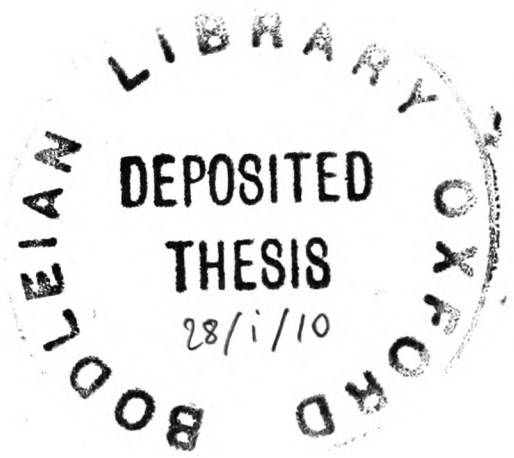
DPHIL THESIS IN ECONOMICS

ON SECURITISATIONS OF ASSETS

MACIEJ FIRLA-CUCHRA
UNIVERSITY OF OXFORD
OXFORD 2005

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ABSTRACT

In the first chapter we introduce securitisations and discuss the current state of structured finance in Europe; we also explore the main trends in securitisations and future prospects. Next, we provide a general introduction to the theoretical and empirical literature concerning securitisations and structured finance more generally: we discuss theoretical hypotheses concerning different rationales for structured credit and explore the empirical literature on the topic.

In the second chapter, we look at financial contracts determining implicit boundaries of a firm. In the spirit of the incomplete contract theory, we analyse optimal allocations of control in financial contracts involving limits on managerial discretion and legal separation of assets. Our model explores the interplay between different groups of creditors and managers in a symmetric information environment. The results display optimality conditions for different contracts from asset-backed securities through project finance to debt with covenants vis-à-vis a standard debt contract.

In the third chapter, we provide the first systematic testing of the theories of tranching. We find support for asymmetric information and market segmentation explanations for tranching and present evidence on how such different rationales influence the structuring process in practice. We also investigate the impact of tranching on the price of securities at the issue level.

In the fourth chapter, we investigate determinants of launch spreads in securitisation transactions. First, we develop a reduced-form pricing model of tranches across different transaction types and test it. We document the importance of credit ratings for prices of structured securities. Next, we test for the effect of tranching on pricing of individual securities. Finally, we develop a simultaneous equations supply and demand model with endogenous structuring to further investigate the effects of structuring on prices at launch.

In the fifth chapter, we investigate returns to equity around securitisation dates, and explore how different factors influence the size and the direction of the potential effects. We find significant, positive, and consistent abnormal returns to equity on the pricing date, over longer event windows, and over the period immediately prior to the issue date. We find support for the theory that equity holders in well-capitalised banks and firms with low gearing benefit from securitisations. Furthermore, we show that more developed securitisation markets, larger issuers, and banks in particular all benefit from securitisations.

CONTENTS:

Chapter 1: On Securitisations: Introduction to Structured Finance
Chapter 2: Financial Contracting at the Boundary of a Firm
Chapter 3: Why Are Securitisation Issues Tranched?
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Chapter 5: Do Securitisations Add Value?

ON SECURITISATIONS:

INTRODUCTION TO STRUCTURED FINANCE[1]

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[1] Maciej Firla-Cuchra, University of Oxford, Department of Economics, Manor Road Building, Manor Road Oxford OX1 3UQ. An adapted version of this paper appears under the title 'Structured Finance' in *Financial Markets and Institutions: A European Perspective*, ed. Freixas, X., P. Hartmann, and C. Mayer, Oxford University Press 2007 (forthcoming). I am most indebted to Colin Mayer, Tim Jenkinson, Alan Morrison, Ian Jewitt, and Steve Bond for guidance in writing this Thesis. I am also grateful to Pete Kyle, Andrew Winton, and Patrick Bolton for useful discussions. I would also like to thank Margaret Meyer, Alan Morrison, Oren Sussman, Jos Van Bommel, Dimitrios Tsomocos, and Alexander Guembel for their comments and suggestions. This and following chapters have greatly benefited from my conversations with numerous professionals in the field including Ravi Joseph, Ellen Brunsberg and Christian Janssen of Morgan Stanley, Michael Raynes of Deutsche Bank, Lorenzo Isla and Karl Prazmo of Barclays Capital, Brad Craighead and Edward Reardon of JP Morgan, and many others, as well as from my work on securitisations at Merrill Lynch in London. This should not be taken as a transfer of responsibility for any potential mistakes.

I. INTRODUCTION

A. The securitisation transaction

Structured finance is one of the leading growth areas in securities markets encompassing everything from mainstream securitisations, through project finance, to repackagings and synthetic portfolios of credit derivatives. According to Alan Greenspan, securitisation is one of the major financial innovations to have occurred over recent decades.[2] This rapid expansion in depth and breadth of structured finance markets has resulted in a great variety of associated financial products and their designs. As a result, no single, generic structure can be identified as representative of the relevant segments of the market, but certain broad characteristics of typical structured finance products can be outlined. These common characteristics are largely shared across different transactions and help to identify structured issues in general.

The principal tool behind structured finance, securitisations in particular, is a method of converting idiosyncratic, illiquid, on-balance sheet receivables (or receivables expected to be created in the future) and other, similar financial claims into tradable financial securities.[3] This conversion process or 'structuring' underscores terms such as 'structured finance' and 'securitisation' in their most generic sense: ie, as a transformation of the cash-flow generating, 'real' assets into financial securities with investor-tailored engineered (structured) payment profiles.

This process includes multiple steps such as: selecting (pooling) a group of assets from the balance sheet of the originating company, separation of these assets from other assets (typically by means of placing them in a stand-alone, legal vehicle—the SPV—created for that purpose), issuance of financial securities by the legal vehicle, either directly

[2] Greenspan, A. (1998): The Role of Capital in Optimal Banking Supervision and Regulation, *Federal Reserve Bank of New York Policy Review* 4, pp. 163-168.

[3] We use the term 'structured finance' to describe all types of securitisations as well as some related contracts such as project finance contracts.

backed by the securitised assets or contractually linked to the assets' risk profile, and the purchase of such securities by external creditors. Furthermore, the securities issued to investors (ie, the securitisation notes) are often divided into multiple 'tranches' before being sold. These tranches differ in terms of their risk profile, duration, or size, among other characteristics, while being backed, most typically, by one and the same pool of assets.

In contrast to standard financing contracts such as debt or equity, securitisations can be compared to 'complete' contracts in the spirit of the incomplete contract theory.[4] This is because in securitisations, in contrast to other forms of corporate financing, the use of (securitised) assets can be seen as essentially outside the scope of managerial discretion. Instead, the use of assets is governed by a detailed legal contract, signed up-front and based on extensive monitoring of the assets' performance.[5] The enforcement of this contract, which specifies in detail the use of securitised assets and the distribution of associated cash flows (also known as the 'cash waterfall') is assigned to a third party, typically a trustee, if the SPV takes the legal form of a trust. The trustee is the legal 'owner' of the assets, although he can only act within the scope of his duties, as set out by the contract, in order to serve interests of the beneficial owners, namely—creditors. In effect, the role of the trustee is that of a contract 'watchdog' rather than a decision maker; he is also important to overcome the coordination problem with multiple creditors.[6]

A basic, generic securitisation structure is schematically presented in Fig. 1 below, where the new SPV and its creditors (the *new* creditors) are legally separated from the originating company and its *old* creditors by non-recourse provisions—ie, they hold no claims vis-à-vis each others' assets. The SPV, as a distinct legal entity, purchases assets from the originator in exchange for the funds raised from the new creditors. The originator might repay the existing loans to the old creditors using the newly raised funds.

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[4] Hart (1988).
[5] There exist some exceptions to this general rule such as e.g. managed loan portfolios among CDO issues.
[6] There is typically no scope for an agency problem between creditors and the trustee because the latter performs its statutory duties in accordance with a legal contract – the trustee has little discretion and no financial interest in the assets.

[FIG 1. INSERT HERE]

Securitised asset classes typically include mortgages, consumer and corporate loans, assets and future receivables of utilities companies, large transportation assets such as airplanes or ships, infrastructure assets such as airports, sea ports, or railways, inventories of firms, or even government obligations. Transactions involving different asset classes vary in terms of structures and design characteristics. Although some of the transactions represent important structural innovations, the differences are often driven by the necessary adaptation of the generic securitisation concept to the particular asset characteristics. For example, the so-called 'breathing structures' in the case of credit card securitisations allow for variable amounts of funding to be drawn at any point (similarly to revolving credits). A fully comprehensive review of all different structures is beyond the scope of this short introduction, but has been extensively described by other authors, eg Fabozzi (2001).

In addition to different types of assets, the expansion of credit derivatives in recent years has resulted in a fundamental division between 'synthetic' and 'true sale' transactions. The innovative 'synthetic' deals typically involve derivatives of cash flows from existing assets or financial contracts linked to purpose-defined 'signals' indicating assets' performance. In these transactions, the pool of assets backing securitisation notes (bonds) often involves the so-called 'secondary assets', serving as an investment collateral in the transactions referred to as 'funded'. The secondary assets can be compared with the 'primary assets', to which the contract is referenced. In contrast to funded products, in transactions referred to as 'unfunded' no collateral is posted against contractual liabilities of the sellers of protection (ie, creditors). In mainstream securitisation transactions, referred to

as 'true sale' transactions, the actual, legal transfers of primary assets is the vital part of the overall setup.[7]

The recent issuance of synthetic securitisations has primarily concentrated on the collateralised debt obligations (CDOs), which are estimated to constitute between 50% and 90% of the total market volume.[8] For comparison, for other asset classes such as mortgage-backed securities or the asset-backed securities, synthetic deals represent 5 to 15 percent of the total issuance.[9]

Since CDOs are the fastest growing market segment, it might be expected that the issuance of synthetic deals will continue to increase in the future with a likely expansion into new asset classes, similarly to the historical development of the 'true sale' market. The latter has also been growing, albeit at a slower pace, and now includes a wide selection of assets such as third party liabilities towards government or entire stand-alone businesses, in addition to standard mortgage-backed securities.

B. Exploring securitisations

Following the initial development of the securitisation market in the US, substantial professional literature has emerged to describe the securitisation phenomenon. This literature has largely concentrated on the description of the securitisation process *per se*, together with its many nuances and variations, as well as on the practical legal and market considerations linked to the issuance of structured securities more generally. Related professional research into security design and cash flow modelling, conducted by credit rating agencies and investment banks, has largely concentrated on the issue of different pricing methodologies for asset-backed securities. The latter includes the development of continuous- and discrete-time pricing models to correctly value new, innovative deal

[7] For an introduction to the legal background on structured finance see Schwarcz (2003) or Deacon (2004).
[8] Collateralised debt obligations or CDOs constitute repackaged pools of multiple corporate loans.
[9] There is no industry-wide standard for measuring CDO issuance; available estimates are from leading arrangers.

structures of progressively increasing complexity. In parallel, the academic literature on the topic has explored the rationale for 'pooling' and 'tranching' of securities—two fundamental parts of the structuring process described above. The suggested rationale for 'pooling' and 'tranching' of securities includes the presence of heterogeneous investors with asymmetric information, poor liquidity of assets, or incomplete markets with potential arbitrage opportunities through more complete spanning, according to the security design literature.[10]

Given accelerated development of securitisation markets over the last decade, it has become clear that the securitisation methodology has a considerably greater range of potential applications than what might have been expected initially. Earlier, securitisations were largely associated with the creation of a secondary market to trade residential mortgages. Despite the fact that mortgages still dominate the US securitisation issuance in terms of volume, they do not constitute a majority of securitised assets in what can be seen as more innovative European markets. This can be linked to the fact that in Europe there exists no explicit or implicit public support for the securitisation market, while in the US the largest issuers—the government sponsored enterprises (or GSEs)—enjoy implicit public support.

It can be argued that the research in finance so far has paid relatively little attention to the question about the rationale for securitisations. In particular, the fundamental question about the choice of different forms of corporate finance vis-à-vis securitisations, especially in the context of different business characteristics, different categories of assets, and in different financial circumstances, has not been addressed in great detail. Similarly, the research on financial gains from securitisations to the originating companies and the study of potential associated value transfers among different groups of claimants has been, arguably, limited. The academic literature, often targeted at professionals and focused on pricing and arbitrage methods, has concentrated on the question of 'how' rather than

[10] See for example DeMarzo (2005).

'whether' to use structured finance. The literature has also addressed the above questions more from the perspective of an intermediary than from that of an issuer. For example, although the potential tax and regulatory arbitrage opportunities for intermediaries created by securitisations have been said to motivate securitisations relatively early on, the idea of securitisations as solutions to agency problems or as optimal allocations of control has not been explored in detail.[11] Similarly, few empirical studies have explored the design of securities or prices of securitisation issues in large samples; remarkably few studies have empirically analysed implications of a securitisation decision for the originator, despite the widespread occurrence of securitisations as a part of the regular corporate finance activity. Even when the singular studies did explore these issues, they have largely concentrated on specific markets, small samples, or individual case studies.

This Thesis aims to partly address this gap by offering a set of theoretical and empirical studies of securitisations concentrating on some of the key issues in these markets, as identified above. The selection of research papers presented in this Thesis should not be viewed as jointly constituting any form of comprehensive coverage of all or part of structured finance. Instead, the presented selection of papers aims to address some unanswered questions that appear fundamental to the understanding of today's structured finance markets as well as future financial innovation. At the same time, the empirical analysis, constituting an important part of this Thesis, concentrates on the European rather than US securitisations markets, which have been not been explored in great detail before.

The rest of this Thesis is structured as follows: The reminder of Chapter 1 introduces structured finance in Europe and includes the discussion of the main trends and historical developments. The second part of this Chapter provides a general introduction to the theoretical and empirical literature concerning securitisations, hypotheses about the rationale behind the securitisation practice, as well as existing research and empirical tests

[11] For a review of different theories see for example Iacobucci and Winter (2005).

in this area. This introduction does not explore any issues in depth, but aims to introduce the reader to the topics addressed in greater detail in the relevant chapters.

Chapter 2 follows with a general corporate finance model of financial contracts characterised by limits on managerial discretion as well as legal separation of different groups of assets. Along these two dimensions it contrasts two stylised extreme forms of financial contracts: a 'securitisation' contract and a 'standard debt' contract and explores other, 'in-between' arrangements sharing the features of both. The aim of the analysis is to describe the optimal contracts under the agency problems and capital constraints in the general spirit of the incomplete contract theory.[12]

Chapter 3 explores the question of security design: specifically, it investigates the methodology and rationale behind tranching—a critical tool of structuring. It presents the first empirical tests of different theories of tranching using a large dataset of all European securitisation issues.

Chapter 4 addresses the question of pricing of securitisation issues at launch. It develops a pricing model for structured bonds from a simple, reduced-form specification as well as a more complete, structural, supply-and-demand model, which endogenises the tranching/structuring process. This model is then used to explore the determinants of different pricing factors of securitisation prices at launch, to test a selection of hypotheses concerning different motivations for structuring, and to investigate the effect of tranching on pricing.

Finally, Chapter 5 tests the impact of securitisation decisions on the originators' market valuations from the perspective of different theories regarding the potential rationales for securitisation, structuring process in particular. This paper explores the effects of securitisation announcements and determination of securities prices on originators' returns to equity. In this context, it also investigates the analogous effects of different characteristics of issues and issuers as well as variations to the placement process.

[12] Hart (1995).

II. DEVELOPMENT OF EUROPEAN SECURITISATION MARKETS

A. Overview and leading trends

The first and the most basic type of an asset-backed security (ABS) is a mortgage-backed security (MBS). While MBSs were initially issued over 30 years ago in the United States, their issuance has been growing steadily over the last 25 years in the United States and over the last 10 years in Europe. By 1999 the outstanding volume of the so-called 'agency securities' in the US (encompassing MBSs issued by government-sponsored entities such as Fannie Mae and Freddie Mac, as well as non-agency MBSs) has surpassed that of US Treasury securities. By the first quarter of 2005 a considerable gap has opened between these markets with the combined outstanding volume of MBSs and ABSs totalling US$7.4 trillion—over 80% more than the treasuries' market and over 50% more the corporate bond market.[13] This has prompted some to view agency MBSs as capable of becoming the benchmarks securities for the entire financial market constituting an alternative to US Treasury securities.[14] In terms of corporate debt alone, by the end of the first quarter of 2005, ABSs (excluding MBSs) represented just under 40% of the corporate bond market in the US.

The European securitisation market was initiated considerably later than the US market with the first MBSs issued in the UK in 1987.[15] Nevertheless, the subsequent development has been characterised by rapid growth, especially between 1998 and 2003, featuring 50% CAGR over the period. By 2006, European RMBS issuance has reached €250 billion per annum and European CMBS issuance €60 billion per annum, according to

[13] Outstanding levels of public and private bond market debt according to the Bond Markets Association (2005) http://www.bondmarkets.com/.
[14] Commentators have pointed at GSEs' own use of the term 'benchmark' with respect to some of their securities.
[15] Davidson et al. (2003).

some estimates.[16] To put this recent growth in perspective it is worth noting that the total amount of asset-backed securities issued in the first quarter of 2005 in Europe has been close to that issued during the entire year 2000. However, the combined volume of outstanding European MBSs and ABSs in 2005 represented just 16% of the US ABS market alone (excluding all agency securities) and under 4% of the combined MBS and ABS volume worldwide. Hence, a considerably smaller proportion of European balance sheets is being securitised in Europe than in the US.

Europe might witness in the future a rise in the number of conduits set up by banks with portfolios of different loans repackaged as bonds, which are often regarded as typical of the next stage of the securitisation market development. It is thought that there are now about a dozen conduits in Europe compared with as many as 70 in the US. These observations support the general conclusion that securitisation markets are more developed in the US than in Europe at the moment.

Growth in European structured finance has diminished in 2004 with estimates of the annual growth in total issuance ranging from 12% to -2%, according to leading arrangers.[17] However, according to the European Securitisation Forum (ESF), which collects continent-wide data on new issuance and provides the high-end estimates, the European securitisation market has managed to continue its double-digit growth in 2005 and 2006 with the total volume rising to €458.9 billion.

In the longer term Europe is likely to continue on its growth path given the large size the balance sheets of some European banks and corporates. This might be expected in the light of the significant securitisation potential of the European banks' balance sheets combined with limited penetration of structured finance products. A consistent use of securitisations as one of the mainstream funding mechanisms, akin to the US, represents

[16] European Securitisation Forum Data Report, Winter 2007.

[17] Sources: European Securitisation Forum: www.esf.org; Commerzbank Corporates & Markets – Structured Finance (Pan European), Facts & Figures 2004: The way it was; 11 February 2005. Differences between sources are likely to be due to different classification methods of some secured loan transactions.

tbhe necessary condition for the future development of European structured finance markets. In this context, both the European Commission and the European Investment Bank have recently undertaken steps to investigate the possibility of stimulating growth of securitisation markets. While it is difficult to estimate how long it might take for European markets to reach the US volume of issuance, Chapter 3 estimates the current gap at 13 years on the basis of the nature of structuring in securitisation issues.

Despite the slowdown in some parts of structured finance issuance in Europe, not all securitisation markets have undergone stagnation over the last year. To underline European market's significant growth potential as well as its somewhat erratic development, European issuance of commercial mortgage-backed securities (CMBSs) has grown seven-fold in the first half of 2005 versus the first half of 2004, according to Moody's, a rating agency.[18] This highlights the nature of European markets' expansion where, in contrast to recent trends in the United States, the MBS market has been grown more rapidly than the ABS market since 2000. By the end of 2004 MBS issuance was approximately twice as large as ABS issuance—a significant change from the lag of *circa* 20% in 2001—although the relative sizes of these markets do not seem to be stable in the medium term. Still, this might be taken as an indication of the European market converging (albeit slowly) towards the US model, where MBSs represent the majority of all issues, even if the underlying product structure is fundamentally different.

The patterns of growth in securitisations can be seen as typical of a new market segment at its early stage of development, where the market is already firmly established, but still exhibits significant volume fluctuations. Sporadic rather than consistent use of the securitisation technology by European banks underscores this observation. However, the fact that European securitisation markets have been characterised by a high degree of adaptation and a broad selection of different asset classes not seen in the US before, suggests high growth potential in the future. Also, the combination of an increasing number

[18] *Ibid.*

of investors becoming familiar with structured finance products and significant reductions in fees might make future originators more willing to take advantage of a greater demand for this corporate finance tool.

Despite record low spreads in 2005, there has been no dramatic increase in ABS volume vis-à-vis earlier years. This might be linked to an increase in the use of securitisations to fund new growth in addition to the refinancing of existing debts. According to a recent survey of first-time European securitisation issuers by PricewaterhouseCoopers, the primary objective of securitisations is simply to provide new funding.[19] In this context, some market participants have pointed at the correlation between the growth of the ABS market and the restrictions on the corporate access to unsecured bond markets. According to this view, earlier growth of the ABS market has been indicative of firms seeking alternative forms of funding vis-à-vis traditional funding sources in fixed income, which have been less accessible lately. As investors became more cautious, securitisations have been offering attractive, secured alternatives to traditional debt products, although corporations would still prefer to use unsecured credit when available. This view suggests a negative correlation between structured finance issuance and the overall economic climate where downturns in economic activity force companies to seek funding from securitisations. At the same time, European securitisation markets also seem to have been suffering from significant volatility in the demand and supply of securitised bonds, rendering the secondary market less liquid and the primary market more sporadic than that of the US. This could be attributed to the fact that European ABS issues have not been dominated by repeated offerings from the same group of leading issuers, as seen in the US.

[19] Asset Securitization Report; *Thomson Media*, 20 June 2005.

B. National markets and legal jurisdictions

European issuance is very unevenly distributed geographically with approximately half of the entire market concentrated in the UK in terms of both the origin of assets as well as that of investors. Beyond the UK, Italy, Spain and the Netherlands stand out as other critical jurisdictions for asset origination. In terms of collateral, in the first quarter of 2005 they represented 19%, 16%, and 8% of the total market, respectively.[20] Since the four leading countries together represent almost 90% of the entire market, there remains a substantial scope for growth in other jurisdictions. However, important legal, structural and tax differences exist between the UK and leading followers, as well as other countries.[21] These differences are not limited to the unique development of the legal form of a trust and the associated separation between beneficial and legal ownership present in the English legal tradition; they also include other key areas such as the legal setup for determining the 'true sale' and the 'true control' status of securitised assets.

In broad terms the 'true sale' concept refers to the *ex-post* legal recognition by a court of the separation of securitised assets from the originator's balance sheet in the case of its bankruptcy. The concept of 'true control' mainly applies to corporate securitisations of productive assets and refers to creditors' ability to operate assets following a credit event. Whether the transaction is recognised as 'true sale' is critical to the conduct of the bankruptcy proceedings and the recognition of the legal separation of different groups of assets. Similarly, applicability of 'true control' provisions distinguishes securitisations from a standard debt contract, where a default could be followed by a stay on assets and could affect existing management's ability to conduct reorganisation, effectively preventing transfer of control over assets. In some jurisdictions, control over assets might be transferred to a 'receiver' appointed by the court to represent interests of different stakeholders, including creditors.

[20] European Securitisation Forum: www.esf.org.
[21] See for example Deacon (2003).

Legal provisions concerning securitised creditors differ by market and according to each jurisdiction's own securitisation laws. As they were only enacted in recent years these laws have often not been fully tested in practice. At the same time, local deal structures typically reflect corresponding jurisdiction's features, which are often linked to different levels of creditors' protection and their ability to exercise control over assets.[22] As a result, unlike in the US, the European securitisation markets are fragmented in legal as well as regulatory terms. This is despite the existence of the more universal realm of securitisation investors, which has resulted in a degree of structural coordination across jurisdictions, such as the standard listing at the Luxembourg Exchange required by many international investors. There is some concern that legal and regulatory differences might have formed an effective barrier to the early application of securitisation technology in some European markets because of the high setup costs of the first transactions.

III. LEADING CHARACTERISTICS OF EUROPEAN SECURITISATIONS

A. Asset and originator characteristics

Greater diversity of European assets seems to be caused not only by the cross-country differences, but also by the wider range of originators as well as the continuing push for new, more innovative structures aimed at exploiting specific market niches. These niches are largely created by the imperfectly integrated and relatively idiosyncratic European corporate finance markets.

Structured finance markets in Europe have been particularly innovative in the areas of synthetic securitisations and in the corporate sector, despite the fact that both, in line with the US experience, have represented a relatively small part of the total pool of securitised assets. In this respect, Europe (and the UK in particular) have produced entirely new types

[22] See for example: Porta, R. La; F. Lopez de Silane, A. Shleifer, and R. Vishny (1996): Law and Finance, *National Bureau of Economic Research*, NBER Working Papers: 5661.

of securitisations, such as whole business securitisations or inventory securitisations, as well as securitisations of future flows. At the same time, the growth of synthetic deals has been stimulated in Europe by the balance sheet management and credit risk trading among European banks.

European securitisations have also been characterised by a lower number of deals per originator and, related to that, substantially less common occurrence of frequent, off-the-shelf securitisations by the same, returning originator, which characterise the US market. While the US market has been dominated by a number of large, consistent issuers, European companies' approach to structured finance (with some notable exceptions) can be described as much more erratic. In many cases, European financials and industrials alike have approached securitisations, in contrast to their US peers, in a relatively exploratory manner.

On one hand, this approach could be seen as a barrier to the development of an efficient, standardised securitisation market. On the other hand, it has also been associated with greater innovation and more flexible adaptation of the basic structures to a variety of different purposes. This is directly linked to a wider range of the potential rationales for the use of securitisations.

A particularly striking feature of the European market in this respect is the high differentiation between similar companies in their approaches to securitisation. For example, even in relatively developed securitisation markets such as the UK or France, leading banks of similar size in a single jurisdiction might adopt diametrically opposed approaches to securitisations—from non-participation to consistent adoption of the technology in a manner similar to their US peers. While these distinctions might indicate the greater potential of the European securitisation issuance in the future, it might also point at the lack of a single, overarching rationale behind the transactions that have occurred so far and structural barriers to wide adoption of structured finance solutions.

Overall, the European structured finance markets differ from their US counterparts not only because of their greater asset diversity, but also due to their lower level of structural standardisation, lesser tranching, and a different role of the public sector—namely, that of an active issuer. While these differences do not undermine the simple fact that the securitisation technology and its *modus operandi* are fundamentally the same on both sides of the Atlantic, any comprehensive, empirical analysis of the European structured finance markets has to take these important differences into account.

Ahead of the analysis presented in chapters 2 to 5, it is also critical to understand the key features of the specific asset markets that distinguish different types of securitisations. This is necessary in order to both position the presented research in the broader market perspective as well as to correctly interpret the reported findings. Still, it would be difficult in this short introduction to provide the full account of all different asset classes. Hence, in the discussion below we concentrate on the three leading market segments, which have been particularly important for the European securitisation market. These segments include: (i) the largest single asset class—the mortgage backed securities, (ii) corporate securitisations (with their many structural variations unique to Europe), and (iii) the relatively new area of synthetic securitisations.

B. European mortgage-backed securities

In the absence of the US GSE-equivalent institutions on either the continent-wide or the country-wide level, European markets for securities backed by pools of mortgages have been effectively built from the bottom up by the financial sector, largely without any government intervention. This 'organic' type of growth is likely to have been responsible for the lack of the most basic 'pass-through' securities, which have initiated the US securitisation experience. As a result, agency securities that dominate the US market have been absent from the European concept of securitisations, being replaced instead by more

structured issues, to which investors were exposed from the outset. In that respect, Europe has been characterised not only by the lack of government coordination in creating the secondary market for residential housing loans, but also by the lack of strict standardisation of issues or that of the underlying collateral.

Overall, residential mortgage-backed securities currently represent just under 50% of European securitisation issuance with the total volume reaching *circa* €244.6 billion in 2006.[23] Approximately 50% of that total is backed by the so-called 'prime' residential mortgage-backed securities (or prime RMBSs) followed by the 'sub-prime' RMBSs—market akin to home equity loans in the US. The originators' realm has been dominated by a few leading issuers, including the Royal Bank of Scotland, Northern Rock, and Abbey National in the UK, as well as BNP Paribas, ABN Amro, and Banco Santander on the continent.[24]

In general, in comparison with the US, the European MBS markets remain relatively undeveloped and are characterised by historically low levels of growth. For example, the total outstanding agency MBS issuance in the US was US$3.5 trillion at the beginning of 2005, which represented an increase of over US$1 trillion over the last four years (excluding *circa* US$500 billion of outstanding securities backed by home equity loans and manufactured housing credits). In Europe, the residential mortgage backed securities represented just 4% of the total outstanding residential market loans—almost ten times less than in the US. European RMBS volumes were also highly differentiated by country, ranging from 3.6% for the UK through to 7-8% for Spain and the Netherlands, to 10% for Ireland. For comparison, the residential debt to GDP in Europe has been historically highest in the Netherlands (almost 100%), Denmark (*circa* 90%) and the UK (*circa* 70%).[25]

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[23] European Securitisation Forum: www.esf.org.

[24] Based on the database of European securitisation transactions compiled by JP Morgan International Securitisation Research Desk, London, and the listings of structured finance transactions from *Structured Finance International*: http://www.ew-sfi.com.

[25] Sources: European Securitisation Forum: www.esf.org. Commerzbank Corporates & Markets – Structured Finance (Pan European), Facts & Figures 2004: The way it was; 11 February 2005. KfW Bankengruppe, Market Data 2004 (European ABS Markets).

In parallel to structured RMBSs, alternative forms of mortgage-related products have emerged in several countries outside the UK, such as the so-called 'Pfandbriefe' bonds in Germany or Switzerland. Still, the UK market has dominated pan-European issuance with over 50% of the total volume. Moreover, in contrast to the US, the UK RMBS market continues to be dominated by floating rate issues. In fact, even the UK 'fixed rate' issues typically only remain fixed for a specified period of time, which is considerably shorter than their expected average maturities of 2 to 5 years. This is not surprising in as far as the UK RMBS issuance is seen as a reflection of the key characteristics of the UK mortgage market, where variable-rate loans constitute a substantial part of all originations. Moreover, a significant share of all UK mortgages remains non-amortizing with the interest-only securitisations still representing as much as 50% of all originations.[26] The UK RMBS market has also been characterised by its 'true-sale' nature with no synthetic RMBS structures issued in the UK, in contrast to, for example, Germany or France. In the near future the UK market is expected to continue to represent the majority of the European total issuance with the share of the non-conforming loans (already above the US level) likely to rise even further, according to market analysts.

A crucial aspect of the RMBS market is the level of prepayment—one of the main sources of risk for the RMBS investors. The prepayment rates on RMBSs have been historically more stable in the UK than in the US, despite a similar housing turnover. Although this prepayment differential has persisted for a couple of decades, there are signs that it might be diminishing, albeit slowly. In the UK, the actual prepayment rates have been generally low at *circa* 8% CPR and rarely exceeded 11 to 13% in the past.[27] This might change as markets become more competitive with a rising number of alternative financing options offered to borrowers.[28]

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[26] Hayre (ed.) (2001); Fabozzi and Choudhry (eds.) (2004).
[27] 'CPR' or the 'constant prepayment rate', represents the basic assumption behind the market convention in reporting different levels of prepayment assumptions across transactions.
[28] *Ibid.* and Fitch Ratings Research: www.fitchratings.com.

The UK sub-prime RMBSs have also exhibited very low loss rates, decreasing continuously since 2001 to *circa* 0.2% by the year-end of 2004. In contrast to the US, where the average recovery rate is 60% for RMBSs, the average annual default rate in the UK has been 0.4% and the historic loss rate just 0.2%. European RMBS issues have also exhibited rather stable ratings—a factor contributing to rather low spreads. According to Fitch, a credit ratings agency, historically 99.6% of single A-rated European RMBS issues had the same or higher rating when compared with a year before. The analogous figures for BBB-rated and B-rated issues were at 99.4% and at 100%, respectively.[29]

Overall, the European RMBS markets represent a fertile ground for empirical research into securitisations, but also exhibit important differences across different jurisdictions. The important characteristics include the rates of prepayment, the dominant position of the floating-rate issues, the variety of issuers, as well as stable ratings, among other factors. Moreover, the dominant position and the unique characteristics of the UK market must be taken into account when studying the European RMBS markets given that majority of European issues originate in the UK.

C. Synthetic securitisations

The concept of synthetic securitisations introduced briefly in the first section above differs from the classical concept of securitisation in so far as it relies on an effective but *notional* risk transfer rather than the *explicit* asset transfer as in the case of 'true sale'. In that respect, synthetics more closely resemble what can be described as 'collateralised insurance policies' than any standard, off-balance sheet financing or asset sales.

In a generic synthetic transaction, the originator buys protection for its portfolio of assets against its exposure to some specific, clearly defined credit event. The protection is in the form of a contract with a selected group of 'creditors' (or protection sellers) and linked to a special purpose vehicle (SPV). If a credit event occurs, the SPV is typically obliged to

[29] Fitch Ratings Research: www.fitchratings.com.

compensate the protection buyer for its losses according to the terms of the transaction. In order to fund the claims in the first place, the SPV issues credit securities, which are placed with a selected group of protection sellers. The SPV invests the proceeds from the issue into liquid assets to serve as collateral against its contingent liability. At maturity, by selling the remaining collateral, the SPV pays back the principal, reduced by the amount of the collateral previously used to service any claims, to investors. During the lifetime of the transaction, the payments from the originator, supplemented by the returns from the collateral investment, are used to service the synthetic securities. It is important to note that, despite the fact that in a synthetic securitisation the reference assets never actually leave originator's balance sheet, investors *de facto* 'buy' them by agreeing to assume the assets' risk in exchange for an interest premium linked to the assets' risk profile.

According to one estimate, the total synthetic issuance reached *circa* US$600 billion in 2004, but a large part of this represented the notional volume of all forms of credit derivatives, which have experienced a remarkable level of growth over the recent years. For example, synthetic CDO issuance has been growing steadily year on year in Europe and was expected to reach the all-time record of €200 billion globally in 2005.[30] However, an important part of the market was represented by the so-called 'bespoke' issues (privately arranged between banks or other counterparties), which have not always been publicly disclosed, so that market volume estimates have proved highly differentiated in the past. In 2004, the synthetic, 'funded' securitisations in Europe represented just 6% of the total securitisation issuance (a 7% decline versus 2003), while the synthetic 'unfunded' securities represented 11% of the total (a 53% decline versus 2003).[31] According to Fitch, total synthetic CDO issuance in Europe in 2004 reached almost €20 billion.[32] Interestingly, approximately 40% of that total might have been accounted for by the so-called 'CDO^2'

[30] Tett, G., *Global CDO issuance sees sharp upturn*, Financial Times, 4 August 2005, quoted JP Morgan estimates.
[31] Commerzbank Corporates & Markets – Structured Finance (Pan European), Facts & Figures 2004: The way it was; 11 February 2005.
[32] Skorecki, A., *CDO2 meets search for yield*, Financial Times, 20 December 2004.

issues – portfolios of credit derivatives on the underlying credit derivatives portfolios, which allow for maximum gearing (and hence exposure), but also feature considerably higher spreads.

The distinction between 'synthetic' versus 'true sale' might be particularly important in the case of different CDO classes and is relevant almost exclusively with regard to financial institutions. However, since the comprehensive market data analysed in this Thesis covers the period until the end of 2003, synthetic securitisations do not represent a very significant portion of our entire dataset. Nevertheless, they are also likely to become considerably more important in the future—in that respect, they represent a fertile ground for further research.

D. Corporate securitisations

Despite being smaller than RMBSs or CDOs in terms of their total issuance volume, corporate securitisations have grown in Europe to become one of the most innovative areas of structured finance. In the greater realm of corporate finance this category includes related financial contracts such as project finance, equity securitisations, monetisations, or whole business securitisations—hybrid structures with features of both traditional corporate loans and securitisations.

The basic principles underlying corporate securitisation transactions are essentially the same as in the case of loan securitisations by financial institutions and consist of the legal separation of assets, detailed performance monitoring supported by covenants, and the issuance of structured, asset-backed securities. However, since in the case corporate securitisations the collateral often includes operating assets other than simple receivables, the contractual relationship between the originator and the SPV is often more complex than in the case of standard loan packages. This often requires not just the 'true sale' status, but also creditors' ability to effectively continue to operate securitised assets following a credit event (also known as 'true control'). Moreover, while featuring a more diverse asset range

than in the case of MBSs or consumer loans, corporate transactions are far less standardised. In this case, the assets can be stocks or business inventories, properties, or fixed operating assets, alongside the most popular asset types such as receivables or leases. A separate category in this segment is the 'future flows' favoured for their quick capital release potential by levered buyouts, where issued securities are backed by future revenue streams rather than by the intrinsic 'face' value of the assets today.

Similarly, the whole business securitisations (WBSs), which have been unique to Europe and largely (90%) concentrated in the UK, represent a departure from traditional securitisation contracts. Much interest has been generated by the corporate securitisations of popular brands such as Formula One, Lanson Champagne, Canary Wharf, or Madam Tussauds, as well as transactions involving unique industries such as diamonds, funeral houses, hospitals, or ports. Many of these transactions have been termed 'whole-business securitisations' because they involve the process of 'ring-fencing' entire companies, akin to project finance, rather than just a selected group of assets (eg, receivables).[33]

In contrast to standard debt, in corporate securitisations the originator effectively surrounds control over securitised operating assets to creditors according a detailed financial contract in order to create value for equity holders by reducing agency costs, removing the 'opaqueness discount', and diminishing variability in returns while increasing leverage. Corporate securitisations could therefore be seen as a remedy to the agency problem with regard to perquisites, misuse of free cash flows, and the potential dilution of value through investments in alternative, risky or NPV-negative projects. Whether they concern details on routes and maintenance schedules of securitised airplanes, specific rules of properties' management, or the step-by-step characteristics of the champagne production process, they essentially tend to 'micro-manage' the relevant businesses through an exhaustive list of covenants monitored by external agents with the help of extensive operational information

[33] Insolvency ring-fencing structure of the whole business securitisations in the UK is dependent on the ability of the holder of a floating charge to appoint an administrative receiver in order to block the appointment of an administrator and moratorium proceedings and the ability of that receiver to run the business. Deacon (2003).

disclosure. In the sense of the incomplete contract theory, therefore, they represent close approximations to what could be termed 'complete contracts'. In this spirit, Chapter 2 presents a model of corporate securitisations as an alternative financing method to a standard debt contract.

An example of a WBS structure based on a securitisation of future flows is shown in Fig. 2 below:

[FIG 2 INSERT HERE]

The key feature of this hypothetical transaction is the separation of the operating arm from the financing arm and from the parent. This might allow for a degree of flexibility in the way creditors remotely 'manage' the business with the help of a trustee. Effectively, creditors can, for example, replace the company management (the operating company) without triggering bankruptcy proceedings. The structure also ensures a close control over cash flows generated by the business. We investigate corporate securitisations in greater detail in the next chapter.

E. Pricing

Beyond different asset classes, it is also worth to briefly introduce the patterns of prices prevalent in the structured bond markets over the recent years. The full analysis of prices in European securitisation issues is provided in Chapter 4.

Structured credit spreads (option-adjusted and measured over the relevant market benchmarks) have been gradually decreasing in Europe over the last few years, accelerating downward in 2004, but exhibiting greater volatility and slower decline in 2005. This process has reduced the persistent gap between corporate and asset-backed securities of the same rating. Although spreads of unsecured corporate loans have been generally decreasing over the recent years, spreads on structured issues have exhibited greater decline. For example,

the European AAA-rated prime RMBS spreads have fallen by more than 50% since 2003. In contrast, the analogous corporate credit spreads have decreased by less than 20% over the same period.[34]

There is much reported interaction between corporate finance and structured finance credit spreads (particularly with respect to CDOs) with some evidence of the mutual reinforcement of their respective trends. On one hand, the growth of European CDO markets has added liquidity and increased spanning in corporate securities, which had an expected effect of bringing corporate spreads down. On the other hand, falling corporate spreads have been reported to exercise further downward pressure on the asset-backed securities driven by the decline in the underlying default rates.

The growing participation of synthetic issues in the overall product mix has been generally associated with significantly increased levels of volatility and, hence, higher expected spreads. Clearly, multiple arbitrage opportunities are among the most critical drivers behind investment banks' involvement in synthetic securitisations with promises of large returns and high achievable levels of leverage available to sophisticated arbitrageurs. Since synthetic markets are still seen as relatively opaque, while significant parts of credit markets remain relatively illiquid, arbitrage opportunities are likely to exist. However, the associated risks have been highlighted by heavy losses on these products sustained by some hedge funds and investment banks over the last coupe of years.

In general, although arrangers and market specialists have been improving their pricing models, the latter are still perceived as inadequate given multiplicity of different risks, such as counter-party, execution, and legal risks, beyond the simple credit spread. As a result, different market segments, such as synthetic portfolios of credit derivatives, are still seen as relatively untested. One challenge has been to correctly account for portfolios' correlation risk. Another challenge is that many synthetic products have not been tested in practice for their structural robustness as well as counterparty and contractual risks.

[34] The Bond Market Association, www.bondmarkets.com.

Consequently, the potential effects of a systemic shock, or a sharp, coordinated rise in credit events, remain largely unclear.

These issues are likely to be contributing to the fact that the option-adjusted spreads on structured issues remain above the levels predicted by historical or modelled default rates, despite their overall downward trend. Another possible reason for this discrepancy might be the so-called 'complexity premium', as investors and issuers alike struggle to keep up with the pace of financial innovation in the area. Legal complexities are also likely to represent an important contributing factor. Nevertheless, these considerations do not seem to have negatively affected the structured finance issuance in the medium- to long-term.

Prices in securitisation transactions have been investigated in the academic literature in the past, although relevant papers have largely concentrated on the issue of correctly pricing the prepayment option in mortgage backed securities given the term structure of the interest rates, an issue of lesser significance in the European context. Among these studies, Boudoukh, Richardson and Stanton (1997) concentrate on pricing of the GSE-sponsored, mortgage-backed securities in a multifactor interest rate environment motivated by the implicit, default-free nature of such agency MBS issues. Similarly, Goodman and Ho (2002) model the spread of mortgage-backed securities over US treasuries. A different approach and more relevant to our work is adopted by Ammer and Clinton (2004) who investigate the impact of changes in credit ratings on the price of ABS issues using a dataset of US securities from 1996 to 2003.[35] At the same time, the most prominent lines of research into determinants of bond spreads generally are readily applicable to structured bond issues. We build up on the vast bond pricing literature in Chapter 4, where we also review the existing research in greater in detail.

[35] Ammer and Clinton (2004).

IV. SEEKING RATIONALE BEHIND SECURITISATIONS

Given multiplicity of features and potential applications of securitisations, it is clear that these transactions might be driven by numerous, differing rationales, which are also likely to be distinct from those behind other forms of financings. In general, there seems to exist some confusion as to what exactly justifies securitisations, who it benefits, and why. This might be, at least partly, due to perceived complexity of securitisation transactions, featuring some of the most extensive financial contracts in the capital markets more generally, as well as still limited academic research in the area, rapid market development and innovation, and the debate about the pros and cons of securitisations being dominated by the marketing effort from the leading arrangers. However, understanding of the true drivers behind structured finance as well as the associated costs and benefits to issuers, might be particularly important not only from the theoretical perspective, but also for the simple, practical reason of high transaction fees (being significantly above those in the case of plan vanilla bonds) as well as in order to facilitate the choice of an optimal financing method under specific circumstances and given alternative funding opportunities available to originators.

In this section, we introduce and review for the first time some of the key rationales behind structured finance transactions, the exploration of which is one of the overarching themes of this Thesis. In order to link the specific features and contractual solutions found in securitisation markets to different purposes they are designed to serve more closely, we divide our analysis into two parts:

The first part concerns the design of securitised portfolios of assets as well as the structuring process of creating new asset-backed securities (also known as pooling and tranching). These themes have been primarily addressed in the past by the security design literature and include considerations of issues such as market incompleteness, market segmentation, liquidity, and asymmetric information. In this context, we test different

theories of tranching empirically using a dataset of all European securitisations in Chapter 3.

The second part of this section concerns institutional and contractual features of securitisations, as explained by the corporate finance theory, which focuses on the transfer of assets, the legal setup, as well as managerial incentives involved in securitisation transactions. Research in this area has concentrated on issues such as the agency rationale for ring-fencing, design of contracts governing securitised assets and free cash flows, and availability of funding in the presence of various externalities such as credit rationing and the underinvestment problem, among others.

