 4,000 per month would have the same repayments and contract duration under all three contracts; this represents the 56th percentile of the income distribution for Uplifters from our pilot, and provides a relatively fair 'horse race' between the contracts, abstracting from risk.[21]

The grey, pink and blue contracts were successfully implemented in our pilot, which demonstrated strong demand and a good understanding of all three contracts. Further, our MFI partner was satisfied with the structure of the 'equity-based' contracts, which performed well in the field. However, based on feedback we received, we decided to include one more contract in the list of those implemented in the field for our scaled-up project, which is ongoing. Our hypothesis is that 'equity-like' contracts, through performance-contingent payments, have the potential to benefit microentrepreneurs through the provision of implicit insurance, by automatically reducing repayment requirements when business conditions are challenging. We confirmed the potential importance of such a mechanism by analysis of variance of administrative data on incomes of all Uplifters in the Wrigley program, which revealed the importance of both within-Uplifter as well as between-Uplifter variation. However, this value of performance-contingent payments could also in principle be achieved by an index insurance contract, which would not directly tax an Uplifter's income. Index insurance may also be preferred to our 'equity-based' contracts, if common shocks are the primary concern for Uplifters. Therefore, to provide a sharper test of the value of our 'equity-like' contracts, we added an index insurance contract. This new yellow contract has the same payment structure as the pink contract (fixed-duration,

increases to 8,000, which is approximately the mean of Uplifters in the pilot, the grey contract now has the most attractive NPV, followed by the blue contract. In summary, the relative preference between contracts is primarily driven by the level of income of Uplifters, with the ordering of preferences not significantly affected by the level of discounting, in this simple accounting exercise that abstracts from risk.

[21] In designing the contracts, we also extended the simple conceptual framework to introduce risk. We assumed a basic constant absolute risk aversion (CARA) utility function for Uplifters and modelled the decision of whether or not to accept the income-sharing contracts. Using a certainty equivalent framework and the properties of the log-normal distribution, we calculated the expected utility of taking the financing contract and bicycle. This leads to a quadratic equation, which can be solved for the maximum sharing ratio that the entrepreneur would accept, and above which they would prefer not to take the financing contract and the bicycle. The final equation has three key components: (i) the Uplifter's coefficient of relative risk aversion; (ii) their coefficient of variation of income; and (iii) the relative increase in income from having the bicycle. Using reasonable values for these coefficients from baseline data, and the upper bound identified in this exercise, we decided on a sharing ratio of 10%, which our MFI partner approved.

income-sharing plus half of the fixed repayment of the grey contract), with the major difference being how the income-sharing payments are calculated; in the yellow contract, the 10% income-sharing payments are based on an index constructed from the sales of other Uplifters. We explored different levels of aggregation, and decided on a region-based index (there are five main regions in Kenya). We constructed the index based on the average sales of every other Uplifter in the region for a particular month, excluding the Uplifter's own stock point to mitigate the risk of manipulation. A historical analysis of the correlation between the constructed index and Uplifter incomes reveals lower basis risk than in many other studies that have used index insurance products.[22]

Finally, we also explored demand for a fifth contract: the white contract. One possible benefit of the blue contract, which has a flexible duration, is in the ability to end the contract early by making higher payments when performance is greater. This 'savings-like' element may be more important than the 'insurance-like' element of performance-contingent repayments. As such, to provide a sharper test of the value of the blue contract relative to the fixed-repayment 12-month grey contract, we added another contract that was identical to the grey contract except that Uplifters were free to make early repayments in multiples of the monthly amount. While it was important to investigate demand for this contract, in order to simplify the logistics of the experiment and the contracts being implemented in the field, we assigned a very low probability to this contract being drawn for Uplifters.