The above distinction of two aspects of structured finance is not new: for example, Oldfield (2000) also separates 'structuring' from 'securitisation' along similar lines. According to Oldfield, the former concerns tranching and structuring of securities issued by the special purpose vehicle (SPV), whereas the latter concerns the contractual and legal process of transferring assets to the SPV and issuing securities. Oldfield (2000) uses the 'pass-through' securities as examples of securitisations without structuring. Although this separation is implicit rather than explicit in the European context given that the pure 'pass-through' securities are rare (practically all securitisation issues in Europe are structured, although some categories of assets feature relatively little tranching—see Chapter 3 for details), it remains useful for categorising different types of potential drivers of securitisations.[36] We explore each of those issues in turn.

A. *Security design literature explanations of pooling and tranching: market incompleteness and market segmentation*

The existing theoretical literature concerning structuring in securitisations derives from the general area of security design driven by arbitrage. According to Greenspan:

[36] That is, cash flows are contractually amended with the help of a variety of tools, even if just a single tranched is publicly issued.

> *Securitization is, without a doubt, the major tool used by large banks to engage in arbitrage.*[37]

If structuring is driven by arbitrage opportunities reflected in profitable activities performed by arrangers and intermediaries, these might be due to market incompleteness, characterised by missing financial securities or even missing markets, existing markets' segmentation, as well as persisting barriers to arbitrage such as informational asymmetries, exclusive origination skills, or unique technologies.

With respect to market incompleteness, structuring and tranching can be used as a process by which new securities are created where no securities existed before. Importantly, this requires a sufficient degree of market incompleteness to exist *ex ante* as well as for such incompleteness to persist over some time. From the point of view of spanning, there must exist incentives to set up markets for securities for which there are no close substitutes. This implies that more sophisticated structuring might be optimal in more incomplete or segmented markets. Both professional and theoretical literature suggests that this problem might be particularly important for junior tranches, since the market for AAA-rated securities is usually perceived as quite efficient. With the level of standardisation typical of mature structured finance markets, securitisations might in fact allow for the least expensive means of arbitraging different market segments, while being more flexible than corporate loans with respect to specific designs matching the needs of particular clienteles.

Early papers on market incompleteness include Duffie and Rahi (1995), which combines spanning with asymmetric information. This is important because, as others have stressed, both explanations could potentially coexist with respect to different securities (tranches) issued within the same transaction.[38] For example Riddiough (1997) notes that

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[37] Greenspan, A. (1998): The Role of Capital in Optimal Banking Supervision and Regulation, *Federal Reserve Bank of New York Policy Review* 4, pp. 163-168.

[38] In Chapter 3 we show that indeed different types of structuring seem to be associated with different motivations behind securitisations.

although the creation of a senior tranche could be driven by asymmetric information, multiple junior tranches might be created to suit particular tastes of investors in order to facilitate the placement of the information-sensitive tranches in the market.

One of the recent contributions to the incompleteness literature, Gaur, Seshadri and Subrahmanyam (2004), models a market where all assets cannot be uniquely priced: attainable claims have unique prices, but prices of unattainable claims can only be bounded. In this setup holders of unique assets can take advantage of markets' incompleteness by focusing on claims that augment market spanning. The authors show that the value of a new asset can be enhanced by 'stripping away' the maximal attainable portfolio—the senior, near-riskless tranche—for which market prices are readily available, and selling the rest (the junior tranches) at the arbitrage-free or 'conservative' prices. Specifically in relation to securitisations, the authors solve a value maximization problem of the price of securities sold in the market and backed by multiple originators' assets for different levels of pooling and tranching.[39] The optimal regions for tranching and pooling are dependent on the relative unit prices at which originators sell securities to the intermediary and are non-monotonic.

The evidence from other markets and from the professional literature on structuring suggests that market segmentation might justify structuring and tranching if each market segment has limited capacity and no arbitrage opportunities exist. This would imply that when trying to place a larger, 'composite' issue with its idiosyncratic asset characteristics, the arranger might face a downward-sloping demand curve in contravention of effective arbitrage outlined by Scholes (1972). Downward sloping demand is well documented in other financial markets.[40] Such market segmentation problem is related to market incompleteness, as discussed above, in so far as the latter highlights the potential premium that might be obtained by moving part of a large issue into a new market segment, but

[39] This is 'extremal' nature of the security design: extremal securities cannot be formed as convex combinations of others and have maximal market span (maximal feasible portfolio payoffs); see Gaur et al. (2004).
[40] We list examples in Chapter 3.

differs in terms of its rationale. In the segmentation context structuring could be value-creating by tapping greater demand in several market segments at once, while avoiding the problem of limited capacity in any specific segment. This 'market segmentation hypothesis' implies that splitting larger issues into several tranches could be particularly important for large issues and in difficult market conditions. By dividing the issue, the arranger would enlarge the investors' base and avoid a detrimental effect of quantity on price.

The 'market segmentation' hypothesis alone would imply that the optimal level of structuring consists of splitting each issue into a large number of tranches of different characteristics. This might not be optimal since structuring is reported to be costly due to high legal, regulatory, servicing, and rating costs in the case of multiple groups of creditors with different cash flow rights. For example, Schwarcz (1994) reports that securitisations are rarely cost effective for transactions of US$50-100 million or less. In fact, the average European securitisation issue is over €700 million. Moreover, the existing bond pricing literature suggests that there is strong evidence for the existence of a positive effect of liquidity on spreads. Several studies such as Chen, Lesmond and Wei (2001) show that liquidity has a significant impact on bond prices.

A different motivation for structuring and tranching is analysed by Allen and Gale (1990), who focus on the short sale restrictions, which might result in situations where two portfolios of securities paying the same total amount may sell for different prices – the difference is the source of value in securitisations. Since there is a fixed cost of setting up a new financial structure, if no agent is bound by a short sale constraint, the only financial structures that appear in the equilibrium are those with minimal transaction costs. Authors assert that issuers do not attempt to identify unspanned risks and cater directly to implied needs for insurance (as in the incomplete markets literature), but they merely issue the package of securities fetching the highest announced market value net of issuing costs:

> *One is breaking the point into pieces and selling the pieces to the clientele that values it most. It is this ability to increase the value of the firm that provides the incentive to innovate and allows the cost of innovation to be covered.*[41]

B. Security design literature explanations of pooling and tranching: asymmetric information

Although markets often see securitisations as driven by market incompleteness, market segmentation, and hence 'simple' arbitrage opportunities, a majority of security design literature has focused on asymmetric information. As stated by DeMarzo and Duffie (1999):

> *The motivation for 'splitting' securities in this setting* [with asymmetric information] *is independent of motivations due to spanning or clientele effects.*[42]

Among influential asymmetric information models, Boot and Thakor (1993) noisy rational expectations model might be particularly important. The authors aim to explain issuers' selling of multiple, stratified financial claims, which partition cash flows from a pool of securitised assets into tranches differentiated by their information sensitivity. Investors are assumed to differ in their ability to screen the collateral. The authors claim that such 'informational leveraging up' implies that an informed trader can be compensated for his information acquisition cost with a smaller divergence from the 'true value' and the equilibrium price, when the information-sensitive tranche is separated vis-à-vis the composite security. The model concentrates on the decision by the issuer with high quality collateral to split cash flows because of the gains from improving security design. The low quality collateral issuer then mimics the 'high quality' issuer with the same security design. The focus here is on the issuer's desire to create an illiquid, information-sensitive security

[41] Allen and Gale (1990).
[42] DeMarzo and Duffie (1999).

rather than the need to construct a liquid, information-insensitive security, as in the earlier security design literature.

Boot and Thakor (1997) stress the potential liquidity-reducing effect of tranching due to liquidity demand being diverted from the information-sensitive tranche to the riskless tranche.

Earlier models such as Gorton and Pennacchi (1990) are commonly thought not to be able to explain why cash flows from the pool of assets are tranched given liquidity costs since:

> *such partitioning seems antithetical to the desire to create liquidity, which is the driving force behind the analysis in these papers.*[43]

Boot and Thakor (1997) show that gains from structuring can outweigh the loss of liquidity as long as some liquidity trade remains in the info-sensitive tranche. They predict that with more than two types of issuers, those with the highest quality of collateral might split securities into three tranches ranked by seniority, if the gain is greater than the loss due to the reduction in liquidity. Boot and Thakor's model requires structuring and tranching to reduce the variance of pricing (true value assessment) per tranche. Since issuers' revenues are positively correlated with the information sensitivity of the junior tranches and tranching is costly, the issuers with highly information-sensitive assets should tranche more. In other words, if tranching is unable to establish the minimum threshold of private information concentration in a junior tranche it might not be worth pursuing.

Riddiough (1997) has a related, yet simpler, model where tranching is optimal because by splitting assets into information-invariant and information-sensitive tranches, the capital-constrained issuer reduces liquidation costs from the lemons problem. Highly information-sensitive assets need to be tranched to avoid these costs. The model predicts that the subordination level increases with assets' opaqueness, but it decreases as asset

[43] Boot and Thakor (1993), p. 1351.

diversification in the collateral pool increases. Riddiough also acknowledges the possibility that tranching could be simply too costly vis-à-vis its potential benefits for some issuers/issues. Multiple junior and senior securities are rationalized by Riddiough with the varying severity of the capital constraint: splitting the junior tranche might be necessary with a severe constraint if the issuer is forced to sell a portion of it at a discount. It follows that across a spectrum of firms opaque asset pools are more costly to securitise.

A series of papers by DeMarzo (1997), (2001), (2005) considers the problem of a financial intermediary, who sells assets in the presence of asymmetric information and encounters the 'lemons problem'. The lemons problem results in illiquidity or a downward sloping demand as "*the price for the assets is decreasing with the quantity sold*".[44] The model is driven by the assumption that an informed intermediary with some private information can acquire assets with some common residual risk from informed and uninformed investors. DeMarzo describes an 'information destruction effect' of pooling based on the premise that an informed intermediary will not prefer to sell a single, pass-through security, but individual securities. At the same time uninformed originators will prefer to sell pooled assets to avoid adverse selection by informed intermediaries. However, pooling and tranching might be optimal for an informed investor due to the 'risk diversification effect', which allows an informed investor to create a riskless tranche. This combination is optimal when private information is common to all assets but information risks are idiosyncratic or asset-specific. This combination best allows for the creation of a riskless tranche. Finally, pools of third-party loans such as MBS or CLOs might be characterized by less-informed originators, high diversification of assets, and high differentiation of known risks. Overall, DeMarzo's model has similar implications: structuring should be particularly attractive in cases where private information or screening ability is pool-specific or characteristic of the type of the asset:

[44] DeMarzo (1997).

> [This] *may explain the tendency not to combine types of underlying assets (e.g. mortgages and corporate bonds), since for these different asset classes the private information is likely to be uncorrelated.*[45]

In DeMarzo and Duffie (1999) the issuer or the underwriter faces a trade-off between retention costs (exogenously given) and lemons-like liquidity costs (in the form of a downward sloping demand curve) of including in the security private information sensitive cash flows. A downward sloping demand curve results from the issuer's incentive to sell more when low value is revealed from his private information. In this setup, DeMarzo and Duffie derive the model design of an optimal security, which overcomes high issue costs of signalling quality based on the issuance of a senior, riskless claim with the issuer retaining a part or all of the residual. DeMarzo and Duffie's model implies that information sensitive (junior) portions of the cash flows should be sold rather than retained "(...) *if the degree of asymmetric information is not too severe.*"[46]

This implies that any potential junior tranches that are issued should represent a greater portion of the entire issue in the case of less information-sensitive assets where the 'informational sensitivity' of assets is measured in terms of the private valuation relative to the worst-case private valuation. Although the authors focus on the single security-design problem they acknowledge that "*in principle, the issuer prefers to decompose this security into heterogeneous pieces (...)*" and construct an example of a situation where both senior and junior securities are issued.[47] They conclude that:

> *This reasoning suggests that an issuer might prefer to issue prioritized debt structures when multiple securities can be issued. Examples include the various tranches of a structure of collateralized mortgages obligations by a given pool of mortgages.*[48]

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[45] Ibid.
[46] DeMarzo and Duffie (1999), p. 83.
[47] *Ibid.*
[48] Authors refer to DeMarzo and Duffie (1993) for the more general model, but this work seems to be incomplete and the final version is not currently available.

Several other papers take up the issue of the optimal number of creditors and the number of different securities issued. For example Bolton and Scharfstein (1996) conclude that firms with a higher quality of assets should issue multiple securities to multiple creditors whereas those with low quality of assets should be financed with a single debt claim. A lower number of creditors is also optimal if 'asset complementarity' – the degree to which assets are worth more together than apart – is high, and when the degree to which they can be redeployed is also high. As the authors admit these effects act in opposite direction so the general effect of asset-uniqueness on the number of creditors is ambiguous. However, in structured finance 'asset complementarity' could be linked with the existence of very large pools of many individual loans, which are highly complimentary in a sense that there exist significant benefits from managing a pool rather than individual loans. At the same time, redeployment could be easier for individual automobiles or houses than for corporate assets.

One consideration with respect to information asymmetry models is that *ex ante* information asymmetries might be eliminated by the rating process. However, since at least some junior tranches are typically unrated, the credit rating agencies might actually exaggerate the information asymmetry between junior and senior tranches. Complexity of securitisations means that securitisation technology might often exaggerate informational asymmetry overall. For example, the proprietary MBS and ABS valuation models which are used by arrangers, rating agencies, and some sophisticated investors, but are not typically available to others, might significantly contribute to that asymmetry.

Overall, the security design literature provides some important, yet diverse, suggestions as to how market incompleteness, market segmentation, illiquidity, and asymmetric information might represent sources of value, which can be unlocked with the help of the structuring process intrinsic to the securitisation issues. Importantly, several of those different rationales presented in the stylised theoretical models might coexist in

practice. They might also have a simultaneous impact on different aspects of structuring as show empirically in the following chapters. We extract testable hypotheses from this literature in Chapter 3 and test the leading conclusions specifically with respect to tranching in the same paper. We further use these hypotheses to test for the effect of structuring on prices in Chapter 4.

C. Corporate finance theories of securitisations

Beyond security design, we are primarily interested in the rationale for the contractual design of securitisation structures *per se*, as explained in the introduction to this section. Few theoretical models have attempted to explain the development and the application of the securitisation technology based on observed features of different transactions such as separation of assets, incorporation of extensive covenants, or contractual control of cash flows. Only most recently some preliminary research has focused on the relationship between the securitised assets and the originator's characteristics, as well as securities' governance structure, or the relationships between different groups of creditors and managers—we discuss these issues in more detail below. Overall, this literature has been largely limited in scope in comparison with, for example, the theoretical models of standard debt and equity contracts.

Among the most recent studies concerned with this aspect of structured finance are those that have focused on the securitisation contract as a solution to the problems of asymmetric information between managers and creditors as well as those that have focused on the agency problem as the key rationale for securitisations. Chapter 2 takes up this issue explicitly with a formal analysis of stylised financial contracts characterised by a degree of legal separation of distinct groups of assets (with non-recourse provisions and ring-fencing) as well as limits on managerial discretion. We show that agency costs, which cannot be reduced by standard debt contracts, make securitisations optimal for low-return, NPV-positive assets that might not otherwise be funded. According to our results, securitisations

are optimal in this framework providing that the costs of eliminating active management and severing cross-subsidisation linkages between different parts of the firm are not too high. More generally, the agency rationale for the issuance of asset-backed securities is based on the idea of limiting free cash flows in the spirit of Jensen (1976). This could imply that firms with low leverage, weak controls over management, and large cash flow-generating potential, might benefit from securitisations more than firms with limited potential for agency problems. We find empirical evidence supporting this hypothesis in Chapter 5.

Potential rationales for securitisations have also been extensively discussed by legal scholars. For example, the analysis by LoPucki (1996) makes an interesting suggestion that securitisations act as 'judgement-proofing' devices, ultimately designed to 'kill liability' vis-à-vis for example tort claimants and involuntary creditors. In economic terms this could be translated as a method for asset expropriation away from creditors, although Schwarcz (1999), among others, point out that this is subject to the use of proceeds. Stulz and Johnson (1985) and Minton *et al.* (1997) among others, suggest that the expropriation might be the rationale behind securitisations in some cases, especially where managers might invest the proceeds in NPV-negative projects or in private benefits.

Legal scholars have also suggested that securitisations might be designed to reduce the costs of bankruptcy proceedings. This point has been made, for example, by Frost (1997). More recently this argument has been explored further by Skarabot (2001) and Gorton (2005), who justified the creation of an external legal vehicle as facilitating bankruptcy proceedings. However, Iacobucci and Winter (2005) describe these explanations as limited since:

> (...) *securitization can add value even in bankruptcy-free, regulation-free context because of matters internal to the firm and its investors.*[49]

[49] Iacobucci and Winter (2005), p. 171.

These authors classify theories of securitisation based on asymmetric information into two groups: (i) asymmetries of information between different groups of ABS investors (creditors) and (ii) asymmetries between managers and creditors. The first group covers explanations explored by the security design literature discussed above, whereas the second can be described as broadly related to the agency problem. In this context, the authors identify five mechanisms through which agency costs might be reduced by securitisations: (i) enhanced monitoring by creditors; (ii) greater discipline through the elimination of assets independent of managerial effort ('reputation'); (iii) corporate control (which is closely linked to the previous motivation); (iv) explicit incentive pay schemes; and (v) limits on free cash flows.

The last one, which is seen as the most important by the authors and also corresponds to the model presented in Chapter 2 of this Thesis, is focused on a simple observation that the ring-fenced assets and the associated cash flows are put outside of managers' control and hence cannot be misappropriated. Importantly, according to Iacobucci and Winter (2005), proceeds from securitisations do not represent free cash windfall because: (i) they are used for refinancing; (ii) might be part of balance sheet restructuring during, for example, a leverage buyout transaction with predetermined use of proceeds; and (iii) are easier to monitor than small, annual cash flows. Furthermore, although the authors claim that securitised creditors do not monitor issuers, they might have an interest in the on-going relationship, as pointed out by Gorton (2005) or Higgins and Mason (2004).

Other possible rationale for securitisations includes avoidance of the 'lemons discount' with the help of external financing based on full information disclosure ensured by the SPV structure as well as the 'signalling benefit'. The latter is essentially based on the assumption that high-quality firms are more willing to disclose information about their assets than low-quality firms, and that securitised assets are representative of the firm as a whole. Essentially, managers might engage in an activity to reduce asymmetry of

information where possible and beneficial: ie, for high-quality assets, which can be made more transparent (eg, receivables).

Ambrose et al. (2003) explore whether securitisations are driven by capital arbitrage or by asymmetric information by investigating whether less risky loans are securitised first, as suggested by the former theory (assuming that securitisations of less risky assets offer greater potential gains from arbitrage). They interpret the present findings from the security design literature as implying that informational asymmetries render sales of relatively strong assets unattractive due to the lemons discount. However, the key conclusions from the security design theories based on asymmetric information are typically interpreted to imply that the best assets with the highest rating (where credit ratings are assumed to remedy informational asymmetries) should be sold rather than retained, since they do not pose major informational asymmetries problems, whereas the most risky assets, which cannot be properly assessed by outsiders, should be kept on the balance sheet. This means that both theories could imply that the best assets should be sold.

Calomiris and Mason (2004) as well as Ambrose et al. (2003), among others, discuss securitisations as means of regulatory arbitrage, especially with respect to capital requirements for banks. These theories explain how banks might benefit from securitisations more than other financial intermediaries due to minimum capital requirements. This behaviour has been clearly observed in practice, although it is generally expected that Basel II will reduce incentives behind this application of the securitisation technology. This explanation of securitisations has been long established and is likely to coexist with any other explanation, but it is not relevant to corporate securitisations.

Securitisations have also been linked to Myers (1977) underinvestment problem in so far as firms in a weak financial position or facing the debt overhang problem might engage in securitisations to raise financing for new projects that could not otherwise be funded. Berkovitch and Kim (1990), Stultz and Johnson (1985), and James (1988) all show that any secured debt can be used to address the underinvestment problem. These theories

imply that highly indebted firms could benefit from securitisation providing investors are confident that new projects will be NPV-positive. Although there are fundamental differences between collateralised debt and securitisations (see Chapter 2 for details), these studies support our conclusions about the use of security over a group of assets where there is a danger of underinvestment.

Another suggested rationale for securitisations is the explicit avoidance of the agency costs of debt in the spirit of Jensen and Meckling's (1976) asset substitution problem, given that securitised assets are ring-fenced and securitised debt holders do not capture gains from future projects. Still, securitisation transactions typically require a higher degree of information disclosure, strict covenants (although only on securitised assets), and consequently might be associated with *greater* agency costs of debt. In that respect securitisations could be value-destroying if pursued for liquidity or other reasons if the firm simultaneously incurs large agency costs of debt.

Overall, asymmetric information, in one form or another, has been perceived as one of the potential drivers for securitisations. In contrast, our model in Chapter 2 assumes no such asymmetries because it concentrates on the agency problem. Several, recent working papers have linked the securitisation concept to the issues of asymmetric information as well as to the agency problem in addition to the previous explanations based on regulatory arbitrage or bankruptcy costs. We do not address the latter issues explicitly, but they are compatible with the drivers that we explore.

Only a few of the above-mentioned studies have developed rigorous theoretical models—a large majority represent more informal discussions of different, potential hypotheses and rationales for securitisations. The studies that have explicitly suggested the agency rationale for securitisations have typically approached this topic from the legal perspective, which can be seen as complementary to our research and supports our conclusions outlined in Chapter 2. More fundamentally, as far as we know, none of the

earlier studies have explicitly considered securitisations from the perspective of the allocation of control in the spirit of the incomplete contract theory, as we do.

V. CONCLUSIONS

Securitisations are at the forefront of contemporary finance and their better understanding and further development can be seen as one of the most critical determinants of future innovation and value creation by the financial industry as a whole. This is particularly clear from the increasing importance and sophistication of securitisation contracts as well as the growing range of assets being securitised.

European securitisations markets are different from the US markets in some important respects, including greater diversity of assets, broader range of different types of investors, greater importance of corporate securitisations as the leading area for innovative applications of the securitisation technology to corporate finance, greater adaptability of securitisation structures, and different forms of structuring, among others. In terms of specific aspects of the security design and their implications for pricing, European issues are less linked to prepayment patterns, feature a greater number of synthetic transactions, while exhibit a lower degree of structuring in general. The understanding of these and other differences as well as of general market characteristics and trends in European structured finance is important for the correct interpretation of the results of the empirical analysis presented in Chapters 3 to 5.

The theoretical explanations of securitisations have focused on two distinct aspects of the securitisation technology: On one hand, the security design literature has thoroughly explored the rationale behind the formation of asset pools with specific features and the associated process of structuring of asset-backed securities (also known as pooling and tranching). The leading drivers identified in earlier research include asymmetric information, market incompleteness and market segmentation. On the other hand, the corporate finance literature has only recently started exploring the microeconomics of securitisation structures, where the latter might represent the optimal financial contracts for some issuers due to asset and market characteristics.

The areas that might require particular attention in the future include new pricing models aimed at facilitating new product developments. Such techniques might help to eliminate opaqueness, particularly in the synthetic market, and better address risks, such as eg correlation risks. Further research is also required in the area of the cost-benefit assessment of securitisations as an alternative to more traditional sources of funding from the issuer's perspective, as well as further empirical studies of security design.

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FIG. 1: SCHEMATIC REPRESENTATION OF A GENERIC STRUCTURE OF A TRUE SALE SECURITISATION

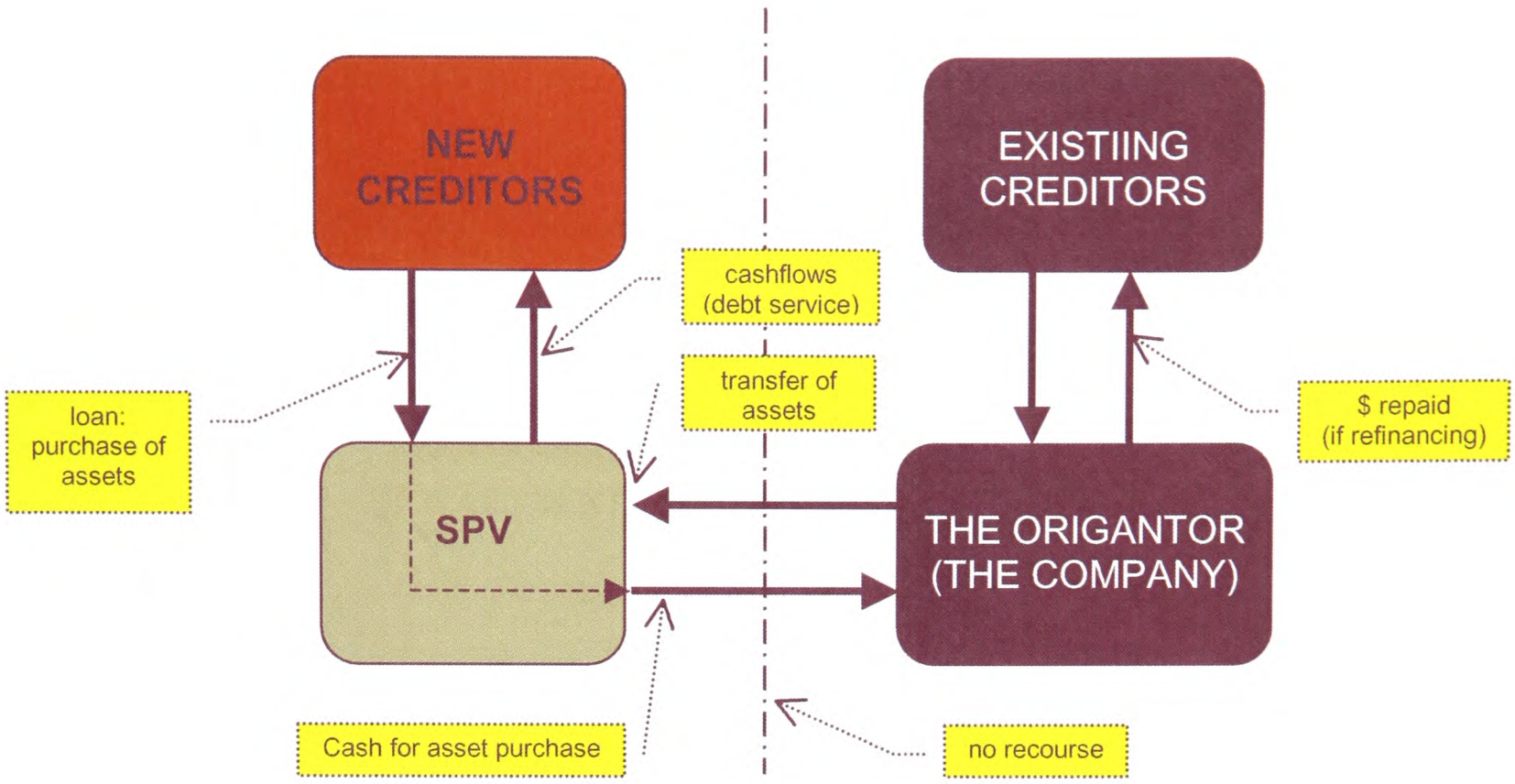
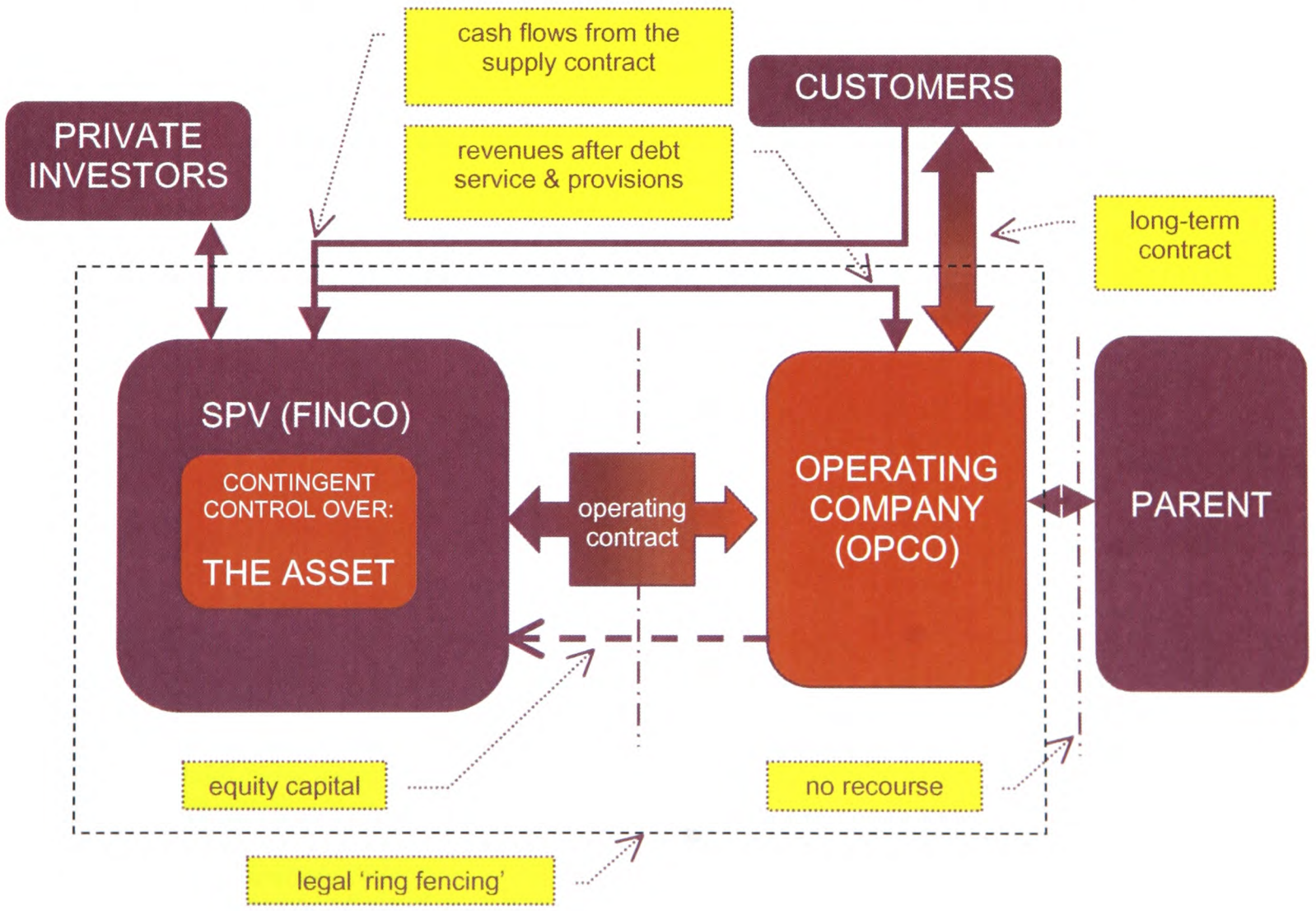


FIG. 2: SCHEMATIC REPRESENTATION OF A GENERIC STRUCTURE OF A WHOLE BUSINESS SECURITISATION (WBS) BASED ON FUTURE FLOWS



FINANCIAL CONTRACTING AT THE BOUNDARY OF A FIRM[1]

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ABSTRACT

We look at financial contracts determining boundaries of a firm. In the spirit of the incomplete contract theory, we analyse optimal allocations of control in financial contracts involving limits on managerial discretion and legal separation of distinct groups of assets. Our model explores the interplay between different groups of creditors and managers in a symmetric information environment. The results display optimality conditions for a variety of contracts, from asset-backed securities through project finance to debt with covenants vis-à-vis a standard debt contract with a contingent allocation of control. We also show how such contracts defining the boundaries of the firm might be welfare enhancing.

JEL classification: G32, G33, G21

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I. INTRODUCTION

A. Financial contracts with limited managerial discretion and recourse

According to the Modigliani-Miller (MM) theorem the type of financing a firm employs should have no impact on its value in certain idealized conditions, including perfect markets and no taxes.[2] It should also carry no welfare implications. Ever since Modigliani and Miller published their paper, decades of academic research have shown that various factors, which constitute departures from those idealized conditions, might create incentives for firms and investors to prefer one type of financing contract to another.[3] Taxes, costs of bankruptcy and asymmetric information have all been among prominent lines of research producing valuable insights into decisions regarding corporate finance . More recent research on financial contracting, inspired by the seminal work of Oliver Hart and John Moore, has concentrated on the issue of allocation of control over the company's assets constituting an inherent part of any financing contract.[4] In this context, the 'incomplete contract' theory has made the fundamental observation that contracts, including financial contracts, are inherently incomplete: they cannot account for every possibility that might arise in the future. Instead, they allocate control to different parties in different circumstances in parallel with specifying the terms of repayment.

The incomplete contract theory and related models of contractual allocation of control have been widely applied over the last decade to explain standard financial contracts such as debt or equity. In the case of debt contracts, for example, they have attempted to explain the notion of a contingent shift in control to creditors in the 'bad' state of the world, or when the company defaults, while management retains control of

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[2] Modigliani, F. and Miller, M. (1958). 'The Cost of Capital, Corporation Finance, and the Theory of Investment'. *American Economic Review*, 48:261-97.
[3] See Harris and Raviv (1991) for an excellent review of literature on capital structures.
[4] See Hart and Moore (1988), (1989) and (1990).

the company in the 'good' state or when it is able to meet its financial obligations.[5] However, contrary to the assumptions of many theoretical models, standard debt contracts do not effectively transfer control over assets to creditors when the default occurs: foreclosure of assets is often pre-empted by a debt moratorium and restructuring, or by the automatic stay on assets. As a result, management often effectively retains control over the corporate assets. Other contractual arrangements might be needed in order to fully secure creditors' rights by means of, for example, an appointment of an administrative receiver who can block the moratorium proceedings. This process can be defined and instituted *ex ante* when the initial contract is signed with a 'charge' placed over some assets. This 'charge' is an explicit allocation of a group of assets and their returns to specific claimants (secured creditors) and represents a *full* transfer of property rights.

More generally, there exists a plethora of financial contracts where the loss of a degree of control over some company assets by managers is not just contingent on some future event, such as non-payment of debt service, but is put in place outright, *ex ante*, when the contract is signed. In these cases, managerial discretion over specified assets is removed and replaced by legal provisions governing the use of assets, which is defined explicitly, while creditors through their representatives (eg, a trustee) gain specific, contractual rights to control the assets in case of credit event. Such 'complete' contracts can be seen to have two contrasting implications. First, they might add value by constraining managers in their ability to misappropriate assets for their own benefit and/or the benefit of other stakeholders by making assets' returns *verifiable*.[6] Second, in

[5] For example: Aghion and Bolton (1992).

[6] By definition, the complete legal contract over returns on assets requires verifiability of such returns in order for the contract to be enforceable; in other words, the returns on assets must be verifiable in order for the contract to be complete and effective. When a traditional, *incomplete* financial contract, which allocates contingent control over assets, is replaced by an effectively *complete* contract, enforced by an independent, legal representative (eg a trustee), detailed legal provisions specifying the use of assets in all circumstances are substituted *in lieu* of managerial discretion. In the absence of managerial discretion, specifying the cash waterfall (ie, a step-by-step regulation of the use of cash flows) becomes possible—a critical requirement

so far as managerial discretion is a valuable call option on alternative ways to reinvest assets under managers' control, these contracts might destroy value.

Consider the example of 'corporate' securitisations, where asset-backed securities (ABSs) are issued backed by corporate assets. In securitisations, a portion of originator's assets is reallocated to an external legal vehicle, the special purpose vehicle (SPV) or a special purpose entity (SPE), often set up in the form of a trust. The SPE remains under control of creditors' representative—the trustee—whose actions are governed by the initial contract.[7] Creditors have the first claim on cash flows generated by the securitised assets, typically up to a certain limit—typically the contractual repayment of their claims plus a cushion for risk from excess payments accumulated in a designated account. Creditors' cash flow rights are enforced by the trustee, in line with the initial agreement, with the help of extensive reporting requirements regarding assets' performance as well as third-party agents, including custodians and paying agents. Although the managers of the originating company do not control the assets' cash flows, the originator might have, *ipso facto*, an 'equity' interest in the pool of securitised assets and retain some rights to excess returns.

In addition to reallocating control over assets to creditors up-front via detailed contractual provisions, these financial contracts legally separate different groups of

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for verifiability. That is, each step in the management of the assets becomes a legally verifiable action with no outside control or discretion over the use of assets and the returns on those assets beyond that specified in the contract. Moreover, in order to make the returns verifiable, the contract does not only specify the rules for how the assets are to be managed under all contingencies, but also requires extensive reporting on the performance of the assets and on the actions taken with respect to those assets by specified parties, including external agents.

[7] Securitisations are often associated with pooling and tranching of loans rather than contractual arrangements governing the use of assets. In this respect, Oldfield (2000), among others, makes a useful distinction between 'securitisation' *per se* and 'structured finance'. While the latter (structuring) constitutes an important part of the securitisation process, it concerns the security design largely in terms of different bond characteristics. On the other hand, 'securitisation' itself concerns the legal arrangements, the non-recourse provisions and the asset re-allocation regardless of the subsequent structuring of financial securities backed by securitised assets. This distinction is important in this context since the present chapter concerns 'securitisation' and related contracts rather than 'structured finance'; chapters 3 and 4 deal with structured finance *per se*.

creditors' claims with an explicit charge over certain assets.[8] Such legal separation of distinct groups of assets reallocates value between different creditors by introducing limits and barriers to cash flow transfers between separate groups of assets. Where managers are left with a choice to realise such transfers, the contracts are expected to take into account relevant managerial incentives in order to secure creditors' interests. In the extreme case of complete legal separation of claims in both directions, ie when transfers are neither allowed in the course of normal business activity nor in the case of default, all creditors are fully dependent on the performance of assets they actually sponsor in line with the legal contracts.

This is in contrast to the standard debt contract, where company's default on any one loan opens the path to bankruptcy of the firm as a whole, subject to standard cross-default provisions. The standard debt creditors diversify across a number of company's investments by implicitly purchasing from each other call options on the company other assets, which are automatically exercised in the case of poor performance of assets they formally sponsor, subject to the company overall liquidity position.[9] If they want to keep the company afloat, managers must inject additional funds into underperforming assets and their claimants by liquidating other assets or from new financing, although the latter might not be available due to e.g. the previous track record of underperformance.

In cases other than these two extremes, the reallocation of value between groups of assets and creditors often becomes less determined and subjected to specific managerial incentives. In the case of assets financed with ABSs, the legal vehicle carrying securitised assets typically has no recourse to the rest of the company. In other words, a default by the SPE does not trigger bankruptcy of a firm as a whole. But since the company assets are financed with a standard debt contract, they might not be protected

[8] The general issue of a company division into different entities or conglomeration into a single firm from the management control perspective is considered, for example, by Lee and Lee (2001).
[9] In the reminder of the paper we refer to the overall liquidity conditions as 'global' conditions.

from the situation where managers use those assets to prop-up the 'remote assets' via eg initial over-collateralisation of securitised loans or through implicit recourse to other assets.[10] In effect, sponsors of the SPE no longer offer a call option on their assets to other creditors. At the same time, managers can exercise the call option on the balance-sheet assets only, rather than on all assets. As a result, managers can choose whether to transfer funds into the SPE from the returns on the company assets or from liquidating the company assets, but not the other way around.[11]

B. Motivation

The critical question we would like to address in this context is why we observe the financial contracts described above in practice?

We are interested in finding explanations for financial contracting phenomena such as securitisations, project finance, collateralised debt, and debt with covenants that broadly exhibit the characteristics outlined above. Our analysis addresses this question by showing that such contracts and contractual features might be efficient from various parties' perspectives, given their respective incentives, even when they share the same information about the underlying assets. Moreover, a natural implication of posing the problem in this way is to ask why, and under what circumstances, these contracts result not just in a redistribution of value between different parties, but are also welfare enhancing? In this chapter, we show that they can be effective in eliminating agency costs, but they can also create conflicts of interest resulting in value transfers between

[10] Over-collateralisation consists of a security placed over a group of assets with returns in excess of those required to service collateralised debt. This implies that collateralised loans are secured by assets with the value in excess of the value of the loans, which provides additional protection to creditors.

[11] Although the 'true-sale' requirements might theoretically forbid any recourse, even voluntary, and occasionally draw a sharp condemnation from the regulators, there is no evidence of such regulations being effectively implemented in practice. The question of incentives for managers to conduct such transfers is a critical one: for example, empirical studies of such cases by Higgins and Mason (2004) or Gorton (2005) claim that such implicit recourse is driven by reputation with regards to future financings.

different claimants. We also show that they can be attractive to different parties under different profiles of assets.

By constructing a simple, yet sufficiently general, discrete-time model of a financing decision by the manager/shareholder, we derive a set of optimality conditions for a spectrum of financial contracts characterised by different limits on managerial discretion and different levels of legal separation of assets and cash flows. The obtained set of results allows us to interpret the rationale for contractual solutions ranging from simple covenants in standard debt contracts to whole business securitisations.

C. Modelling structured finance contracts

Securitisation contracts typically feature covenants far stricter than in the case of standard debt as well as additional contractual provisions defining control over assets and cash flows. Such provisions impose specific constraints on management, feature purpose-designed terms of cash flows, and define fixed and floating charges over a portion of assets. In the extreme cases of stylised 'pure' standard debt and securitisation contracts, the limits on managerial discretion over assets can be thought of as perfectly correlated with the ring-fencing of these assets from other creditors. In these cases, it is implicitly assumed that legally separating one set of financial cash flows must be associated with taking these assets out of managerial control; the alternative being to have neither. While this assumption might be useful when distinguishing securitisations from the standard debt contracts in general, financial contracting is inherently more complex than that.

C.1 Ring-fencing and managerial discretion. The important observation is that separating assets and cash flows into different legal entities is fundamentally different from contracting on the degree of discretion that the agent enjoys in managing assets *within* each legal entity. By exercising managerial control *within* different legal entities,

manager E can alter the value of creditors' claims *within* that entity, but cannot transfer funds between distinct entities or swap the assets over which creditors hold their legal rights (charges). Since the manager retains control over assets, his actions might enhance or destroy value, but not change the allocation of creditors' contingent claims across different groups of assets. In contrast, by transferring funds from one group of assets (or one legal entity) to another, E explicitly reallocates contingent claims between different groups of claimants. Hence, if E is allowed to make transfers across different entities, he can alter the value of creditors' relative claims vis-à-vis each other.

In this context, it is useful to consider a stylised project finance contract where, in contrast to a securitisation contract, the manager might be allowed a degree of discretion in managing project assets. However, due to legal separation of assets and cash flows, he cannot re-allocate assets between different groups of claimants. Although the project has no recourse to the parent and covenants might prevent the manager from using funds in the project to prop up assets in other legal entities (i.e. the parent company), he usually retains a degree of control over the assets *within* the subsidiary set up for that specific purpose. Unlike in the case of, for example, a standard securitisation of receivables, productive assets in project finance (e.g. used to finance a power plant) typically require a degree of active management to generate returns—managerial discretion is clearly more valuable or even indispensable here. Moreover, the limits set on asset transfers between the project and the originating company are often one-directional: the parent is free to support the project (eg by guaranteeing project debt), but the contract with the project creditors forbids any transfers of cash flows or assets out of the project vehicle. On the other hand, a non-recourse loan to finance project assets will not allow for any claims to be made over the company assets outside of the project.

In general, choices over limiting managerial discretion and legally separating different groups of assets and cash flows are rarely binary, with a plethora of potential

contractual arrangements. For example, in a securitisation of future revenues from a specific business activity, e.g. a water utility, managers might be limited in the way they can use free cash flows, but they retain some level of discretion necessary to generate revenues. At the same time, however, the limits on contingent allocation of claims can be explicit: cash flows from the securitised utility franchise cannot be used to invest in other assets sponsored by other creditors. Hence, there is a clear distinction between limits on managerial control in generating revenues and the level of discretion over reallocating claims over securitised assets. Across typical debt contracts, we observe multiple covenants limiting how raised funds can be used and/or imposing detailed monitoring of managerial actions, but not establishing any explicit control over cash flows. A particular debt contract with covenants might partially limit managerial discretion over how the funds are employed, but typically will not prevent the management from transferring funds between different groups of assets with different claimants.

C.2 Description of a financial contract. In order to investigate the incentives leading to the design of financial contracts along the dimensions discussed above, we introduce a formal, stylised model of corporate financing. There are two groups of assets in the model: the first group—the 'company'—is financed with a standard debt contract; we consider the optimal financing contract for the second group—the 'project'. The level of control over the project assets is determined by a financial contract defined over two dimensions: (1) the extent of managerial discretion over the use of funds (θ), and (2) the degree of separation of assets and cash flows into independent, bankruptcy-remote entities with no recourse vis-à-vis each other (ρ).

In order to model a contract along these two dimensions, consider a stylised collateralized debt contract that could be seen as the mid-point financing arrangement between securitisation and standard debt. A collateralised debt contract, in case of

bankruptcy, weakly reallocates control over collateralised assets to secured creditors, but allows for managerial discretion in managing assets under no bankruptcy. So far, when discussing separation of different groups of assets and cash flows into different legal entities, we referred to both, the provisions making different groups of assets bankruptcy-remote and the provisions limiting cash transfers between the groups of assets as one and the same. In fact they are not. In order to consider this distinction explicitly, it would be necessary to separate: (i) the company division into different bankruptcy-remote units, (ii) the degree of managerial discretion over transfers between different groups of assets or reallocation of claims among them, and (iii) the degree of discretion over managing assets *within* each group (company, project).

One approach to modelling these contractual features could be to discard the distinction between the second and the third set of conditions by assuming that limits on managerial discretion are the same regardless of whether they consider discretion in the way the funds are managed within a single legal entity or in-between different entities. An alternative approach that we employ here is to merge the first and the second set of provisions by allowing one dimension to reflect both: the division of assets into separate bankruptcy-remote entities and the degree of cash transfers between different groups of assets. In other words, in our model, the legal separation of assets means both: bankruptcy separation as well as cash flow separation, which is commonly observed in practice.[12]

We model differing degrees of legal separation by changing the proportion of the project assets that is both bankruptcy-wise and cash flow-wise linked to the company. At the extreme, if $\rho=0$, then the new project remains on the company books, but if $\rho=1$ then the project assets and cash flows are fully 'ring-fenced'. If $\theta=0$ then the manager enjoys complete freedom in managing the project assets *within* their legal boundaries; if $\theta=1$,

[12] The alternative way of modelling these distinctions does not alter our principal results. This is discussed further in section V.

then the project assets are outside of manager's control and are their returns are verifiable.[13] Note that the returns on the assets are verifiable in this case because the use of assets and the allocation of cash flows are governed by the legal provisions that are enforceable in court.

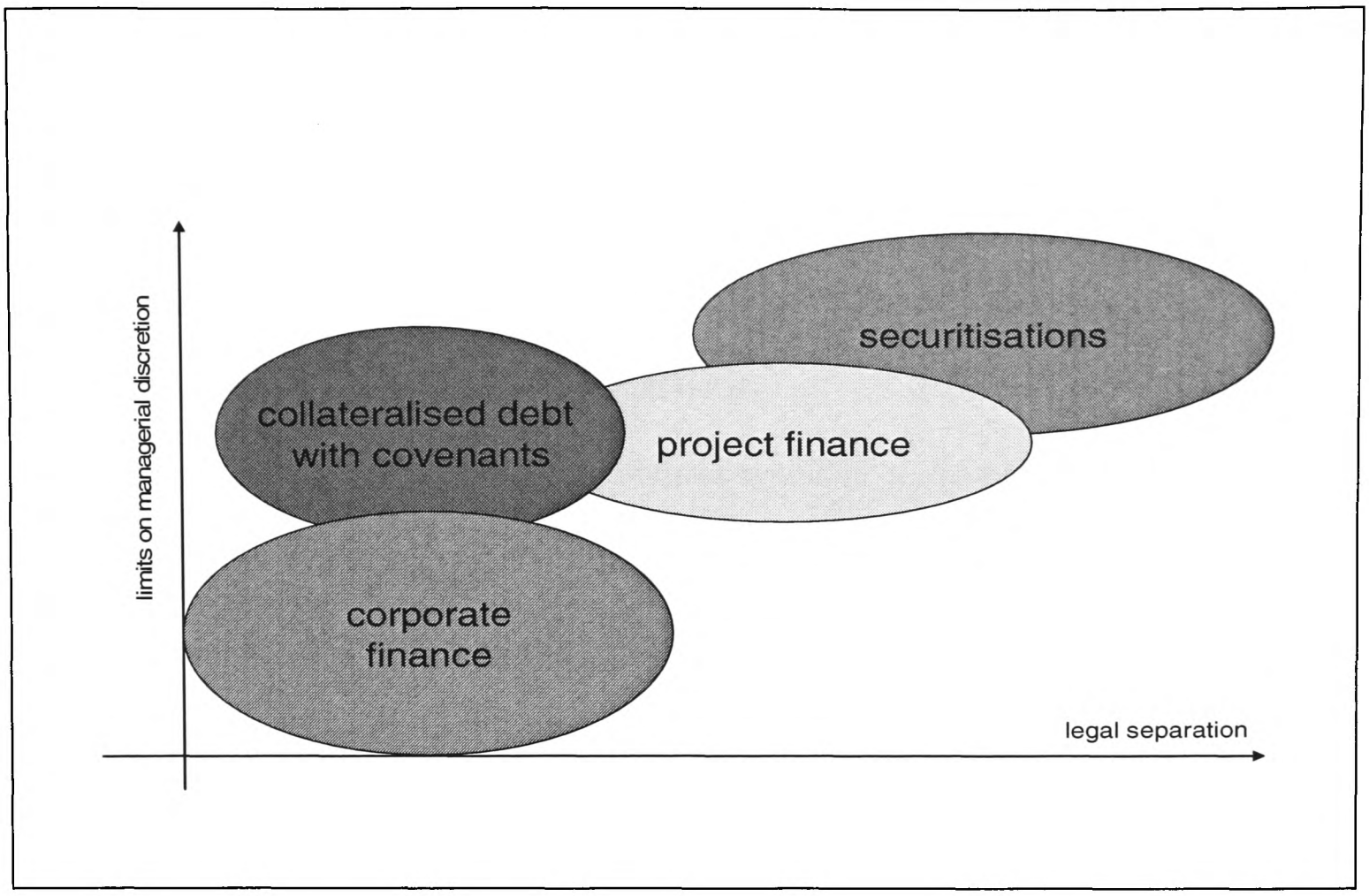
To offer some additional intuition behind these distinctions consider a securitisation of receivables from small, dispersed payees characterised by a limited value of the forgone option on managerial discretion. In contrast to other types of assets, there is relatively little that management can do to enhance the value of such receivables. On the other hand, the opportunity to misappropriate revenues from these assets, when held together with all the other assets of the company, might be significant and attractive to the management insofar as they can be used to finance other, more risky or less profitable projects, which, nevertheless, serve managers' interests. We might therefore expect a securitisation contract to limit the latter, where the loss from the former is not substantial. We hypothesise that a high ρ, high θ, (stylised) optimal contract might be expected to emerge in this case.[14]

Potential examples of stylised financial contracts mapped onto this framework are shown in Fig. 1A below:

[13] The basic intuition behind a contract being structured in this way is simple: limiting the level of managerial discretion (high θ) prevents the manager from misappropriating cash flows, but it also prevents him from enhancing the asset value, where such opportunity to emerge. Similarly, limiting the possibility for transfers (high ρ) prevents the manager from transferring value between creditors' claims; that is, using funds raised to finance one group of assets to invest in another group of assets. It also legally disassociates the project assets from the rest of the company in the case of bankruptcy.

[14] Consider a different example: starting a new line of business might carry fundamentally different types of risks than those that are characteristic of the company's existing activities. On one hand, managerial discretion might be critical for the success of such a venture, but on the other, especially in the case of a firm with a diverse portfolio of investments, controlling or even monitoring the risks of such projects might prove difficult for creditors. If creditors can be assured that their funds will be spent on the specific activity, it might be efficient to limit transfers, while giving management considerable discretion over management of the project assets. High ρ and low θ might be optimal in this case.

FIGURE 1A: STYLISED EXAMPLES OF FINANCIAL CONTRACTS



Our next step is to analyse when such contracts might be optimal—we introduce this problem formally in section II of this chapter and analyse in sections III-V.

D. Related literature

There is vast literature on financial contracting and capital structure that is relevant to our study. It would be impossible to discuss this literature in detail in this short space; fortunately, there are some excellent reviews that serve this purpose: Harris and Raviv (1991), Zingales (2000), or De Matos (2001), to name a few. In addition, Shleifer and Vishy (1997) review the corporate governance literature related to the agency problems.

In general, our analysis aims to show how financial contracts sponsoring assets at the boundary of a firm—i.e. contracts that severe the linkages of these assets to the rest of the firm—make returns more verifiable under more complete contracts and hence deal with the agency problems in the general spirit of the literature on incomplete contracts

originating from Grossman and Hart (1986). Although it primarily concerns different financing arrangements, our model is perhaps most closely related in its basic setup to the diversion model of Hart and Moore (1989) and Hart and Moore (1995).[15] Therefore, it also belongs to a broader group of models related to that of Aghion and Bolton (1992), although it is more explicitly focused on two specific contractual features discussed above and not on contingent allocations of control.

In much of the related literature, authors typically analyse the optimal allocation of contingent control when managers enjoy private benefits. Incomplete contract models share with our model the assumption of non-verifiability of returns from assets under managerial control. Aghion and Bolton (1992), for example, explain why the contingent allocation of control in general might be efficient. They show that managerial control can be welfare maximizing, tough unavailable, in certain situations when capital providers receive insufficient returns to fund the project in the first place because managers aim to maximise their private returns. Since these situations arise in low income states, it might be optimal to allocate control over assets to investors in low return states, while managers retain control in high return states. In contrast, we ask when managerial control over assets in terms of active management and redistributions of cash flows across claimants should be limited up-front.

Hart and Moore (1989) and (1995) also investigate contingent allocations of control, specifically in relation to a standard debt contract. Moreover, the literature on modelling control in general, and Hart and Moore (1989) in particular, analyses a financing decision in a dynamic context—a feature naturally present in our model as well. Their results can be interpreted as explaining the optimal allocation of control in the case of standard debt financing. In our model, however, instead of trying to explain a standard debt contract, we concentrate on the issue of optimal departures from it,

[15] See also Bolton and Scharfstein (1990) and (1996).

assuming the contingent allocation of control in a standard debt contract as given. In our analysis, the contingent allocation of control is insufficient to resolve the problem of misappropriation of assets for certain projects. Hence, we consider alternative tools of financial contracting: covenants and non-recourse provisions.[16]

Related issues of the optimal design of financing contracts are considered by Bolton and Scharfstein (1996) who introduce, as we do, multiple creditors. Their primary concern, however, is with the number and the type of different creditors entering into a standard debt contract with a firm. They show, for example, that it might be efficient to increase the number of creditors when the risk of bankruptcy is low. Diamond (1991) and (1993), on the other hand, consider the relative benefits of long- vs. short-term debt contracts and seniority in debt claims as well as linkages and, in particular, complementarities between these two aspects of financial contracting. Hart and Moore (1995) analyse similar issues and, in addition, they look at alternatives to standard, long-term debt and equity financing including debt covenants; a consideration closely related to ours, although, our primary concern is with the explicit legal restrictions on linkages between different groups of assets.

One of the closest studies to ours is that of Li and Li (1996), in so far as they also consider optimal financial contracts in relation to optimal corporate scope, in the general spirit of the incomplete contract theory. However, they concentrate on the merger-versus-divestiture decision and the formation of conglomerates; neither they address different designs of financial contracts beyond the standard debt.[17] However, they use similar methodology to analyse whether different assets should be held together or apart, based on the problem of under- and overinvestment and the agency costs.

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[16] Similarly to other models, a standard debt contract in our model is just a special case of a range of possible financial contracts we consider.

[17] In fact, they explicitly rule out securitisations as one of the areas of applications for their model, precisely because it is based on the up-front, rather than contingent, allocations of control.

In addition to the literature on control, there is a substantial body of theoretical work concerning security design *per se*, which we review in more detail in chapters 1 and 3. This literature is primarily driven by assumptions of asymmetric information, which are not present in our model. Although different in its approach and assumptions, it considers many related issues: Myers and Rajan (1998), for example, link capacity for external finance to liquidity. They point out that liquid assets make managers less able to commit to certain actions, limiting debt capacity. This can also be interpreted as an argument for creditor control of the most liquid assets. In terms of specific financial arrangements, Riddiough (1995) explains cash flow splitting between different classes of securities, loan bundling and packaging strategies in asset backed securities—details we do not go into since our concern is with comparing and contrasting securitisations vis-à-vis other potential financial contracts. Although the specific academic literature on asset-backed securities and related forms of financings is in fact rather limited (in contract to professional literature), it is nevertheless growing: Skarabot (2001), for instance, investigates the subordination structure of asset-backed securities. None of these papers, however, looks at the issue of optimality of different financial contracts belonging to the class described above in a single framework allowing them for comparisons with a standard debt contract financing.

We proceed as follows: following the introduction in Section 1, we discuss our model and the key results in Section 2. In Section 3, we solve the model formally by deriving the optimality conditions for managerial behaviour under different scenarios. In section 4, we analyse creditors' preferences, given managerial optimality conditions, by considering the design of the optimal financial contracts for different groups of creditors. We analyse these potential contracts from the results of our model in Section 5; we conclude in Section 6.

II. MODEL

A. Setup

We now proceed to introduce the formal model. There are two assets (or two groups of uniform assets)—a 'company' and a 'project'—financed by two corresponding groups of creditors.[18] The timeframe is composed of 3 dates and 2 time periods. At $t=0$ the manager/equity-holder E, who has no capital, borrows $b_c>0$ to finance the company assets with a standard debt contract featuring contingent allocation of control over the company assets and no legal separation of debt claims from other assets (namely, project assets), as defined below.[19] This contract offers E full managerial discretion over the company assets as long as debt is serviced with a contractual repayment of interest and principal d_c at $t=2$.

In addition to the financing for the company assets, E seeks to borrow $b_p>0$ in order to finance the project assets.[20] The project assets are financed according to a financial contract characterised by (θ, ρ), where $0\leq\theta\leq1$ is the level of managerial discretion and $0\leq\rho\leq1$ is the degree of legal separation between different groups of assets.[21] For example, a standard debt contract to finance the project is defined by ($\theta=0$, $\rho=0$) since it gives E full managerial discretion and establishes no legal separation (ring-fencing) between groups of assets.

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[18] In this version, the model is symmetric with respect to two claims, except for the choice of financing contracts.

[19] The manager/equity-holder E has two sources of income: private (from misappropriated funds) and a share of company profits. Without any loss of generality we assume that E owns a 100% share of the company equity and benefits from all (100%) of misappropriated funds. Assuming E's lower share of equity or a smaller share of private benefits does not affect the important dynamics of this model in any fundamental way. However, it implies that there are no other equity-holders, other than the manager E, who influence the terms of the financial contracts agreed with creditors. We do not model pure equity holders as a separate party to the bargain, nor we consider the principal-agent conflict between equity holders and E; equity's interests are served only in so far as E cares about company profits.

[20] We refer to the second group of assets as the 'project assets' or the 'project' or the 'secondary assets', although these assets might be intrinsically linked to the first group of assets—the company assets; they might also represent a stand-alone investment. This terminology should not be understood to imply the lack of linkages between the two groups of assets.

[21] Allowing for both contracts to vary does not substantially alter our results.

We model the degree of legal separation simply by means of dividing the project assets in $(1-\rho)/\rho$ proportion between the company (the balance sheet assets) and the SPE (the remote assets), where the bankruptcy-remote part of the project assets with segregated cash flows is placed. There is a contractual repayment of d_p at $t=2$ on the project assets. The financial contract (θ, ρ) to finance the project assets is assumed to be a result of bargaining between the company creditors, the project creditors, and E. In the initial version of the model, we assume that one group of creditors chooses a contract to maximise its returns, subject to the other group of creditors receiving the minimum acceptable expected return (assumed equal to the repayment of invested capital).

At the interim date $t=1$, gross, stochastic returns r_c and r_p are realized, on the company and the project assets respectively, for both the balance-sheet as well as the remote parts of the respective groups of assets, characterised by the joint probability density function $f(r_c,r_p)$ with the same expected, gross return of $E[r_c]=E[r_p]=r^e>1$.[22] All uncertainty is resolved at this point.[23] However, the realised returns at $t=1$ are assumed to be observable, but not verifiable, if assets are under E's control.

Managerial control of any assets is potentially costly in this model: at $t=1$, E can misappropriate some assets by misappropriating α_p and α_c shares of gross returns from (i) the $(1-\theta)$ portion of the remote assets (where the remote assets constitute the ρ part of the project assets), and (ii) the $(1-\theta)$ portion of the balance sheet assets (where the latter include all of the company assets and the 'non-remote' $(1-\rho)$ part of the project assets). If not misappropriated, the assets are reinvested for the second period with the same, but now certain gross return of r^e to be realised at $t=2$.

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[22] This is a simplifying assumption, but allowing for different mean returns for the project assets and the company assets does not fundamentally change the basic dynamics of the model. We return to this assumption later when discussing the solution to the model.

[23] This is a standard set-up in many incomplete contract models: see for example Hart (1985) or Hart and Moore (1984). We discuss the assumption of uncertainty further below when considering a certainty case in section IV-A.

Managerial control carries an upside as well as a downside: if E has control over the assets, he can restructure any portion of these assets, if not misappropriated at *t=1*, in order to reinvest it at the new rate r_n (which is stochastic, independently distributed, and unknown at *t=0*, but becomes known at *t=1*) or can continue with the current investment.[24] Therefore, E can enhance the value of the assets by efficiently exercising his managerial control at *t=1* if $r_n > r_c$. This opportunity represents a call option on the management-controlled part of the investment. This call option is purchased implicitly at *t=0* by means of increasing the level of managerial discretion (which is costly otherwise), and which can be exercised by E at *t=1*, subject to the realization of r_n.[25]

Since E has no discretion over assets that are not under his control, he cannot raise new financing or add any new claims over these assets at the interim date. Also, since returns on assets under E's control are not verifiable at *t=1*, no financial contract on those assets can be written at the interim date *t=1*. Therefore, when assets realise gross negative returns in the first period, and these returns are observable to all parties, E is unable to raise new external financing for those assets. However, each *legally separate* group of assets, i.e. (i) the balance-sheet assets (combining the $(1-\rho)$ portion of the secondary (project) assets and all of the primary (company) assets), and (ii) the remote ρ portion of the secondary (project) assets placed in the SPE, must be independently solvent at t=1 (i.e. must have a non-negative value of equity) after the first period returns and any losses from misappropriation by E are taken into account, in order for their respective operations to continue.[26] Otherwise, a legal entity cannot operate as an on-

[24] Ability to restructure the assets is unique to management. Creditors are assumed to be passive and unable to alter the investment on their own.

[25] The value of this stylised real option can easily be calculated from the Black-Scholes model. The time period T is equal 1 according to the model; we assume an exogenous level of volatility σ_n^2; the price of the underlying asset is equal to the gross return on assets r^e and the exercise price X is r_n.

[26] The two legal entities must be independently solvent since they are legally separated by the non-recourse provisions. We assume the minimum value of assets for continued operations to equal *1* at *t=1*, which is the equivalent of an interim debt service equal to the gross value of debt with subsequent refinancing or a debt roll-over, in order to simplify calculations later, but any other level of debt service or any other

going concern; creditors take control over the remaining assets, which are subsequently liquidated at their gross value.

This solvency condition is closely related to the agency problem: if creditors could verify returns on assets under E's control, then E could raise new financing at the interim date t=1. Instead, creditors concentrate on debt service and the underperforming group of assets must be supported with a cash transfer from another group of assets to avoid default on creditors' claims on the assets that produced the insufficient returns to service debt.[27] With a transfer of funds, E can alter the overall investment profile by using the returns on one investment to invest in the other group of assets.[28] We model the decision regarding transfers with a decision variable s where E makes the transfer when $s>0$. For any gross returns r on one group of assets, a transfer equal to sr, where $s=1$, implies that all assets and returns are transferred from one group of assets to the other (ie, the investment is liquidated); if $s=0$, no transfer is made.[29]

Finally, at $t=2$, gross returns on the company and the project assets (if not liquidated at $t=1$) equal to $r_2 \geq r^e$ are realised (where $r_2=r_n$ if $r_n \geq r^e$ and E efficiently realises his managerial discretion or $r_2=r^e$ otherwise).[30] The company and the project creditors are repaid d_c and d_p, respectively, according to their contracts, before the SPV is closed, legal separation removed, all covenants expire, and the company, and therefore E,

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threshold for refinancing could be assumed without any loss of generality. In the case of the SPV, the failure to reach the minimum threshold is assumed to trigger an early amortization.

[27] This can be done by E at $t=1$ in order to keep the company as an on-going concern and produce returns at $t=2$. By assumption, only the balance sheet assets can be used for cash transfers.

[28] We assume that all investments are scaleable with constant returns.

[29] If a transfer of a λ-portion of gross returns r is considered, a transfer equal to $s\lambda r$, where $s=1$, indicates that the full λ-portion of the gross returns is transferred from one group of assets to the other.

[30] Note that expected returns at $t=2$ might be greater than at $t=1$ since assets under E's control can be restructured, subject to the realization of the call option on managerial discretion. The fact that they cannot be lower when all uncertainty is resolved could be explained for example by the fact that the firm 'knows' how to achieve the realized returns. This is true for both the company assets as well as for the project assets. In the latter case, it is also true when the management has no discretion over assets. This is a simplifying assumption, but it is intuitive: if the firm has some unique ability in investing the assets, the investment in the project assets cannot be easily replicated outside the company—returns on the company assets and the project assets are intrinsically linked. In the real world, the above link is typically strong: the assets in related entities (e.g. securitised receivables) are generated with the company assets and continuously transferred into the SPE, as generated. Therefore, it is natural to link their performance in the second period to the first period returns on the company assets.

gains the residual.[31] If the company cannot repay debts on its books, equal to $1+(1-\rho)$, then it is forced into bankruptcy, creditors assume control over assets, which are subsequently liquidated at the price equal to gross returns and returns to E are zero (assuming limited liability). If the debt that is financing the remote assets is serviced, as per contract with the project creditors, E is entitled to excess cash flows. Otherwise returns to E from these assets are zero. The setup is summarized below in Fig. 1B below.[32]

FIGURE 1B: TIMELINE

t=0	t=1	t=2
• 'Standard' debt contract to finance b_c primary (company) assets • Alternative contract to finance b_p secondary (project) assets: specifying θ level of managerial discretion and ρ degree of legal separation agreed by E and creditors; SPE formed • E borrows b_c, b_p in each and invests in assets with expected gross return r^e	• Stochastic interim returns realized: r_c for primary assets, r_p for secondary; all uncertainty resolved • E can misappropriate α_c portion of balance sheet assets, and α_p of remote assets under his control • E chooses transfer s and can restructure assets under his control • Minimum gross return equal to d required for debt service, otherwise liquidation	• Certain returns $r_2 \geq r^e$ are realised for the second period if investments are not liquidated before • Creditors repaid or take control over assets to liquidate • Excess returns are paid to the manager and equity-holder E • The company and the SPE are closed

Note: At $t=0$, the manager and equity-holder E finances the company with a standard debt contract. A second contract to finance the project is agreed by E with creditors. The assets have an expected return $E[r]=r^e$, and a joint probability density function $f(r_c,r_p)$. The agreed financial contract specifies the level of managerial discretion over project assets, θ, and the level of legal separation of assets and cash flows of the SPE from the rest of the company, ρ (both equal 0 for a standard debt contract). At $t=1$ all uncertainty is resolved and observable, but not verifiable, gross returns are realized: r_c and r_p on the company assets and the project assets, respectively. E's control over any assets carries costs (E can misappropriate an α_c portion of the assets on the company books and an α_p portion of legally 'remote' assets under his control), but also benefits (E can restructure assets under his control to earn the expected return $E[r]=r_n>r^e$, which is uncertain at $t=0$ and becomes known at $t=1$). If the assets are under creditors' control (the equivalent of no managerial discretion) they cannot be actively managed, but their returns become verifiable and a complete contract can be written—no income from these assets can be misappropriated by E. If returns on either group of assets are less than the core minimum (assumed to equal 1), E chooses ($0<s<1$) whether to transfer cash flows, which are necessary for debt service at the interim date and returns in the 2nd period, between groups of assets. Returns on period 2 investment are realized at $t=2$, equity gets excess returns after repaying creditors; otherwise creditors get control over the assets.

It is immediately obvious that E will reinvest all he can at $t=1$ at r_n, if and only if $r_n>r^e$. Otherwise, everything will be reinvested at r^e. Since at $t=0$ managerial discretion over assets represents a valuable call option v on the $(1-\theta)$ portion of the assets, the expected gross return on the $(1-\theta)$ portion of the assets under E's control is $E[r(1-$

[31] We assume that E has all residual equity cash flow rights.

[32] We make the standard assumptions that all parties are risk-neutral and the interest rate is zero; E's reservation level is zero; E has to abide by the legal contract signed at $t=0$; all parties are rational: that is, they make contractual choices at $t=0$ on the basis of their expectations of payoffs at $t=1$ and $t=2$. We also assume that information is symmetric across, at all times.

$\theta)]=(v+r^e)>r^e$ for the assets that E controls as E always efficiently exercises the option whenever the assets are actually reinvested at $t=1$.

For any given investment opportunity characterized by r^e, $v(r_n,r^e,\sigma_n)$, and $f(r_c,r_p)$, we seek to find the optimal contract characterized by (ρ, θ) that is agreed upon by all parties on the equilibrium path. Creditors anticipate E's behaviour at $t=1$ and hence bargain over the terms of the optimal contract at $t=0$, subject to E's compatibility and participation constraints. We start by exploring optimal contracts under the assumption of full bargaining power enjoyed by one group of creditors, given expectations about E's actions at $t=1$ and subject to the minimum expected repayment to the other group of creditors. This renders two alternative formulations of the contract design problem as outlined below.

C. The company creditors' bargaining power

When the company creditors possess all bargaining power, their problem is to secure a financial contract for the secondary (project) assets, which maximises their expected return:

$$\underset{\rho,\theta}{Max} \iint Min\left[\left(v+r^e\right)\left(1-\alpha_c\right)\left(r_c-s\rho\left(1-r_p\right)\right), d_c\right] f(r_c,r_p)dr_c dr_p \geq b_c \qquad (2.1)$$

subject to three constraints: (i) E choosing α_c, α_p, and s at $t=1$ so that he maximises his total returns equal to $(y_m+y_b+y_r)$—as specified further below—this is E's compatibility constraint:

$$\left(\alpha_c(r_c,r_p),\alpha_p(r_c,r_p),s(r_c,r_p)\right) \in \underset{\alpha_c,\alpha_p,s}{\arg\max}\left(y_m+y_b+y_r\right)$$

(ii) E borrowing and investing in the secondary assets according to the contract specified by the company creditors—this is E's participation constraint:

$$E\left[\underset{\alpha_c,\alpha_p,s}{Max}\left(y_m\left(\theta,\rho,\alpha_c,\alpha_p,s\right)+y_b\left(\theta,\rho,\alpha_c,\alpha_p,s\right)+y_r\left(\theta,\rho,\alpha_c,\alpha_p,s\right)\right)\right]\geq \underline{y_{\min}}$$

and (iii) the secondary (project) assets creditors agreeing to the contractual terms proposed by the company creditors, given that their expected returns $E[\varphi_p]$ are greater than their initial investment level b_p:

$$E\left[\varphi_p\left(r^e,r_c,r_p,\rho,\theta,\alpha_c(r_c,r_p),\alpha_p(r_c,r_p),s(r_c,r_p)\right)\right]\geq b_p$$

where φ_c is the return to the company creditors and φ_p is the return to the project creditors equal to the contractual repayment or the actual value of assets, whichever is smaller (assuming liquidation costs of zero):

$$\varphi_c(...)\equiv Min\left[\left(v+r^e\right)\left(1-\alpha_c\right)\left(r_c-s\rho\left(1-r_p\right)\right),d_c\right]$$

$$\varphi_p(...)\equiv Min\left[\left(v+r^e\right)\left(1-\alpha_p\right)\left(r_p\left(1-\rho\right)+s\rho\right)\left(1-\theta\right)+r^e\theta\left(s\rho+r_p\left(1-\rho\right)\right),d_p\right]$$

That is, the return to the company creditors is equal to the portion of the return on the company assets, which is not misappropriated at $t=1$, but reinvested, minus any transfer made, or equal to the promised repayment d_c, whichever is smaller, subject to E's and the project creditors' incentive compatibility constraints.

D. E's total returns

Assuming limited liability, E receives excess cash flows to equity or nothing, whichever is greater. Therefore, E's total returns are composed of three parts: y_m, y_b, and y_r, as defined below. The first part is the total income misappropriated by E at $t=1$, y_m:

$$y_m = Max[\alpha_c[r_c - s\rho(1-r_p)] + \alpha_c[r_p(1-\theta)(1-\rho)] + \alpha_p[(1-\theta)(1-r_p\rho + s\rho(1-r_p))], 0]$$

This is composed of the income from the company assets after the transfer is subtracted: $\alpha_c(\ldots)$, the income from the balance-sheet, project assets under E's control: the second $\alpha_c(\ldots)$ term above, and the income from the portion of the remote assets under E's control, after the transfer is made: $\alpha_p(\ldots)$. The second part of the overall income is the excess return from the assets on the company books, if the company repays its creditors, y_b:

$$y_b = Max[[(1-\alpha_c)(v+r^e)[(r_c - s\rho(1-r_p)) + (r_p(1-\rho)(1-\theta))] + r^e r_p\theta(1-\rho) - (1-\rho) - 1], 0]$$

This part of the overall income is composed of the income from the return on the company assets after the transfer is made and the return from the balance-sheet project assets under E's control: $(1-\alpha_c)(v+r^e)(\ldots)$, plus the income from excess returns on the project assets that remain on the company's books, but not under E's control, as shown in the expression above.

The third part is the excess return from the remote assets in the SPE at $t=2$ if the company repays its creditors *and* the SPE repays its creditors, y_r, which is composed of the returns from the legally remote project assets under E's control plus the returns from the remote assets not under E's control, as shown below:

$$y_r = Max[[s\rho(v+r^e)(1-\alpha_p)(1-\theta)+(r_p\rho\theta s-\rho)],0]$$

Without any loss of generality, we assume that E's reservation income $y_{min}=0$. Hence, E's participation constraint becomes trivial in the presence of limited liability and creditors' full bargaining power. In general, creditors choose the contract (ρ, θ) so that it minimises E's optimal level of misappropriation given E's incentive compatibility constraint (i).

E. Project creditors' bargaining power

An alternative problem formulation is to assume that the project creditors enjoy full bargaining power. Under this setup, project creditors' problem is to choose a financial contract for the project assets, which maximises their expected return subject to: (i) E choosing α_c, α_p and s at $t=1$ so that he maximises his returns (E's compatibility constraint), (ii) E borrowing and investing into project assets according to the contract specified by the project creditors (E's participation constraint), and (iii) the company creditors agreeing to the terms of contract proposed by the project creditors, given that their expected returns $E[\varphi_c]$ are greater than their initial investment b_p.

The project creditors seek to maximise their expected returns from the investment composed of three parts. The first term below (i) represents assets under E's control, which are not misappropriated, but reinvested, including both the assets on the company books and the remote assets. The second term (ii) represents the remote assets, which are not under E's control and are, by default, reinvested at $t=1$. The third term (iii) represents the assets on the company books, which are not under E's control, but are reinvested at $t=1$.

$$\underset{\rho,\theta}{Max} \iint Min\left[\left(v+r^e\right)\left(1-\alpha_p\right)\left(r_p\left(1-\rho\right)+s\rho\right)\left(1-\theta\right)+r^e\theta\left(s\rho+r_p\left(1-\rho\right)\right), d_p\right] f(r_c, r_p) dr_c dr_p \geq b_p$$

subject to:

$$\text{(i)} \qquad \left(\alpha_c(r_c, r_p), \alpha_p(r_c, r_p), s(r_c, r_p)\right) \in \underset{\alpha_c, \alpha_p, s}{\arg\max}\left(y_m + y_b + y_r\right) \tag{2.2}$$

$$\text{(ii)} \qquad E\left[\underset{\alpha_c, \alpha_p, s}{Max}\left(y_m\left(\theta, \rho, \alpha_c, \alpha_p, s\right) + y_b\left(\theta, \rho, \alpha_c, \alpha_p, s\right) + y_r\left(\theta, \rho, \alpha_c, \alpha_p, s\right)\right)\right] \geq y_{\min}$$

$$\text{(iii)} \qquad E\left[\varphi_c\left(r^e, r_c, r_p, \rho, \theta, \alpha_c(r_c, r_p), \alpha_p(r_c, r_p), s(r_c, r_p)\right)\right] \geq b_c$$

where φ_c, φ_p, y_m, y_b, y_r are defined as above.

In order to find the optimal contract, we start by considering E's decision choices at *t=1* given the financial contract (ρ, θ) agreed at *t=0* under each formulation of the problem. We consider four different quadrants of possible realizations of gross returns from the joint probability density function $f(r_c, r_p)$. In each quadrant we identify different regions of E's optimal behaviour. Next, we integrate E's and creditors' payoffs over the joint probability density function in all four quadrants according to distribution of different regions in each quadrant. Having analysed the expected payoffs at *t=1* and *t=2*, subject to different realizations of returns and the corresponding optimal behaviour of different parties, we return to consider the optimal contract at *t=0*.

Finally, we make the following assumptions: In this version of the model, we assume that contractual repayments on the company assets and the project assets are identical and equal to 1. That is, $d_c=d_p=1$ and, hence necessarily: $b_c \leq 1$ and $b_p \leq 1$. All returns are gross returns and include the value of the underlying assets. We do not model depreciation separately, assumed to be included in the calculation of gross returns. We also assume that there are no financial slacks.

F. Selected results

The results of our model indicate that securitisations can efficiently eliminate agency costs under certain conditions: for low return-, low relative value of managerial effort types of assets and businesses, such as bank receivables or cash flow streams of regulated utilities. This is achieved under the first best through limits on managerial discretion, when managers require new financing, as well as under the second best, in circumstances where the first best is not available, by allowing for a selective default on some assets of the company. In the optimal set of contracts that we derive, the level of restrictions placed on managerial discretion is closely correlated with the level of legal separation of assets, across different scenarios that we explore. Furthermore, in the case of companies characterised by moderate expected gains from managerial discretion and average expected returns, contracts featuring some limits on managerial discretion, but no legal separation, are found to be optimal. This seems to correspond closely to financial contracts commonly observed in the real world, where covenants on the use of assets and on the distribution of cash flows typically accompany the non-recourse provisions (and also appear independently of the non-recourse provisions), but not other way around. According to our results, for assets with high potential value of managerial discretion and high expected returns, the optimal financial contract closely resembles a standard debt contract with no limits on managerial discretion and no legal separation.

Furthermore, our model implies the project creditors would be the first to press for limitations on managerial discretion with regards to alternative investments and the use of cash flows. Similarly, across different asset profiles, as the expected value of active management diminishes over a spectrum of different assets, it is the project creditors who first switch their preferences away from the standard debt contract and towards limiting managers' discretion with covenants. This is driven by the fact that, *ceteris paribus*, managers are more likely to misappropriate income from the remote (project) assets than from the company, balance-sheet assets, which they depend on.

At one end of the spectrum of asset profiles, there exist NPV-positive assets (investments) characterized by low expected returns and low potential for added value from managerial effort. According to our model, these assets are not suitable for financing using standard debt contracts, since high degree of legal separation and maximum limits on managerial control are more optimal in this case. Although seemingly benefiting creditors, our model suggests that these financing arrangements might be structured and offered by the management in order to secure financing from rational creditors, who would be reluctant to provide funds otherwise in these circumstances, according to a standard debt contract.

We also show that for assets with particularly low value of managerial discretion and low expected returns, the company creditors would like to see limits on the level of recourse and limits on managerial discretion, combined in a single contract. These contracts can be compared with securitisation and/or project finance arrangements, where barriers to transfers are structured with the help of ring-fencing of assets, strict covenants, 'use of funds' clauses, and detailed rules on monitoring of cash flows. Our results also show why imposing maximum assets separation (true sale) and maximum limits on managerial discretion (true control) is efficient in only special circumstances.

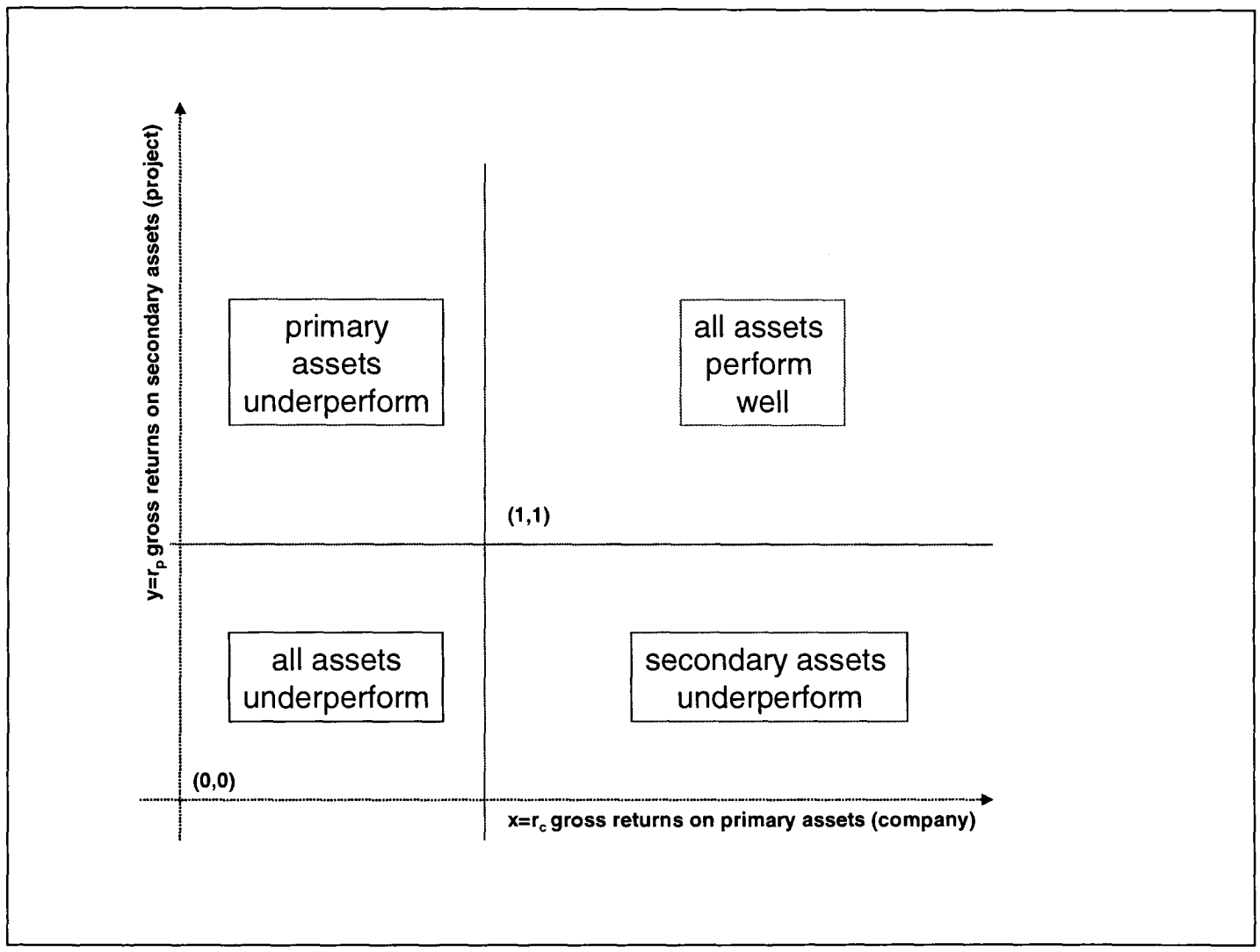
Another implication of our model is that project creditors have a strong incentive to ensure some recourse to the company assets via company's financial exposure to the project. In practice, this is typically achieved with first-loss provisions or retention of the most junior, 'equity' tranche by the originator. Moreover, project creditors' preferences are also driven by the high costs of not transferring cash flows to the company and the low costs of making a transfer, when such transfer becomes efficient. Hence, managerial preferences for an optimal contract are more closely aligned with the company creditors than with the project creditors.

In general, managers are predicted to attempt to secure a lower limit of managerial discretion than optimal for creditors in the case of low managerial value/low return assets and a higher level of legal separation than optimal for creditors in the case of high managerial value/low return assets. The conflict of interest is predicted to be stronger for the former class of assets than for the latter due to agency costs.

III. ANALYSIS OF MANAGERIAL INCENTIVES

We now proceed to solve the model formally and analyse all special cases. We conduct our analysis in three steps. As the first step, in section III, we investigate E's optimal choices at *t=1* by analysing different scenarios of realised returns on the company assets and the project assets, as shown in Fig. 1C below. As the second step, in section IV, we consider the optimal contract at *t=0* given the previously identified managerial incentives. We analyse the optimal contract in section V and derive detailed conclusions.

FIGURE 1C: POSSIBLE REALISATIONS OF RETURNS AT T=1



A. Negative gross returns on the secondary (project) assets

Consider the first quadrant of realized gross returns from the joint probability density function $f(r_c,r_p)$ such that gross returns on project assets are less than *1*, the

threshold required for debt service at the interim date, and gross returns on the company assets are greater than *1* at *t=1*. A thorough analysis of this section allows us to considerably simplify the analysis in other sections. We start by considering E's choice whether to transfer cash flows to support the remote assets. We first show that:

LEMMA 1: It is never optimal for E to make a transfer to the remote assets, where such transfer is larger or smaller than just enough to keep the SPE afloat—ie the transfer is always equal to $s(1-r_p)\rho$ where $s=1$ unless E chooses to make no transfer and hence $s=0$.

PROOF OF LEMMA 1: If funds transferred to the SPE at *t=1* are insufficient to prevent SPE's insolvency, they are simply lost for E since an insolvent SPE returns 0 to E at *t=2*. Transferring too much cash makes no sense either: since at the worst E can get the same expected returns r^e on these assets by keeping them on the company's books at *t=1*, and at worst, by reducing the value of his call option on these assets to 0 if he has no managerial discretion over the SPE (i.e. if $\theta=1$). Therefore, E will choose either $s=0$ or $s=1$ and the transfer will be equal to $s(1-r_p)\rho$ when $s=1$ and will be equal to 0 if $s=0$. ■

In general, the question of transfers is a direct implication of the distinction between different groups of assets and their claimants is. The incentive for transfer of assets between the two groups arises solely with respect to the potential negative gross returns in the first period.[33] If the project assets are financed with a securitisation contract, creditors' control over the SPE implies that E cannot transfer the project assets from the SPE back to the company. In other words, E cannot reallocate these assets to the

[33] An interesting corollary to this interpretation is that of a short-term debt. Even if there is no minimum threshold for a critical set of assets, each investment must be refinanced at *t=1*: the underperforming investment has to be supported with extra cash flows in order to make the debt repayment equal to the initial value of the assets in order for the firm not to default.

company creditors at the cost of the project creditors. Assuming the company assets are financed with a standard debt contract, the restriction can be one-directional: it does not apply to transfers from the company to the SPE.[34] Of course, this is an extreme case of perfect 'ring-fencing', but a critical point to realize here is that the transfer of assets from the company to the project has distributional implications for allocation of different creditors' claims. This is in contrast with the limits on managerial discretion over the assets, where the discretionary management can be exercised regardless of the allocation of creditors' claims.

Despite the transfer, the SPE might go bankrupt, if E controls a sufficient portion of SPE's assets (low θ) *and* misappropriates sufficiently large funds from the SPE at $t=1$ (high α_p). The SPE is therefore bankrupt at $t=2$ if:

$$\alpha_p > 1 - \frac{\theta r_p}{(v + r^e)(1-\theta)} = \alpha_p^* \qquad (3.2)$$

Consider the case where additional cash flows are transferred into the SPE, but the company is left insolvent at $t=2$ and call it *region A*. If the remote assets receive the additional cash flows from the transfer, the SPE survives with the expected return at $t=2$ equal to r^e. E can bankrupt the company for any $E[r]=r^e$, if he chooses α_c to be high enough (i.e. if E misappropriates sufficiently high funds at $t=1$). If both the SPE and the company are bankrupt, E's only returns are from misappropriated funds at $t=1$.

[34] A collateralized debt contract carries similar implications to creditor's control with regards to transfers between collateralized assets sponsored by senior creditors and other assets sponsored by junior creditors. The fundamental difference is that in the case of collateralized debt restrictions on transfers are largely effective when the company files for bankruptcy. In the securitisation case not only the securitised assets are not part of the bankruptcy proceedings, they are also, throughout the life of the contract, under creditors' control (exercised via the custodian of the SPE) effectively preventing any transfers and making returns verifiable.