4.2.2 Preliminary take-up results

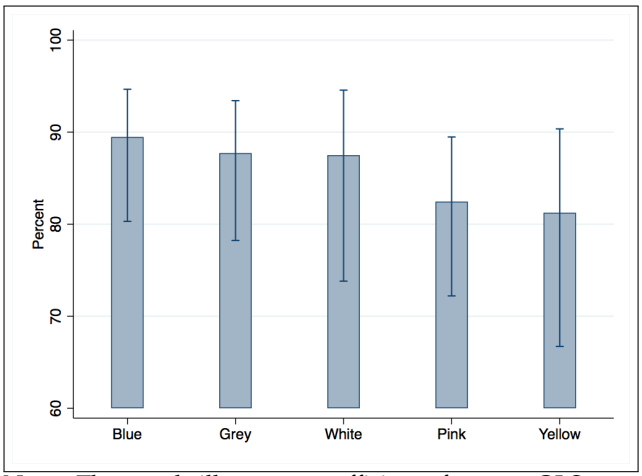
Uplifters are invited to a workshop, where a detailed household and business survey is conducted, as well as behavioural games to measure risk preferences, time preferences, and loss aversion (using the same materials as the activities conducted in Chapters 2 and 3 of this thesis). A strategy method is then used to elicit the contract preferences of each Uplifter. Five enumerators wear coloured shirts, representing the different contracts: (i) grey; (ii) pink; (iii) blue; (iv) yellow; and (v) white. Each Uplifter is required to state whether they would accept the contract if they were to draw that coloured ball from the bag during the final randomisation. Uplifters are permitted to accept or reject as many of the contracts as they desire, and it is explained that their decisions do not influence their allocation of contracts. After recording decisions from

[22] See Cole, Giné, Tobacman, Topalova, Townsend, and Vickery (2013); Carter, Janvry, Sadoulet, Sarris, et al. (2014); Clarke (2016).

every Uplifter for each of the five contracts, a public randomisation is conducted using a bag containing 101 balls. The bag contains 20 grey, blue, pink and yellow balls, as well as 20 green balls for a pure control group, who receive no contract offer. Only one ball is coloured white, to make it possible but unlikely to be drawn in practice.[23] Uplifters who draw a colour for which they had pre-specified their acceptance are immediately directed to a representative from the MFI, who is present and proceeds with signing of contracts.[24]

Uplifters have thus far shown interest in all of the contracts, and demonstrated a high level of understanding of the structure of contracts. Table 4.3 presents preliminary take-up results, comprising 235 unique Uplifter-contract observations from 57 Uplifters in both the initial pilot and the on-going scaled-up project. Thus far, take-up of the blue contract (flexible-duration, income-sharing) is highest at 89.5%, followed by the grey contract (loan) at 87.7%, the white contract (loan with early-repayment option) at 87.5%, the pink contract (fixed duration, income-sharing) with 82.5% and finally the yellow contract (index-insurance) with 81.3%. In future work, we hope to investigate heterogeneous demand by risk and loss aversion, time preferences, and income, as well as the impacts of the contracts on the performance of microentrepreneurs and their repayment behaviour under each contract.

Figure 4.3: CONTRACT TAKE-UP



Note: The graph illustrates coefficients from an OLS regression of a binary dependent variable for stated take-up by the micro-distributor on indicator variables for each contract. Standard errors are clustered at the individual level and 90% confidence intervals are displayed.

[23] Uplifters are not informed of the numbers of balls in the bag.

[24] The choice of bicycle is made before contract decisions are elicited; most bikes are 'work friendly' bikes with a rear rack. The menu of bikes includes one model that is of a higher quality and nearly twice as expensive, one that is female-friendly with a dipped bar, and one mountain bike.

4.3 Designing a 'venture-capital-like' model for microenterprises

Results in Chapter 2 of this thesis revealed the difficulties of implementing equity-like contracts within a conventional microcredit institution, where loan officers typically disburse a large number of standardised loans with an identical repayment structure, and are not required to expend significant effort monitoring the performance of the businesses that they finance.[25] Renumeration structures in microcredit institutions usually directly incentivise the minimisation of loan portfolio default rates, which can conflict with the policy objective of seeking to stimulate local economies by financing higher-risk, higher-potential-return entrepreneurs, many of whom would be expected to fail, with a few succeeding and generating overall benefits.

One of the insights from NRSP's experience described in Chapter 2 is that it may be necessary to operate such a model outside of the usual structure of a microcredit organisation, and by hiring staff who are dedicated to such activities. In the spirit of such financing models, Allianz, the largest insurance company in the world, recently launched a microequity project called 'Equitree' that aims to establish such a 'venture-capital-like' investment fund for microenterprises in Indonesia. We have just completed a post-hoc survey with clients of their program, in collaboration with Simon Quinn, Russell Toth (University of Sydney), and the Abdul Latif Jameel Poverty Action Lab (JPAL), as part of an exploratory grant funded by the Australian Government's Department of Foreign Affairs and Trade (DFAT) to investigate the viability of such an equity-based model.