Therefore, in this case E will optimally choose both α_c and α_p equal to *1*.[35] E's total returns in this case when $r_p<1$ and $r_c>1$ will be, therefore:[36]

$$E_A^{/+} = r_c + \rho\theta(r_p - 1) + r_p(1-\theta) \tag{3.3}$$

A.1. No Transfer Case: Now consider the case when E decides not to transfer any additional funds into the SPE ($s=0$). In this case the SPE is forced into insolvency (or an early amortization is triggered). E's returns, in general, will consist of excess returns at $t=2$ and the funds misappropriated at $t=1$. That is, they will come from the returns on the continued investment of the company assets under E's control, plus from the returns on the continued investment of the balance-sheet project assets under E's control, plus from the returns on the continued investment of the on-balance sheet project assets not under E's control:[37]

$$E_{s=0}^{/+} = (v + r^e)r_c(1-\alpha_c) + (v + r^e)r_p(1-\rho)(1-\theta)(1-\alpha_c) + r^e r_p(1-\rho)\theta - 1 - (1-\rho) +$$

...plus the misappropriated company assets and project assets under E's control:

$$+\alpha_c r_c + \alpha_c(1-\theta)r_p(1-\rho) + \alpha_p r_p(1-\theta)\rho) \tag{3.4}$$

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[35] The SPE might actually survive despite E choosing maximum $\alpha_p=1$, providing E's control of the SPE's assets is sufficiently limited ($\theta<1$). But since in this case, the company is also bankrupt, any returns from the SPE at $t=2$ are lost to E and are therefore irrelevant for E's choice at $t=1$.

[36] We use the following notation: *+/* indicates $r_c<1$, $r_p>1$ quadrant, */+* indicates $r_c>1$, $r_p<1$ quadrant, *+* indicates $r_c<1$, $r_p<1$ quadrant, and *+* indicates $r_c<1$, $r_p>1$ quadrant.

[37] Recall that we allow E to set α_p and α_c for the SPE and the company independently. This is in fact a simplifying assumption ensuring E always chooses boundary values of α (*0* or *1*). If α_c must equal α_p, then in region M (see below), it might be optimal for E to choose α such that $0<\alpha< 1$. In fact, in all other cases E chooses $\alpha_p=\alpha_c$ and equal to *0* or *1*. Requiring $\alpha_p=\alpha_c$ does not change the results in any fundamental way, but complicates our analysis. An alternative treatment would be to allow E independently to choose α for (i) *all* project's assets (not just remote assets in the SPE) and (ii) balance-sheet company assets excluding project assets.

LEMMA 2: E will optimally choose $\alpha_p=1$ when $s=0$ and $\alpha_p=0$ when $s=1$.

PROOF OF LEMMA 2: If E decides to transfer funds into the SPE, then he must be better off investing in the SPE than misappropriating SPE's assets, hence he will set $\alpha_p=0$. However, whenever E decides not to transfer funds into the SPE, he will also optimally choose $\alpha_p=1$ in order to misappropriate all funds from the SPE since without the transfer the SPE will bring no returns at $t=2$. ■

For E to decide whether to misappropriate any funds from the balance-sheet company assets is a more complex choice.

LEMMA 3 (for the proof of Lemma 3 see Appendix 1): E will choose $\alpha_c=0$ whenever the optimal α_c is smaller or equal to $\alpha_{c,s=0}^*$, where $\alpha_{c,s=0}^*$ is the critical value of α_c for the company to stay solvent when $s=0$, and E will choose $\alpha_c=1$ whenever the optimal α_c is greater than $\alpha_{c,s=0}^*$ and the company does not stay solvent. ■

E's optimal choice of α_c is therefore dependent on whether the company becomes insolvent at $t=1$ (or equivalently at $t=2$). Therefore, the critical value of α_c and the solvency condition is:

$$\alpha_c < \frac{(1-\rho)+1-(v+r^e+r_p(1-\rho))r_c - vr_p(1-\rho)(1-\theta)}{(v+r^e)(r_p(1-\rho)(\theta-1)-r_c)} = \alpha_{c,s=0}^* \qquad (3.5)$$

Hence, by Lemma 2, for each α_c optimal for E, such that $\alpha_c>\alpha_{c,s=0}^*$ (providing $\alpha_{c,s=0}^*\leq 1$, otherwise E sets $\alpha_c=0$), E in fact sets $\alpha_c=1$ and the company becomes insolvent. Let's call this *region B* where E gets the total returns from misappropriating all

of the company assets and the project assets that he controls. Note that in this case E sets $\alpha_p=1$ by Lemma 2:

$$E_B^{I+} = r_c + (1-\theta)r_p \tag{3.6}$$

Alternatively, for the optimal value of $\alpha_c \leq \alpha_{c,s=0}^*$ (providing $\alpha_{c,s=0}^* \geq 0$, otherwise E optimally sets $\alpha_c=1$), E sets $\alpha_c=0$ and the company stays solvent, but given $s=0$, the SPE does not survive and, as above, by Lemma 1, E sets $\alpha_p=1$. Let's call this *region M* where E gets the total returns from the continued investment of the company assets and from the balance-sheet project assets, minus repayments:

$$E_M^{I+} = (v+r^e)r_c + r_p(1-\rho)(v(1-\theta)+r^e) + r_p(1-\theta)\rho - 2 + \rho \tag{3.7}$$

However, this payoff will never be possible unless all the balance sheet assets (the company assets and the non-remote portion of the project assets) are jointly solvent at $t=1$. Hence the global solvency condition II is:

$$(r_c - 1) + (r_p - 1)(1-\rho) > 0 \tag{3.8}$$

Consider again *region B*. For creditors, it represents the worst case scenario: by misappropriating income E makes both the SPE and the company insolvent; his returns consisting exclusively of funds misappropriated at $t=1$. The degree of legal separation of assets and cash flows ρ is essentially irrelevant to E's returns in this scenario: we cannot limit E's returns in region B by shifting assets on-or-off the company balance sheet (although ρ *will* affect E's return in other regions and hence affect E's *relative* valuation

of his actions in this region). Moreover, limiting E's discretion over project assets (that is, increasing θ) will always limit E's absolute returns in this scenario. Finally, we note that E's payoffs under *region B* are always better than under *region A*:

$$r_c + \rho\theta(r_p - 1) + r_p(1-\theta) < r_c + r_p(1-\theta) \qquad \text{since} \quad \rho\theta(r_p - 1) < 0 \tag{3.9}$$

Therefore, *region A* is never optimal for E. This is intuitive: if E's only returns come from misappropriated funds, then by Lemma 1 it will never be optimal for E to transfer funds into the SPE. This is because funds in the SPE can be 'at best' misappropriated at the rate they can be misappropriated from balance-sheet assets: setting transfers $s=0$, is at least as good as setting them at any other level. It will never be optimal for E to transfer funds into the SPE and leave the company insolvent. E will therefore set $s=0$ whenever he sets $\alpha_c=1$.

A.2. Full Transfer Case: Now consider a scenario where E decides to transfer cash flows from the company in order to keep the SPE afloat at $t=1$. By Lemma 1, the optimal size of this transfer is always: $s(1-r_p)\rho$ and $s=1$. However, even if $s=1$, SPE's survival cannot be guaranteed, but determined by the level of α_p set by E. If E sets α_p high enough ($\alpha_p > \alpha_p^*$), the SPE will not survive as per condition (3.2). When $s=1$, the company will remain solvent if α_c is greater than the threshold $\alpha_{c,s=1}^*$.

$$\alpha_c > 1 + \frac{r^e r_p(1-\rho)\theta - 1}{(v + r^e)(r_c - \rho + r_p - \theta r_p(1-\rho))} = \alpha_{c,s=1}^* \tag{3.10}$$

Therefore, if E sets *both* α_p and α_c high enough for *both* the SPE and the company to become insolvent (or if, despite setting α_p and α_c at the minimum—equal zero—the

SPE and the company does not survive anyway), E's return must come exclusively from assets misappropriated at *t=1*. But with *s=1*, this is exactly *region A* as described above. Since this is never optimal, as shown above, we can ignore this scenario. Moreover, if E sets α_p *low enough* for the SPE to survive and the α_c *high enough* for the company to go bankrupt, E's returns will be exclusively from assets misappropriated at *t=1*; this again folds into *region A*.

If the opposite is true, that is if α_c is *low* enough for the company to survive, but α_p is *high* enough for the SPE to go bankrupt (providing it is possible), then again we have to consider the optimal levels of α_c and α_p for E to choose. If the company survives, then α_c is low enough already to expect the repayment to creditors at *t=2*. Therefore, all additional investments into the company at *t=1* will go to E at *t=2*. It will not be optimal for E to misappropriate anything: E will optimally set $\alpha_c=0$ by Lemma 3. The choice of α_p is even simpler: if the SPE is expected to go bankrupt at *t=2*, E will set $\alpha_p=1$ at *t=1*, since his only chance to get some returns from the SPE is to misappropriate the assets early. But if α_c is set at the *minimum* and α_p at the *maximum*, then the transfer is irrelevant at best (if $\theta=0$) and in fact wasteful for all $\theta>0$. So E will optimally choose *s=0* rather than *s=1* in this scenario, which folds it into *region M* as described above. Hence, Lemma 4 below:

LEMMA 4: If E transfers funds into the SPE with *s=1* then he will optimally set $\alpha_c=0$ and $\alpha_p=0$.

PROOF OF LEMMA 4: From E's perspective, there is no reason to make a transfer unless both the SPE and the company are expected to survive until *t=2*. E will never be charitable towards the SPE's creditors: he will never willingly 'waste' resources on the SPE, with no expected benefit. E will therefore choose *s=1* only if both the SPE *and* the

company are expected to survive. But if that is the case, we can be certain that he will set both α_p and $\alpha_c=0$ since creditors are already expected to be repaid, returns from all excess returns going to E; he would waste resources misappropriating the assets early. ■

We can now write the expression for the expected returns to E when E decides $s=1$ –let's call it *region G*. Optimally setting $s=1$, $\alpha_c=0$ and $\alpha_p=0$, E is expected to get the total returns from the continued investment of the company assets plus the continued investment of the project assets (both the balance-sheet and the remote assets encompassing assets that E controls as well as those that E does not control):

$$E_G^{/+} = (v+r^e)r_c + (v+r^e)r_p(\theta\rho+1-\theta) - v\theta\rho + r^e r_p\theta(1-\rho) - 2 \qquad (3.11)$$

However, this will never be possible unless both groups of assets, the project and the company, are jointly solvent at $t=1$. That is the global solvency condition G for payoff $E^{/+}{}_G$ must be: $r_c+r_p>2$ (3.12). Hence, E selects his optimal payoffs by comparing regions B, M and G for each realization of the joint probability distribution $f(r_c, r_p)$. Therefore, E will optimally choose the payoff E_B in region B defined by:

$$\begin{cases} E_B^{/+} = r_c + r_p(1-\theta) \;>\; E_G^{/+} = r_c(v+r^e) + r_p((v+r^e)(\theta\rho+1-\theta) + r^e\theta(1-\rho)) - v\theta\rho - 2 \\ E_B^{/+} = r_c + r_p(1-\theta) \;>\; E_M^{/+} = r_c(v+r^e) + r_p((1-\rho)(v(1-\theta)+r^e) + (1-\theta)\rho) + \rho - 2 \end{cases} \qquad (3.13)$$

E will optimally choose payoff E_G in region G defined by:

$$\begin{cases} E_G^{+/-} = r_c(v+r^e) + r_p((v+r^e)(\theta\rho+1-\theta) + r^e\theta(1-\rho)) - v\theta\rho - 2 \;> \\ > \; E_M^{/+} = r_c(v+r^e) + r_p((1-\rho)(v(1-\theta)+r^e) + (1-\theta)\rho) + \rho - 2 \\ E_G^{+/-} = r_c(v+r^e) + r_p((v+r^e)(\theta\rho+1-\theta) + r^e\theta(1-\rho)) - v\theta\rho - 2 \;>\; E_B^{/+} = r_c + r_p(1-\theta) \end{cases} \qquad (3.14)$$

And E will optimally choose payoff E_M in region M defined by:

$$\begin{cases} E_M^{/+} = r_c(v+r^e) + r_p((1-\rho)(v(1-\theta)+r^e)+(1-\theta)\rho)+\rho-2 \; > \\ > \; E_G^{+/-} = r_c(v+r^e) + r_p((v+r^e)(\theta\rho+1-\theta)+r^e\theta(1-\rho))-v\theta\rho-2 \\ E_M^{/+} = r_c(v+r^e) + r_p((1-\rho)(v(1-\theta)+r^e)+(1-\theta)\rho)+\rho-2 \; > \; E_B^{/+} = r_c + r_p(1-\theta) \end{cases} \tag{3.15}$$

The results from this section are summarized in Proposition 1 below:

PROPOSITION 1: In the case when the company assets perform well ($r_C>1$), but project assets produce a gross return below the required threshold at t=1 for continued operations in period 2 ($r_p<1$), E will receive a payoff equal to $E^{/+}{}_G$ if (3.12) and (3.14) are both true, payoff of $E^{+/}{}_M$ if (3.8) and (3.15) and are both true, and E_B otherwise. ■

B. Negative gross returns on the primary (company) assets

We now turn to the problem of E's decision when the company assets in period 1 produce a gross return, which is lower than the minimum threshold for assets required for servicing debt. Since at $t=1$ the company must have a positive book value for the operations to continue in the second period, and no funds can be transferred into the company from the legally 'remote' assets, the legal linkages between the company assets and the project assets play a critical role here. In the case when the project assets are fully legally separated from the company assets, for example, there are no funds available for management to transfer to the balance-sheet company assets and the corporation becomes insolvent by default. In general, subject to the degree of legal separation between the company and the project, the company remains solvent if the global solvency condition (3.8) is fulfilled.

In the case of a standard debt contract, E would 'automatically' transfer cash flows into the company assets from the project assets since cross-default clauses (ie, a common balance sheet) force E to make all parts of the firm solvent for it to continue operations, unless it is optimal for E to misappropriate assets at $t=1$. In other words, when the financial contract introduces no legal separation of assets, the previous choice of cash transfer becomes automatic and no longer subject to E's discretion: E must legally choose $s=0$ (no transfer) for cash flows from remote assets, and optimally chooses $s=1$ (full transfer) from the balance-sheet assets. The latter being true unless E misappropriates all income. This considerably simplifies our analysis vis-à-vis the previous case.

In this case, if there are insufficient assets available for the transfer, then it is optimal for E to misappropriate all income at his control at $t=1$ from both the company and the project. This is because his returns at $t=2$ would otherwise be zero since the contingent control debt contract would transfer all assets under creditors' control. E's returns in this case are the same as inn *region B* before:

$$E_B^{+/} = r_c + r_p(1-\theta) = E_B^{/+} = E_B \qquad (4.1)$$

E's behaviour in this scenario is summarized in Lemma 5:

LEMMA 5 (for the proof of Lemma 5 see Appendix 1): when the project assets perform well ($r_p>1$) and the company assets perform poorly ($r_c<1$), E will never misappropriate any assets from the project, unless he also misappropriates all assets from the company and the company becomes insolvent. ■

E's payoff, if he were to misappropriate all residual income from the project and leave the company solvent, would have been composed of four parts: (1) the return on the balance-sheet company assets, (2) the return on the balance-sheet project assets that E controls and (3) and that he does not control, and (4) the misappropriated income from remote assets E controls (4) minus debt repayments:

$$E_M^{+/} = \underbrace{r_c(v+r^e)}_{(1)} + r_p(\underbrace{(1-\rho)(1-\theta)(v+r^e)}_{(2)} + \underbrace{(1-\rho)r^e\theta}_{(3)} + \underbrace{\rho(1-\theta)}_{(4)}) + \rho - 2 \qquad (4.2)$$

However, by Lemma 5, this option will be universally suboptimal for E for the case of realized returns on the company assets being smaller than the required threshold *versus* one of either of the two other options: (i) misappropriating all income from both the company and the project, or (ii) misappropriating no income at all. This is because, on one hand, if the project performed better than the company, then it could not be beneficial for E to close the project when it is optimal to keep the company. On the other hand, if it is optimal to close the project, it must be optimal for E to close the company as well.

In the case when it is optimal *not* to misappropriate any income in order to keep the company solvent, (providing this is possible: i.e. subject to the solvency condition II (3.8)), E's returns are composed of returns from: (i) main company assets, (ii) project assets E controls and assets E does not control, but which are *not* legally separated from the company balance sheet, plus (3) project assets E controls and project assets E does not control, but which that are legally separated from the main company, minus repayments. E's returns in this case are therefore:

$$E_G^{+/} = \underbrace{r_c(v+r^e)}_{(1)} + r_p(\underbrace{(v+r^e)(1-\theta)}_{(2)} + \underbrace{r^e\theta\rho}_{(3)}) - 2 \qquad (4.3)$$

Note that this is not the same as before in region G since in the latter case there are no transfers between the company and the SPE. E's payoffs in this case are summarized in Proposition 2:

PROPOSITION 2: In the case when the project assets perform well ($r_p>1$), but the company assets produce a gross return below the required threshold for continued operations ($r_c<1$), E will receive payoffs of $E^{+/}{}_G$ if and only if $E^{+/}{}_G>E_B$ and (3.8) is fulfilled, and E_B otherwise. ■

C. Positive gross returns on the primary (company) and secondary (project) assets; negative gross returns on the primary (company) and secondary (project) assets.

We now turn to consider the case when both groups of assets produce gross returns at $t=1$ greater than the minimum for continued operations. This is a scenario corresponding to the certainty case discussed later. In this case, no transfer will be made:

LEMMA 6: When all assets perform above the minimum threshold, there will be no transfers.

PROOF OF LEMMA 6: In this case, neither the company nor the project can become insolvent without E's actually misappropriating some assets. Hence, the transfer in this case would only be necessary because of E's misappropriations of assets. However, by Lemma 2, we know that it then would be suboptimal for E. ■

We now establish E's payoffs under positive gross returns for both the company and the project assets:

PROPOSITION 3 (for the proof of Proposition 3 see Appendix 1): In the case when both the company and the project assets perform well ($r_p>1$, $r_c>1$), E will receive the payoff of $E^{\setminus +}{}_G=E^{+/}{}_G$ with no misappropriation, $E^{\setminus +}{}_B= E^{+/}{}_B=E_B$ with maximum misappropriation and E_M when $\alpha_c=0$ and $\alpha_p=1$. ■

Finally, we consider a situation when both the project and the company produce gross returns above the minimum requirement at $t=1$. This corresponds to global solvency condition II.

PROPOSITION 4.A: In the case when both the company and the project assets perform poorly ($r_p<1$, $r_c<1$), E will receive the payoff of E_B.

PROOF OF PROPOSITION 4.A: Under this scenario, E will choose to misappropriate all assets under his discretion because there are insufficient funds at his disposal to make the company solvent. Hence, his payoff $E^{+\setminus}{}_B$ will be equal to E_B. Note that E cannot transfer funds into the balance-sheet project or into the company assets from the remote assets. Although E could save the SPE in this case by transferring funds from the company assets to the remote assets, E's payoff would then diminish because he will not be entitled to any payments once the company is bankrupt. ■

To summarize our results: E's payoffs are identical in all quadrants in regions B and M. That is, when all assets are misappropriated or when only project assets are misappropriated, E's payoffs are identical throughout all quadrants conditional on realizations of $f(r_c,r_p)$. Hence, the only difference between E's payoff formulas in different quadrants lies in payoffs in region G. However, even in region G, E's payoffs

are identical in three quadrants where the project assets deliver gross returns greater than 1 *or* the company assets deliver gross returns lower than *1*. Therefore, we can consider just two scenarios: (1) where the project assets deliver gross returns greater than 1 *or* the company assets deliver gross returns lower than 1, and, (2) where the project assets deliver gross returns lower than 1 *and* the company assets deliver gross returns greater than *1*.

It is helpful to at this point to define parameters a and b, where a is independent of ρ and b is independent of both θ and ρ; b can be interpreted as a joint measure of project's potential returns; a is equal to b adjusted for the costs of limits on managerial discretion in retrieving potential added value v, where $a=(v-1)(1-\theta)+r^e$ and $b=v+r^e-1$ and note that $a, b>0$.

We list below the conditions for E's actions under the first scenario, when project assets deliver strong gross returns $r_p>1$ *or* the company assets deliver poor returns $r_c<1$: and under the second scenario, when the project assets deliver poor gross returns ($r_p<1$) *and* the company assets deliver strong returns ($r_c<1$). Hence, conditions (3.13), (3.14) and (3.15) become:[38]

TABLE 1:

CONDITION:	SCENARIO 1:		SCENARIO 2:	
REGION G PREFERRED TO B	$br_c+ar_p>2$	(5.1)	$br_c+ar_p+\theta v\rho(r_p-1)>2$	(5.2)
REGION M PREFERRED TO B	$br_c+(ar_p-1)(1-\rho)>1$	(5.3)	$br_c+(ar_p-1)(1-\rho)>1$	(5.3)
REGION G PREFERRED TO M	$ar_p>1$	(5.4)	$(a+\theta v)r_p-(1+\theta v)>0$	(5.5)
GLOBAL SOLVENCY CONDITION I	$(r_c-1)+(r_p-1)(1-\rho)>0$			(5.7)
GLOBAL SOLVENCY CONDITION II	$r_c+r_p>2$			(5.8)

[38] For each inequality (5.x), when we refer to a condition (5.x) we mean the corresponding equality.

Recall that the last two conditions determine choices that are available to E in regions M and G, rather than representing E's actual choices. Hence, for any combination of (r_c, r_p), where G is optimal, B ensues nevertheless, unless condition (5.7) is true in scenario 1 and unless condition (5.8) is true in scenario 2. Similarly, for any combination of (r_c, r_p), where M is optimal, B ensues nevertheless, unless condition (5.7) is true in either scenario.

IV. DETERMINING OPTIMAL CONTRACTS

A. The case of certainty

A.1. Certainty: Before we analyse the choice of an optimal contract, we consider a simplified case of certainty, where identical returns on the company and project assets are r^e in period 1 and r^n in per period 2 (where $r^n=r^e$ for $v(r^n)=0$ and $r^n>r^e$ for $v(r^n)>0$) and are known *ex ante* with certainty and hence v is known with certainty as well.[39] The assumption of identical returns on the company and the project assets is crucial here. We switch back to the original setup in the next section. We prove that under certainty legal separation is irrelevant and the choice of managerial discretion is binary:

PROPOSITION 4.B: In the case of certainty, the legal separation is irrelevant and the company and project creditors jointly demand a contract characterised by $\theta=1$ for assets characterised by (v, r^e) that would otherwise be misappropriated by E at $t=1$, and agree for a contract characterised by $\theta=0$ for all other assets.

PROOF OF PROPOSITION 4.B: First, we note that, under certainty, the creditors know E's behaviour at $t=1$. Hence, no investment will take place for any assets with $r^e<1$ since E will misappropriate all assets per Proposition 4.A. In other words, the gross return on invested assets must be positive for any financing contract to be signed since otherwise creditors cannot expect their investment to be repaid. The 'no contract' outcome is true even if v is sufficiently high to compensate for $r^e<1$, the gross negative return at $t=1$, since insufficient funds will be available at $t=1$. ■

[39] Note that all assets have an identical expected return under uncertainty. We relax this assumption later for the certainty case: see section 4.5.

Next, note that for any assets with $r^e>1$ (this corresponds to the joint positive returns scenario and Proposition 3 discussed above) invested with certainty, there will be no transfers, as neither group of assets will require it, unless some assets are misappropriated by E, in which case no transfer will be made as per Lemma 2 and Lemma 3. However, E might abandon the company and the project for low $r^e>1$, as per Proposition 3. As long as the expected and known returns on the project assets and the company assets are identical, E will never abandon the project alone. Therefore, under certainty with identical returns the level of legal separation ρ is irrelevant.

Also, under these conditions, the choice of the limit on managerial discretion θ is binary and there is no conflict between creditors: All creditors would require an identical contract ($\theta=1$) for any assets characterised by (r^e, $v(r^n)$) such that E would otherwise misappropriate all assets at $t=1$ and a contract ($\theta=0$) for any assets characterised by (r^e, $v(r^n)$) such that E would otherwise misappropriate all assets at $t=1$.[40]

A.2 Period 2 uncertainty: As we have seen above, uncertainty in the first period allows us to interpret a rich set of contracts; it is also necessarily linked to the legal separation of assets. However, assuming stochastic returns in the second period, given that there are no restrictions on the joint probability distribution of returns in the first period, adds little to the discussion of strategic choices of E at $t=1$. One important difference is that under uncertain returns in the second period, the transfer of cash flows becomes costly for creditors of the balance-sheet assets (their expected returns at $t=2$ are lower). In the case of period 2 uncertainty with the same expected rates of return as in period 1, the risk of E misappropriating income at $t=1$ decreases in the low-returns states. When E enjoys control over assets and the gross returns in the two periods are not independent, E rationally updates his beliefs at $t=1$. Therefore, the stylised 'securitisation' contract characterized by full limits on managerial discretion and full

[40] As we will see, this is also true under uncertainty, where projects with low, positive return will feature an optimal contract with a maximum limit on managerial discretion.

legal separation of the two groups of assets (as a protection against E's misappropriation of cash flows) becomes more optimal in the case when information on project returns are updated during its duration.

B. Choice of an optimal contract

We now return to the problem of writing the optimal contract at $t=0$ under uncertainty in period 1 and given E's expected behaviour at $t=1$, as analysed in section III. First, it is helpful to understand how E's choices at $t=1$ alter the payoffs to creditors and to E himself across the spectrum of possible realisations of gross returns on the company assets and the project assets. The answer is provided by Lemma 7:

LEMMA 7 (for the proof of Lemma 7 see Appendix 1): In the (r_c, r_p) space of realized returns, the company creditors seek a financing contract (ρ, θ) such that region B, where E misappropriates all assets under his control, is minimised; the project creditors seek a financing contract (ρ, θ), which jointly minimises regions B and M where E misappropriates the project assets under his control. ■

In a fully generalized version of our model, the optimal contract (ρ, θ) might be chosen jointly by the two groups of creditors and E as a result of a bargaining process between the three parties. The nature of this bargaining process would then be critical for determination of the optimal contract.

We start our analysis by assuming that E has no bargaining power. This could be because of a large number of similar investment opportunities available in the market, but a limited amount of capital, or because E's reservation level is 0 and therefore he is

prepared to accept any NPV-positive contract.[41] We analyse preferences of each group of creditors in turn. Implicitly, we assume that the company creditors can effectively influence the shape of the financial contract concerning the secondary (project) assets. This is often found in practice being implemented by the negative pledge clauses or other restrictive covenants in the other (company) financing contract.[42]

To simplify the problem, we assume that both r_c and r_p are uniformly distributed with the same mean return $r^e>1$. A direct implication of this assumption is that all investments, being NPV-positive, are in fact socially optimal, so the continuation of operations at $t=1$, rather than income diversion, is naturally welfare-enhancing. In other words, any agreement on a contract, which provides financing for the assets that would not otherwise be financed, constitutes a welfare improvement.

We now turn to analyse the creditors maximization problem, given E's expected behaviour at $t=1$, under two scenarios in the ($r_c>0$, $r_p>0$) space. We also note that all E's incentive criteria from $t=1$—i.e. conditions (5.1)-(5.8) (equations 1 to 8)—are straight lines in that space; we indicate the relevant intersection points by z_{xy}.[43] Note that every outcome can be compared against the benchmark case as established by Lemma 8 below:

LEMMA 8 (for the proof of Lemma 8 see Appendix 1): For any contract, the minimum (benchmark) size of region B is $1+½(1-\rho)$. ■

We now establish several important results. First, we note continuity of region G from region B across all quadrants along the lines of E's preference of region G over B,

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[41] Note that in this setup any contract (ρ,θ) will offer E an expected payoff greater than 0, E's reservation level.

[42] Even if the standard debt contract to finance company assets is negotiated first, company creditors might influence the project contract by imposing various restrictions on any future borrowings.

[43] We use the following notation: $r_c=x$ and $r_p=y$; z_{xlk} indicates the x-coordinate of the z point of intersection between lines (5.L) and (5.K) and z_{ylk} indicates the y-coordinate of the point of intersection between lines (5.L) and (5.K). Also, x_l indicates the x-coordinate of (5.L) when $y=0$, and y_k indicates the y-coordinate of (5.K) when $x=0$. Finally, y_{K0} indicates condition (5.K) in the functional form $y=y_{K0}(x)$.

according to conditions (5.1) and (5.2), which intersect at ($z_{x12}=(2-a)/b$, $z_{y12}=1$). Second, we establish the key possibility result for E's potential choices when the realized (gross) returns on the project are negative and the realized (gross) returns on the company assets are positive:

LEMMA 9 (for the proof of Lemma 9 see Appendix 1): In the /+ quadrant, when the project underperforms but the company assets perform well, the condition (5.8) is always stronger than the condition (5.7). That is, E can always save the company and bankrupt the project when he can save both. However, there exists a region, greater or equal to zero, where E can save the company, but cannot save both the company and the project.■

We also establish two important results regarding the point of intersection of different conditions under each of the two scenarios:

LEMMA 10 (for the proof of Lemma 10 see Appendix 1): E chooses G over M, where available, for realized returns on the project $r_p>1$ *or* realized returns on the company assets $r_c<1$ (that is, in every quadrant *except* for the /+ quadrant) when $r_p>y_4$, and where $y_4=z_{y13}=z_{y14}=z_{y34}<1$ if and only if $a>1$, and $z_{x13}=z_{x14}=z_{x34}>1$ if and only if $b<1$. ■

LEMMA 11 (for the proof of Lemma 11 see Appendix 1): E chooses G over M, where available, for realized returns on the project $r_p<1$ and realized returns on the company assets $r_c>1$ (that is, in the /+ quadrant) when $r_p>y_5$, and where $y_5=z_{y23}=z_{y25}=z_{y35}<1$ for $a>1$ and $y_5>1$ for $a<1$; also $z_{x23}=z_{x25}=z_{x35}<1$ if $a>1$, $b>1$, and $z_{x23}>1$ if and only if $z_{y28}>z_{y23}$. ■

Finally, we state one more important result:

LEMMA 12 (for the proof of Lemma 12 see Appendix 1): The x-coordinate of the point of intersection of (5.7) and $y=0$, x_7, is smaller than that for (5.3), x_3, when $b<1$, and the latter is smaller than that for (5.2), x_2, for any (a, b). (5.3) has a greater slope (more negative) than (5.1) and (5.1) has a greater slope (more negative) than (5.2) for any (v, r^e) and greater than (5.8) for $b>a$; (5.2) has a slope greater (more negative) than (5.8) for $a+v\rho\theta<b(v\rho<1-v)$. ■

It turns out that it is convenient to analyse our results separately for two scenarios: (i) when $v+r^e>2$ and (ii) when $v+r^e<2$. When $v+r^e>2$, then, necessarily, $a>1$ and $b>1$.[44] When $v+r^e<2$, then, necessarily, $b<1$ and $a<2$ and $v<1$ and $b<a$ since $r^e>1$, $v>0$, $0<\theta<1$, and $0<\rho<1$.

C. The optimal contract with high value of managerial discretion, high expected returns (scenario 1): $v+r^e>2$.

We start by considering the +/ quadrant when $v+r^e>2$, that is, when there is either a high expected return on assets or managerial discretion is relatively valuable, or both. We present the analysis of this case below; for other cases, we include the complete analyses in Appendix 1.

Recall that (5.1) indicates where G is better for E than B and note that (5.1) lies entirely below (5.7) in this region since $y_1=2/a$ and $a>1$, but $y_7=(2-\rho)/(1-\rho)>2$, and $z_{1,y=1}=(2-b)/a<1$ for $b>1$ and $a>1$. Therefore there is no additional B area in the +/ quadrant. Now consider the \+ quadrant: recall that (5.3) indicates where D is better than B in this quadrant. There is no additional B area in the \+ quadrant either since this entire quadrant is covered by region G. This is because region G lies above lines (5.1) and (5.3)

[44] To see that $a\geq 1$, note that $a=v+r^e-1+\theta(1-v)$ and $Min[a]=1$ when $v=1$, and $a>1$ for $v<1$ and $v>1$.

and since z_{13} lies in the +\ quadrant because $z_{x13}=1/b<1$ and $z_{y13}=1/a<1$ as shown on Fig. 2 below.

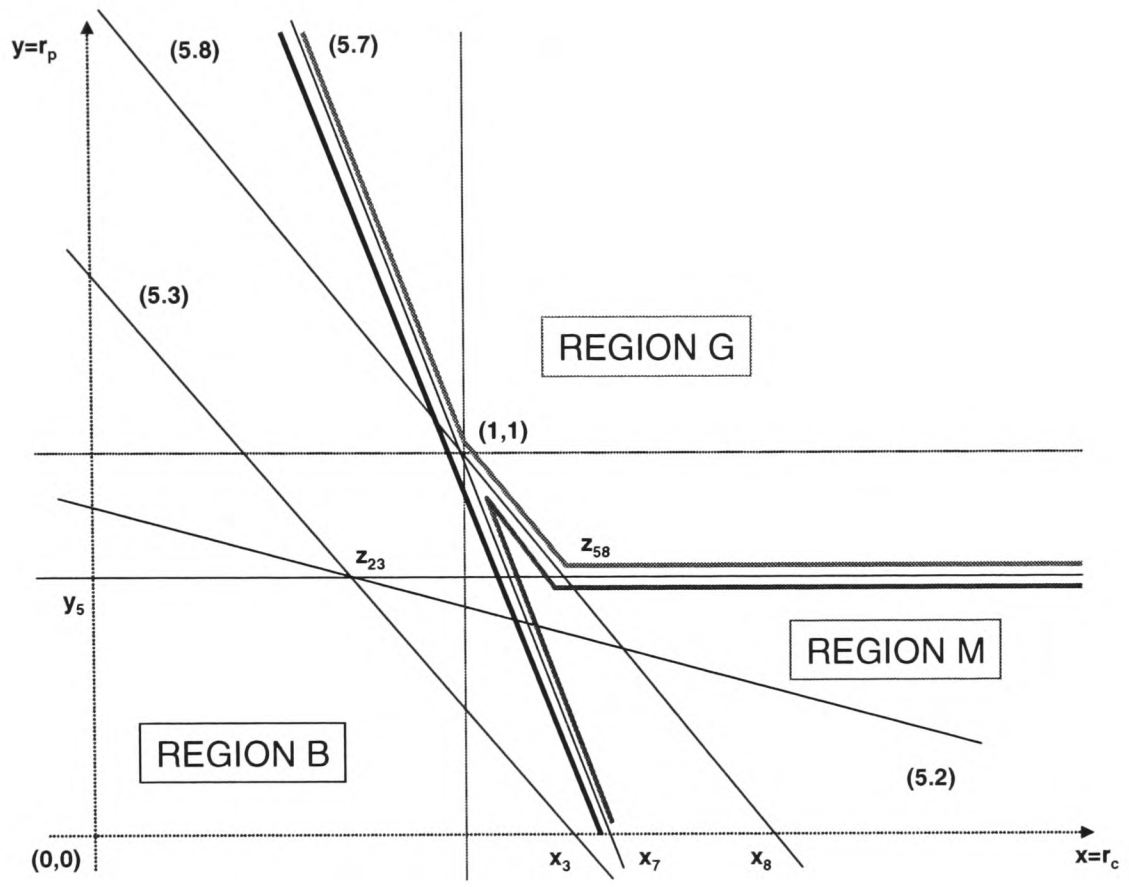


FIGURE 2 : SCENARIO 1

We now consider the /+ quadrant under the $v+r^e>2$ scenario. It can be seen that since $z_{x23}<1$ and $z_{y23}=y_5<1$ when $v+r^e>2$ by Lemma 11, (5.2) and (5.3) cross in the +\ quadrant. Since $x_3<x_7$ by Lemma 12, (5.3) is entirely to the left of (5.7) in the /+ quadrant. That is, M is always preferable to B where it is achievable, and G is chosen by E above M for all (x, y) such that $y_5<y<1$ wherever G is possible—i.e. above (5.8)—that is, for $x>2-y$. Therefore, when $v+r^e>2$, E seeks G or M wherever it is possible and the company creditors try to minimise the total region B where the company cannot survive:

$$\underset{\rho,\theta}{Min}\left[\int_0^{x_7} y_{70}dx\right] = \underset{\rho,\theta}{Min}\left[\frac{(\rho-2)^2}{2(1-\rho)}\right] \tag{6.1}$$

$$\frac{\partial}{\partial\rho}(...) = \frac{(2-\rho)\rho}{2(\rho-1)^2} > 0 \tag{6.2}$$

This is minimised for $\rho=0$ and any θ. Therefore under this scenario, it is optimal for the company creditors to demand $\rho=0$. This is intuitive since the company creditors face a bigger potential loss from E not being able to transfer funds into the company when the company assets perform poorly (due to remote legal status of project assets) than from transferring funds into the project assets when the latter perform poorly in order to save the company as a whole. Limiting managerial incentive is irrelevant here for the company creditors since for high v, r^e E faces sufficient incentives from the company assets.

Under the same scenario, project creditors try to minimise the total area of combined regions B and M:

$$\underset{\rho,\theta}{Min}\left[1+\frac{1}{2(1-\rho)}+\int_1^{z_{x58}} y_{80}dx+\int_{z_{x58}}^{2r^e} y_{50}dx\right] \tag{6.3}$$

$$=\underset{\rho,\theta}{Min}\left[1+\frac{1}{2(1-\rho)}+\frac{(a-1)(a+1)+2(1+\theta V)\left((b+\theta)(2r^e+1)+(a-1)\right)}{2(b+\theta)^2}\right] \tag{6.4}$$

Note that the last term is independent of ρ and the project creditors have an even stronger preference for $\rho=0$ under this scenario than the company creditors. The former do not gain from a higher ρ in the case when the project underperforms and the company performs well, because E can selectively bankrupt the project. In other words, it is region M, rather than region G, that replaces B in the /+ quadrant. However, they *benefit from*

lower ρ when the company underperforms. That is, when the company assets underperform, but the project assets perform well, the project creditors might actually gain from transferring some funds to the company. This is because higher ρ increases the area where E, not being able to save the company with the help of project assets' cash flows, will actually close both.

Their choice of θ is more complicated since:

$$\frac{\partial}{\partial\theta}(...)=\frac{(bv-1)(\theta v+1+2(r^e-1)(b+\theta))}{(b+\theta)^2}>0 \text{ iff } bv>1 \tag{6.5}$$

In order to maximise G versus M, the project creditors would like to *minimise* y_5. This achieves its minimum with $\theta=0$ if $bv>1$, and with $\theta=1$ if $bv<1$. In other words, for the highest combinations of $(v,\ r^e)$ such that $v(v+r^e-1)>1$, $\theta=0$ is optimal for project creditors. But for cases where r^e is high, but v is low ($v<1$), the project creditors might prefer $\theta=1$. In addition, recall that for each $\delta\theta$ decrease in θ project creditors face potential losses in the B area equal to:

$$\frac{\partial\theta(\rho-2)^2}{2(1-\rho)} \tag{6.6}$$

But when $\theta=0$ is optimal, they gain an extra strip of region G from region D equal to:

$$\partial\theta\left[2r^e-1-\frac{1+\theta v}{b+\theta}\right] \tag{6.7}$$

Therefore for very high v and r^e it is optimal for the project creditors to choose $\rho=0$ and $\theta=0$ when gains from enlarging G at the cost of D are large enough to

compensate for lesser protection under B. When these gains are insufficient or when v is low, they will switch to $\rho=0$, $\theta=1$ contract. These results are summarized in the Proposition 5 below:

PROPOSITION 5: In the case of high expected returns and high value of managerial discretion when $v+r^e>2$, both the company creditors and the project creditors prefer no legal separation $\rho=0$, although potential losses from $\rho>0$ are greater for project creditors. The level of managerial discretion, θ, is irrelevant for the company creditors and the project creditors prefer $\theta=0$ when $v\geq 1$ or when $bv\geq 1$, and $\theta=1$ otherwise. ■

D. The optimal contract with low value of managerial discretion, low expected returns (scenarios 2 & 3): $v+r^e<2$.

We now consider the more complex, low-returns scenario, where $v+r^e<2$ (and hence: $v<1$, $b<1$, $a>b$). We start by considering a situation where $a<1$—this is achieved by setting θ sufficiently low (higher for a lower v).[45] Since $y_7=(2-\rho)/(1-\rho)$, hence y_7 is independent of a or b. However, both (5.7) and (5.1) must be true for G to be better than B in the +/ quadrant. Also, when $b<1$ and $a<1$, then $z_{x13}>1$ and $z_{y13}>1$ by Lemma 11. Hence, (5.1) and (5.3) intersect at z_{13} in the \+ quadrant, where M becomes better than G below (5.4).[46]

D.1 Scenario 2: $a<1$. We first consider a scenario when a<1 and $v+r^e<2$ and $a<1$—this is shown in Fig. 3 below. In this case all creditors choose the maximum θ subject to a<1, but differ in their preferences for the level of legal separation:

[45] Note that $a<1$ is possible for any (v, r^e) such that $v+r^e<2$ for sufficiently low level θ^* in the contract.
[46] Recall that since (5.7) and (5.8) cross at (1,1) C and D are achievable in the entire \+ quadrant.

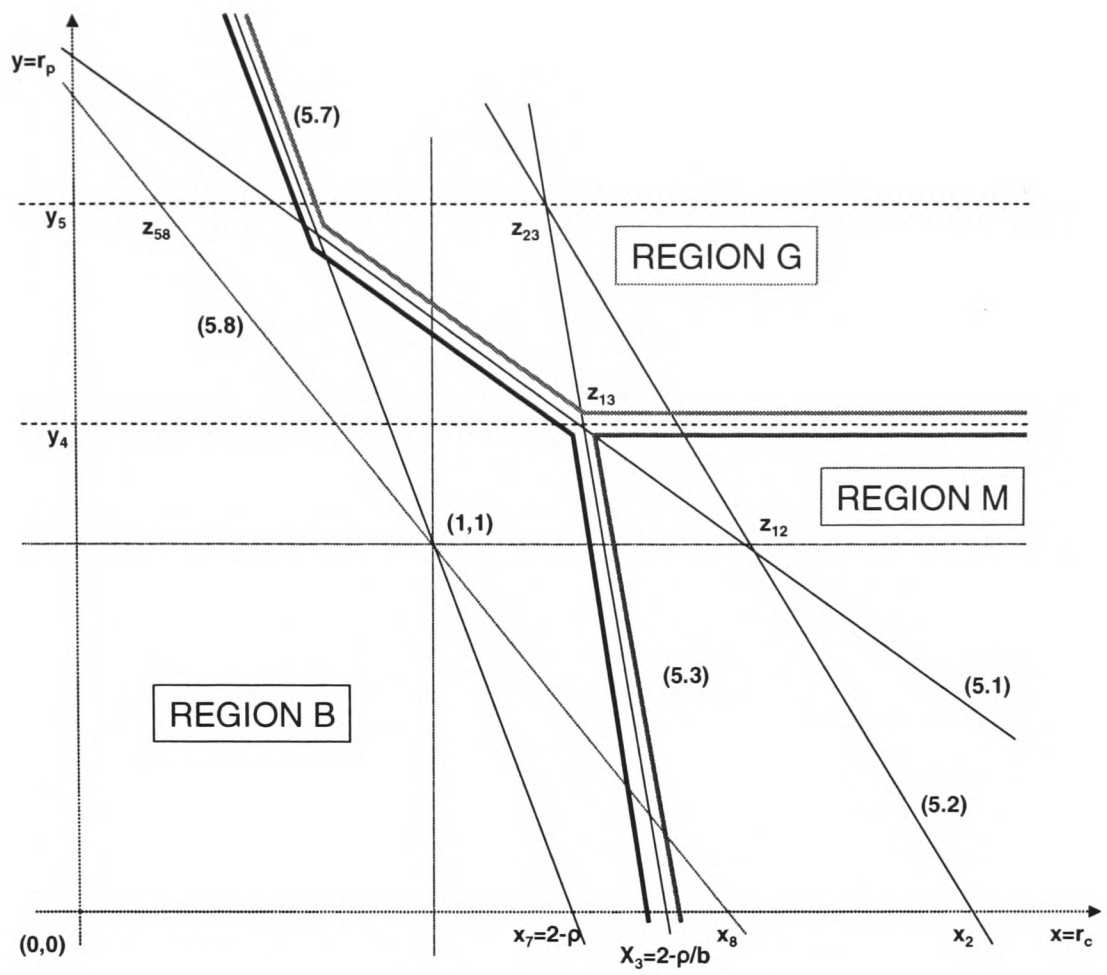


FIGURE 3 : SCENARIO 2

PROPOSITION 6 (for the proof of Proposition 6 see Appendix 1): In the case of low expected returns and low value of managerial discretion ($v+r^e<2$, $a<1$), both the company and the project creditors choose the maximum $\theta=\theta^1_{a<1}$ subject to $a<1$. The project creditors prefer no legal separation of assets $\rho=0$, but the company creditors seek their optimal $\rho^1_{a<1}>0$. ■

D.2 Scenario 3: a>1. We now consider the case when $v+r^e<2$, but $a>1$.[47] In this sub-scenario we analyse two possible sub-cases: (i) $a+b<2$ and (ii) $a+b>2$. In the +/ quadrant, since $2/a<2$ for $a>1$, (5.1) cuts the $x=0$ axis below 2 and hence below (5.7). Therefore, G is preferable to B for E in the area between (5.1) and (5.7) for $x<z_{x17}$, but it is not available. Hence, the additional B area exists only for $x>z_{x17}$. In fact, (5.1) crosses

[47] For $v+r^e<2$ ($v<1$), a>1 is possible if and only if θ is sufficiently high and v is sufficiently low.

(5.8) and (5.7) in the +/ quadrant if and only if $z_{y18}>1$ and $z_{y18}=2(1-b)/\theta(1-V)>1$ if and only if $a+b<2$, i.e. only in the 1st case.

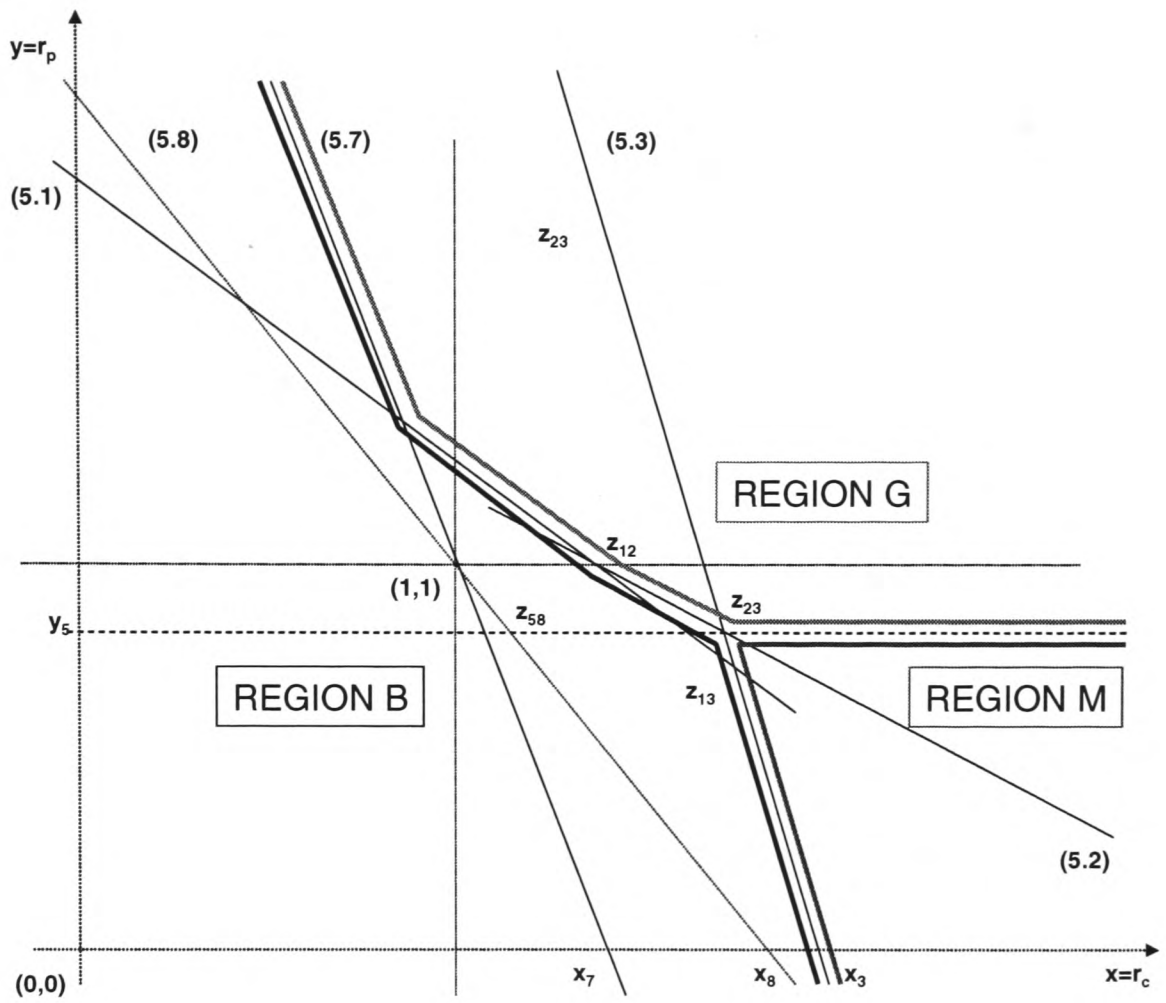


FIGURE 4 : SCENARIO 3.1

In both cases, by Lemma 10, we know that $y_4=z_{y13}<1$ when $a>1$. Hence, there is no region M in the \+ quadrant. Also, by Lemma 11, we know that $y_5=z_{y23}<1$ when $a>1$. Therefore, (5.2) intersects with (5.3) where $y<1$. When $a+b<2$, $z_{y28}>1$ for $a+b<2$; hence (5.2) intersects (5.8) in the +/ quadrant. Also, (5.1) intersects (5.2) crossing from the \+ into the /+ quadrant at $z_{x12}=(2-a)/b>1$ as shown in Fig. 4 above.

D.3 Scenario 3.1: a>1, a+b<2. When a>1 and $a+b<2$, as shown in Fig. 4 above, different groups of creditors have divergent interests, as summarised in Proposition 7 below:

PROPOSITION 7 (for the proof of Proposition 7 see Appendix 1): In the case when $v+r^e<2$, $a>1$, and $a+b<2$, the company creditors seek their optimal level of legal separation $\rho^2_{a>1}$ in the contract, lower than in the case when $a<1$. They also seek their optimum level of managerial discretion $\theta=\theta^2_{a>1}$. Project creditors prefer no legal separation of assets $\rho=0$, but maximum limits on managerial discretion $\theta=1$. ■

D.4 Scenario 3.2: a>1, a+b>2. Now, we consider the case when $v+r^e<2$, $2>a>1$, ($v<1$, $b<1$) and $a+b>2$. Now (5.1) is entirely underneath (5.8) and (5.7) in the +/ quadrant and does not enter into the \+ quadrant at all. Hence, there is no additional region B above the benchmark area anywhere except in the /+ quadrant, for $x<1$ B in minimised for $\rho=0$. Note that for $x<1$, potential losses from $\rho>0$ are greater than before since G is better than B wherever it is available in the entire +/ quadrant.

D.5 Scenario 3.2.1: a+b>2, $z_{y28}<z_{y23}$. Next, we consider a scenario when a+b>2, but $z_{y28}<z_{y23}$—this is shown in Fig. 5 below. In this case all creditors have identical preferences as specified in Proposition 8 below:

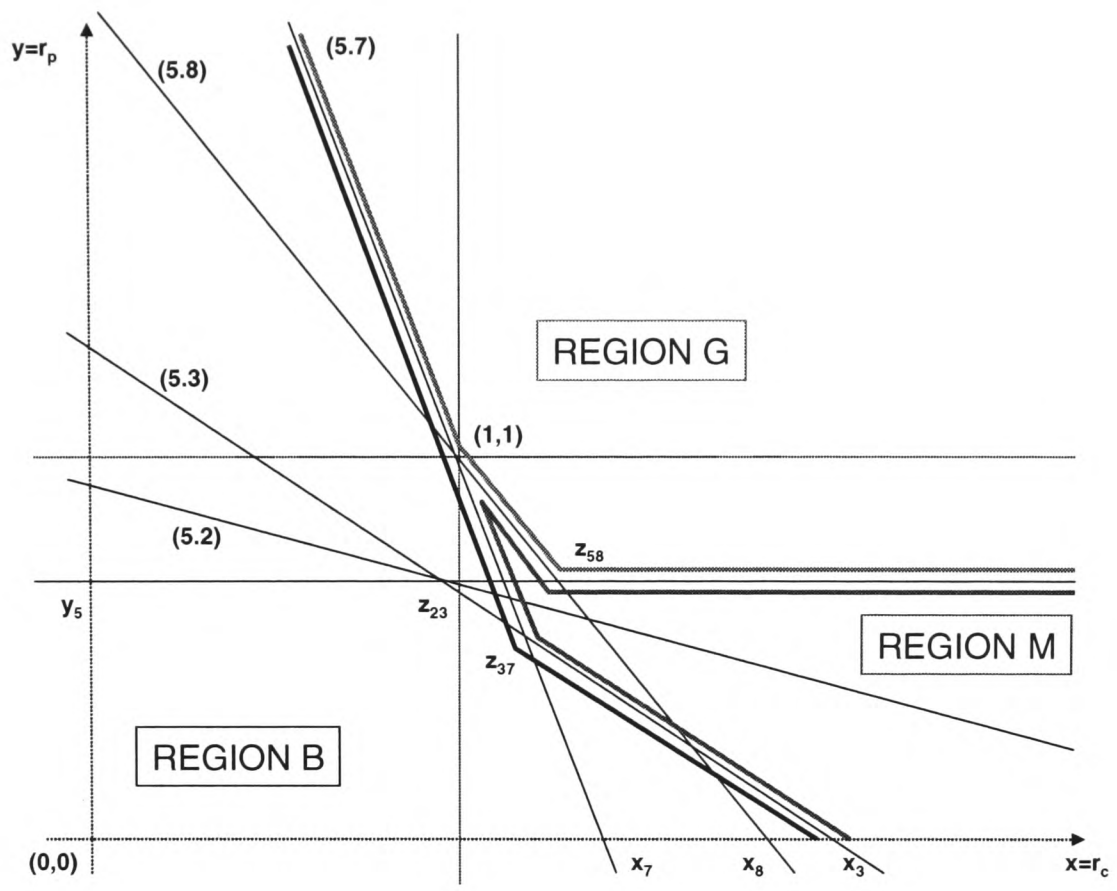


FIGURE 5 : SCENARIO 3.2.1

PROPOSITION 8 (for the proof of Proposition 8 see Appendix 1): In the case when $v+r^e<2$, but $a>1$, $a+b>2$ and $y_5>z_{y28}$, there is no conflict between the company creditors and the project creditors—they both choose no legal separation of assets $\rho=0$ and maximum limits on managerial discretion $\theta=1$. This is consistent on the equilibrium path with maximizing θ for project creditors to minimise their losses in region B and ensuring that $a>1$. ■

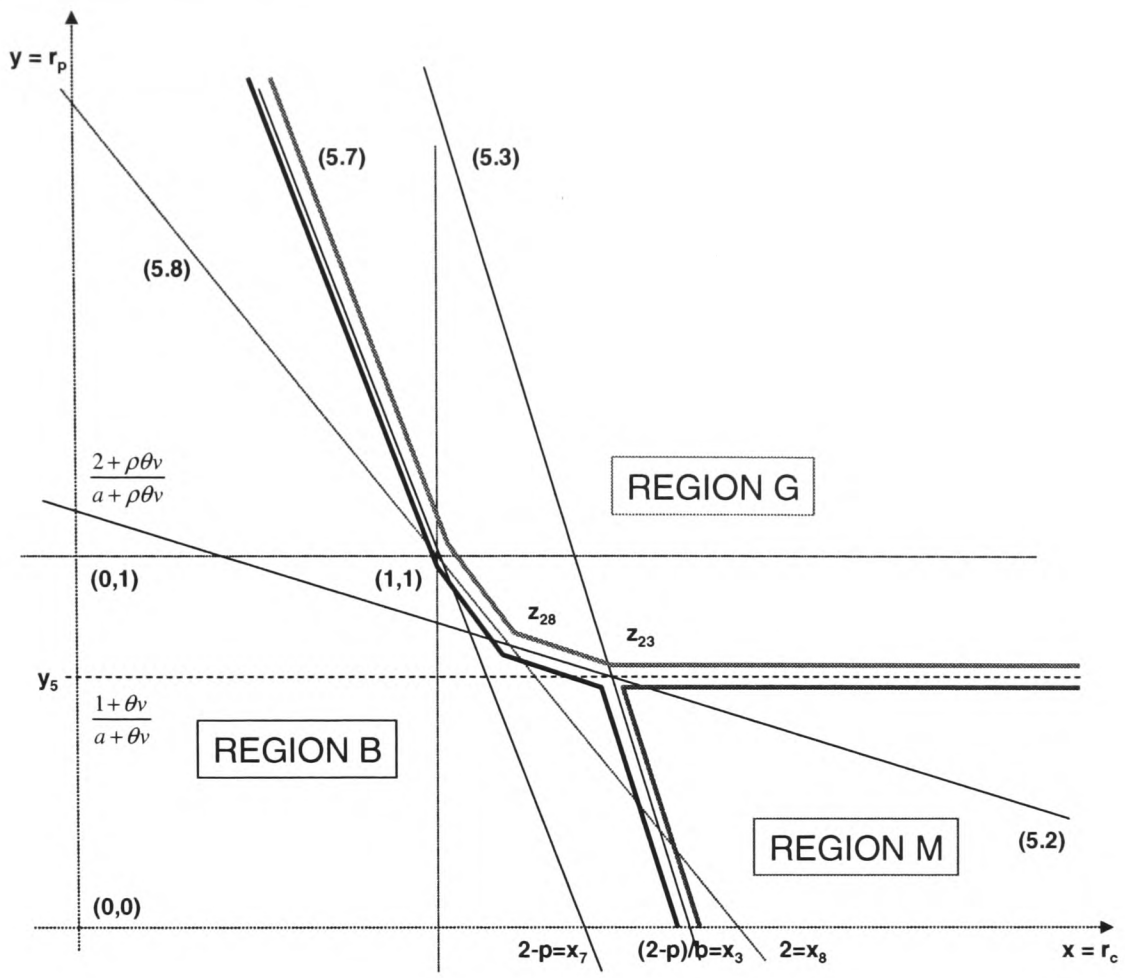


FIGURE 6 : SCENARIO 3.2.2

D.6 Scenario 3.2.2: a+b>2, $z_{y28}>z_{y23}$. Next, we consider a scenario when a+b>2, but $z_{y28}>z_{y23}$—this is shown in Fig. 6 above. In this case all creditors prefer maximum limits on managerial discretion, but the company creditors a higher degree of legal separation, as summarised in Proposition 9 below:

PROPOSITION 9 (for the proof of Proposition 9 see Appendix 1): In the case when $v+r^e<2$, $a>1$, $a+b>2$, and $z_{y23}<z_{y28}$, the company creditors prefer a level of legal separation $\rho^2_{a+b>2}$ such that $\rho^1_{a+b<2}>\rho^2_{a+b>2}>0$; project creditors prefer a $\rho=0$ contract. Both prefer maximum limits on managerial discretion $\theta=1$. This is consistent on the equilibrium path with maximizing θ for project creditors to minimise their losses in region B and ensuring that $a>1$. ■

Having analysed preferences for an optimal contract under all the scenarios we summarize our results in Table 2 below. For each scenario we list the project creditors preferences and the company creditors preferences. These preferences would characterize the optimal contracts when the project creditors and the company creditors have all the bargaining power, respectively, in each case.

TABLE 2: OPTIMAL CONTRACT CHARATCERISTICS FOR COMPANY AND PROJECT CREDITORS IN DIFFERENT SCENARIOS

scenario	**scenario characteristics**	**company creditors' preferences**	**project creditors' preferences**	**other conditions and comments**
scenario 1.1	$v+r^e>2$ (b>1) high r^e, high v $v>1$	$\rho=0$ any θ	$\rho=0$ $\theta=0$	$r^e>1$, b>1, a>1, $v>1$ no conflict
scenario 1.2	$v+r^e>2$ (b>1) high r^e $v<1$ bv>1	$\rho=0$ any θ	$\rho=0$ $\theta=0$	$r^e>1$, b>1, a>1, $v<1$ if r^e high with lower v
scenario 1.3	$v+r^e>2$ (b>1) medium r^e $v<1$ bv<1 (r^e not too high)	$\rho=0$ any θ	$\rho=0$ $\theta=1$	$r^e>1$, b>1, a>1, $v<1$ if r^e medium with lower v
scenario 3.2.1	$v+r^e<2$ (b<1) a>1 (higher v, r^e & high θ) a+b>2, (high b) $z_{y23}>z_{y28}$ (b sufficiently high)	$\rho=0$ $\theta=1$	$\rho=0$ $\theta=1$	$r^e>1$, $v<1$, 2>a>1>b>0, a+b>2 identical preferences
scenario 3.2.2	$v+r^e<2$ (b<1) a>1 (higher v, r^e & high θ) a+b>2, (higher b) $z_{y23}<z_{y28}$ (b sufficiently low)	$\rho=\rho^3<\rho^2$ $\theta=1$	$\rho=0$ $\theta=1$	$r^e>1$, $v<1$, 2>a>1>b>0, a+b>2 low level of legal separation ρ
scenario 3.1	$v+r^e<2$ (b<1) a>1 (medium v, r^e, high θ) a+b<2 (b low: lower v, r^e)	$\rho=\rho^2<\rho^1$ & $\rho^2>\rho^3$ $\theta=\theta^2$	$\rho=0$ $\theta=1$	$r^e>1$, $v<1$, 2>a>1>b>0, a+b<2 ρ^2 higher (lower) if $v\theta$ low (high) both parameters different
scenario 2	$v+r^e<2$ (b<1) low r^e, low v a<1 low v allows for higher θ higher v requires low θ	$\rho=\rho^1>\rho^2$ Max possible $\theta=\theta^1$ for a<1	$\rho=0$ Max possible $\theta=\theta^1$ for a<1	$r^e>1$, $v<1$, 1>a>b>0, a+b<2 high level of legal separation ρ higher θ possible for low v

Note: The asset categories are listed above according to conditions on v and r^e. Note that $b>1$ for all projects with $v>1$ since r^e is always greater than *1*. Therefore, when $v+r^e<2$, then $v<1$ necessarily (for higher r^e, v must be even smaller). When $v+r^e>2$, we distinguish 3 scenarios: (i) when $v>1$, (ii), when $v<1$, but $bv>1$, and (iii) when $v<1$ and $bv<1$. Note that in the last case v must be smaller than under (ii). In order to understand the role of the parameter 'a' in the above scenarios note that since $a=b+\theta(1-v)=r^e+(1-v)(\theta-1)$, a is increasing in r^e, maximised for $v\rightarrow 1$ and minimum for $\theta\rightarrow 1$. Hence, v will be greater (closer to *1*) when $a>1$ than when $a<1$. Also, for greater v it will be easier to achieve $a>1$ (i.e. it can be achieved with lower θ).

V. INTERPRETING OPTIMAL CONTRACTS

A. *Manager's and equity-holder's preferences*

Unlike the project creditors or the company creditors, manager E always prefers a contract with no limits on managerial discretion ($\theta=0$) since $\theta>0$ reduces his options and hence limits his ability to maximise his returns in at least some outcomes. More precisely, a direct implication of $\theta>0$ for E is that in situations where E would benefit from misapproprating cash flows from secondary assets (in region M), only the second best option is available to him. Although E prefers $\theta=0$ in general, in the case of some firms, assets or projects, he might be willing to accept a higher level of θ in order to obtain financing. That is, if E has no bargaining power due to, for example, company's financial difficulties or even financial distress, low capitalisation (for banks), or difficult market conditions (e.g. high credit spreads), E might accept a contact with a higher level of θ, which would make it acceptable to creditors.[48] This is because E would like to pursue every possible project—his expected returns are always greater than zero—as he is always better off with the most restrictive contract than with no financing contract at all. E might also accept a higher θ in order to finance a particularly important investment or to refinance existing assets to make a new investment. However, if E enjoys bargaining power, he will offer creditors a contract with minimum restrictions on managerial discretion, which is, at the same time, marginally acceptable to creditors.

E's choice of the level of legal separation is more nuanced: legal separation offers E the additional choice of an efficient (from E's perspective), selective default in the case of an underperforming project, but limits the possibility of an efficient cash transfer away from the company when the latter is underperforming. When a selective default on the project assets is optimal, but not available to E (when $\rho=0$ or when $\rho<1$ in certain

[48] This could be also due to e.g. a large number of possible investments available in the market place.

conditions), E chooses actions corresponding to regions B or G according to conditions (5.1) and (5.2). In general, E will benefit from the maximum size of region M and hence maximum choice, whenever it becomes available at the cost of B or G, since M can simulate his payoffs from B or G under M. Importantly, this implies that E will bargain for greater legal separation whenever the M region is large and more likely to occur. By inspection, from the analysis in the previous section, it is clear that this will be the case for weakly correlated assets. Therefore, our model makes the prediction opposite to that of Li and Li (1996), who suggest that only strongly negatively correlated assets should be merged.[49]

Moreover, wherever region G is replaced by region B, as a result of higher ρ, E's payoff will be lower than under G, but still greater than zero, which is the payoff to the company creditors under the same circumstances (assuming $\theta=0$). Hence, our model implies that E's preferences with respect to the new financial contract are more closely aligned with those of the company creditors than with those of the project creditors, both in terms of the level of managerial discretion and the level of legal separation of assets. This is partly driven by the fact the company assets can only be financed with a standard debt contract, by assumption, in our model. These results are summarized in Proposition 10 below:

PROPOSITION 10: E would like to minimise the limit on managerial discretion θ for any firm characteristics. E's preferred level of ρ will always be greater than that optimal for the company creditors and hence also greater than that preferred by the project creditors.■

[49] Note, however, that we investigate the mutual relationship between different parts of the firm only in so far as it concerns the legal separation of distinct groups of assets from the perspective of a an optimal financial contract with non-recourse provisions and limits on managerial discretion rather than from the perspective of completely divesting or merging different corporate activities.

In general, E will try to secure a lower limit on managerial discretion θ ($\theta<1$) than optimal for creditors in general in the case of low v-, low r^e-assets and a higher ρ ($\rho>0$) than optimal for creditors, the project creditors in particular, in the case of high v-, high r^e-assets, since stronger ties between primary and secondary assets make E less likely to misappropriate assets. Also, the conflict of interest between managers and creditors is predicted to be stronger for the former class of assets than for the latter, due to agency costs.

For realizations over region M, E benefits from the maximum level of ρ (i.e. $\rho=1$ if achievable) since E's preference of M over G or B from the returns differential that accumulates to E is maximised for the highest ρ in this case. This represents the critical difference between all creditors' preferences and E's preferences. In as far as E's choice in region M is also optimal for the company creditors, the latter will seek a contract characterized by ρ just high enough to achieve the optimal size of region M versus the costs of high ρ elsewhere (ie when the company defaults).[50] However, E has the added incentive to maximise ρ beyond the level optimal to the company creditors in order to extract the maximum potential benefits for any given size of region M. This implies that managers, as oppose to existing creditors, might be driving the legal separation of assets.

B. Project creditors' and company creditors' preferences

One immediately transparent feature of the results of our model is that the project creditors prefer no legal separation of the project assets from the rest of the company. This is because legal separation introduces a possibility of a selective default in the case of underperforming project assets, but a selective default on the company assets is not possible (the management cannot misappropriate cash flows from the balance-sheet assets by closing the company while continuing to run the project). Naturally, this is an

[50] This is because a higher ρ renders greater costs to the company creditors than to E (unless $\theta=1$).

implication of our assumption of asymmetry in the non-recourse provisions, as often observed in practice. For example, managers are unlikely to be able to selectively abandon the main holding company, while still operating the subsidiaries. The implication of our model is that the project creditors have a strong incentive to ensure some recourse to the company, via for example the company's financial exposure to the secondary assets in the form of a first-loss position or a retained 'equity' tranche, as commonly observed in securitisations. Similarly, project finance creditors often insist on certain parental guarantees or set the maximum gearing threshold level. In that sense, the results of our model seem to closely correspond to financial contracts observed in practice.

The project creditors' preferences for $\rho=0$ is also due to two drivers: (i) the high cost of not transferring funds to the main company insofar as E's incentive to continue operations of the entire enterprise, including the project assets, are concerned, and (ii) no costs of transferring sufficient funds for the company to continue operations where such transfer is efficient from E's perspective. The first driver is due to the fact that the project assets are affected by the company's underperformance: E has no interest in the project assets' survival without the continued investment in the company assets. If the company is shut down, E will misappropriate the project assets regardless of their own merits. The second driver—no costs of the transfer —is due to the assumption of no uncertainty in period 2. The risk cushion from the returns on the project assets is not needed beyond $t=1$ and, hence, can be freely used to support the company without any negative consequences for the project creditors. However, if uncertainty in the second period is introduced, the project creditors' preferences would shift towards more legal separation (higher ρ). This could be interpreted as indicating that more risky securitised assets imply a higher level of required over-collateralisation or a higher threshold for the cash flows' accumulation in the segregated account, before excess returns are repaid to the originator.

Another prediction of our model is that, as the expected returns and the value of managerial discretion diminish (i.e. for assets with lower expected returns and requiring less management), the project creditors will switch their preferences towards greater limits on managerial discretion before the company creditors do. This is intuitive since the project creditors are more vulnerable to E's misappropriations than the company creditors, as E has stronger interests in the company as remain an on-going concern than in the project. Moreover, our model also predicts that, as the expected returns and the value of managerial discretion diminish in a spectrum of different assets, all creditors will insist on limits on managerial discretion before demanding legal separation. This is true for the primary assets creditors as well as the secondary assets creditors, independently, and at different levels of expected returns. In general, this implies that we should observe the optimal financial contracts for assets with average expected returns and average demands on management effort to be characterised by some limits on managerial discretion (covenants) and no legal separation, but not other way around. Indeed, it could be argued that, while many debt contracts carry some covenants, few project finance or securitisation transactions feature no covenants, but strict non-recourse provisions. In that sense, predictions of our model seem to correspond well with the characteristics of standard debt contracts observed in practice.

The company creditors might not directly influence the new financing contract in practice, but are likely to do it indirectly, through existing financial covenants regulating new borrowings, or at the moment of refinancing. For large corporations, this is likely to be a continuing process. In general, according to our results, the company creditors are keen to ensure limits on managerial discretion for assets that are characterised by a low level of the required managerial effort and low expected returns, similarly to the project creditors, but also to impose a degree of legal separation—in contrast to the project

creditors' preferences.[51] Clearly, therefore, the possibility of eliminating some misappropriations, and hence agency costs, in some cases, by allowing for a selective default, is a source of conflict between different groups of creditors, according to our model. Moreover, our results indicate that for any type of assets, the company creditors will always prefer a greater degree of managerial discretion than do project creditors.

In the case of low v- and low r^e-assets, the company creditors' preferences for legal separation of assets comes primarily from the possibility of an efficient, selective default on project assets under the scenario where these assets perform poorly. Although the company creditors face a trade-off between the efficient default on the poorly performing project assets and the opportunity to transfer funds into the company assets from the project assets, this trade-off becomes most attractive with low v. As seen before, as v increases, the area of the efficient default on the project assets decreases, whereas the area of efficient support for the company assets increases. Importantly, the legal separation ensures under this scenario that the management does not misappropriate returns from the company assets when the project assets perform poorly. Note that in the case of full recourse, managers face an additional incentive to misappropriate cash flows instead of supporting a poorly performing project because they cannot treat two groups of assets differently. In that respect, legal separation offers an attractive alternative. This can be compared with project finance, where the company managers as well as current creditors might want to avoid financing a project that risks serious financial implications for the company as a whole.

C. Standard debt and related contracts

The most general implication of our results is that limits on managerial discretion and legal separation of assets are correlated in a majority of optimal contracts across

[51] Note that we assume the fair price obtained for securitized assets throughout.

different scenarios.[52] This seems to correspond with financial contracts seen in the real world, where non-recourse provisions usually accompany covenants on cash flows. In general, contracts with a higher optimal level of legal separation also feature greater limits on managerial discretion. This can be seen across most forms of financing: from standard debt contracts to securitisations. In some cases we analysed, the two characteristics seem to complement and reinforce each other, as discussed above.

According to our results, for assets with a high potential value of active management, as indicated by high v, and high mean expected returns r^e, the optimal financial contract resembles a standard debt contract with no limits on managerial discretion and no legal separation of assets. This is intuitive: with prospects for high returns, managers have little incentive to misappropriate income. At the same time, creditors would act inefficiently trying to limit managerial ability in circumstances where asset returns are highly dependent on managerial effort. However, while some limits on managerial actions will not cause managers to misappropriate assets from the company, the project creditors need to actually ensure the minimum level of managerial discretion. This is because limits on managerial discretion primarily affect payoffs to the project creditors as project creditors are more sensitive to changes in managerial incentives, in both directions.

Progressively, as the expected value from active management of assets diminishes along the spectrum of assets (lower v), it is the project assets' creditors who first switch their preferences towards limiting managers' discretion with covenants represented by θ. This is not unexpected, since, in general, the management is more likely to misappropriate income from the project than from the company. Below the threshold value of managerial discretion v^*, managers have insufficient incentives not to

[52] Except for specific circumstances that we discuss separately.

misappropriate any returns from the secondary assets and the creditors prefer to secure their minimum cash flows by limiting managerial freedom.

D. Securitisations

On the other extreme of the spectrum of different asset characteristics investigated by the model there exist NPV-positive assets characterised by low potential of managerial effort to contribute to the realised returns. The value of these assets cannot be readily enhanced by the management in any significant way (as indicated by very low v), but could potentially be destroyed with perquisites, wasteful spending, excessive costs, and other agency costs. According to our model, such assets are not suitable for standard debt financing. Since management incentives are not well aligned with those of creditors in these circumstances, the debt holders are unwilling to sponsor such assets without additional security. As a result, managers are predicted to be willing to tie their own hands with explicit limits on managerial freedom in order to secure the necessary funding.

The optimal financial contracts in this case seem to be characterized by a high degree of legal separation of project assets from the main company and maximum limits on managerial control. While creditors do not seem be in a position to structure such assets, the management might propose securitisations in order to secure creditors' interest. Another interpretation of this result is that additional financing simply allows for higher leverage, which is otherwise too expensive or unavailable.

As can be seen from Table 2, for very low v and r^e assets, the company creditors would like to see limits on both the degree of transfers as well as on the level of managerial discretion together in a hypothetical structured finance contract. This type of a contract can be compared with securitisations and project finance contracts in the real world, where limitations are imposed on SPE assets through strict covenants, the 'use of funds' clauses, or extensive rules on the control and use of free cash flows.

Therefore, in the presence of agency costs, securitisations create value by imposing limits on managerial discretion, where optimal, agreed by all parties. However, securitisation might also create value in these circumstances by limiting misappropriation via allowing for a partial, selective default on some secondary assets to the extent that such contract can be agreed with the project creditors. The agreement from the secondary assets creditors might be secured with e.g. first-loss positions, as discussed above. That is, in circumstances where E might otherwise misappropriate all available assets from the company in our model, due to insufficient incentives to continue its operations, he is likely only to abandon the project instead. In other words, even in circumstances where the first best of continuing all operations is not available, the second best might be available through a securitisation contract.

It is also worth considering one special case of our model. According to the results, the lowest returns scenario (scenario 2, where $a<1$), characterised by an optimal contract for the company creditors featuring the maximum level of legal separation, can only be attained with a sufficiently low θ, unless v is very low. However, this scenario can fold into Scenario 3 for a higher θ in the contract, even in the case of minimum v and r^e. Since high θ is generally efficient under this scenario, $a<1$ actually occurs only for the lowest values of v, where sufficiently high θ is still possible. Therefore, there is a trade-off in this case between the benefits of higher θ and the benefits under the '$a<1$' scenario achieved for marginally lower θ. This indicates why imposing maximum assets' separation and maximum limits on managerial discretion is rare, but efficient in very special circumstances.[53]

[53] If Scenario 2 offers better payoffs than Scenario 3 (for very low v, r^e), then creditors would set θ at the highest possible level, but just low enough to attain $a<1$.

VI. CONCLUSIONS AND APPLICATIONS

Looking at the future prospects of corporate finance, Luigi Zingales argues that new research has to tackle explicitly the nature and the limits of a firm.[54] When a 'firm' is defined as a set of contractual arrangements that link in a legal way various assets and their corresponding claims and place them under the control of management, the financial contracts described above can be seen as pushing some assets into the 'boundary' of a firm, by reallocating control over these assets in two ways. First, they make returns on a selected group of assets verifiable by placing them under creditors' control at the cost of the managerial discretion. Second, they make reallocations of value between distinct groups of creditors contingent on managerial incentives by breaking the legal recourse between assets. Therefore, these contracts are, arguably, the mid-point arrangements between the company ownership and control over assets, and their outright sale.

This paper uses a stylised model in the spirit of the incomplete contract theory to analyse the optimality conditions for financial contracts that shift assets to the boundary of a firm by severing these assets' linkages with the rest of the company. Specifically, it analyses contracts that restrict managerial control over assets upfront as well as restrict legal linkages between different groups of assets by introducing non-recourse provisions. A broad range of financial contracts from securitisations, through project finance, to debt with covenants can be analysed in this context—our results, therefore, are rather general in scope.

The results of our model indicate that securitisations might eliminate agency costs for low return-, low value of managerial effort- types of assets, such as bank receivables or future flows from regulated utilities in the case of corporate securitisations. This is achieved under first best through explicit limits on managerial discretion, when managers

[54] Zingales, L. (2000).

require new financing, as well as under the second best, by allowing for a selective default on some assets of the company. In the realm of optimal contracts that we derive, the level of restrictions placed on managerial discretion is closely correlated with the level of legal separation of assets, across different scenarios. Furthermore, in the case of companies characterised by moderate value of managerial discretion, contracts featuring some limits on managerial discretion, but no legal separation, are found to be optimal. This seems to correspond to financial contracts observed in the real world, where covenants on the use of assets and distribution of cash flows typically accompany non-recourse provisions, but also appear independently of the non-recourse provisions, but not other way around. According to our results, for assets with the high potential value of managerial discretion and high expected returns, the optimal financial contract closely resembles a standard debt contract.

According to our results, the assets characterised by low expected returns and low potential for added value from managerial effort are not suitable for financing using standard debt contracts, since a higher degree of legal separation and maximum limits on managerial control are more optimal in this case to most of the parties. Although seemingly benefiting creditors, our model suggests that the management might structure these financing arrangements in order to secure financing from rational creditors, who would be reluctant otherwise to provide funds according to standard debt contracts in these circumstances. The motivation in this case could be financial constraints or the possibility of obtaining a lower cost of capital due to elimination of a discount for the agency costs.[55]

We also show that for assets with particularly low value of managerial discretion and low expected returns, the company creditors would like to see limits on the level of recourse and on managerial discretion combined in a single contract. These contracts can

[55] We assume the first motivation: namely, that the company has no alternative sources of funding. We do not model variable costs of debt.

be compared with securitisation and/or project finance arrangements, where barriers to transfers are structured with the help of asset ring-fencing, strict covenants, the 'use of funds' clauses, and detailed rules on the control and monitoring of cash flows.

Another implication of model is the observation that the project creditors have a strong incentive to ensure some recourse to the company assets via company's financial exposure to the project. In practice, this is typically achieved with the first-loss provisions or the retention of the most junior, 'equity' tranche by the originator. In general, managers are predicted to try to secure a lower limit of managerial discretion than optimal for creditors in the case of low managerial value/low return assets and a higher level of legal separation than optimal for creditors in the case of high managerial value/low return assets.

As far as we know, we are the first to analyse comprehensively this set of financial contracts in a single model that allows us to compare contracts at the boundary of the firm, such as securitisation or project finance contracts, with standard debt contracts explicitly. In contrast to the bulk of literature on the incomplete contract theory, we are not concerned with the task of explaining the standard debt contract vis-à-vis equity or other contingent allocations of control. Instead, we show when departures from standard debt contracts might be efficient.

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APPENDIX 1

PROOF OF LEMMA 3: First, even if E sets $\alpha=1$, the company might still survive, providing E's control over the portion of the project assets on the company's books θ is small and the return on the company assets r_c is sufficiently high. In this case, the project assets on the company's books, but outside of E's control, implicitly provide support for the assets, that E controls and potentially misappropriates. In this case, E will optimally set $\alpha_c=0$, since the company survives regardless of E's actions with a guaranteed repayment to creditors at $t=2$. This is because all returns from the assets that E could misappropriate at $t=1$, if actually reinvested rather than misappropriated, will go to E anyway and exceed E's potential gain from misappropriating assets at $t=1$. It is straightforward now to see why, if the company survives, it is *always* optimal for the manager to set $\alpha_c=0$. If the company becomes insolvent, however, E will optimally set $\alpha_c=1$, since his only return will come from the misappropriated assets. ■

PROOF OF LEMMA 5: Under the scenario when the project performs well and the company performs poorly, but the balance-sheet company and project assets are jointly solvent, it might still be optimal for E to misappropriate some assets. By Lemma 2, if it is indeed optimal for E to misappropriate some assets, E will misappropriate all assets that he controls and his payoff will be as in (3.6). However, in this case, it will never be optimal for E to misappropriate a portion of the remote assets from the project, if E, due to his limited control over assets (high θ), cannot bankrupt the SPE, unless he misappropriates all assets from the company, and, as a result that, the company becomes insolvent as well. This is so since in this case returns are sufficient to repay creditors at $t=2$ regardless of what E will do and hence his returns will be necessarily less than those he would receive at $t=2$. That is, region M will be empty in the upper-left quadrant of the space of joint realised returns. ■

PROOF OF PROPOSITION 3: From Lemma 3 we know that it will always be optimal for E to either misappropriate all assets or no assets under E's control, due to linearity of E's returns in α, and it will never be optimal for E to misappropriate any assets from the company when the company stays solvent after t=1, regardless of what E chooses to do. If E misappropriates all assets from the company (if and only if the company becomes insolvent) and, simultaneously, E misappropriates all assets under E's control from the project (and only if the company becomes insolvent as a result of E's actions) E's payoff will come exclusively from the misappropriated assets, as before, in (4.1). That is, E's returns will be:

$$E_B^{\setminus +} = r_c + r_p(1-\theta) = E_B^{+/} = E_B^{/+} = E_B$$

When the gross returns on both the project and the company are greater than the minimum threshold of 1 and E does not misappropriate any assets, then E's payoff will be exactly the same as in the case (4.3):

$$E_G^{\setminus +} = r_c(v+r^e) + r_p((v+r^e)(1-\theta) + r^e\theta\rho) - 2 = E_G^{+/} \neq E_G^{/+}$$

Note that this payoff will be possible in all circumstances when returns to both groups of assets are positive, since the global solvency conditions are necessarily true in this quadrant of the space of joint realized returns. Nevertheless, even if returns on both the project assets and the company assets are greater than 1, in certain circumstances it will be still beneficial for E to misappropriate all assets from the project, but not from the

company. This will be the case when the financing contract (θ, ρ) offers E a high degree of discretion over the project assets (i.e. low θ) and, simultaneously, a high degree of legal separation between the two groups of assets (i.e. high ρ). Under such a contract, if gross returns on the project are low, but positive, E will selectively misappropriate assets from the project, while continuing to operate the company. This corresponds to *region M* described earlier and E's payoff will be exactly the same as in the case of $r_p<1$, $r_c>1$ and equal to those reported in (3.7). ■

PROOF OF LEMMA 7: Note that in regions G and M the company creditors receive the promised repayment $d_c=1$, but they receive nothing in region B. Hence, the company creditors' objective is to minimise region B. Similarly, the project creditors receive the promised repayment $d_p=1$ in region G, but in regions B and M they only receive the θ portion of the project assets, which are *not* under E's control. Therefore, the project creditors' objective is to minimise *jointly* regions B and M. Both groups of creditors would like to maximise G, but the conflict between them exists where introducing region M diminishes region B. This implies higher expected returns to the company creditors, but lower returns to the project creditors. In other words, the project creditors would prefer to enlarge B at the cost of M, providing that this also enlarges G.[56] ■

PROOF OF LEMMA 8: Recall that by Proposition 4A only B is possible in the +\ quadrant (for $r_p<1$ & $r_c<1$), and that by Lemma 5, M is never optimal in the +/ quadrant. In the latter case, by Proposition 2, only equations (5.4) and (5.9) are relevant. In other words, E will never selectively misappropriate the returns from the project and not from the company, if the company is performing well, but the gross returns on the project are less than 1, for any type of contract (θ,ρ). Therefore, the minimum size of region B is $1+\frac{1}{2}(1-\rho)$ for any possible contract, since the area of the entire +\ quadrant in the joint space of realised returns is equal to 1 and the region B under (5.7) in +/ quadrant is equal to $\frac{1}{2}(1-\rho)$. ■

PROOF OF LEMMA 9: Recall that in the /+ quadrant (5.2) indicates where G is better for E than B and (5.3) indicates where M is better than B. Note that in this quadrant (5.7) lies below (5.8) since (5.7) and (5.8) cross at ($r_c=x=1$, $r_p=y=1$) and (5.7) crosses $y=0$ at $y_7=2-\rho<y_8=2$—the point where (5.8) also crosses $y=0$. Therefore, in the /+ quadrant, when the project underperforms and the company assets perform well, the condition (5.8) is always stronger than the condition (5.7). That is, E can always save the company and bankrupt the project when he can save both, but there exists a region, greater or equal to zero, where E can save the company, but cannot save both the company and the project. ■

PROOF OF LEMMA 10 AND LEMMA 11: Lemma 11 can be seen from the fact that (5.2) and (5.3) cross at the same point as (5.2) and (5.5) and, hence, $z_{x23}=z_{x25}$ and $z_{y23}=z_{y25}=y_5$, where $y=y_5$ is a horizontal line. Note further that $y_5=(1+\theta v)/(b+\theta)=(1+\theta v)/(a+\theta v)$ since $b+\theta=a+\theta v$. Hence: (5.2), (5.3) and (5.5) always cross at a single point z_{23}, where $z_{y23}=y_5<1$ if $a>1$ and $y_5>1$ if $a<1$. The x-coordinate of the point of intersection is $z_{x23}=(1/b)+(\theta v(1-a)(1-p)/b(b+\theta))$ and $z_{x23}<1$ when $v+r^e>2$ since the first term of z_{x23}, 1/b, is less than 1 and the second term is less than 0 since $(1-a)<0$ when $a>1$. Hence, E chooses G over M, where available, for the realized returns on the project $r_p<1$ and the realized returns on the company assets $r_c>1$ (that is, in the /+ quadrant), when $r_p>y_5$, and

[56] Note that region M is incorporated into region G under $\rho=0$. Note also that where $1>\rho>0$, although E would like to selectively default on the project under region M, he does that only w.r.t. the remote assets portion ρ of the entire project.

where $y_5=z_{y23}=z_{y25}=z_{y35}<1$ for $a>1$ and $y_5>1$ for $a<1$. Also $z_{x23}=z_{x25}=z_{x35}<1$ if $a>1$, $b>1$, and $z_{x23}>1$ if and only if $z_{y28}>z_{y23}$. Lemma 10 holds by analogy for $r_p>1$ *or* $r_c<1$. ■

PROOF OF LEMMA 12: The x-coordinate of the point of intersection of (5.7) and $y=0$, x_7, is lower than that for (5.3), x_3, when $b<1$, and the latter is lower than that for (5.2), x_2, for any (a, b). (5.3) has a greater slope (more negative) than (5.1) and (5.1) has a greater slope (i.e. more negative) than (5.2) for any (v, r^e) and greater than (5.8) for $b>a$. (5.2) has a greater slope (more negative) than (5.8) for $a+v\rho\theta<b(v\rho<1-v)$ because the slopes of (5.3), (5.1) and (5.2) are: (i) $-b/a(1-\rho)$, (ii) $-b/a$, and (iii) $-b/(a+\rho\theta V)$, respectively. Hence, (5.3) has a greater slope (more negative) than (5.1) for all v and r^e. Also, (5.1) has a greater slope (more negative) than (5.2). The first condition is true since $(1-\rho)<0$ and the second condition is true since $v\rho\theta>0$. Note also that the point of intersection of (5.7) with the horizontal axis $y=0$, $x_7=2-\rho$, is less than the point of intersection of (5.3), $x_3=(2-\rho)/b$, for $b<1$, and the latter is less than the point of intersection of (5.2) with the $y=0$ axis, $x_2=(2+v\rho\theta)/b$, for any b. ■

PROOF OF PROPOSITION 6 (Scenario 2: a<1). When $v+r^e<2$ and $a<1$, (5.3) intersects the line $x=1$ at $y_{3,x=1}=(2-\rho-b)/a(1-\rho)>1$. Since $(1-\rho)$ is positive, $(1-a)$ is positive and $(b-1)$ is negative in this scenario, and hence the above inequality is necessarily true. Similarly, by Lemma 11, we know that (5.2) and (5.3) cross at $z_{x23}>1$, when $a<1$ and $z_{y23}>1$. Note also that when $a<1$, then $z_{x37}<0$ and $z_{y37}>0$. Hence, (5.3) lies to the right of (5.7) and to the left of (5.2) in the entire /+ quadrant of the space of joint realised returns. Therefore, the /+ quadrant is divided by (5.3) between region B and region M only, as shown in Fig. 3.