The model being implemented by Allianz involves an initial selection phase of microentrepreneurs, who are given six-month uncollateralised zero-interest loans of up to $150 and are encouraged to share some of their business profits from using the loans. Indonesia has a population of approximately 225 million Muslims, many of whom lack access to financial services due to their aversion to borrowing with interest, so the provision of zero-interest loans is intended to provide financing to a large number of potentially unbanked microentrepreneurs. The loans are used as a screening mechanism; microentrepreneurs who demonstrate good repayment behaviour and share some of their profits are given larger loans, after which they become eligible

[25] In fact, there is no necessity for them to ensure that the loans are used for business investment purposes.

to graduate to the mentoring phase. This is similar to 'capital staging' that is done by 'business angel' groups and venture capital firms in developed countries. In the mentoring phase, microenterprises are matched with a business mentor and provided with a larger amount of financing. Some microenterprises are then expected to move into the business professionalisation phase, where Allianz proposes to formally register the business and take an equity share, with a view to exiting the investment by selling their stake in the final phase, for example to a social impact investor. The Equitree model has been designed in a venture capital-like manner, with the aim of filtering out all but the most promising entrepreneurs. Thus far, 138 investments have been made since June 2016, with a number of microenterprises progressing to the mentoring phase of the program. Microenterprises are classified into four categories, based on their repayment behaviour:

(i) 'Baddies' are those who do not return their zero-interest loan on time;

(ii) 'Goodies' return their loan on time, and also share some of their profits (up to 10% of the loan amount);

(iii) 'Stars' return their loan on time and share profits greater than 10% of the loan amount;

(iv) 'Superstars' are those who have been classified as stars for two consecutive loans.

Despite some reservations about the classification system that Allianz had implemented, in particular the potential for 'gaming' of the system by claiming that returned funds were from profits in order to obtain a larger loan, in December 2017 we agreed to conduct surveys with some of Equitree's clients for the purpose of a post-hoc analysis and to advise Allianz on the design of their program. We carried out detailed household and business surveys with 71 clients, in collaboration with the University of Indonesia and JPAL. The overall profile of our sample was similar to the broader group of all Equitree clients, based on a comparison with Allianz's administrative data.[26] The objective of our analysis was to test clients' understanding of the structure of the Equitree graduation model, and to investigate which particular aspect of the model was the most influential in their decision to join the program. Finally, we wanted to explore which business and household variables correlated most strongly with administrative data on repayment behaviour, using a simple variable selection algorithm, in order to shed

[26]However, our sample contains slightly more 'stars' and 'superstars' than the broader population.

light on whether it was possible to identify microenterprises with the highest growth potential.

The average age of the sample was 35, with 61% females. The average household size was four, containing two income earners. 98% of respondents were running a business, and the mean number of businesses in the household was 1.5 (median 1). 31% of businesses were in the food and beverages sector, with 11% being retail shops. Mean monthly business sales were $600 (median $255) and mean profits were $150 (median $110). The mean number of employees was 1.1 (median 0). As such, these microenterprises are not very dissimilar to those studied in Chapters 2 and 3 of this thesis. 17.5% of clients used their Equitree loan proceeds for an asset, while 70% purchased working capital. 80% of clients said that their loan repayments were out of actual profits, with the remainder using alternative sources to repay.

When testing respondents on their understanding of the Equitree model and its various stages, we found that clients showed relatively poor understanding. Only 19% knew the classification of a 'baddie', with 30% knowing that of a 'goodie' and 33% knowing the classification of a 'star'. Some of this may reflect measurement error, but it is clear that understanding was much lower than we had anticipated. While 51% of clients knew that the phase after the loan was mentorship, 71% stated that they would have still taken a loan even if the Equitree program did not contain a mentorship element, which was the first sign that the initial zero-interest loan may have been the main motivation for many people joining the program. Only 10% of respondents were aware that the formalisation stage came after the mentorship stage.

We asked respondents about their main reasons for joining the program as opposed to taking finance from a conventional source; 26% responded that the application process was easier, 14% cited the lack of collateral requirement, and 18% mentioned repayment flexibility (the loan has a single 'bullet payment' at the end of the six months, and allows early repayment). The most popular response was the zero-interest nature of the loan, which was cited by 74% of respondents. We then used a LASSO method to investigate what variables were most correlated with the feature of the Equitree program identified by the clients as the most important for them, by regressing a binary variable for which feature was preferred on a large selection of household and business characteristics. We find that households containing a higher number of businesses and those with better business management practices are *less* likely to have reported the initial

loan as the most influential reason for their decision to join the program. Consistent with this, we find that households with a greater number of businesses and better business management practices are *more* likely to report the mentorship phase as the most important reason for their joining. Finally, with regards to the microentrepreneurs who reported the formalisation stage as the most significant for them, we find that those running a retail shop are *less* likely to be interested in formalisation, while those who spent the loan funds on the purpose that they had originally intended were more likely to state that the formalisation stage was the most important.