The company creditors' minimization problem, when $v+r^e<2$ and $a<1$ is, therefore, to minimise region B given by:[1]

$$\underset{\rho,\theta}{Min}\left[\int_0^1 y_{70}dx+\int_{z_{x17}}^1 (y_{10}-y_{70})dx+\int_1^{z_{x13}} y_{10}dx+\int_{z_{x13}}^{x_3} y_{30}dx\right] \tag{6.8}$$

$$=\underset{\rho,\theta}{Min}\left[1+\frac{1}{2(1-\rho)}+\frac{(1-\rho)(a+b-2)^2}{2a(b\rho+\theta-\theta v)}+\frac{(b-2)^2-\rho}{2ab}\right] \tag{6.9}$$

The first term of the above is increasing in ρ—this says that the higher the legal separation of assets, the more likely that E will have to close the business when the company performs badly, because he will not be able transfer sufficient funds in order to keep it afloat. Although the second term is decreasing in ρ, it has no independent effect: it signifies the transfer between the two parts of region B. However, the third term of (6.9) is decreasing in ρ and combines the last two terms of the original expression: that is, region M increases with ρ against B (legal separation makes selective default a more attractive option) since differentiating with respect to ρ we obtain:

$$\frac{\partial}{\partial\rho}(...)=\frac{2}{(2-2\rho)^2}-\frac{(a+b-2)^2}{2(b\rho+\theta-\theta v)^2}-\frac{1}{2ab} \tag{6.10}$$

Therefore, there exists $\rho^1{}_{a<1}$, for which region B in minimised in this scenario. The optimal level of legal separation for the company creditors, $\rho^1{}_{a<1}$, occurs when the marginal cost of the enlarged domain of cases where E misappropriates all assets (when the company performs badly) is equal to the marginal benefit of the enlarged domain of

cases when E misappropriates project assets *only* (when the company performs well) instead of misappropriating assets from both the company and the project.

The optimal limit on managerial discretion θ is determined by the second and third term in the expression (6.8) above. Since both are decreasing in θ, the company creditors seek to maximise θ with $\theta^{1}_{a<1}$ for $a<1$.[1]

Simultaneously, the project creditors' minimization problem, when $v+r^{e}<2$, $a<1$, is to minimise areas B and M combined. That differs from the company creditors in the /+ quadrant only. That is, project creditors' optimisation condition is:

$$\underset{\rho,\theta}{Min}\left[\int_{0}^{1} y_{70}dx+\int_{z_{x17}}^{1}(y_{10}-y_{70})dx+\int_{1}^{z_{x13}} y_{10}dx+\int_{z_{x13}}^{2r^{e}} y_{40}dx\right] \tag{6.11}$$

$$=\underset{\rho,\theta}{Min}\left[\left(1+\frac{1}{2(1-\rho)}\right)+\left(\frac{(1-\rho)(a+b-2)^{2}}{2a(b\rho+\theta(1-v))}\right)+\left(\frac{1-4b+b^{2}+4br^{e}}{2ab}\right)\right] \tag{6.12}$$

The difference is represented by the last term in the expression above—unlike the company creditors, the project creditors are not interested in substituting region M for B. Since the last term of the expression above is independent of ρ, project creditors' preferences for ρ are determined by the first two terms only. And since the second term is just a partial effect of the first term, the overall effect of these two terms is negative and the project creditors aim to minimise ρ with $\rho=0$.

Also, the project creditors would like to maximise θ, since the third term of the above is decreasing in θ. i.e. differentiating with respect to θ we obtain:

$$\frac{\partial}{\partial\theta}(...)=\frac{(1-4b+4br^{e}+b^{2})(v-1)}{2ba^{2}}<0 \tag{6.13}$$

Moreover, as in the previous scenario, maximizing θ also minimises the project creditors' losses under B. For the project creditors and the company creditors alike, this case is feasible only if $a<1$. For if v is close enough to 1 and r^{e} is small enough for $v+r^{e}<2$, this can be achieved with high θ, but for very low values of v, a low θ is necessary in order to ensure sufficiently low a. However, a low level of θ has a double cost for the project creditors: it expands the combined regions B and M as well as decreases the project creditors' returns under region B.

To summarize: in the case of low expected returns and low value of managerial discretion ($v+r^{e}<2$, $a<1$), both the company creditors and the project creditors choose the maximum $\theta=\theta^{1}_{a<1}$ subject to $a<1$. The project creditors prefer no legal separation of assets $\rho=0$, but the company creditors seek their optimal $\rho^{1}_{a<1}>0$. ■

PROOF OF PROPOSITION 7 (Scenario 3.1: a>1, a+b<2): In the case where $a+b<2$, the company creditors' optimality condition becomes:

$$\underset{\rho,\theta}{Min}\left[\int_{0}^{1} y_{70}dx+\int_{z_{x17}}^{1}(y_{10}-y_{70})dx+\int_{1}^{z_{x12}} y_{10}dx+\int_{z_{x12}}^{z_{x23}} y_{20}dx+\int_{z_{x23}}^{x_{3}} y_{30}dx\right]^{1} \tag{6.14}$$

$$=\underset{\rho,\theta}{Min}\left[1+\frac{1}{2(1-\rho)}+\frac{(1-\rho)(a+b-2)^{2}}{2a(b\rho+\theta-\theta v)}+(...)\right]$$

The first part of (6.14), as shown above, is identical as in the previous scenario (and is increasing in ρ)—it captures the effect of diminished opportunities for transferring funds into the company assets that have underperformed in the past with a higher ρ.

$$\left[(...)+\frac{(\theta v-\theta-2)(a+b-2)}{2ab}+\frac{(a-1)(a+1)(a+\rho\theta v)}{2b(b+\theta)^2}+\frac{a(1-\rho)(1+\theta v)^2}{2b(b+\theta)^2}\right] \tag{6.15}$$

The second part of (6.14), as shown above, is composed of three terms: the first term is independent of ρ; the third term is decreasing in ρ and represents a trade-off of region M against B as in the previous scenario. Finally, the second term is new and increasing in ρ. Higher ρ further disincentivises E from *not* misappropriating cash flows, when a is high or when θv is high. As θv increases, it becomes 'more costly' to enlarge region M for E. Therefore, there is an optimal level of the degree of legal separation ${\rho^2}_{a>1}$ for the company creditors in this case, high for low values of θv and low for high values of θv, and ${\rho^2}_{a>1}<{\rho^1}_{a<1}$.

In order to consider the total effect of θ, first note that θ must be sufficiently high for this case to occur (otherwise situation reverts back to $a<1$ or $v+r^e>2$). We eliminate all terms in (6.15) that are independent of θ to obtain the simplified optimality condition reported below:

$$\underset{\rho,\theta}{Min}\left[\frac{\rho(\theta v(a-2)-1)}{b(b+\theta)}+\frac{(2+b(\rho-2))^2}{b(b\rho+\theta(1-v))}\right] \tag{6.16}$$

The second term of the above condition is decreasing in θ. However, the first term is increasing in θ (it becomes negative for $\theta=0$). This is because the term in brackets in the numerator of the first term of the derivative below must be a fraction. Hence, there is an optimal level of the limit on managerial discretion ${\theta^2}_{a>1}\leq 1$. Here, the company creditors no longer seek to maximise θ unconditionally, as in the case when $a<1$. Differentiating (6.16) we obtain:

$$\frac{\partial}{\partial\theta}(...)=\frac{\rho+\rho v(b(b-2)+2b\theta(1-v)+\theta^2(1-v))}{b(b+\theta)^2}+\frac{(2+b(\rho-2))^2(v-1)}{b(b\rho+\theta-\theta v)^2} \tag{6.17}$$

The project creditors minimise combined regions B and M, hence we extend the above to the M area for $x>z_{x23}$:

$$\underset{\rho,\theta}{Min}\left[\int_0^1 y_{70}dx+\int_{z_{x17}}^1 (y_{10}-y_{70})dx+\int_1^{z_{x12}} y_{10}dx+\int_{z_{x12}}^{z_{x23}} y_{20}dx+\int_{z_{x23}}^{2r^e} y_{50}dx\right] \tag{6.18}$$

Again, the first two terms of the above expression (6.18) are identical as in the case when $a<1$. When $a>1$, the project creditors differ from the company creditors in terms of the last term of the above expression only. The last three terms are given by:

$$=\underset{\rho,\theta}{Min}\frac{1}{2b}\left[\begin{array}{l}\dfrac{(2+\theta(1-v))(2-a-b)}{a}+\dfrac{(a-1)(a+1)(a-\rho\theta v)}{(b+\theta)^2}+\\ +2(1+\theta v)\dfrac{(b+\theta)(2br^e-1)+(1-\rho)(a-1)\theta v+(\rho-1)\theta^2v^2}{(b+\theta)^2}\end{array}\right] \tag{6.19}$$

And together are increasing in ρ since differentiating with respect to ρ we obtain:

$$\frac{\partial}{\partial\rho}(...)=\frac{(a-1)^2\,\theta v}{2(b+\theta)^2}>0 \tag{6.20}$$

Since the first two terms of (6.18) are identical as before and also increasing in ρ, the project creditors seek to minimise ρ. The first term of (6.18) is independent of θ and the second term is decreasing in θ, as in previous scenarios. Therefore, the net effect of changes in θ depends on the last three terms shown in (6.19). Minimizing regions B and M for $x>1$ in this case is equivalent to minimizing z_{x12}, z_{x23} and z_{y23}. Since $z_{x12}=2-a/b$, it is minimised for $\theta=1$; z_{y23} is also minimised for $\theta=1$ since:

$$z_{y23}=\frac{1+\theta v}{b+\theta}\quad\&\quad\frac{\partial z_{y23}}{\partial\theta}=\frac{bv-1}{(b+\theta)^2}<0 \tag{6.21}$$

Finally, z_{x23} is increasing in θ for small θ, but decreasing in θ for large θ:

$$\frac{\partial z_{x23}}{\partial\theta}=\frac{(\rho-1)(2\theta b(1-v)-b((1-v)+(1-r))+\theta^2(1-v))}{b(b+\theta)^2}\quad\&\quad\frac{\partial z_{x23}^2}{\partial\theta^2}=\frac{2v(1-\rho)(bv-1)}{(b+\theta)^2}<0 \tag{6.22}$$

Since z_{x23} is smaller for $\theta=1$ than for $\theta=0$, the company creditors must prefer a contract with maximum θ.

Therefore, in the case when $v+r^e<2$, $a>1$, and $a+b<2$, the company creditors seek their optimal level of legal separation $\rho^2_{a>1}$ in the contract to be lower than in the case when $a<1$. They also seek their optimum level of managerial discretion $\theta=\theta^2_{a>1}$. The project creditors prefer no legal separation of assets $\rho=0$, but maximum limits on managerial discretion $\theta=1$. ■

PROOF OF PROPOSITION 8: (Scenario 3.2.1: $a+b>2$, $z_{y28}<z_{y23}$): By Lemma 11, (5.2) and (5.3) cross in the /+ quadrant and $z_{x23}>1$ if and only if $z_{y28}>z_{y23}$, otherwise (5.3) is entirely above (5.2) in the /+ quadrant. In other words, if $z_{y28}<z_{y23}$, then G is always better than B, whenever M is better than B for E, but *not* vice versa as shown in Fig. 5. Note that $z_{y28}<z_{y23}$ if and only if b is sufficiently large (i.e. for large v and/or r^e), i.e.:

$$z_{y28}=\frac{(1+\theta v)-(\theta v(1-\rho)+b)+(1-b)}{(a+\theta v)-(\theta v(1-\rho)+b)+(1-1)}<\frac{1+\theta v}{a+\theta v}=z_{y23} \tag{6.23}$$

Note, however, that by Lemma 9 and Lemma 12, M is not always available when M is better than B, but G is not better than B, or when G is unavailable. Hence, region M is left-hand side bounded by (5.7) up to $x=z_{x37}$. Therefore, when in the case when $z_{y28}<z_{y23}$ the company creditors' optimisation problem is:

$$\underset{\rho,\theta}{Min}\left[\int_0^{z_{x37}} y_{70}dx+\int_{z_{x37}}^{x_3} y_{30}dx\right]=\underset{\rho,\theta}{Min}\left[\frac{(\rho-2)^2(1+b(a-2))}{2b(1-\rho)\theta(1-v)}\right] \tag{6.24}$$

Differentiating (6.24) w.r.t. θ and ρ we obtain, respectively:

$$\frac{\partial}{\partial\theta}(...)=\frac{(b-1)^2(\rho-2)^2}{2b(1-\rho)\underbrace{(v-1)}_{<0}\theta^2}<0 \quad \text{and} \quad \frac{\partial}{\partial\rho}(...)=\frac{\rho\overbrace{(\rho-2)}^{<0}(1+b(a-2))}{2b(\rho-1)^2\underbrace{(v-1)}_{<0}\theta}>0 \tag{6.25}$$

Therefore, since region B decreases in θ and increases in ρ, the company creditors' returns are maximised for the ($\theta=1$, $\rho=0$) contract, when $z_{y28}<z_{y23}$ for $v+r^e<2$, $a>1$, $a+b>2$. At the same time, the project creditors' optimisation problem is:

$$\underset{\rho,\theta}{Min}\left[\int_0^1 y_{70}dx+\int_1^{z_{x58}} y_{80}dx+\left(2r^e-z_{x58}\right)y_5\right] \tag{6.26}$$

$$=\underset{\rho,\theta}{Min}\left[1+\frac{1}{2(1-\rho)}+\frac{(a-1)(a+1+2\theta v)+2(1+\theta v)(1+2b(r^e-1)+\theta(b+r^e-1)}{2(b+\theta)^2}\right] \tag{6.27}$$

Therefore the combined regions B and M are minimised for $\theta=1$, $\rho=0$ since differentiating w.r.t. θ and ρ, respectively, we obtain:

$$\frac{\partial}{\partial\theta}(...)=\frac{\overbrace{(bv-1)}^{<0}\left(1+2b(r^e-1)+\theta(b+r^e-1\right)}{\left(b+\theta\right)^2}<0 \quad \text{and} \quad \frac{\partial}{\partial\rho}(...)=\frac{2}{4(1-\rho)^2}>0 \tag{6.28}$$

To summarize: in the case when $v+r^e<2$, but $a>1$, $a+b>2$ and $y_5>z_{y28}$, there is no conflict between the company creditors and the project creditors—they both choose no legal separation of assets $\rho=0$ and the maximum limits on managerial discretion $\theta=1$. This is consistent on the equilibrium path with maximizing θ for the project creditors to minimise their losses in region B while ensuring that $a>1$. ■

PROOF OF PROPOSITION 9 (Scenario 3.2.2: a+b>2, $z_{y28}>z_{y23}$): When $z_{y28}>z_{y23}$ regions B and G expand at the cost of region M. Also, since (5.3) is now to the right of (5.7), there is no region M for $x<z_{x28}$, as shown in Fig. 6. Conditions for the company creditors to minimise their losses in region B are analogical to those in the case when $z_{y28}<z_{y23}$, i.e.:

$$\underset{\rho,\theta}{Min}\left[\int_0^1 y_{70}dx+\int_1^{z_{x28}} y_{80}dx+\int_{z_{x28}}^{z_{x23}} y_{20}dx+\int_{z_{x23}}^{x_3} y_{30}dx\right] \tag{6.29}$$

$$=\underset{\rho,\theta}{Min}\left[\frac{4b^3-b^2(8+\theta(v+3\rho v-5))+\theta(4+\rho+v\rho(1+\theta(2+(2+\theta(v-1))v)-\rho^2(1+\theta(2+\theta(v-1)v)))}{2b\theta(b+\theta)(1-v+v\rho)}+\right.$$

$$\left.+\frac{b(4+\theta(4\rho v-8+\theta(1+v(\rho(\rho v-3)-1))))}{2b\theta(b+\theta)(1-v(1-\rho))}\right] \tag{6.30}$$

Minimizing region B for $x>1$ in this case is equivalent to minimizing z_{y28}, z_{y23}, and x_3. For $x<1$, B is minimised for $\rho=0$:

$$z_{y28}=\frac{2-2b+\rho\theta v}{\theta(1-v+\rho v)} \;\&\; \frac{\partial z_{y28}}{\partial\rho}=\frac{v(a+b-2)}{\theta(1+v(\rho-1))^2}>0 \;\&\; \frac{\partial z_{y28}}{\partial\theta}=\frac{2(b-1)}{\theta^2(1+v(\rho-1))}<0 \quad (6.31)$$

$$z_{x23}=\frac{1}{b}+\frac{(\rho-1)(a-1)\theta v}{b(b+\theta)} \;\&\; \frac{\partial z_{x23}}{\partial\rho}=\frac{(a-1)\theta v}{b(b+\theta)}>0 \quad (6.32)$$

$$z_{y23}=\frac{1+\theta v}{b+\theta} \;\&\; \frac{\partial z_{y23}}{\partial\rho}=0 \;\&\; \frac{\partial z_{y23}}{\partial\theta}=\frac{bv-1}{(b+\theta)^2}<0 \quad (6.33)$$

$$x_3=\frac{2-\rho}{b} \;\&\; \frac{\partial x_3}{\partial\rho}=-\frac{1}{b}<0 \;\&\; \frac{\partial x_3}{\partial\theta}=0 \quad (6.34)$$

Hence, z_{y28} increases with ρ, and ρ has no impact on z_{y23}, but x_3 decreases with ρ. Therefore, the company creditors choose ${\rho^3}_{a+b>2}$ such that ${\rho^2}_{a+b<2}>{\rho^3}_{a+b>2}$. This is because increasing ρ is now more costly for two reasons (each representing an effect stronger than that in the case of $a+b<2$): (i) for $x<1$, G is *always* preferable to B, where available, and (ii) there is an extra gain in G versus B for incrementally smaller ρ vis-à-vis the $a+b<2$ case.

Simultaneously, note that x_3 is independent of θ, z_{y28} decreases with θ, and z_{y23} also decreases with θ. As before, z_{x23} is increasing in θ for small θ, but decreasing in θ for large θ and since z_{x23} is smaller for $\theta=1$ than for $\theta=0$, the company creditors prefer a contract where $\theta=1$. In this case, the project creditors would like to minimise the combined regions B and M given by:

$$\underset{\rho,\theta}{Min}\left[\int_0^1 y_{70}dx+\int_1^{z_{x28}} y_{80}dx+\int_{z_{x28}}^{z_{x23}} y_{20}dx+\left(2r^e-z_{x23}\right)y_5\right] \quad (6.35)$$

Minimizing combined regions B and M is equivalent here to minimizing z_{y28}, z_{y23} and z_{x23} (x_3 is not relevant for the project creditors since they do not distinguish between regions M and B). Since z_{y28} and z_{x23} both increase with ρ and ρ has no impact on z_{y23}, and z_{y28} decreases with θ, and z_{y23} also decreases with θ, the project creditors prefer a contract ($\theta=1$, $\rho=0$) in this scenario.

To summarize: in the case when $v+r^e<2$, $a>1$, $a+b>2$, and $z_{y23}<z_{y28}$, the company creditors prefer a level of legal separation ${\rho^2}_{a+b>2}$ such that ${\rho^1}_{a+b<2}>{\rho^2}_{a+b>2}>0$; the project creditors prefer a ($\rho=0$) contract. All creditors prefer maximum limits on managerial discretion $\theta=1$. This is consistent on the equilibrium path with maximizing θ in order for the project creditors to minimise their losses in region B while ensuring that $a>1$. ■

WHY ARE SECURITIZATION ISSUES TRANCHED?[1]

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ABSTRACT

Securitisations usually involve creating multiple tranches of a single issue with different characteristics, placed on the market as separate securities. Various theoretical explanations have been advanced to explain such tranching. This paper provides the first systematic testing of such theories using a proprietary database of over 5000 separate tranches in European securitisations raising a total of $1 trillion. We find support for asymmetric information and market segmentation explanations for tranching and present evidence on how such different rationales influence the structuring process in practice. We also investigate the impact of tranching on the price of securities issued. For those issues where our model predicts a higher optimal number of tranches, we find that additional uniquely-rated tranches are associated with higher prices for the issue as a whole.

JEL classification: G14, G15, G32

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I. Introduction

Securitization has become established as an important way for financial institutions, and companies, to pool assets and sell them to investors. Within Europe, total issuance of such asset-backed securities (ABS) has been estimated at Euro 255 billion in 2004, and has been growing rapidly in recent years. In the US the ABS market is even more developed, and represents almost 30% of the total corporate bond market.[2]

In securitizations, the assets themselves are typically financial obligations of third parties such as receivables, mortgages or loans, but they can also be cash flow-generating fixed assets such as aircraft or even whole businesses. At the beginning of the securitization process, a company (the "originator") decides to sell a certain group of its assets. This group of assets is pooled together and sold to an external legal entity - a special purpose vehicle (SPV). The SPV (the "issuer") buys the assets from the originator with funds raised from investors who purchase the ABS issued by the SPV and backed by that pool of assets. Under the guidance of ratings agencies, the profile of expected cash flows from securitised assets is often synthetically amended and transformed by an investment bank (the "arranger") into multiple tranches. These tranches usually have different risk, duration, and other characteristics, but they are backed by the same pool of assets.

Although tranching is now a standard practice when securitizations are undertaken, the factors that determine the extent and nature of tranching remain largely unknown. This paper provides the first systematic empirical analysis of tranching.[3] We employ a proprietary, and comprehensive, database – originally compiled by JP Morgan – of securitizations undertaken

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[2] European Securitization Forum Data Reports 2001-4; Bond Market Association for the US data (www.bondmarkets.com).

[3] We are not aware of any empirical paper devoted specifically to tranching. The institutional and legal background on securitizations can be found in Schwarcz (1993), one of many legal studies of the subject. The few existing empirical studies of securitizations include event-studies such as Thomas (1999, 2001) and Cuchra (2004), who aim to test the impact of securitizations on the prices of companies' debt and equity securities in the United States and Europe, respectively. Lockwood et. al. (1996) focuses on the wealth effects of securitizations for banks' investors.

in Europe between 1987 and 2003. The sample consists of 1605 issues, and 5161 separate tranches. In total, the issues in our sample raised just over $1 trillion – this is very close to the totals for all European securitization issuance as reported by different sources.[4] We provide some interesting stylised facts about the cross-sectional differences in the extent of tranching according to underlying asset type, and the time-series trends in the way securitizations are structured. We also use this data to test the theoretical predictions regarding the motivation for pooling and tranching.

At first sight, the creation of tranches is difficult to explain from the standard Modigliani-Miller perspective, since structuring additional tranches incurs transactions costs and because the creation of multiple tranches may reduce ex-post trading liquidity as average tranche size decreases. However, as noted by Mitchell (2004) and further explored by DeMarzo (2005), there are three broad explanations: market incompleteness, asymmetric information, and market segmentation.[5] In this paper we lack information on transactions costs, and so focus on the predictions of the three sets of theories.

A number of theoretical models have been proposed explaining pooling and tranching under the assumption of asymmetric information. The basic intuition of many of the models (such as Boot and Thakor (1993), Riddiough (1997), and Plantin (2004)) is that tranching may add value in the presence of heterogeneous investors with differential private information and different abilities to screen investments. For instance, by creating an essentially riskless senior tranche – attractive to those with a low ability to screen the underlying assets – the issuer is able to create a separating equilibrium and focus the returns to information acquisition on the sophisticated investors who are attracted to the more junior tranches. Such benefits from

[4] European Securitization Forum Data Report Autumn 2004.

[5] There is also a growing theoretical literature on the decision to securitise in the first place, with a focus on agency issues - see, for example, Cuchra (2002) for a model of securitizations in the spirit of incomplete contract theory, or Iacobucci and Winter (2005) for a review of different rationales from the issuer's perspective.

tranching have to be compared with the potential detrimental impact on post-issue trading liquidity.

Similarly, DeMarzo and Duffie (1999) and DeMarzo (2005) develop models in which an informed issuer trades off an information-destruction effect from pooling assets against a risk-diversification effect, and show how tranching can be optimal for large enough pools of assets. Pooling can also play a role in overcoming adverse selection problems faced by uninformed investors. Such adverse selection problems may be particularly acute given the existence of informed intermediaries who are able to purchase the high quality pools of assets, which they can then pool, repackage and sell. However, given their superior information, such intermediaries face a "lemons" problem that can result in illiquidity, and a price that declines as the quantity sold increases. In this model of informed financial intermediation, pooling and tranching play a key role in allowing intermediaries to re-cycle their capital and to enhance the returns to their private information.

The second group of theoretical explanations focuses on market incompleteness. For instance, tranches might be designed to exploit specific appetites of various investor clienteles in an environment characterised by imperfect arbitrage and missing markets. Early papers on market incompleteness include Duffie and Rahi (1995) which combines spanning with asymmetric information. This is appealing because, as others have stressed, both explanations could potentially coexist with respect to different tranches created within a single issue. For example, Riddiough (1997) notes that although the creation of a senior tranche could be driven by asymmetric information, multiple junior tranches might be created to suit particular tastes of investors in order to facilitate the placement of the information-sensitive tranches in the market. More recently, Gaur, Seshadri and Subrahmanyam (2004) model a market where all assets cannot be uniquely priced: attainable claims have unique prices, but prices of unattainable claims can only be bounded. In this setup, holders of unique assets can take advantage of market incompleteness by focusing on claims that augment market spanning.

The authors show that the value of a new asset can be enhanced by 'stripping away' the maximal attainable portfolio – the senior, near-riskless tranche – for which market prices are readily available, and selling the rest (the junior tranches) at the arbitrage-free prices. This suggests that market incompleteness can imply similar security design solutions as informational asymmetry.

Evidence from other markets, and from the professional literature on structuring, suggests that market incompleteness might also justify tranching if a given market segment has limited capacity and no arbitrage opportunities exist. This would imply that an arranger, when trying to place a larger 'composite' issue with its idiosyncratic characteristics, might face a downward sloping demand curve. Such market segmentation could be due to limits on arbitrage (see for example Shleifer and Vishny (1997)). Also, imperfect arbitrage has been documented in other financial markets (Froot and Dabora (1999), Richardson and Ofek (2001), Wurglar and Zhuravskaya (2001)). At a more informal level, market incompleteness may vary over time as investor sophistication increases.

We propose some tests of these alternative hypotheses regarding the determinants of tranching. We find evidence that the nature of tranching is developing over time in Europe, with a tendency towards more extensive tranching. This is consistent with European investors becoming more sophisticated over time, but European securitizations still remained in 2003 (the end of our sample period) significantly less tranched than equivalent US issues. We also find strong evidence that larger issues tend to be tranched more extensively. Indeed, the nature of this increased tranching is interesting: issuers can create additional tranches with distinct ratings, or they can tranche within a ratings class. We find a strong relationship between issue size and intra-rating-class tranching, which suggests that market segmentation and/or downward sloping demand curve effects may indeed be significant, and dominate, at least in our sample, the ex-post trading liquidity effects.

We also test whether asymmetric information provides an explanation for tranching. By constructing a measure of the informational-sensitivity of different asset types based on the variance of observed launch spreads, we find that information asymmetry has a significant impact on the number, and type, of observed tranches. However, and consistent with the theory, this effect is much stronger in relation to the creation of additional tranches with distinct ratings, rather than further tranches within a particular ratings-class.

Finally, we investigate the impact of tranching on pricing. We show how the calculated weighted average issue spreads on the pricing date relate to the way the issue is tranched. Clearly the tranching decision itself is endogenous – depending, for example, on the size of the issue, the type of assets, the extent of information asymmetry, market conditions etc. – and so we use the predictions from our econometric model of the tranching decision to investigate the relationship between structuring and pricing. We find evidence that tranching might be successful in remedying problems of market segmentation. For those issues where our model predicts a higher optimal number of tranches, we find that additional uniquely-rated tranches are associated with higher prices for the issue as a whole. This suggests that structuring is allowing issuers to exploit market factors such as greater investor sophistication, diversification, and heterogeneous screening skills related to asymmetric information, to their advantage via tranching.

The remainder of the paper proceeds as follows. In the next section we describe the data and provide some stylised facts on the nature of securitizations and tranching. Section II focuses on possible market incompleteness explanations for tranching. In section III we develop our proxy for asymmetric information, and test whether this provides an explanation for the extent, and nature, of tranching. Section IV then considers the relationship between tranching and pricing. Section V concludes.

II. Data and Stylised Facts

A. *Dataset*

Our study is based on a comprehensive dataset of European securitization transactions from 1987 to 2003. The original database was compiled by JP Morgan Securitization Research Desk in London. We have cross-checked the database against the records of securitization transactions in Bloomberg and Thompson Financial. There are 1605 issues, comprising 5161 separate tranches, so on average there are 3.22 tranches per issue. Approximately 86% of all issues are floating rate issues. The dataset includes a wide range of structured finance transactions including residential mortgage-backed securities (RMBS), collateralised debt obligations (CDOs), credit card receivables and other ABS transactions.[6]

From the original dataset, as well as from our data gathering and cross-checking exercises, we have data on the characteristics of each tranche, including the date of the issue, the issuer, the originator, the price at issue (almost all floating rate issues are sold at par), the coupon, the launch spread measured against a given benchmark, the weighted average life until maturity, any call/put features, the rating (if rated) according to different rating agencies, plus a composite rating as reported to investors. We also have data on the type of assets being securitised (according to a European classification), the size per tranche, the country of origin of assets, the currency of issue, and other details. In addition, we have some category-specific information for certain types of assets, such as market-value/cash flow or balance sheet/arbitrage specification for the CDOs.

We also have pricing data for approximately 80% of the tranches. Out of the 1082 tranches for which we have no pricing data, 702 are parts of CDOs and 380 are from other types of securitizations. If we eliminate all issues for which we have no pricing data for at least one of the tranches per issue, then we are left with 2518 tranches from 824 issues,

[6] For comparative purposes, we also use a separate dataset from the same source of 768 issues with 4388 tranches issued in the US in the single year of 2003.

approximately one-half of the original set. Since we use the pricing data only in selected parts of our study, we do not dispose of the non-priced tranches up-front.

B. Types of securitization transactions

As can be seen from Table I we have 10 main transaction categories corresponding to the types of assets being securitised, with RMBS representing the largest share of all issues (~37%) followed by CDOs. In terms of tranches, our dataset contains 1901 RMBS securities, followed by 1730 CDOs – comprised of 790 'balance sheet' and 940 'arbitrage' CDOs (including 85 'super senior' tranches)[7] – and 470 commercial mortgage backed securities (CMBS).

Securities backed by various types of consumer loans are characterised by the largest average tranche size relative to issue size – they are, therefore, tranched *least*, not only in nominal terms, but also less than other types in relative terms. CMBS, CDO, RMBS, and the whole business (WB) securitizations are tranched most relative to their size. Since asset type might be important both in terms of structuring as well as information asymmetry, we also create a summary classification assigning different types of assets into five main categories: 709 mortgage issues (2373 tranches), 132 corporate issues (346), 407 CDOs (1730), 242 consumer issues (488), 19 securitizations of government assets or those of government agencies (41), and 96 unclassified or 'other' issues (183 tranches).

Table II reports summary statistics on issue size. Securitizations of sovereign and public agency assets and obligations are largest overall across different types, with a mean issue size in excess of US$2 billion, followed by whole-business (corporate) securitizations, CDO, CMBS and RMBS. The average size of a tranche is $196 million, although there is

[7] A super senior tranche might be kept by the selling US bank (European banks sell its risk via a CDS to another bank, typically from the US). Risk-free assets such as super-senior tranches require only 20% of capital according to US regulations (instead of normal 100%) of which 8% is immobilized in both cases. Source: SG ABS Research Report 2000.

significant cross-sectional variation. For instance, the two largest tranches in our sample are $6.8 billion each, being part of the same AAA-rated issue from Cyber-Val in 1997. The third largest is the $5 billion issue by the Spanish government to collateralize its nuclear payment obligations. Out of 38 tranches in the sample that are larger than $2 billion, 26 are CDO tranches. The bottom 10% of all tranches are $9.4 million or less in size and the top 10% are $520 million or more.

C. Tranching and ratings

Tranches in our dataset are rated by several credit rating agencies: 70% of all tranches are rated by Moody's, 65% are rated by S&P, and 55% are rated by Fitch. Almost 14% of all tranches are not rated by any of the agencies. The original database also features a 'composite' rating, drawing on the separate ratings of different agencies. This composite rating is reported in the following broad categories, without any refinements: AAA, AA, A, BBB, BB and B. In our sample 1831 securities are rated AAA, 622 are rated AA, 957 are rated A, 784 are rated BBB, and 240 are rated BB or less. There are only six securities rated single-B and only one security rated below B, according to the composite rating. From Cuchra (2004) we adopt another set of ratings - the 'extended Moody's ratings'. This has the advantage of preserving all refinements while incorporating ratings from other agencies for issues not rated by Moody's and hence being as comprehensive as the composite rating. For comparison, Ammer and Clinton (2004) use a composite credit rating constructed from Moody's and S&P's ratings using the average based on the standard mapping between their respective rating scales. Their dataset excludes securities that are rated below BBB3 or less than US$ 25 million in size. In comparison, 32% of tranches in our dataset are less than US$25 million.

Since tranching is often said to be about carving out a riskless tranche, we are interested in the relative size of senior tranches. As can be seen in Table III, transactions

based on 'consumer' obligations (as per our general classification) other than mortgages are characterised by the largest AAA-tranches relative to the size of issue. This might in part be due to the low risk of the entire pool. However, consumer loans other than cards and auto loans also exhibit large senior tranches, relative to their issue size, despite being rather risky overall. On the other hand, AAA-rated tranches are relatively small in the case of corporate assets, such as whole-business securitizations and commercial property. The same picture emerges when we take into account all senior tranches, not just AAA-rated, since for some issues an AAA-rated tranche is never created. This picture is to a lesser degree reflected by the relative sizes of the most junior tranches.

Although there is no consistent relationship between the number of tranches and the size of issue, it is clear in the extremes: issues over $1 billion in size have, on average, over 5 tranches, issues of $100 million or less have barely 2 tranches. As shown in Table IV, the share of issues tranched into 1-4 securities varies significantly according to issue size, but there is a significantly greater number of single-tranche issues among very small transactions. Very large issues differ considerably in the extent of tranching: for example, 22% of all issues of $1 billion or more have only 1 or 2 tranches, although a similar proportion (24%) have 7 or more tranches.

D. Expected maturity, pre-payment and market characteristics

Among other characteristics differentiating tranches in securitization transactions, the expected maturity or 'life' is reported by practitioners to be important. This is because nominal maturity is typically meaningless in securitizations because of different prepayment schedules as well as embedded options (see Fabozzi (2001)). The 'weighted average life' or 'WAL' is a catch-all variable that is often reported in the prospectus with the corresponding prepayment assumptions (where applicable), any possible step-ups (of the coupon), and any embedded options, if present.

In our sample we know the expected life of each tranche for 968 issues, comprising 3257 tranches. For 2392 or 73% of all tranches in this sub-sample, there exists at least one tranche with an *identical* expected life in the same issue. Therefore, only 0.89 out of the average of 3.36 tranches per issue has a unique expected life in that issue. Expected life least differentiates CDO, CMBS and RMBS tranches. Similarly, there is a significantly greater number of tranches than the number of unique rating groups observed per issue. In other words, some tranches have the same rating as other tranches, which is surprising given the typical assumption that tranches are differentiated by rating. Sovereign agency, whole-business and CDO issues are least differentiated by rating: e.g. only 69% of tranching in the whole-business securitizations is characterised by differentiated credit ratings. In our econometric models the distinction between the number of uniquely-rated tranches (which we refer to as *rating classes*) and the number of same-rated tranches (referred to as *market classes*) is often important.

Given the popularity of 'clientele effects' as a practitioner explanation for structuring, we are naturally interested in differentiation by target markets. 3231 of all our tranches are sold in one of the European 'public' markets, 1803 in the European 'private' market, and 127 are issued as public securities in the US backed by European assets. Most of the transactions in the dataset are classified as 'European' on the basis of the origin of assets, but 9 securities are classified as 'international', 119 securities are classified as 'European' and for 242 securities no country has been specified.[8] Overall, we have 27 countries represented, 14 of which have more than 20 observations. United Kingdom represents the greatest share with 460 securities, followed by Italy with 164, Spain with 101, France with 97, Netherlands with 75, US with 69, Germany with 61, and Portugal with 41. In terms of the currency of issue, we have 2933 securities denominated in Euro and 1209 denominated in British pounds – both of which have an identical average tranche size of $183 million – as well as 446 securities

[8] There are also some assets in the dataset which come from non-European originators, but are placed in Europe.

denominated in US dollars (average size of $273 million) and 118 originally denominated in French francs ($380 million); other currencies are represented by less than 100 securities each.

III. Tranching, Sophistication and Market Incompleteness

A. Tranching and investors' sophistication

The first set of hypotheses we would like to test concerns markets' and investors' sophistication in relation to structuring. For example Plantin (2004), among others, predicts that increasing investor sophistication should be associated with more tranching and greater differentiation among the constituent parts. Plantin's model suggests that issuers in particular should be interested in tranching securities backed by high quality, info-sensitive assets to attract classes of sophisticated investors. Issuers might also want to tranche securities backed by assets that are not very info-sensitive if investors' sophistication is sufficiently high and if a sufficient number of sophisticated investors exist. This implies that tranching of less info-sensitive assets should be increasing with investors' sophistication. The author also shows that multiple tranches might be optimal in equilibrium with several different 'classes' of investors as long as there is a sufficient gradation in screening skills – the key measure of investors' sophistication.[9] Growth of securitizations in general has also been linked to market sophistication: for example, a recent study of ABS for the European Commission identifies improvements in the techniques of risk analysis and advances in information technology as the two most important drivers behind the growth of securitizations, whereas greater investors' sophistication is among top 6 drivers identified by the study.[10]

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[9] One of his findings is that the average sophistication of the successful bidder for a given tranche decreases with its seniority.

[10] 'Study on Asset-Backed Securities: Impact and Use of ABS on SME Finance', Final Report for the Enterprise and Industry Directorate-General of the European Commission, November 2004.

We start with the most obvious measures of market development and sophistication – the number of securitizations per year, and the number of tranches per issue. Since our data covers virtually the entire history of securitizations in Europe, we would expect investors to develop greater sophistication in line with market development throughout time. The strong market development is confirmed by Figure I: there has been a steady increase in the number of securitization transactions (issues) year by year.

However, it is also clear from Figure I that as the number of securitization issues has increased, so has the extent of tranching. This increasing number of tranches per issue over time does not seem to be explained by a changing composition of issues, as can be seen from Table V. For example, the share of mortgages, one of the most 'tranched' categories, has fallen steadily throughout the period, but the average number of tranches per mortgage securitization has increased almost every year throughout the period. Therefore, one very simple proxy for investor sophistication, given the reasonably linear development of the market observed in Figure I, would to include a simple time trend in a model explaining the extent of tranching.

Before we proceed to our empirical models, however, we briefly compare US and European markets. It is widely reported that the US securitization market is more mature and more sophisticated than the European market. We would therefore expect to see the number of tranches per issue in the US market exceed that in Europe for the same types of assets. This is indeed what we find. We only have information on the US market for 2003, so we limit the comparison to this year. As can be seen from Table VI, the average number of tranches per issue is greater in the US than in European for all asset-types, with the exception of credit cards. For some asset types, the tranching averages in the US securitizations exceed those in Europe by as much as 100%, despite the fact that the average issue size in Europe (US$1127 million) is almost twice the size of the average US issue (US$ 659).

The aggregate market evidence, therefore, shows a rapid growth of the European securitization market since 1987, and this growth has been accompanied by increased tranching of issues. The extent of tranching, however, is still considerably less than observed in the more developed US market, suggesting that investor sophistication has been increasing in Europe but has yet to converge with that of US investors.

To analyse the determinants of tranching more rigorously we initially run an ordered logit regression to explain the number of tranches per transaction with the year index and several controls for all 1605 issues in our dataset (in subsequent sections we introduce measures of market incompleteness, information asymmetry etc.). The advantage of the ordered logit methodology in this context is that it allows for purely normative ordering without any assumptions about the relative size of each 'step' between two consecutive, discrete realizations of the dependent variable. However, we also report equivalent results using OLS for comparison.

Our controls include a measure of the type of collateral. We are also interested in seeing if there is asset-specific innovation so we include interaction controls of the year index with type dummies (not reported). We also control for the size of issue and for the issue 'life': the size-weighted, average expected maturity of an issue across all tranches as explained in the previous section. This is important since these controls might be related to tranching by channels other than market sophistication, which we investigate further below. As noted earlier, our sample is reduced by approx. 1/3 when controlling for the weighted average life due to missing information on this variable.

Our results, presented in Table VII, show that the year index – the most simple proxy for investors' sophistication – has a significant and positive effect on the number of tranches after controlling for the type of assets. It also remains significant and of similar magnitude after we conduct robustness checks by adding additional controls including the size of an issue. The year index remains significant, but weaker when we include the weighted average

life of an issue. This would suggest that there are more longer-dated issues in recent years than before, and longer expected maturities make tranching more beneficial, perhaps because they add an extra dimension for splitting securities. Finally, in order to check that we are not influenced by the quality of assets, we also control for the weighted average launch spread per issue (the weighted sum of launch spreads of each tranche). Although average issue spread has a positive and significant coefficient, the impact of the year index remains almost unchanged.

As an additional check on our results, we introduce two cross-sectional proxies for investors' sophistication in specific markets. This has the advantage that we can simultaneously test different dimensions of sophistication. As a first proxy we include a dummy for European issues that are placed on the US market – we have 127 such tranches in our dataset. The dummy is significant at the 10% level, but becomes stronger and significant at 5% level when we drop controls for the expected life of the issue and the average launch spread. This is likely to be due to the fact that our sample of issues placed in the US is significantly reduced with those controls. Given these problems, we would like to test for an alternative, cross-sectional proxy of investor sophistication. As a second proxy, therefore, we use the level of sophistication of each market across Europe determined by the ranking of countries according to the overall number of securitization issues originated each state. We then regress the number of tranches on the set of all controls, the year index, and the country ranking. The coefficient on the country variable is strong and significant. Clearly, developed securitization markets with many originators and sophisticated investors are characterised by a substantially higher optimal number of tranches per issue than smaller, developing securitization markets. We note that although the year effect is now weaker, it remains significant at 10% level, but of the same magnitude as before.

This initial analysis of the determinants of tranching has demonstrated that the European market has been developing considerably in the last few years. Controlling for asset

type, size, maturity and other factors, it remains the case that the extent of tranching has increased steadily, although it remains at levels below those observed in the US.

B. Market incompleteness and segmentation

According to information asymmetry theories, tranches should be differentiated by seniority. To offer an example, a CDO issue might be tranched into a senior AAA-rated tranche and a junior BB-rated tranche. If there is sufficient differentiation among investors, then the junior tranche might be tranched further into a BBB-rated tranche and the so-called 'kitchen-sink', subordinated junior tranche, which might be B-rated or not rated at all. However, theories of tranching based on informational asymmetry might have difficulties explaining why a senior AAA-rated tranche would be tranched further into two *pari-pasu* AAA-rated tranches with different expected maturities or denominated in different currencies.

In general, our dataset strongly supports the hypothesis that tranches should be differentiated by rating: on average, there are 2.07 differently rated groups of tranches per issue.[11] However, since there are 3.22 tranches per issue overall, 36% of tranching is unrelated to the differentiation by rating.[12] In Table VIII we show how such differentiation varies according to asset type. The results are not affected by single-tranche issues: if we eliminate all such issues (representing 24.6% of all issues) the average overall number of tranches rises to 3.94 per issue of which over 35% cannot be differentiated by rating. This simple evidence strongly points to the conclusion that market segmentation, market incompleteness and liquidity factors might play an important role in tranching.

The incomplete markets argument for tranching is presented in a model by Gaur, Seshadri and Subrahmanyam (2004) who solve a value maximization problem of the price of

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[11] Almost all issues in our sample have external or internal enhancement based on a first-loss 'equity' tranche retained by the issuer or, equivalently, external first-loss insurance from a mono-line insurer.

[12] In order to determine rating groups we use the 'extended Moody's ratings' (as explained in the previous section) instead of composite ratings in order to capture all refinements.

securities sold in the market and backed by multiple originators' assets, for different levels of pooling and tranching. The optimal regions for tranching and pooling are dependent on the relative unit prices at which originators sell securities to the intermediary and are non-monotonic. In this context tranching could be particularly attractive at times of lower *market* liquidity associated with imperfect arbitrage and missing markets.

Similarly, the problem of market segmentation implies that splitting larger issues into several, more refined tranches should be particularly important for large issues, junior classes, and in difficult market conditions. By dividing the issue, the arranger could enlarge the investor base and avoid a detrimental effect of quantity on price. But these 'market incompleteness' and 'market segmentation' hypotheses alone would imply that optimal tranching consists of splitting each issue into a large number of tranches of different characteristics. This might not be optimal since tranching is costly due to high legal, regulatory, servicing and rating agency costs in the case of multiple groups of creditors with different cash flow rights – see for example Schwarcz (1994), who reports that securitizations are rarely cost effective for transactions of US$50-100 million or less.[13] Moreover, tranching is likely to be costly in terms of post-issue trading liquidity.

By combining these effects, tranching could represent a trade-off between: (i) the benefits of tapping different market segments while avoiding a downward sloping demand curve in each segment for large issues, and (ii) the ex-post liquidity and transaction costs of finely tranched transactions. Taken together, 'market segmentation' and 'liquidity premium' hypotheses jointly imply a positive relation between size of an issue and the number of tranches resulting in a relatively stable average size of a tranche. Since liquidity and market segmentation should be associated with the issue size, we can use it as a proxy for the post-issue liquidity and the severity of market segmentation. Small issues are expected to be

[13] 3.4% of the issues in our sample are less than US$50 million in size and 10.2% of the issues are less than US$100 million.

tranched less in order to preserve post-issue liquidity, whereas large issues might be expected to be tranched more if they face segmented markets. Jointly, these theories predict a strong, positive relationship between size and the number of tranches as well as a relatively stable average nominal size of a tranche.

We find strong evidence in support of these factors determining the optimal number of tranches. The results of the ordered logit regressions in Table VII show that the number of tranches decreases as the issue size falls. Since this relationship is predicted jointly by the liquidity and market segmentation hypotheses as well as by significant transaction costs of tranching, the importance of this effect can be easily explained.

So far, this initial analysis of the tranching decision has looked mainly at the development of the securitization market over time, and the impact of issue size on the extent of tranching, controlling for asset types. In the next section we consider whether asymmetric information can explain the tranching decision, which leads us to analyse not only the extent but the nature of tranching.

IV. Tranching and Asymmetric Information

A. Information asymmetry, asset differentiation and tranching

One of the most important conclusions from the security design literature is that the optimum level of tranching is predicted to be higher for information-sensitive assets.[14] For example, the effect of tranching in the Boot and Thakor (1993) model is to reduce the variance of pricing (true value assessment) per tranche. Since issuers' revenues are positively correlated with the information sensitivity of the junior tranches and tranching is costly, the issuers with highly information-sensitive assets should tranche more. If tranching is unable to

[14] This might be due to technical complexity of some assets, as in the case of elaborate prepayment models, or a significant impact of the private information factor on price. DeMarzo (2001), for example, links such information sensitivity with the type of assets being securitised – a critical determinant given the fact that structuring features are generally shared across different transactions of the same type.

establish the minimum threshold of private information concentration in a junior tranche, it might not be worth pursuing. Similarly, Riddiough's (1997) model implies that multiple-tranched issues should be typical of more information-sensitive assets since the latter offer greater benefits to compensate for higher transaction costs.

Also DeMarzo (2005) shows that a combination of pooling and tranching is optimal when private information is common to all assets, but information risks are idiosyncratic (asset-specific), since this combination best allows for the creation of a riskless tranche. He asserts that tranching should be particularly attractive when private information (screening ability) is pool-specific and characteristic of the type of the asset. This "may explain the tendency not to combine types of underlying assets (e.g. mortgages and corporate bonds), since for these different asset classes the private information is likely to be uncorrelated".[15] It follows that if types of assets are differentiated by the degree of information sensitivity, those where private information is important can benefit more from tranching. Also, since gains from tranching are enhanced if the pool has lower residual risk, issues with better collateral should be tranched more.

In order to test these hypotheses, we proxy the informational asymmetry of assets being securitised by ranking 10 categories of asset types according to the standard deviation of launch spreads *within* each type/rating group at the time of issue. The variability in spreads has been linked to information asymmetry before: for example, Bernardo and Cornell (1997) conclude that significant variance in MBS spreads is related to private information. This approach implicitly assumes that price implications of any tranche characteristics beyond a given 'rating/type' group can only be understood by sophisticated investors and are related to

[15] Ibid. p. 19.

private information. In effect, this implies that unsophisticated investors cannot fully understand why such issues are priced differently.[16]

Since a simple standard deviation of launch spreads across all tranches of a given type might be related to the number of tranches by construction (because structuring an issue with a higher number of tranches might result in greater differentiation of tranches by price) we first calculate the standard deviation of spreads within each rating/type group, and then calculate the average standard deviation (across ratings classes) for each type of asset. We then rank the asset types from 1 (low standard deviation) to 10, as a broad measure of the relative asymmetric information.

Table IX reports our findings: in general, it is clear that asset pools with corporate obligors, such as CMBS, CDOs or whole-business securitizations are characterized by a higher standard deviation of spreads than pools of consumer loans, such as credit cards or auto-loans. This might be expected because consumer loans are typically more numerous and homogeneous in any asset pool – and hence the individual variances might be better diversified away – than the industry- or company-specific corporate securitizations. We also note that mortgage-backed securities have relatively high variance vis-à-vis other assets, which might be due to pool-specific pre-payment risks, and that the launch spreads on CMBS have greater variability that those on RMBS for every rating group.

We now turn to testing the information asymmetry hypothesis by using the ordered logit and OLS models used in the previous section. We control for investor's sophistication (proxied by the year index) and the log of issue size to proxy for the effects of post-issue liquidity and severity of market segmentation on the optimal number of tranches. The asset-

[16] It could be argued that the 'information asymmetry frontier' is located elsewhere. On the one hand, unsophisticated investors might not fully understand the implications of differences in the type of assets and only consider the rating as a 'catch-all' variable. On the other hand, they might be able to price more complex characteristics of each tranche, such as the payment structure or the prepayment risks. Here, we take the middle ground by assuming that the rating-type combination captures most of the significant information understood by unsophisticated investors. We have tested the implications of constructing more refined classifications with other characteristics as extra dimensions, but these do not change our ordering in any substantial way.

type dummies are now replaced by our information asymmetry index taking values 1 to 10 across asset types. The results, presented in Table X, strongly indicate that information asymmetry exhibits a positive and significant relation to the number of tranches, as predicted by the asymmetric information literature. A move by 3-4 asset categories towards the most information-sensitive end of the spectrum is associated with an increase in the optimal number of tranches per issue by 1. This effect remains significant after we control for the weighted average life. Our conclusions are even more significant given that the construction of the information asymmetry index might be producing a bias *against* our results. This is because assets that are tranched more might have a lower variance of launch spreads per tranche, purely because of more refined tranching. This would imply that our measure of information asymmetry would actually underestimate it for the more finely tranched assets.

B. Asymmetric information and the quality of assets

Asymmetric information theories directly or indirectly predict that tranching should be particularly beneficial for better quality assets. For example, Plantin (2004) gives the example of the balance sheet- and arbitrage-type CDOs, which are driven by 'immunization' and 'sensitization', respectively: tranching should be particularly attractive for high quality assets in case of the former and when investors are sufficiently sophisticated in case of the latter.[17] Boot and Thakor (1993) predict that issuers with better quality of collateral might tranche more despite the fact that low-quality issuers would also tranche in equilibrium. They show that with more than two types of issuers, those with the highest quality of collateral might split securities into 3 tranches ranked by seniority, if the gain is greater than the loss due to

[17] Other papers in financial contracting literature take up the issue of the optimal number of creditors and the number of securities issued. For example, Bolton and Scharfstein (1996) conclude that firms with a higher quality of assets should issue multiple securities to multiple creditors. A lower number of creditors is optimal if 'asset complementarity' – the degree to which assets are worth more together than apart – is high, and when the degree to which they can be redeployed is also high. These effects act in opposite direction so the overall effect is ambiguous, but in securitizations 'asset complementarity' could be linked to large pools of many individual loans, which are highly complimentary in terms of benefits from managing the entire pool, while redeployment could be easier for individual automobiles or houses than for corporate assets.

reduction in liquidity. However, market segmentation and liquidity hypotheses imply the opposite: segmentation should be less severe for better quality assets, *ceteris paribus*, as the market for high quality issues, such as AAA-rated bonds, is generally seen as very deep. In terms of placement, less effort might be required to sell better quality assets implying greater demand for equity and simpler structures of junior tranches; high quality assets might also be easier to place due to greater post-issue trading liquidity.

In order to test these hypotheses we proxy the quality of assets in each issue by the weighted average composite rating index of an issue, where 6 is assigned to AAA tranches and 0 to the non-rated tranches. However, when we add this proxy for quality to our model, it turns out to be insignificant. This could indicate that forces operate in both directions, as explained above, rendering the overall effect null. Finally, Plantin (2004) predicts that less information-sensitive assets should be tranched when there are more sophisticated investors in the market and market sophistication overall is higher. This would imply interaction between the time dimension as measured by time index as a proxy for market sophistication and the type-ranking of assets. To test this prediction we interact year with type (not reported), but the coefficient is not significant.

C. Rating classes and same-rated market classes

One potential problem with information asymmetry models is that any *ex ante* information asymmetries might be eliminated by the rating process. Moreover, asymmetric information theories face difficulties explaining tranching within a given rating class, since it is not clear how such 'extra' tranches differentiate between sophisticated and unsophisticated investors. An alternative set of possible justifications for tranching is based on market incompleteness. As DeMarzo and Duffie (1999) point out: "The motivation for 'splitting' securities in this setting (with asymmetric information) is independent of motivations due to

spanning or clientele effects."[18] Under market incompleteness, tranching becomes a process by which new securities, not available before, are created.

To investigate these issues better, we next split tranches into two groups. First, for each issue we calculate the number of unique rating groups according to the 'Moody's extended rating', which is more precise than the composite rating because it includes all refinements. The result is the number of 'rating classes' uniquely defined by credit ratings. For example, an issue of 5 tranches with 2 AAA-rated tranches, 2 BB-rated tranches, and a single B-rated tranche will feature 3 rating classes. Non-rated issues are not considered to be a separate rating class.

The number of rating classes would be equal to the number of tranches if all tranches were differentiated by rating. However, some additional tranches (after the rating differentiation) are often created within the same rating class by differentiating the securities issued in terms of the currency, the weighted average life, the payment structure, or some other feature. It is commonly reported in the professional literature that they are created to meet "investors' needs". To capture these, we calculate the number of such extra 'market classes' equal to the difference between the overall number of tranches and the number of rating classes for each issue. Around 56% of issues have additional same-rated market classes: on average, there are 1.14 additional market classes per issue, although the maximum observed in the sample is 13.

Since the same-rated market classes are not differentiated by rating, but only by market characteristics, they are predicted to be related to clientele effects and designed to exploit market incompleteness or as a remedy for market segmentation controlling for the liquidity problem. It is more difficult to explain the existence of those market classes from the

[18] Ibid, p. 95.

asymmetric information security design vantage point.[19] On the other hand, it is clear that the rating classes should primarily be associated with the asymmetric information theories of tranching if the latter are correct. This division is not without precedent in theoretical literature. Riddiough (1997), for example, suggests that although two classes might be created to differentiate informed and uninformed investors, further tranching might be necessary to place an issue due to 'clientele effects'.

The division between rating classes and same-rated market classes allows us to compare and contrast the potential effects of asymmetric information versus market segmentation, incompleteness and liquidity effects. To do this, we conduct the same regressions as before for 'rating classes' and the same-rated 'market classes' separately. The results are reported in regressions IV and V in Table X. It is clear that different effects influence these two sub-groups of tranches very differently: The coefficient on the information asymmetry index is over 70% greater (and almost twice as significant) for the number of rating classes as for the number of same-rated extra market classes. However, this pattern is reversed for the size factor – our proxy for liquidity and segmentation effects – where the coefficient on size is now over twice as high for the rating classes as for the same-rated market classes and almost twice as significant. This is as predicted by theory since the issue size is not predicted to be an important determinant of tranching by the asymmetric information literature.

This distinction between the two classes has important implications for our proxy for the quality of assets – the weighted average rating – which is now strongly significant in both cases, but in opposite directions. This seems to confirm that higher quality assets are tranched more to the extent that tranching is associated with remedying the problem of asymmetric

[19] Naturally, this distinction is not perfect. Occasionally, an 'extra class' is differentiated from one of the rating classes by seniority, despite having the same rating, but a different level of enhancement. In those cases, the creation of an 'extra class' can still be, at least theoretically, explained by the 'asymmetric information' arguments. At the same time, creating different rating classes might be explained by market segmentation or incompleteness.

information, as predicted by the asymmetric information literature. At the same time, some additional tranches (the same-rated market classes) are typically created in the case of poor quality assets, when the latter might be more difficult to place. Moreover, the year index as a proxy for investors' sophistication is now significant for the rating classes only; it does not have a significant impact on the number of the same-rated market classes per issue. Finally, longer expected life is associated with a larger number of the same-rated market classes, perhaps because it facilitates the creation of the same-rated market classes only distinguished by expected life. However, a long expected life of an issue might pose problems for seniority-tranching by making it difficult to create an AAA-rated tranche necessary to appeal to unsophisticated investors. This is supported by the fact that although AAA-rated tranches represent 77% of all tranches with expected maturity of less than 2 years, they represent only 26% of tranches with life longer than 7 years.

We also investigate the impact of market conditions by including controls for the three leading bond market characteristics: the level of interest rate (proxied by the corresponding 10-year government bond), the slope of the yield curve (proxied by the 10-year minus 2-year swap differential) and the 'curve' - the interaction variable of weighted average expected life per issue and the slope of the yield curve since the yield curve might be expected to have a different impact on issues of different maturities. We expect the number of the same-rated market classes to be higher in severe bond market conditions when more effort might be needed to cater for investors' specific tastes or for exploring market niches, especially when placing the junior tranches of each issue. Our results (equations VI and VII) broadly confirm this view. Although the interest rate is not significant, a steep yield curve, associated with rising interest rates in the future (and hence falling bond prices), is related to a greater number of the same-rated market classes being carved out, as expected, but a lower number of rating classes. Also, the coefficient on the interaction variable of life and the slope, another proxy for market conditions, is negative and very significant for the same-rated market classes.

In order to explore the distinction between the rating classes and the same-rated market classes further, we test the impact of additional factors, which might have a different effect on the two groups of tranches. For example, we would expect the asset type characteristics to have a dominant impact upon the number of rating classes per issue and the market conditions to primarily influence the number of the same-rated market classes per issue. To test the former, we now replace the info-asymmetry index with individual dummies for all asset types (regressions VIII-IX using OLS, X-XI with ordered logit).[20] The impact of asset dummies turns out to be much stronger on the number of rating classes than on the number of the same-rated market classes, as expected. Whereas a dummy on *each* asset type is significant at the 1% level for the number of rating classes, only the CDO dummy (out of 10 different asset types) has a strong and significant impact on the number of same-rated market classes. This result underlines the difference in the impact of the information-asymmetry asset type index on the rating classes and the same-rated market classes as reported earlier. It also provides an important robustness check by showing that our results are not dependent on any single group of assets such as the CDOs.

The analysis so far has focussed on the factors that can explain the extent and nature of tranching. Clearly, tranching itself is a means to an ends, the ultimate objective being a higher price for the issue as a whole. In the next section we shift the focus of attention to the impact of tranching on pricing for the subset of issues for which we have complete pricing information.

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[20] We report OLS results with robust standard errors for comparison. This might be important since differences in the number of ratings might carry more information than a simple ordinal ranking.

V. Tranching and pricing

A. Pricing model

In this section we test whether a higher predicted number of tranches is associated with a better price for the originator of the issue as a whole – i.e. the average launch spread of the entire issue obtained from spreads on individual tranches weighted by their respective sizes. In order to do this we adopt a simple pricing model that uses a similar set of controls to those typically used in the reduced form models from the existing literature on bond pricing.[21] Our market controls include the interest rate level (proxied by the government 10-year benchmark bond), the slope of the yield curve (proxied by the difference between the 10-year and the 2-year government bond), as well as the implied volatility of interest rates at the time of issue and the issue weighted average expected life (weighted average of WALs across tranches), both of which are important due to embedded options.[22] We also include additional factors: the combined size of all tranches per issue and the total number of lead managers (arrangers), which might be related to the placement effort. Our regressions also include dummies for all asset types, each composite rating category, year and the month of issue.

Our pricing sample is half the size of the original set of all issues because we eliminate all issues where at least one tranche has at least one control missing: we eliminate all issues for which we lack the launch spread, cannot identify the currency of issue, no relevant benchmark can be found, or the key control variables are not available, for at least one tranche. We also eliminate issues with tranches denominated in currencies other than euro, US dollar, or pound sterling and exclude all issues with a non-European country of origin of

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[21] See e.g. Campbell and Taskler (2003).

[22] Note that the number of tranches per issue is predicted in the 1st stage regression using the issue characteristics and date-specific market controls, where the latter are taken from the currency market of the most senior tranche. Same controls are used here for the pricing regressions.

assets.[23] We also remove all issues that contain fixed rate tranches because they might require a different pricing model.

B. Relationship between tranching and pricing

We start by regressing the issue weighted average launch spread on the set of controls. As can be seen from Table XI (regression I), the issue size has a negative impact on launch spread – i.e. a positive impact on the implicit price obtained by the originator for its securitised assets. Since the issue size is a major determinant of the number of tranches, the negative coefficient could be an early indicator of the positive effect of tranching on price due to structuring via a successful resolution of the problem of market segmentation. Here, the issue size might also be important independently of tranching: first, in a sufficiently deep market the issue size might also serve as a proxy for post-issue trading liquidity;[24] second, it might be related to originator's reputation, size, and name recognition. In contrast, a positive coefficient on size would indicate that placing a large issue poses problems *despite* tranching.

Beyond size, other pricing factors exhibit estimated coefficients of expected sign and magnitude – in line with those from earlier bond pricing models – although the coefficients on the interest rate level and the number of lead managers per issue are almost never significant. The coefficient on the proxy for the shape of the yield curve (the swap differential between the 10-year and 2-year swap yield in the currency of issue) has the expected negative sign and is always significant. Similarly, the market volatility proxy (implied volatility) is associated with the expected positive and significant effect on spreads. Finally, a higher weighted average rating per issue and an AAA rating of the most senior tranche are both associated, as expected, with a lower spread.

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[23] These issues constitute less than 10% of all issues and they are typically priced against benchmarks other than LIBOR or EURIBOR.

[24] In a market with no negative effect of the downward sloping demand curve due to e.g. segmentation, a large issue might carry a liquidity premium.

In order to test the effect of tranching on pricing, we now predict the simple total number of all tranches per issue using our tranching model outlined in section 4 including all individual asset types (to proxy for the asymmetry of information and any other potential, type-specific characteristics), the year index (to capture differences in investors' sophistication and market development), and the issue size (to capture tranching due to market segmentation, incompleteness and liquidity effects). For comparative purposes, we use the ordered logit as well as the least squares methods.

The predicted total number of tranches is highly significant in both cases as well as being consistently strong and *negative* (any differences in results between the two estimation methods for tranching are small); an extra tranche is associated with a drop in spread by circa 20 bps.[25] This implies a strong, positive relationship between the predicted number of tranches and price. Under the assumption that the optimal number of tranches is chosen to maximize the value of assets, this positive correspondence implies that for issues with a higher optimal number of tranches arrangers obtain a better price. In other words, when our model predicts more tranching (at the optimum), the price effect of those circumstances *via optimal tranching* is, on average, positive. Hence, given arrangers' access to the structuring technology and hence their ability to tranche, greater market sophistication, segmentation, and/or incompleteness, as well as other factors which our model associates with more tranching, have an overall *negative* effect on the spread (positive effect on price to the originator).

On the other hand, a hypothetical negative relationship between the number of predicted tranches and price would not necessarily imply that tranching is inefficient or does not add value. Instead, it could indicate that in issues with a higher optimal number of

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[25] When using the OLS, we predict the log of the number of tranches (to avoid the problem of normal distribution and truncation of the sample at zero) and then convert our predicted logs into the actual number of tranches. We do not use the OLS for separate rating groups/additional same-rated market classes predictions as they contain 226/709 'zero' outcome observations, respectively.

tranches arrangers are still achieving lower prices, *despite* tranching.[26] This would imply that factors such as asymmetric information or market segmentation, which we have associated in our model with a higher optimal level of tranching, would still have a net *negative* effect on price, although presumably lesser than otherwise. In this case, tranching could be preventing investors from discounting such issues even further, but we do not find evidence to support this interpretation.

When the predicted number of tranches is included in the model, the coefficient on (issue) size becomes positive, consistent, and of similar magnitude as before. This seems to confirm the hypothesis that the previously observed *negative* effect of size on spread (a positive effect on price) was due to structuring (tranching). Now, holding structuring constant, an increase in size is associated with an increase in spreads. This can be interpreted as indicating that: (i) there is a downward sloping demand curve – bond markets have limited capacity at any given time for any particular type of issue, but (ii) tranching is at least partly successful in remedying the problem of market segmentation in as far as the latter requires more tranching to access larger markets. In other words, it indicates that tranching seems to be removing any potential downward sloping demand curve effect, which would otherwise impose a price discount on larger issues. This conclusion is consistent with the positive relationship between the predicted number of tranches and price.

In order to explore these issues further by investigating other dimensions of structuring, we now predict the number of the uniquely-rated groups (of tranches) and the number of same-rated tranches (market classes) per issue, separately using the ordered logit models developed earlier. We then add them up to get the composite total - the predicted composite number of tranches per issue might be more precise than the total number of tranches where both groups are jointly predicted. The coefficient on the number of tranches is

[26] That is, in circumstances predicted by our model to be associated with more tranching, the price effect of those circumstances affecting the price via tranching would be negative.

now even more significant (regression IV) and more negative than before. Other variables have similar coefficients as before, although the impact of the issue size variable is noticeably larger (and more significant).

VI. Conclusions

Securitizations have become established as an important source of finance for financial institutions and companies alike. Tranching is the process by which securitization issues are structured, by creating different securities with different risk, duration or other characteristics backed by the same pool of assets. Although such structured financings have become an increasingly important function within investment banks, there has been little academic research on the subject beyond pure theory. This paper represents the first attempt to shed empirical light on the key factors that determine the tranching decision.

We have tested several key hypotheses regarding tranching derived from the security design literature. We find strong support for the theoretical prediction that greater sophistication of investors and progressive market development should be associated with more tranching. On this basis, we estimate that European securitization markets seem to be several years behind the US. Next, we show that a greater degree of asymmetric information is associated with a higher optimal number of tranches issued in any given deal. Again, this is in line with theoretical predictions. We also find some support for more nuanced modelling predictions such as the positive impact of the average quality of assets on tranching.

Most importantly, we show that different explanations of tranching are responsible for the creation of different groups of tranches in the same deal. Alongside tranching driven by information asymmetry we delineate tranching driven by market conditions such as market segmentation, incompleteness and post-issuance liquidity, and show the factors associated with each of those groups.

Finally, we investigate the effect of tranching on the pricing of issues at launch. Our results indicate a consistent and significant positive relationship between tranching and the prices of securities issued in any given transaction. This suggests that structuring is allowing issuers to exploit market factors – such as market incompleteness, greater investor sophistication, and heterogeneous screening skills related to asymmetric information – to their advantage via tranching.

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Table I: Issues by Type and Number of Tranches per Issue

Classification by type is according to the European classification of securitizations: 'CDO' are collateralised debt obligations; 'CMBS' are commercial mortgages; 'WB' are whole-business securitizations; 'RMBS' are residential mortgages, 'Equip' are securitizations of equipment assets, 'Cons' are securitizations of consumer assets other than auto-loans, credit cards or mortgages; 'SA' are securitizations by government or public agencies' assets or obligations; 'Auto' are auto-loans; 'Cards' are credit-card securitizations.

	Issues with the given number of tranches as percentage of all issues per asset type										
tranches per issue	CDO	CMBS	WB	RMBS	Equip	Cons	SA	Auto	Other	Cards	Total
1	16.0%	15.0%	21.6%	20.5%	24.4%	25.0%	36.8%	27.8%	53.8%	58.1%	24.6%
2	9.8%	13.3%	15.7%	26.5%	41.5%	30.0%	36.8%	55.7%	25.5%	17.6%	22.6%
3	18.9%	17.7%	19.6%	19.6%	14.6%	33.8%	10.5%	13.9%	9.0%	20.3%	18.6%
4	16.5%	12.4%	21.6%	13.4%	12.2%	7.5%	5.3%	1.3%	6.9%	2.7%	12.3%
5	13.5%	13.3%	3.9%	10.2%	7.3%	3.8%	10.5%	1.3%	2.1%	1.4%	9.0%
6	8.6%	10.6%	7.8%	3.9%					1.4%		4.9%
7	5.2%	10.6%	3.9%	2.0%					1.4%		3.1%
8	3.9%	1.8%	2.0%	0.8%							1.5%
9	2.9%	1.8%		0.2%							0.9%
10+	4.7%	3.5%	3.9%	2.9%							2.6%
Mean tranches per issue	4.25	4.16	3.51	3.19	2.37	2.35	2.16	1.94	1.88	1.73	3.22
Std. dev.	2.65	2.41	2.36	2.32	1.20	1.06	1.30	0.82	1.28	1.02	2.33
Total Issues	407	113	51	596	41	80	19	79	145	74	1605
Total Tranches	1730	470	179	1901	98	188	41	153	273	128	5161

Table II: Distribution of Transaction Sizes by Type

The nominal value of each tranche in the currency of issue is converted into US dollars at the closing exchange rate on the date of issue, as reported by Datastream. See Table I for explanation of the classification.

	Asset Type										
	SA	WB	CDO	RMBS	CMBS	Cards	Equip	Auto	Cons	Other	Total
Issues											
- mean size ($m)	2029	828	727	659	594	571	420	405	377	362	630
- std. dev. ($m)	1842	785	1277	849	722	223	331	302	317	508	923
- skewness	1.07	1.37	5.41	4.05	4.35	0.41	1.43	1.56	2.72	5.77	5.55
Tranches											
- mean size ($m)	940	236	171	207	143	330	177	209	160	193	196
- median ($m)	891	180	32	60	56	331	70	130	85	98	53
- std dev ($m)	613	222	497	337	223	288	228	272	221	365	
- skewness	0.29	2.19	6.73	3.84	3.89	0.62	1.69	2.12	3.31	8.91	6.13

Table III: Tranching and Ratings

See Table I for explanation of the classification. *Excluding all issues with no tranches rated. **Bottom-rated tranches excluded tranches classified at the same time as top-rated: e.g. in the case of all single-tranche issues. Rating is the composite rating of all ratings assigned by rating agencies to the particular tranche. Top tranches include all tranches with the highest rating in the issue (can be multiple); bottom tranches include all tranches with the lowest rating in the issue (can be multiple) but exclude single-tranche cases).

	Asset Type										
	Cards	Auto	SA	Equip	RMBS	CMBS	Other	Cons	WB	CDO	Total
% of all issues with at least 1 AAA-rated tranche	95%	87%	47%	83%	80%	74%	57%	68%	37%	66%	73%
average size of all top-rated tranches % of the issue*	96%	96%	99%	90%	90%	72%	91%	90%	73%	55%	81%
average size of the bottom-rated tranche % of the issue**	6%	5%	8%	11%	5%	11%	15%	8%	18%	21%	12%
average issue rating (AAA=6) weighted by tranche size	5.7	5.3	5.1	4.9	4.8	4.8	4.7	4.5	4	3.2	4.4
most senior tranches #	80	93	39	59	990	183	188	101	105	664	2502
most junior tranches #	30	51	1	26	502	111	51	54	44	415	1285
average # of most senior tranches per issue	1.08	1.18	2.05	1.44	1.66	1.62	1.30	1.26	2.06	1.63	1.56
mean size of AAA-rated tranches (where present) % of the issue	89%	80%	42%	64%	53%	43%	69%	69%	30%	35%	52%
mean size of BBB and below tranches % of the issue	15%	45%	-	28%	22%	13%	43%	37%	28%	23%	23%

Table IV: Issues by Size and the Number of tranches

Size of each tranche is calculated in US$ by converting the size of each tranche in the currency of issue at the exchange rate from the date of issue; issue size is the sum of all tranches of a given issue in the dataset.

	Issue Size			
tranches	**<US$100m**	**US$100-500m**	**US$500-1000m**	**>US$1000m**
1	79 (46%)	216 (25%)	69 (21%)	31 (13%)
2	38 (22%)	232 (27%)	71 (21%)	22 (9%)
3	30 (18%)	176 (21%)	61 (18%)	31 (13%)
4	14 (8%)	93 (11%)	52 (16%)	38 (16%)
5	5 (3%)	59 (7%)	42 (13%)	38 (16%)
6	3 (2%)	33 (4%)	19 (6%)	23 (10%)
7+	2 (1%)	47 (5%)	21 (6%)	58 (24%)
Mean	2.09	2.89	3.28	5.07
Total	171	858	335	241

Table V: Issues, Tranches and Collateral Types Across Time

The average size of a tranche is reported in millions of US dollars (converted into US dollars at the current exchange rate if denominated in another currency).

	Year of Issue																
	87	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**
Average size of a tranche	185	181	328	258	171	158	153	149	123	311	299	178	168	137	145	149	286
Number of issues per year	8	17	12	17	26	12	17	34	44	54	84	102	159	177	252	261	329
Agency (%)													1	2	3	1	1
CDO (%)				6					20	12	17	10	17	23	34	32	39
Consumer (%)				29	19	50	29	15	12	31	20	24	20	12	12	15	9
Corporate (%)						8	6	15	7	7	5	6	10	11	8	9	8
Mortgage (%)	100	100	100	65	81	42	65	70	59	43	46	47	42	42	35	40	41
Other (%)									2	7	12	13	10	10	8	3	2

Table VI: Tranching in Europe and the United States, 2003

See Table I for explanation of the classification. This table compares the 2003 securitization from our European sample, with a similar sample of US securitizations for 2003. The US classification differs slightly from that employed in our European sample. 'HOMEQ' are home equity loans and other mortgages; 'STUDL' are student loans. In the US sample there are no separate categories representing CMBS, whole-business or sovereign/agency securitizations.

	Panel A: European securitizations during 2003										
	CDO	CMBS	WB	RMBS	EQUIP	CONS	SA	AUTO	OTHER	CARDS	TOTAL
Number of issues	129	24	13	110	5	6	3	9	20	10	329
Mean tranches per issue	4.10	4.5	2.92	4.53	2.8	3.17	3.67	2.56	1.55	2.5	3.93
	Panel B: US securitizations during 2003										
	CDO			HOMEQ	EQUIP	STUDL		AUTO	OTHER	CARDS	TOTAL
Number of issues	135			384	16	31		92	33	95	786
Mean tranches per issue	5.8			6.88	5.56	6.03		4.74	2.64	1.72	5.58

Table VII: Initial Determinants of Tranching

Dependent variable in all regressions is the number of tranches per issue. Each observation represents a single issue. Independent variables: 'log of issue size' is the log of the sum of sizes of all tranches expressed millions of US$ converted from the issue currency at the FX rate at the date of issue; 'year index' is the year of issue; 'issue life' is the weighted average (by size) of component tranches' expected maturities in years since launch; 'average launch' is the weighted average spread of component tranches per issue at launch over LIBOR; 'us public' is a dummy =1 if an issue is placed on the US public market (there are no issues placed in the US private market); 'issues per country' is the total number of all securitization issues per country; 'auto' is a dummy =1 if the issue type is auto-loans or auto-leases (= 0 otherwise); 'cards' is a dummy =1 if the issue is backed by revenues from credit or debit card payments (= 0 otherwise); 'rmbs' is a dummy =1 if the issue is backed by residential mortgages (= 0 otherwise); 'cmbs' is a dummy =1 if the issue is backed by commercial mortgage (= 0 otherwise); 'cdo' is a dummy =1 if athe issue type is a collateralized debt obligation (= 0 otherwise); 'whole business' is a dummy =1 if the issue is a whole business securitization; 'consumer' is a dummy =1 if the issue type is backed by consumer loans other than consumer loans classified in other categories; 'other' is a dummy =1 if the issue is not otherwise classified; 'equipment' is a dummy =1 if the issue type is backed by corporate equipment assets; a dummy for securitizations of sovereign and public agencies' assets is omitted. The OLS regression includes a constant. Z-statistics in ordered logit regressions and t-statistics in the OLS regression, calculated from the Huber-White robust errors, are reported in brackets. Pseudo R^2 is reported for ordered logit regressions; adjusted R^2 is reported for the OLS regression.

	I	II	III	IV	V	VI	VII
	ologit	OLS	ologit	ologit	ologit	ologit	ologit
constant	-	**-4.81**	-	-	-	-	-
		(-8.35)					
year index	**0.17**	**0.12**	**0.09**	**0.08**	**0.08**	**0.17**	0.07
(sophistication proxy I)	(11.32)	(7.92)	(3.00)	(2.72)	(2.65)	(11.18)	(1.70)
auto	***1.05***	***1.01***	***1.18***	***1.24***	***1.22***	***1.03***	**1.38**
	(2.30)	(2.01)	(2.41)	(2.53)	(2.48)	(2.26)	(2.72)
cards	0.25	0.46	0.40	0.45	0.43	0.24	0.45
	(0.54)	(0.92)	(0.50)	(0.90)	(0.85)	(0.51)	(0.81)
cdo	**3.05**	**3.06**	**4.60**	**4.53**	**4.51**	**3.03**	**4.86**
	(7.09)	(6.61)	(9.49)	(9.32)	(9.28)	(7.05)	(8.22)
cmbs	**3.06**	**2.97**	**4.39**	**4.29**	**4.28**	**3.04**	**3.44**
	(6.81)	(6.08)	(8.84)	(8.61)	(8.58)	(6.78)	(6.46)
consumer	**1.75**	**1.51**	**2.40**	**2.45**	**2.42**	**1.72**	**2.42**
	(3.84)	(2.99)	(4.78)	(4.86)	(4.80)	(3.79)	(4.58)
equipment	**1.64**	**1.45**	***1.29***	***1.29***	***1.26***	**1.62**	***1.30***
	(3.28)	(2.66)	(2.22)	(2.21)	(2.17)	(3.24)	(2.17)
other	0.79	***1.17***	**1.66**	**1.46**	**1.43**	0.77	**1.27**
	(1.76)	(2.42)	(3.35)	(2.91)	(2.85)	(1.71)	(2.42)
rmbs	**2.25**	**2.14**	**2.77**	**2.81**	**2.76**	**2.21**	**2.61**
	(5.35)	(4.66)	(6.16)	(6.23)	(6.11)	(5.24)	(5.64)
whole business	**2.06**	**2.00**	**3.64**	**3.22**	**3.21**	**2.05**	**2.53**
	(4.25)	(3.78)	(6.66)	(5.70)	(5.68)	(4.23)	(4.24)
log of issue size	**0.64**	**0.72**	**0.96**	**1.04**	**1.01**	**0.63**	**1.10**
	(12.52)	(14.78)	(12.71)	(12.90)	(12.53)	(12.21)	(11.23)
issue life			**-0.08**	**-0.09**	**-0.09**		**-0.10**
			(-5.40)	(-5.57)	(-5.50)		(-5.60)
average launch				**0.004**	**0.004**		**0.006**
				(2.91)	(2.84)		(3.32)
us public					0.88	***1.23***	
(sophistication proxy II)					(1.70)	(2.43)	
issues per country							**0.001**
(sophistication proxy III)							(6.56)
issue type	all	all	all	all	all	all	all
pseudo-R^2 / adj. R^2	10.9	29.7	13.8	14.0	14.1	11.0	13.5
no. of observations	1605	1605	968	968	968	1605	729

Table VIII: Tranches, Ratings and Expected Maturities

% of tranches per issue differentiated by rating = average number of identically rated groups of tranches per issue divided by the number of tranches per issue in a given asset category. % of tranches per issue differentiated by expected life = average number of groups of tranches per issue with the same expected life divided by the number of tranches per issue in a given asset category. See Table I for explanation of the classification.

	Asset Type										
	SA	WB	CDO	CMBS	RMBS	Equip	Other	Cons	Auto	Cards	**Total**
% of tranches per issue differentiated by rating	51%	56%	57%	71%	64%	69%	76%	78%	82%	93%	**64%**
% of tranches per issue differentiated by expected life	98%	81%	53%	61%	75%	80%	88%	83%	87%	77%	**71%**

Table IX : Types of Asset and the Information Asymmetry Index

The table reports a mean launch spread (in basis points) for each type of asset by composite rating. B and CCC rated categories are not reported. Standard deviations of the launch spreads within each asset type and rating category are shown in brackets. Mean st. dev. shows the average standard deviation of launch spreads for each type for collateral, i.e. the mean across different rating categories. The ranking of the mean st. dev. by asset type is used to create the information asymmetry (IA) index. See Table I for explanation of the classification. The 'CORP' category includes all types of securities backed by corporate collateral except for CDOs and CMBS; the 'CON' category includes all types of securities backed by consumers' collateral except for RMBS.

rating	Asset Type										***Broad categories***	
	CDO	CMBS	WB	RMBS	Equip	Cons	SA	Auto	Cards	Other	*CORP*	*CON*
AAA	45 (48)	51 (34)	57 (23)	28 (17)	35 (15)	32 (13)	19 (10)	29 (12)	22 (12)	51 (38)	*47 (25)*	*28 (13)*
AA	74 (40)	73 (37)	74 (-)	53 (25)	59 (37)	66 (28)	44 (35)	42 (4)	-	78 (34)	*61 (25)*	*63 (27)*
A	135 (75)	109 (51)	113 (30)	80 (33)	74 (27)	77 (27)	44 (36)	64 (24)	58 (18)	132 (53)	*103 (32)*	*68 (25)*
BBB	247 (130)	207 (65)	250 (63)	162 (58)	197 (116)	167 (59)	-	152 (33)	145 (51)	260 (103)	*258 (83)*	*154 (52)*
BB	481 (203)	424 (171)	586 (64)	367 (103)	170 (184)	400 (-)	-	-	-	527 (156)	*516 (181)*	*400 (-)*
NR	250 (331)	169 (154)	163 (110)	85 (98)	96 (68)	38 (13)	-	88 (46)	-	204 (137)	*111 (76)*	*66 (43)*
mean st. dev.	123	63	54	37	46	26	22	21	22	55	***70***	***32***
IA index	**10**	**9**	**7**	**5**	**6**	**4**	**3**	**1**	**2**	**8**		

Table X : Tranching, Asymmetric Information and Market Incompleteness

The dependent variable in regressions I, II and III is the number of tranches per issue; the dependent variable in regressions IV, VI, VIII and X is the number 'rating' classes per issue as distinguished by the 'Moody's +' composite rating index; the dependent variable in regressions V, VII, IX, and XI is the number of 'market' classes – the additional tranches beyond the 'rating' classes differentiated from the latter by characteristics other than rating. Independent variables: the *info-asymmetry index* is derived from Table IX; *log of issue size* is the log of the sum of sizes of all tranches expressed in millions of US$ converted from the issue currency at the exchange rate at the date of issue; *year index* is the year of issue =1 if 1987 and =16 if 2003; *issue life* is the weighted average (by size) life of component tranches' expected maturities at launch (in years); *average rating* is the weighted average of component tranches' composite ratings where AAA=6 and not rated issues NR=0; *irate* is the yield on the government 10-year benchmark security on the date of issue; *swap diff* is the difference between the 10-year and 2-year swap rate on the date of issue; *curve* is equal to *swap diff* * *issue life* on the date of issue. The OLS regressions include a constant as reported. Z-statistics in ordered logit regressions and t-statistics in the OLS regressions, calculated from the Huber-White robust errors, are reported in brackets. Pseudo R^2 is reported for ordered logit regressions; adjusted R^2 is reported for the OLS regressions.