Finally, we combined the survey data with administrative data on total loans taken by clients and their repayment behaviour. We again employed LASSO to identify the strongest predictors of repayment behaviour, using a large set of household and business characteristics. We start with the administrative data based on which clients were classified as 'baddie', owing to their failure to repay their loans on time. Results reveal a strong correlation with microenterprises that have fewer employees, those reporting themselves as being satisfied with their business, and those stating the reason for taking the loan as the lack of interest.

Turning to clients who were classified as 'goodie', LASSO fails to identify any key variables that are good predictors, which is consistent with a large literature that documents the challenges in predicting the best-performing microentrepreneurs.[27] That literature also finds that it is often easier to predict the far-right tail of the microenterprise growth distribution, and our next result is also consistent with this. When exploring which variables predict whether a microenterprise is categorised as a 'star', we find that clients who are more concerned about the religious aspect of the product are *less* likely to be 'stars', while those who have remained in the same business as when they joined the Equitree program and those who report that they would like to continue or expand their existing business are more likely to be classified as 'stars' (which likely reflects reverse causality).

In the final part of this analysis, we investigated which variables best forecasted the total amount of financing taken in the Equitree program, and find that, unsurprisingly, a significant predictor of this is firms with more employees and those with higher profits. Finally, when

[27] See McKenzie and Sansone (2017).

exploring variables that best predict the *number* of loans taken (which vary from one to five), our only finding of note is that more risk-averse individuals are likely to only take two loans, which may indicate a reluctance to take the risk of entering the mentorship and subsequent business expansion and formalisation stages.

Organisations inspired by the investment strategies and incentive structures put in place by 'business angel' groups and venture capital firms in developed countries have the potential to provide an alternative to the current financing options for growth-oriented microenterprises in low-income countries. They may be more effective at fostering the selection and growth of potentially transformational entrepreneurs than a standard microcredit institution, using a separate dedicated organisational structure that adopts a more portfolio-based view of investments. However, the results here indicate the difficulty in predicting which microenterprises will be the most successful, which is consistent with the existing literature.

In this specific Indonesian context, we have found that the program being implemented by Allianz has succeeded in providing low-cost and easily-accessible financing of smaller amounts to microenterprises that may have been financially constrained due to religious reasons. It appears that such individuals have benefitted from the Equitree program, but that these same people are much less likely to perform well in their repayments, or to expand their business. We are currently collaborating with Allianz to re-design the program, with a focus on improving the identification stage. Nonetheless, using small-scale staged loans certainly seems to be an effective negative screening method, by identifying which clients would *not* be good candidates for equity-like financing.

4.4 'Skin in the game': Microequity and mentorship

Another common feature of equity-based financing, which has not been explored in this thesis but follows naturally from the previous section's discussion on integrating mentorship in a microequity model, is the role of 'active' equity investors who provide business advice as well as capital. A combination of mentorship and equity financing could lead to significant benefits for microenterprises, given that many business training programs have yielded limited and short-term benefits for most microentrepreneurs, with little impact on sales or profits (McKenzie and Woodruff, 2013). There is recent evidence that tailored and intensive programs can have a positive impact, with particularly promising results for personalised mentorship, although impacts were again only short-term (Brooks, Donovan, and T. Johnson, 2016). We hypothesise that entrepreneurial mentorship could be more effective when mentors are incentivised directly by the productivity of their mentees, or, in other words, when they have 'skin in the game'. Mentors can help the microentrepreneurs reap the benefits of better management practices, which may lead to more sustained gains, given the alignment of incentives induced by equity financing.

In this project, which is joint work with Mehrab Bakhtiar (University of Maryland), Abu Shonchoy (New York University and IDE-JETRO), and Simon Quinn, we work with an IT company in rural Bangladesh to help train college graduates to become online freelancers. Online freelancing work includes basic data entry as well as more sophisticated activities such as website development, search engine optimisation and social media marketing. Average income for mature online freelancers can be significant, but it takes approximately three to six months of full-time training to get to a basic level, and training programs often have a relatively high upfront cost (approximately $120).

We therefore seek to alleviate both financial and human capital constraints, by providing promising potential freelancers with financing for the program cost, intensive training and mentorship. We use a field experiment to randomly vary the form in which capital is provided; specifically, we offer a fixed-repayment debt contract, as well as 'equity-based' contracts that involve performance-contingent payments, which are feasible because freelancing activities are conducted on an observable online platform. We also hope to monitor the effort entrepreneurs exert in the online marketplace, the reputation they build on the platform, and any shirking from

work. This allows us to test another key prediction from the theoretical literature: that income-sharing arrangements may be inefficient relative to debt contracts because entrepreneurs will exert less effort, since they equate their marginal disutility of effort with their share of their marginal product rather than the total marginal product.

All trainees receive a personal mentor after the intensive training, which lasts approximately three months in our pilot. Given that we are particularly interested in whether entrepreneurial mentorship is more effective when mentors are incentivised directly by the productivity of their mentees, we also include one treatment arm where the mentor is paid based on the performance of the mentee, in comparison to all other contracts where the mentor is paid a fixed wage. Our experimental design involves four treatment groups:

(i) **Control group (CT)**: this group is offered training and a non-incentivised mentor for a fixed up-front cost, with the possibility of a subsidy;

(ii) **Debt group (DT)**: this group is also offered training and a non-incentivised mentor, but with a fixed-repayment zero-interest loan to finance the up-front cost of the program;

(iii) **Equity group (ET1)**: the arrangement for this group is the same as that of DT, except that repayments will be linked to the income of online freelancers;

(iv) **Equity group (ET2)**: this group also features performance-contingent repayments like ET1, with the major difference being that the mentor's compensation will be directly linked to the freelancer's performance.

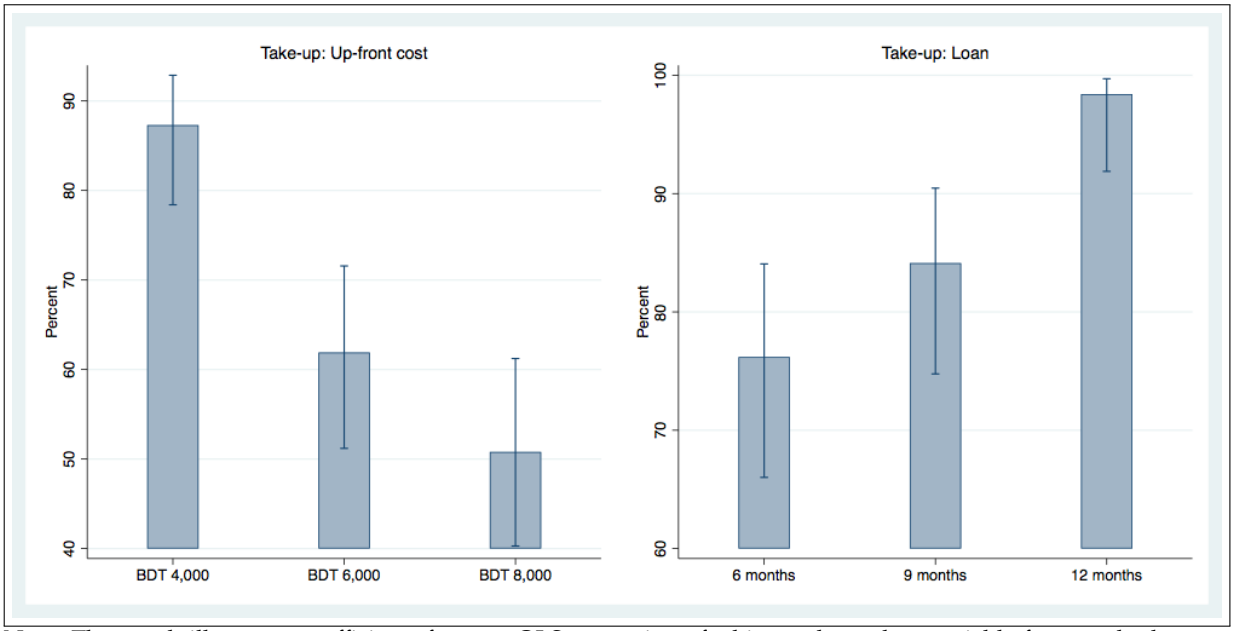
All individuals entering the program, regardless of assigned treatment, will be provided with the initial intensive training and access to a computer facility where they can conduct their business operations. Our local IT company is providing experienced trainers and mentors. We are currently implementing the first phase of the pilot, initially starting with only the control group and the debt group. We used a strategy method to elicit preferences over different variants of each treatment; for the control group, we elicited preferences over various subsidy levels applied to the up-front program cost of BDT 10,000 ($120).

For the debt group, we elicited preferences over different durations of the zero-interest loan (which changes the fixed monthly repayment amount). In order to reduce the number of treatment variants ex-post, we used non-equal assignment probabilities and did not inform participants of the probabilities of each outcome.

Figure 4.4 presents take-up results from the first stage of our pilot, representing 378 unique student-contract take-up decisions from 63 students who had passed our IT company's computer competency screening test. Approximately half of the initially interested individuals were not permitted to continue to the take-up decision stage because their test score was deemed too low based on our IT partner's minimum technical competency requirements. The left-hand panel of Figure 4.4 illustrates a downward-sloping demand curve in terms of program cost; take-up of the contract costing BDT 4,000 (a 60% subsidy from the market price) was 87.3%, decreasing to 61.2% for a price of BDT 6,000 and to 50.7% for BDT 8,000 (which still represented a 20% discount on the usual market price). Further, our early experience collecting repayments reveals that even those students who had accepted this higher price and were subsequently randomised into it have struggled to pay the whole up-front cost. Regarding take-up of the loan, the right-hand panel of Figure 4.4 shows that demand increases significantly when students are provided with loan financing of the program's BDT 8,000 up-front cost. Take-up of the six-month loan was 76.2%, increasing to 84.1% with a greater loan duration of 9 months and 98.4% for the 12-month loan.

In summary, preliminary results reveal a strong demand for the online freelancing program, which is very sensitive to price, with the majority of potential students struggling to raise the required costs of the program. We do identify a high demand for financing the training program with a loan, with a preference for longer-duration loans.

Figure 4.4: TAKE-UP



Note: The graph illustrates coefficients from an OLS regression of a binary dependent variable for stated take-up by students on indicator variables for each contract variant. Standard errors are clustered at the individual level and 90% confidence intervals are displayed.

In the second wave of the pilot, we intend to introduce the equity-based contracts. We will investigate preferences over contracts and how these vary by student and household characteristics, as well as the impact of the different contracts on freelancing behaviour. We plan to collect high-frequency data on: (i) participant income, effort levels and activities on the platform, including sales strategies and other activities to boost their online reputation; (ii) the use of any additional training materials; and (iii) shirking such as using the work terminals to access social media. We are also actively seeking to increase the number of female participants in the program. Online freelancing training programs have a great potential to benefit females in rural areas, who often have few job opportunities and face patriarchal social norms, *'purdhah'* restrictions and family obligations that hinder active labour force participation. An online freelancing platform can enable many women to enter entrepreneurship, with the freedom to work from home and access global clients to earn a competitive wage. There is also substantial policy interest in online freelancing from the Bangladeshi government.

4.5 Summary

Microfinance contracts based on the principles of equity financing have the potential to more effectively stimulate the growth of microenterprises in developing countries, especially for microenterprise owners whose behavioural characteristics such as risk aversion may lead them to under-invest in profitable opportunities. In this thesis, I have explored a number of potential ways in which 'equity-like' contracts can be implemented. These range from simple attempts to use equity contracts in their traditional profit-and-loss-sharing format, to specifically financing the purchase of one asset using a shared-ownership structure or sharing of an income stream, or integrating mentorship within a framework of performance-contingent payments, and more broadly by setting up distinct institutions dedicated to financing promising microentrepreneurs with such contracts.

Progress in financial technology, such as electronic point-of-sale systems and mobile banking, may help mitigate the cost of monitoring business performance, and permit further innovation in equity-based financing models, while taking into consideration the need to tailor appropriate sharing ratios that mitigate moral hazard. Revenue-sharing models may be a particularly fruitful avenue to investigate such contracts, as they avoid the often complicated process of identifying business expenses in order to calculate profits. It is conceivable that costly state verification can be dramatically reduced for firm revenues, whereas it may remain difficult to verify microenterprise profits due to the challenge of measuring and monitoring business expenses directly attributable to sales in a particular period, especially given that many microenterprises face highly volatile incomes, fail to keep good business records, and mix business and household finances. While it may be possible that technological advances can also help monitor expenses, recent work highlights the significant challenges in implementing inventory management devices with microenterprises. A revenue-based financing model avoids the complication of accurately attributing expenses, and it is relatively straightforward to monitor sales using an electronic point-of-sale system. Such innovations in contract structure merit further empirical and theoretical research.

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