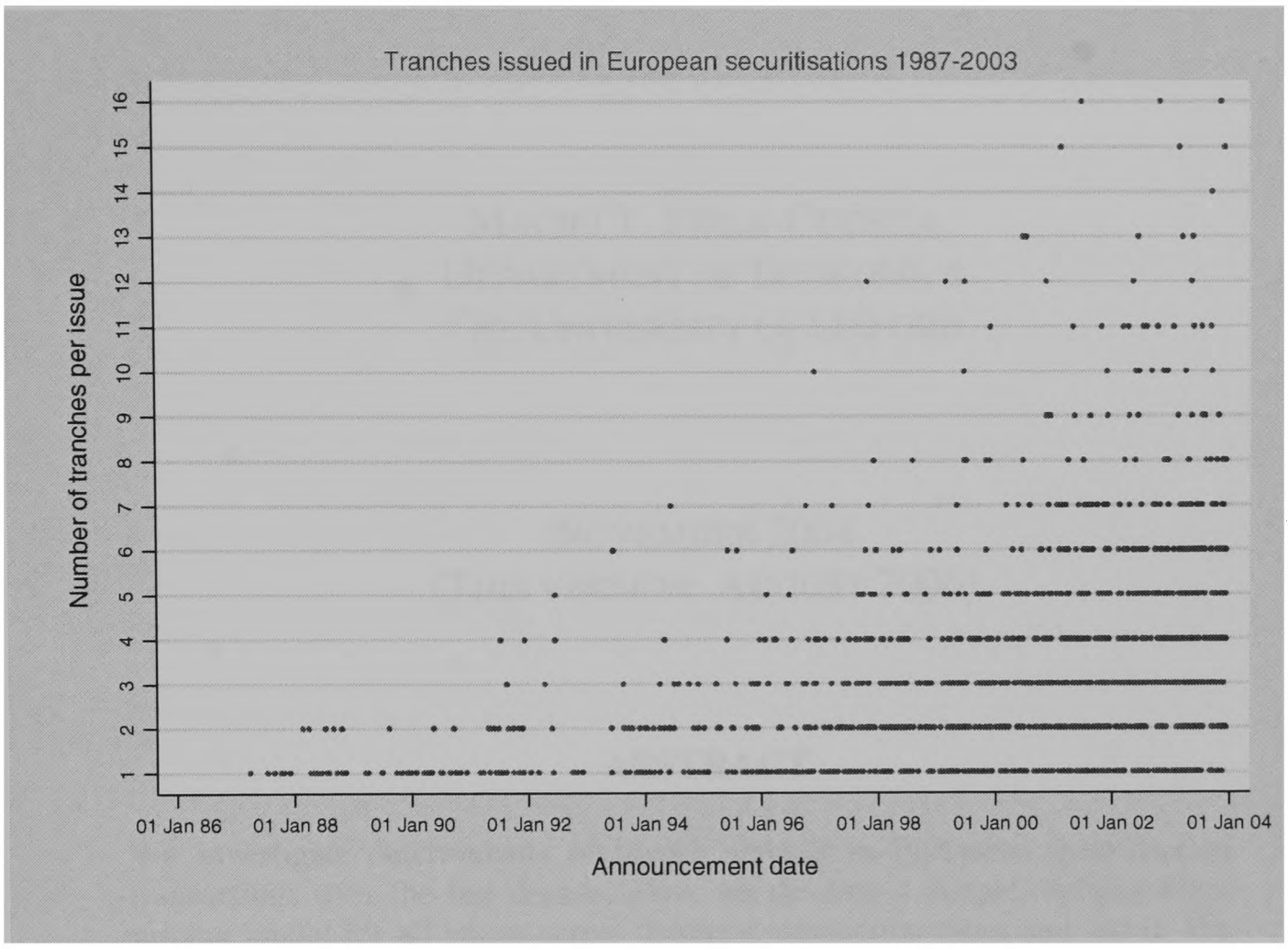
dependent variable	all tranches	all tranches	all tranches	rating classes	market classes	rating classes	market classes	rating classes	market classes	rating classes	market classes
model number	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
estimation method	ologit	ologit	ologit	ologit	ologit	ologit	ologit	OLS	OLS	ologit	ologit
info-asymmetry index	**0.203**	**0.358**	**0.347**	**0.342**	**0.218**	**0.313**	**0.217**	-	-	-	-
	(11.42)	(14.26)	(13.29)	(12.65)	(7.53)	(10.94)	(6.79)				
log of issue size	**0.668**	**0.957**	**0.972**	**0.488**	**1.016**	**0.567**	**1.000**	**0.279**	**0.815**	**0.624**	**0.927**
	(13.50)	(13.38)	(13.43)	(7.26)	(12.31)	(7.56)	(11.09)	(6.89)	(13.05)	(7.69)	(9.71)
year index	**0.150**	**0.087**	**0.088**	**0.154**	-0.057	**0.170**	-0.051	**0.115**	-0.022	**0.196**	-0.028
	(10.05)	(3.00)	(3.04)	(5.17)	(1.71)	(3.06)	(0.79)	(3.79)	(0.49)	(3.47)	(0.43)
issue life		**-0.083**	**-0.085**	**-0.103**	-0.019	**-0.128**	**0.048**	**-0.051**	**0.056**	**-0.107**	***0.048***
		(6.06)	(6.19)	(7.23)	(1.26)	(6.82)	(2.57)	(-5.28)	(3.72)	(5.08)	(2.44)
average rating			-0.101	**0.242**	**-0.399**	0.062	**-0.405**	-0.013	**-0.301**	**-0.125**	**-0.425**
			(1.54)	(3.03)	(6.07)	(0.72)	(5.16)	(0.30)	(4.51)	(1.34)	(4.84)
irate						-0.025	0.095	0.113	0.122	-0.011	0.100
						(0.19)	(0.66)	(0.16)	(1.12)	(0.08)	(0.67)
swap diff (10y-2y)						**-0.562**	**0.949**	**-0.242**	**0.918**	**-0.482**	**0.942**
						(3.62)	(5.52)	(2.87)	(7.07)	(3.03)	(5.36)
curve (life*swap diff)						0.030	**-0.172**	0.005	**-0.152**	0.012	**-0.184**
						(1.20)	(6.09)	(0.40)	(7.38)	(0.44)	(6.23)
auto								**0.949**	0.375	**3.037**	-0.307
								(3.55)	(0.91)	(4.62)	(0.57)
cards								**1.115**	0.167	**3.367**	-1.343
								(3.98)	(0.39)	(4.91)	(1.81)
cdo								**2.692**	**1.632**	**6.251**	**1.813**
								(10.86)	(4.27)	(9.58)	(3.81)
cmbs								**2.645**	***1.028***	**6.256**	***1.056***
								(10.24)	(2.58)	(9.31)	(2.14)
consumer								**1.678**	0.271	**4.455**	-0.773
								(6.02)	(0.63)	(6.57)	(1.24)
equipment								**0.960**	0.418	**2.968**	-0.474
								(3.05)	(0.86)	(4.08)	(0.66)
other								**1.078**	0.639	**2.988**	0.164
								(4.20)	(1.61)	(4.59)	(1.70)
rmbs								**1.640**	***0.874***	**4.328**	0.744
								(6.97)	(2.41)	(6.96)	(1.70)
whole business								**1.426**	***1.122***	**3.861**	***1.239***
								(4.93)	(2.52)	(5.45)	(2.24)
pseudo-R^2, adj. R^2 (OLS)	0.08	0.10	0.10	0.09	0.10	0.10	0.11	0.33	0.31	0.15	0.13
no. of observations	1605	1605	968	968	968	838	838	838	838	838	838

Table XI : Tranching and Pricing

The dependent variable is the weighted average launch yield spread per issue (in bps) above LIBOR. All issues are floating rate. Each observation represents a single issue consisting of several tranches. Independent variables include: *predicted tranches* is the predicted number of tranches from the 1st stage regression as specified in the text (regression II); *issue size* is the issue size in US$ converted from the issue currency at the FX rate at the date of issue; *irate* is the yield on a 10-year government benchmark in the currency of issue on the day of issue; *swap diff* is the difference between a 10-year and a 2-year swap yield in the currency of issue on the day of issue; *cap vol* is the implied volatility of a 5-year interest rate cap in the currency of issue on the day of issue; *issue life* is the expected weighted average life of the entire issue (weighted by tranche size) in years as per assumed prepayment paths per tranche (where relevant); *lead tot* is the total number of lead and co-lead managers (arrangers) for each transaction. Asset types are auto-loans, credit card loans, cdo, cmbs, (other) consumer loans, equipment leases, other, rmbs, whole business, and government/agency securitizations (omitted). All regressions include a constant (not reported). All tranches in issues for which at least one pricing factor/control is not specified for at least one tranche are omitted. t-statistics are reported in brackets.

	I	II	III	IV
1st stage model	-	Ols	ologit Table X	ologit Table X RC &MC estimated separately
predicted variable	-	all tranches	all tranches	
predicted tranches (from 1st stage regression)	-	**-22.016** (-9.20)	**-19.699** (-8.76)	**-26.482** (-11.03)
issue size	**-0.006** (-3.84)	**0.012** (4.64)	**0.011** (4.39)	**0.019** (6.87)
$irate_{10y}$	3.094 (0.82)	2.890 (0.81)	3.674 (1.02)	3.904 (1.11)
swap diff (10y-2y)	**-7.695** (-2.35)	**-12.326** (-3.92)	**-11.755** (-3.73)	**-11.548** (-3.78)
cap $vol_{5y\ i/r\ cap}$	**0.958** (2.20)	0.618 (1.49)	**0.908** (2.18)	**1.152** (2.84)
issue $life_{log\ (WAL)}$	-3.841 (-1.36)	**-11.840** (-4.22)	**-12.140** (-4.27)	**-12.607** (-4.62)
lead tot	-0.375 (0.27)	-0.154 (-0.12)	0.060 (0.05)	-0.014 (-0.01)
issue rating index	**-13.775** (-7.00)	**-20.036** (-10.09)	**-18.510** (-9.49)	**-23.33** (-11.55)
AAA tranche (d)	**-37.115** (-6.53)	**-26.097** (-4.73)	**-27.657** (-5.01)	**-22.13** (-4.06)
9 asset type dummies	yes	yes	yes	yes
8 year dummies	yes	yes	yes	yes
3 quarter dummies	yes	yes	yes	yes
adjusted R^2	47.8	53.0	52.6	55.0
# of observations (issues)	785	785	785	785

Figure I: Development of Tranching in Europe Since 1987



EXPLAINING LAUNCH SPREADS ON STRUCTURED BONDS[1]

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ABSTRACT

We investigate determinants of launch spreads in European securitisation transactions over the last decade. First, we develop a simple, reduced-form pricing model for all issues across different transaction types and test it. We document the importance of credit ratings as key pricing factors for structured securities and hence the critical impact of structuring on prices. Next, we employ the reduced form model to test for the effect of tranching on pricing of individual securities issued and find evidence that arrangers are able to exploit informational asymmetries to obtain better prices. Finally, we develop and employ a simultaneous equations supply and demand model with endogenous structuring and further investigate the effects of structuring on prices at launch. In particular, we find evidence in support of market segmentation, market incompleteness and cost rationales behind structured credit.

JEL classification: G14, G15, G32

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I. INTRODUCTION

A. *Overview*

In contrast to corporate bonds, a critical feature of securitisation issues is the fact that underlying assets are not only homogenous within a given pool, but also similar across different pools and even across distinct originators. This offers an attractive environment for studying the impact of different market and transaction characteristics on the price of fixed income securities. Using a large, proprietary database of over 5000 asset-backed securities (ABSs) issued in Europe between 1987 and 2003, we test for cross-sectional and time-variant determinants of spreads using (i) a reduced-form model similar to analogous models developed for corporate bonds, (ii) a simultaneous equation supply and demand model of structuring. Our objective is to develop an easily applicable, yet sufficiently detailed, pricing model of structured finance issues, which would allow for delineating the key price determinants of securitisations, while addressing the problem of endogeneity of the structuring process. We also aim to explore the impact of structuring on pricing.

In a typical securitisation transaction a group of assets from an enterprise—most typically a financial institution or a financial subsidiary of an industrial company—is pooled together and sold to an external, legal financing entity: a special purpose vehicle or a special purpose entity (SPV or SPE). The SPV buys assets from the originator with funds raised from investors who purchase securities—the asset backed securities (ABS)—structured to feature specific characteristics and issued by the SPV. These securities are backed by a pool of assets acquired from the originator. Since the SPV is essentially a passive investment vehicle, the selection, characteristics, and uses of this pool of assets is governed by a legal contract, which aims to specify in detail all foreseeable contingencies concerning future cash flows from the securitized pool. The

cash flows arising from these assets are subsequently used to make interest payments and eventually repay the principal to investors.

Unlike in the case of corporate bonds, securities issued as a part of a securitisation transaction are structured. Given each issue characteristics, we would like to explore the importance of structuring factors for securitisation issues in general, and for their prices at launch in particular. Among these factors, we explore the tranche-specific, composite credit rating, typically obtained with the help of internal and external enhancements, as one of the key, potential determinants of spreads. Simultaneously, we explore the role of other price determinants that might be of interest in this context such as size, maturity and placement characteristics. These factors include the criteria used by the credit rating agencies as well as other factors, which are not part of the rating process. In this context, we want to delineate the effects of different aspects of structuring and explore the link between structuring and the issues of market segmentation and market incompleteness, as described in the previous chapter.

B. Motivation

As far as we know, ours is the first paper to empirically investigate the importance of different aspects of structuring and related factors in determining prices of securitised debt at issue in general, and in Europe in particular. This is of interest because there have been few empirical studies investigating the nature and pricing of securitisations, despite the fact that they now represent over one quarter of all publicly issued bonds and over 80% of all determinations of credit ratings (in contrast to the relatively well researched realm of corporate bonds). Second, structured finance represents a particularly promising area for research since securitisation transactions include many features that are not present in ordinary bonds. Although these features pose certain difficulties for developing pricing models due to complexity of the ABS

transactions, they also, arguably, facilitate research of the impact of important market features, such as liquidity, segmentation, incompleteness, or timing, on the price of bonds.[2]

Moreover, since the underlying assets are considerably more uniform in securitisation transactions than in the case of corporate bonds, these issues might be less 'noisy' in terms of issuer-specific, idiosyncratic factors that often influence spreads on ordinary bonds. In this respect, the former might represent a particularly fertile ground for investigations of important market and issue determinants of prices previously explored in the context of standard fixed income issues.

C. Plan of the study and preliminary results

In the first part of our study, we develop a simple, reduced-form, tranche-specific pricing model for different securitisation issues and transaction types and test it. Our aim is to obtain a model, which is transparent and adaptable in different contexts. We report that the key pricing controls pass basic reality checks and that our results are consistent with those from relevant earlier studies of ordinary corporate and structured bond issues. We also document the critical importance of structured credit ratings as the most important pricing factors determining the ABS prices at launch. We show that structured credit ratings, which might be endogenous at the tranche level, are more important in their explanatory power than in the case of unsecured corporate bonds, where they have been extensively studied before. This might be expected given the process of structuring—in this context we confirm the results of previous studies indicating that rating refinements in fixed income markets offer limited additional explanatory value.

Next, we move beyond the basic pricing model and present evidence that arrangers are capable of successfully exploiting market incompleteness and/or market

[2] By 'deal concentration' we mean the timing of transactions in terms of the time-profile of the number of transactions placed on the market.

segmentation, as exhibited by clustering of similar bond issues in time, until they exhaust arbitrage opportunities in the relevant market segment(s). Moreover, we document that other price determinants, such as placement characteristics, are consistently significant in their impact on spreads and delineate the opposing effects of liquidity and market segmentation. This is important since it indicates that structuring, in as far as it is applied by lead managers, might be successful at remedying the problem of market segmentation.

In the next part of our analysis, we investigate the impact of tranching on pricing using the instrumental variables (IV) model of tranching developed in the previous chapter, which we now employ at the tranche level rather than at the issue level (ie, without aggregation across tranches for the same issue) and find evidence that issues with a higher optimal number of distinct rating groups obtain better pricing.[3] Finally, we test for the effect of the structuring process in more detail by explicitly addressing the endogeneity problem of structuring by developing a simultaneous equations supply and demand model of structuring and pricing at the tranche level. The results from our structural model present evidence to support the market segmentation and market incompleteness theories of tranching discussed in the previous chapter.

The remainder of the paper proceeds as follows. In the next section, we discuss our research in the context of the relevant literature to date. In section III, we describe our data and provide some stylised facts on the nature of securitisations and launch spreads. Section IV introduces the reduced form pricing model; in section V we test this model and investigate the importance of credit ratings as well as time-variant market characteristics on spreads. Section VI analyses different transaction types and follows up with the analysis of price determinants of launch spreads beyond credit ratings. In Section VII we test the impact of tranching on pricing. In section VIII we develop and estimate the simultaneous equations supply and demand model of structuring and

[3] We use the term 'rating groups' to indicate groupings of tranches that are part of the same issue but have the same rating. With a given rating group, tranches differ in terms of eg currency or maturity.

pricing; we conclude in section IX.

II. RELATED LITERATURE

Despite the fact that the total balance of outstanding ABS in 2004 has reached over US$3 trillion worldwide, there has been surprisingly little academic research investigating structured finance issues, in contrast to the vast professional literature on the subject and its importance for the world financial markets. The existing theoretical explanations of securitisations have focused on regulatory capital, bankruptcy, and, most prominently, asymmetric information, as presented by Boot and Thakor (1993), Riddiough (1997), DeMarzo and Duffie (2001), DeMarzo (2005) among others. More recently, however, alternative explanations have been suggested including agency costs or asymmetric information in the principal-agent framework by Cuchra (2002) or Iacobucci and Winter (2005).

Empirical studies of securitisations based on rigorous statistical analysis are rare. For example, Thomas (1999) & (2001), and Cuchra (2003), employ the event-study methodology to test the impact of securitisations on the prices of issuers' debt and equity securities in the United States and Europe, respectively. Earlier event studies of securitisations such as Lockwood et all. (1996), have focused on the wealth effects of securitisations for banks' investors. The institutional and legal background on securitisations can be found in Schwarcz (1994), one of many legal studies on the subject.

Among research directly relevant to our paper, there exists a limited number of studies investigating pricing in securitisation transactions. In this context, some studies combine a theoretical model with basic empirical tests. Much of this literature is dominated by studies of private and agency MBS issues. For example, Boudoukh,

Richardson and Stanton (1997) investigate pricing of mortgage-backed securities (MBS) in a multifactor interest rate environment. Stanton (1995) concentrates on the issue of prepayment, whereas Goodman and Ho (2002) model the spread of mortgage-backed securities over US treasuries. Earlier papers include Schwartz and Torous (1989) who develop and test a prepayment model for MBS, all in the US context. In one of the more recent studies, which explores transactions more similar to our work, Ammer and Clinton (2004) investigate the impact of changes in credit ratings on the price of ABS issues using a limited dataset of US securities from 1996 to 2003. They report greater asymmetry in the ABS prices' reactions to changes in credit rating than that for corporate bonds.

There exists also a large body of literature aimed at explaining credit spreads on corporate bonds. The study closest to the first part of our paper, but in the context of ordinary bonds, is perhaps John, Lynch and Puri (2004), which employs a similar methodology to investigate determinants of launch spreads as we do. While investigating a range of pricing factors and bond characteristics with respect to their impact on launch spreads, they concentrate on the effect of collateral, after controlling for credit rating, in addition to a set of standard pricing controls, which they explain with the help of an agency model. They find that the presence of collateral is positively correlated with the launch spread. In another recent paper, Campbell and Taksler (2003) analyze factors influencing corporate credit spreads. While they explore a number of factors, their focus is on volatility: they find that equity volatility of corresponding stocks explains as much variation in corporate credit spreads as do credit ratings. In another related work Elton, Gruber et all (2001) attempt to explain the rate spread by estimating the default premium, while controlling for taxes and other market factors. Similarly, Collin-Dufrense, Goldstein, and Martin (2001) look into the determinants of credit spread changes. After including a set of standard pricing controls they come to a conclusion that there exists an

additional, very significant common factor, which, nevertheless, they cannot identify. Delianedis and Geske (2001) investigate the components of credit spreads: they model jumps in a diffusion process, liquidity and check for market factors, including volatility, after controlling for the default risk and recovery. Finally, Chen, Lesmond and Wei (2003) test whether liquidity is priced into the spreads after controlling for the probability of default, equity volatility, taxes, and other factors. Although many of those studies use time-series data on spreads, none account explicitly for the supply and demand effects in bond markets. Neither we are aware of any empirical papers on bond pricing focused on the effects of structuring in securitisation transactions.

III. DATA DESCRIPTION AND STYLISED FACTS

A. Dataset

European securitisation markets have witnessed an explosive growth with the total issuance roughly doubling every two years since 1998. The gap between Europe and United States has been closing with European issues reaching a record €151 billion in 2002 and €151 billion in 2001. In relative terms, European mortgage backed securities have been growing much faster than ABS since 2000. ABS issuance in Europe declined slightly between 2001 and 2002, but started growing again in 2003. However, despite the impressive overall development, European securitisations are very unevenly distributed geographically with almost a half of the entire market concentrated in the UK. Although there are important legal and structural differences between securitisations in the UK and other important markets, the UK remains dominant across all types of transactions. This is significant because the UK case is therefore particularly important for understanding the European securitisation phenomenon in general. Beyond the UK, Italy, Spain and Netherlands already stand out as other critical areas of securitisation origination in

Europe. In terms of the collateral, in the second quarter of 2003 they represented 19%, 16% and 8% of the total market, respectively. Together, these four leading countries represent almost 90% of the entire European securitisation market.

Our dataset is a comprehensive dataset of all securitisation transactions in Europe with the total issuance of over US$1 trillion. Our annual figures are the same or higher than those reported by industry associations.[4] This proprietary database has been compiled by JP Morgan in London throughout a period of several years and we have checked the records against data from Bloomberg and Thompson Financial electronic databases where available.

There are 5161 separate observations in the dataset, each representing a single tranche of 1605 securitisation transactions in Europe in the period between 1987 and 2003; over 86% of all issues are floating rate issues. The dataset includes all structured finance transactions including MBS, CDO and ABS transactions, as classified by JP Morgan. We assemble data on many tranche- and issue-specific characteristics including the date of issue, names of the issuer and the originator, the price at issue (100 when at par), the coupon, the launch spread measured against a corresponding benchmark, the weighted average life until maturity; the enhancement level, ratings (if rated) according to three different rating agencies, where available, plus a composite rating as reported to the investors at the date of issue, the type of assets being securitized, the tranche size, the country of origin of assets, and the currency of issue, among other. We also have notes on the structure of each issue, lead managers, and the target market for the issued securities, where the latter could be European private or public market or the US public market. In addition, we have some category-specific data for certain types of assets such as balance sheet/arbitrage specification for CDO. We discuss these in greater detail further below.

[4] For example, the European Securitisation Forum reports total securitisation issuance in Europe of €217 billion and €158 billion for 2003 and 2002, respectively; the corresponding figures from our dataset are US$371 billion and US$148 billion, respectively.

B. What are launch spreads?

The 'launch spread' is the price of assets sold to investors at issue, which is characteristic of each tranche andtypically calculated as the spread in basis points over a corresponding benchmark—the same-currency LIBOR/EURIBOR rate on the date of issue—for floating rate issues. For fixed rate issues, the launch spread is equal to the coupon while the price is reported separately (if not sold at par). Launch spreads are fixed on the pricing date, subject to investors' demand, following the book building process, and confirmed on the completion date; they are printed on the front page of the issuing prospectus.[5] From our interviews we learn that in over 95% of all cases this price represents the actual price paid by investors.[6]

There are some discrepancies across different studies in the bond pricing literature with regards to the exact specification of bond spreads. In order to better capture the actual spread, adjustments and refinements to the spreads reported from the market are sometimes applied. These refinements range from simple calculations of the difference over the nearest on-the-run government benchmark security to disaggregating and matching individual cash flows to the same maturity, zero-coupon securities. Prices in European, floating-rate securitisations are almost exclusively reported against LIBOR or EURIBOR. We do not add back to the reported spreads the differential between the LIBOR/EURIBOR rate and the government benchmark in order to avoid adding a systematic risk component to our results. This also implies that the market-wide, average spread of corporate bond over the benchmark is excluded from our launch spreads' calculation in so far as it is a component of LIBOR/EURIBOR. In the case of fixed-rate

[5] Cuchra (2005) describes the timeline for an asset backed security issue.

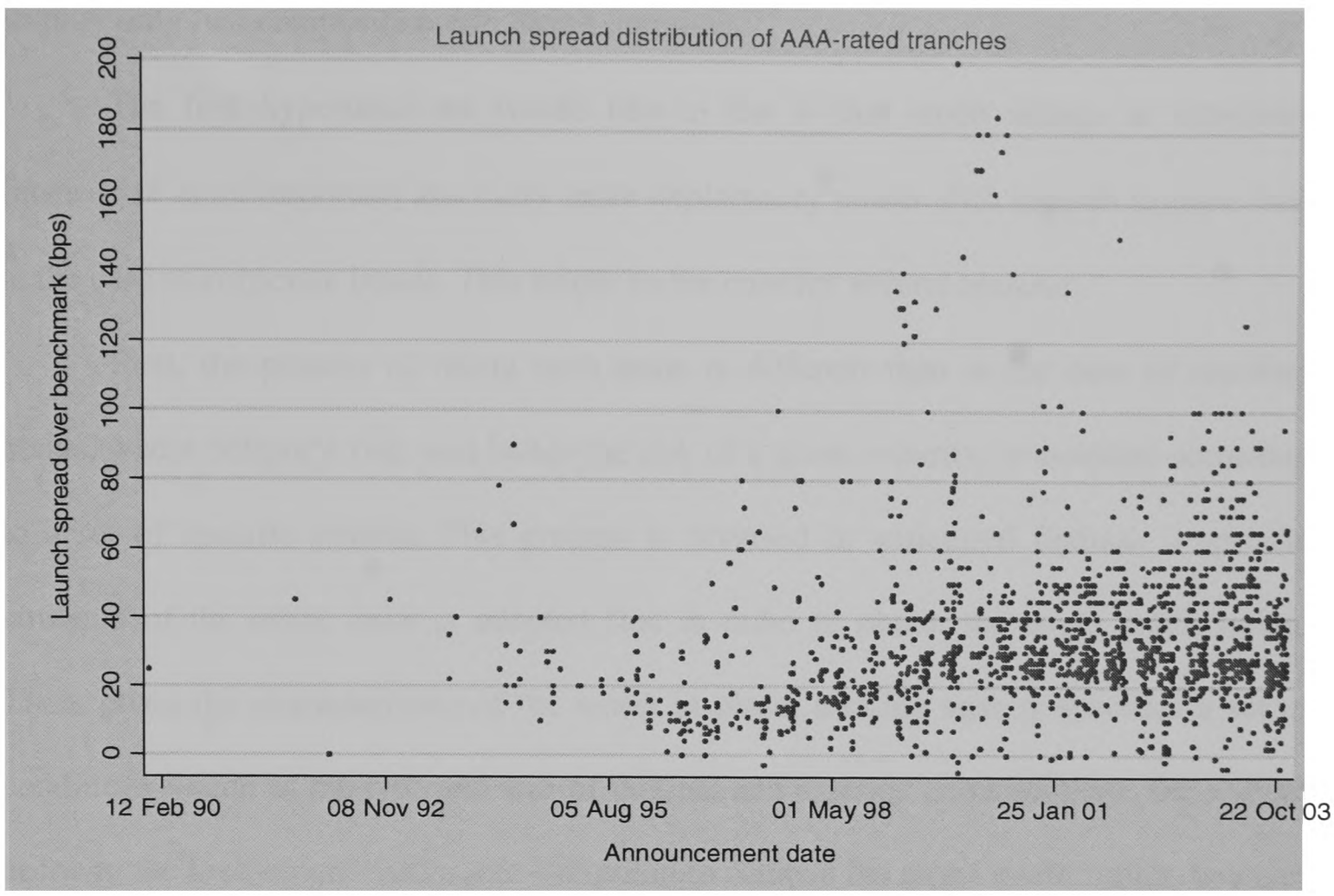
[6] In a very small portion of cases, there a client-specific discount might be applied. If present, it is typically small and part of a long-term arrangement. It is not comparable to the analogous process in the initial public offerings of equity.

issues, the relevant government benchmark is always specified in the prospectus. We study fixed-rate issues separately from floating-rate issues throughout our analysis.

Our dataset is characterised by substantial variation in launch spreads. This is true for all rating classes, including AAA-rated securities, as can be seen in Figure 1 below. The AAA-rated structured finance securities are generally characterised by higher spreads than corporate bonds, but they also represent 33.2% of all structured finance securities (rated by Moody's) versus only 1.5% for corporate bonds, as reported by Hu and Cantor (2003).[7] In general, nominal levels of structured finance spreads cannot be easily compared with corporate spreads for the same credit rating since rating models and rating processes themselves in these fixed income markets are different, according to leading credit rating agencies.[8] Moreover, Perraudin and Van Landschoot (2004), who compare the risks and spreads on structured and corporate bonds, find that while bond volatilities behave in a reasonably consistent way over time and across rating categories, ABS tranche returns exhibit significant regime changes in which "*a particular sector deteriorates dramatically with substantial increases in risk over a relatively short period*".[9] These authors also find that although AAA-rated ABS tranches appear less risky than AAA-rated corporate bonds, junior tranches of the same rating are much more volatile and exhibit considerably greater VaR levels (value-at-risk).

[7] See Hu and Cantor (2003) for more detailed comparisons between structured finance and corporate finance ratings.
[8] See, for example, www.moodys.com
[9] Perraudin and Van Landschoot (2004), p. 20.

FIGURE I



C. Credit ratings

Individual tranches in our dataset are characterised by credit ratings from either Moody's and/or Standard & Poor, and/or Fitch rating agencies; 2823 of our tranches are rated by Fitch and 3340 are rated by S&P. The largest share of tranches is rated by Moody's (70%) and 14% of all tranches are not rated at all (N/R). The CDO asset-type category represents the largest share of non-rated tranches. Our original dataset also features the 'composite' credit rating category reported by JP Morgan. The composite rating is akin to an average rating per tranche assembled from available individual ratings by different credit rating agencies; it is reported in a simplified form without refinements. In the composite rating classification there are only six rating categories in our dataset: AAA, AA, A, BBB, BB, B and the N/R (non-rated) category. We construct a rating index where these ratings are coded 6 to 0, respectively. The use of composite ratings is

typical of the empirical bond literature: Campbell and Taskler (2003), for example, employ only two composite credit rating dummies.[10]

The first hypothesis we would like to test is that credit ratings in structured finance are more important and carry more explanatory power with regards to price than in the case of corporate bonds. This might be the case for several reasons:

First, the process of rating each issue is different than in the case of standard bonds, where obligor's risk, and hence the risk of a given security, is assessed according to a set of specific criteria. This process is reversed in structured finance: a specific structure of the entire issue is adopted first in order to obtain the target credit rating. Then, given the characteristics of the assets in place, a rating agency specifies a set of conditions—such as the type and size of internal and external enhancements, the reserve account, the lock-up provisions, etc—required to achieve the target credit rating, as a part of the preliminary rating assessment.

Second, credit ratings in securitisation transactions can be assigned with more precision, given flexible structuring with the help of statistical models used to estimate payoffs. In some sense, therefore, assigning credit ratings in structured issues is more 'scientific' given that the pricing models developed by the agencies simulate the expected cash waterfall in each transaction. In contrast to standard bonds, where high-level, accounting and financial ratios are used for determining credit ratings, in the case of structured finance the agencies typically model the actual assets' payoffs and their allocations to different creditors in significant detail.

Third, for credit rating agencies, the structured issues are the single most important line of business representing, reportedly, over 70% of rating agencies' total rating fees. This means that considerable effort is made in order to determine the rating correctly in these cases.

[10] Only two dummies are used to represent the composite credit rating in this case since the authors eliminate all AAA-rated issues from their sample.

According to the credit rating agencies, the credit ratings assigned to different bonds should capture all aspects of a given issue related to the timely repayment of interest and principal, probability of default, and ability to foreclose on the assets (including expected recovery rates). The factors that are not included in the credit rating agencies' assessment are time-variant market characteristics such as market volatility, liquidity, and changes in demand and supply, as well as other, specific features related to the securities being issued including taxes or arranger's reputation, which are either subjective or not directly related to the risk of default.

D. Securitisations and asset types

Transactions in our dataset are classified as 'European' on the basis of the country of origin of assets rather than the target market for the securities issued, although we have some securities (less than 5% of the total) placed in Europe by non-European originators and some European originators with tranches placed in the US (circa 2.5% of the original dataset). The country variable we use to classify assets indicates the country where assets were originated. Overall, we have 27 countries represented in the dataset with 14 represented by more than 20 observations. United Kingdom represents the greatest share of the total with 1496 securities, followed by Italy with 437, Spain with 281, and Netherlands with 276, in addition to 561 securities classified as 'European' and 51 as 'international', which represent assets pooled from several different countries.

Our classification contains 10 basic asset-type categories specified according to the European classification of securitisations. Asset types are important because securitised assets tend to differ significantly across types, but not much within each type. Also, securitisations of the same type of assets tend to be structured in a similar fashion. For example, securitisations of credit card loans typically include 'breathing' pools designed to continuously 'churn' receivables as old receivables are repaid and new ones

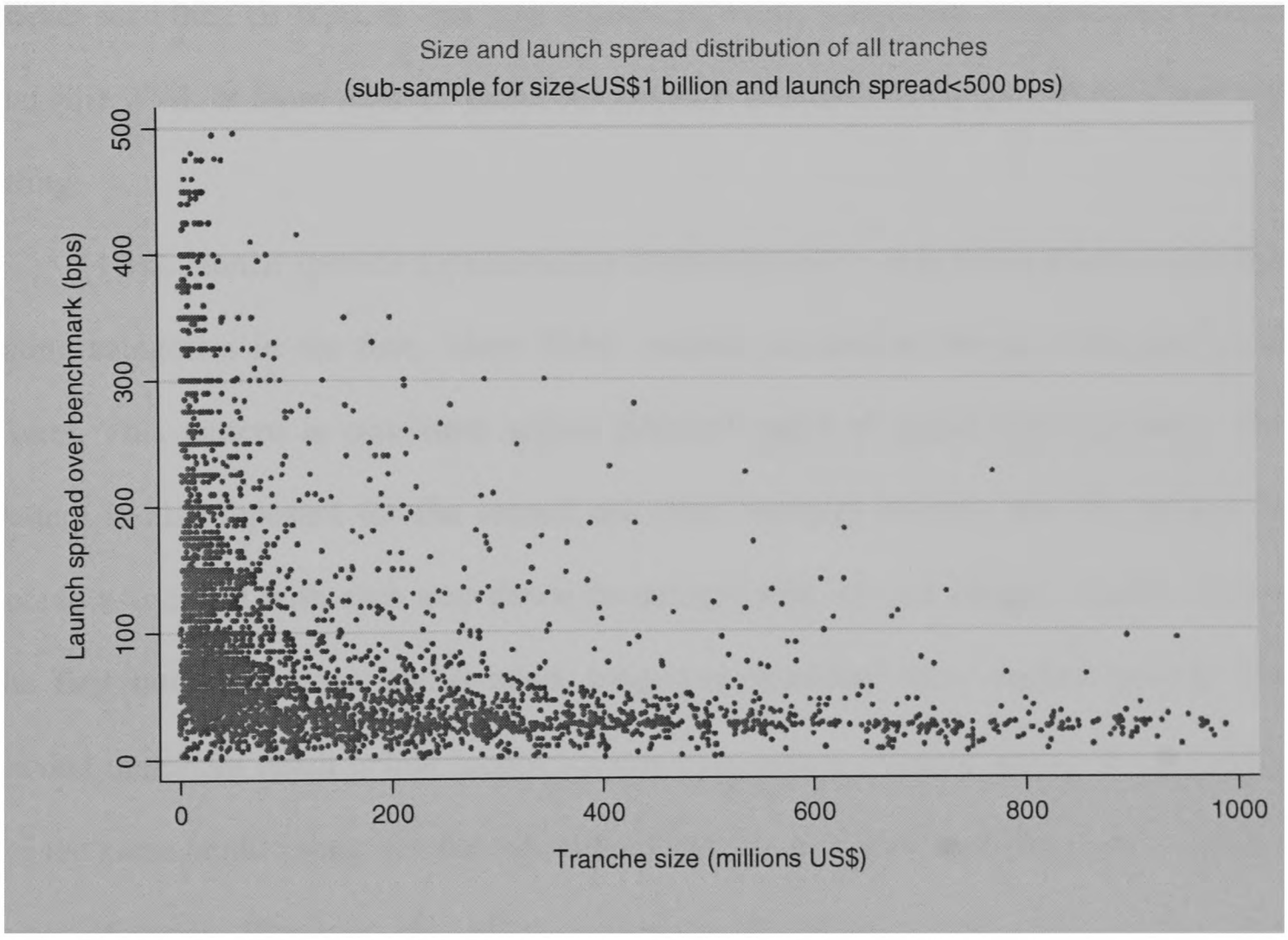
originated. The largest type-categories in our dataset are: RMBS (residential mortgages) with 1903 different securities, CDO (collateralized debt obligations) with 1730 securities issued, CMBS (commercial mortgages) with 470 securities, unsecured consumer loans with 159, and 272 atypical 'other' securities not otherwise classified. In addition to the existing classification, we create a new summary classification pooling different classes of assets into 6 broader categories according to the type of the obligor. The new classification categories are: 2373 mortgage-backed securities, 488 non-mortgage consumer transactions, 346 corporate securitisations, 41 securitisations of government assets (or those of government agencies), in addition to 1730 of CDO and 183 unclassified securities for which we have no sufficient information to classify in any of the above-listed groups.

Table I reports average launch spreads tabulated within the 'type'-'composite rating' matrix. Average spreads increase as ratings fall consistently throughout all asset categories. As expected, lowest spreads are characteristic of securitisations backed by government assets or enjoying explicit government guarantee, such as obligations of government agencies. Also, corporate assets tend to have higher spreads, as represented by the bottom three categories in the table above, whereas consumer assets form most of the remainder at the upper half of the table. This is related to the fact that consumer assets tend to be more uniform, more homogenous and hence more transparent, whereas corporate assets might carry less well-defined elements of corporate risk. The 'risk diversification effect' of pooling, as explained by DeMarzo (2005), might play a role here since consumer assets tend to be considerably more numerous for every given pool. RMBS, which are characterised by higher spreads, represent an exception to the rule, probably due to prepayment risks typically not present in consumer deals. Still, RMBS are characterised by lower launch spreads than corporate mortgage-backed deals (CMBS).

E. Primary tranche characteristics: relationships with launch spreads

There is a strong negative relationship between the launch spread and the tranche size. As can be seen in Figure 2, this is largely due to the fact that there is a substantial number of very small tranches with very high spreads and very large tranches with very low spreads. There are far fewer medium-sized tranches priced in mid-range, which suggests that tranches are constructed to fall within one of the two extremes. Nevertheless, there is also a very substantial number of small (less than US$100 million), but not overly risky tranches with spreads of 0-120 bps.

FIGURE II[11]



The relationship between size and spread is more variable and less clear within

[11] Tranches of more than US$1 billion or with spreads over 500 bps (excluded from the figure) represent less than 1% of the overall sample.

each credit rating category, as can be seen in Table II. Average launch spreads consistently fall with size in the AAA-rated and non-rated categories, but mid-size tranches tend to have higher spreads than large or small tranches in other rating categories.

In terms of maturity, the picture is also mixed, but interesting patterns can be identified. Similarly to Elton and Gruber (2001), we construct maturity buckets for each category of assets. Our buckets, however, are based on the weighted average life (WAL) rather than the nominal maturity, which is a more meaningful measure in the case of securitisations due to structured cashflows and embedded options. Reported weighted average lives (WAL) are calculated during the structuring process and reported in the prospectus, given assumed prepayment and step-up structures.[12] In Table III, for each bucket such that: (i) WAL is less than 5 years, (i) WAL is between 5 years and 15 years, and (iii) WAL is more than 15 years, we tabulate average launch spreads by composite rating.

First, launch spreads approximately double for every step down across composite rating categories in the first, 'short WAL' bucket, as well as for the total pool of all assets. This pattern is consistent across different types of assets (not reported). This pattern is also repeated for the second and third maturity buckets, but the increase in spread associated with each step down the rating ladder is now slightly smaller than in the first bucket because higher-rated, long-term securities have higher spreads. The second important result is that launch spreads consistently increase across WAL buckets for the same credit rating, for the AAA-rated and the AA-rated tranches, across different types of assets. However, this effect weakens and ultimately reverses for lower rated notes (especially for some types of assets). For example, average spreads are almost

[12] Prepayment classifications are standardized and include constant as well as variant measures of prepayment; 'step-up' structures are put in place in order to stimulate exercise of embedded options on given dates. See for example Fabozzi (2001) for more detailed explanations of weighted average life, prepayment calculations, and maturity assumptions in structured finance transactions.

identical across different WAL buckets for BBB-rated securities. The reversal for lower-rated securities is strong enough to make the 'longest-WAL' bucket characterised by the lower average spread for all rating categories analysed jointly than in the case of the 3rd 'longest-WAL' bucket.

Overall, we conclude that although spreads increase with WAL for high-rated tranches, there is no clear pattern for A- and lower-rated categories of notes. There might be several reasons for that: First, AAA-rated and AA-rated classes are more homogenous and more numerous, whereas the low-rated classes are more diverse and include the majority of risky, corporate securitisations. Related to the above, the top-rated classes tend to be more transparent and better defined in terms of associated cash flows so that the maturity (WAL) factor can be more clearly priced.

We clean up the dataset in the following way: First, we eliminate all issues, for which we cannot find the launch spread, and/or for which we cannot identify the currency, and/or for which no relevant benchmark can be found, and/or for which the key control variables are not available for at least one tranche of that issue. The key control variables include the benchmark interest rate and the shape of the yield curve at the date of issue. Second, we eliminate all issues with tranches denominated in currencies other than Euro, US dollar, and pound sterling. These issues constitute less than 10% of all issues and they are typically priced against benchmarks other than LIBOR or EURIBOR, which we cannot easily convert into spreads over LIBOR. Third, we exclude all fixed rate issues with no coupon or price data available. At the end of this process we are left with 3280 tranches (2990 floating rate issues) and 1373 issues (the average of 2.6 tranches per issue) with assets from 512 distinct originators.

IV. A REDUCED FORM PRICING MODEL OF STRUCTURED ISSUES

A. *Structural and reduced-form models*

All studies of bond spreads must make initial assumptions about the underlying pricing model. Examples of early, fully structural models of bond pricing include Black and Scholes (1973) and Ingersoll (1977). Many variations of these models have been developed and adopted since. Among the most popular structural models, Longstaff and Schwartz (1995), for example, developed a highly tractable model with variations for both the fixed-rate as well as the floating rate debt. However, full structural models pose difficulties in empirical tests due to their explicit nature and relative rigidity. Therefore, in the empirical bond pricing literature, 'reduced form' models have been gaining popularity recently.

The 'reduced form' models link multiple, exogenous, pricing factors, derived from structural models, to prices expressed as spreads above the benchmark. They investigate the impact of those factors on prices without complying with the exact specifications of structural models. Typical reduced form models include eg Duffee (1998) developed to study the relationship between treasury yields and corporate bonds, or Campbell and Taskler (2003) used in this research to study the impact of equity volatility on bond spreads. Other prominent examples include Jarrow and Turnball (1995), Duffee and Singleton (1997), or Liu, Longstaff and Mandell (2000). Multifactor, linear models adopted in this context for empirical tests allow for simple econometrics to be used to investigate significance of a plethora of potential pricing factors.

While full structural models aim to develop the *exact* pricing formulation of the actual value of a security, simpler multifactor models:

> (...) *use a less structured econometric analysis asking what observable variables are correlated with corporate bond yields cross-sectionally.*[13]

[13] Campbell and Taskler (2003), p. 2324.

According to Campbell and Taskler (2003), this approach allows for greater flexibility and avoids rigidity of full structural formulations, while still highlights critical linkages. Boudoukh et. al (1997) point out that:

> (...) *current empirical evidence favours a multifactor approach to fixed-income pricing.*[14]

In the structured finance context, some authors have even chosen a non-parametric specification for empirical test of ABS. Boudoukh et. al (1997) use a multivariate density estimation (MDE) to explain MBS pricing. They point at considerable complexity of MBS pricing to explain the need for non-parametric formulation:

> *Although financial economists have good intuition for what the MBS pricing fundamentals are, the exact form is too complex (or assumption specific) to be determined precisely from a parametric model.*[15]

In order to test for the impact of specific structuring factors such as tranching on prices of ABS, we start with a simple, 'reduced form' model of launch spreads to capture the most critical dynamics. In this specification, we incorporate standard pricing factors that earlier bond pricing models share across different models. The basic controls that we use have been derived in earlier structural models such as Longstaff and Schwartz (1995), but are often used in reduced form models as well. Derivation and basic results from our reduced form model are described in the next three sections.

Although highly transparent, the 'reduced form' models might pose problems for empirical tests of bond prices, especially in the context of structured finance issues. This is because they circumvent the entire structuring process by reducing it to a direct link between security price and general market characteristics. Since the structuring process

[14] Boudoukh et all (1997), p. 407.
[15] Boudoukh et all (1997), p. 406-7.

per se is of interest to us, especially in so far as it constitutes a critical departure from the realm of plain corporate bonds, in the second part of this paper we adopt the structural model approach. In section VIII, we develop and test a multi-factor, simultaneous equation, structural supply and demand model of the structuring process. The model allows us to investigate the nature of the structuring process by explicitly testing the structural relationships of the tranche-formation process, while controlling for endogeneity of this process. Consequently, we are able to compare the results and conclusions regarding key pricing factors from the two approaches.

B. A reduced-form model and embedded options

First, by adopting a reduced form model, we gain flexibility vis-à-vis any detailed, structural formulation. Here, we employ the standard pricing factors from the existing bond pricing models. In addition to the level of interest rates, the term structure of interest rates is typically described by a proxy for the slope of the yield curve in order to capture expectations about future short-term interest rates as well as the prevailing interest rate variation by maturity. Although simple, this specification is generally assumed to be exhaustive: Litterman and Scheinkman (1991) and Chen and Scott (1993) document that the vast majority of variation in treasury term structure can be expressed in terms of changes in the level and slope of the yield curve, although Litterman and Scheinkman (1991) also include curvature in their basic setup.

Structured finance issues pose additional challenges vis-à-vis straight bonds because they often include embedded options. All bond issues with embedded options require an adjustment to a simple pricing model in order to account for the price of the underlying option. The most important option embedded in structured finance issues is the prepayment option (written by creditors to obligors) linked to accelerated principal repayments at the obligor's discretion, where present. Some issues also include call

options and coupon 'step-ups'.[16] The established practice to deal with prepayments is to calculate the option-adjusted spread, which corrects the normal yield spread for the price of embedded options in any given issue. More specifically, prepayments are a major factor present in RMBS and some CMBS issues, since they can alter the relationship between price and interest rates as call options become valuable, resulting in the well-established pattern of negative convexity. The prepayment is also occasionally present in some ABS issues backed by consumer loans. However, there is typically no prepayment in CDO securities or in whole business securitisations and it is rare in securitisations of corporate loans, equipment loans or leases. In the case of credit card deals the early amortization is considered to be a credit event rather than a prepayment.

The prepayment option is particularly important for fixed-rate issues, typical of MBS issued in the United States, because its value is highly correlated with the time-variable level of interest rates. In our European sample, over 95% of all RMBS are floaters, for which the prepayment levels have been described as 'remarkably stable' by Hayre and Thompson (2001) and exhibit a low level of correlation with the interest rate.[17] The same authors point out that the European refinancing rates, in contrast to the US,

> (...) *have been relatively insensitive to interest rates* (...) [because] *the coupons on variable loans track prevailing mortgage rates and hence there is little incentive to refinance.*[18]

This is further reinforced by the wide-spread use of prepayment penalties and the lack of attractive prepayment vehicles.[19] In European securitisations prepayment patterns are more typically related to the country of origin of assets or other geographical

[16] Coupon step-ups coincide with call periods and are designed to provide an incentive for the issuer to call the bond at a particular time in order to avoid higher debt service costs.
[17] Hayre, L. (ed.), 2001, Chapter 27, p. 739. Nevertheless, prepayments might still be correlated with interest rates in so far as the latter reflect obligors' general financial conditions.
[18] *Ibid.*
[19] *Ibid.*

characteristics as well as the overall profile of assets. However, despite the fact that prepayment levels are reported to be uniform and stable, we want to control for the price of prepayment options at issue, given changing expectations about volatility of interest rates. Therefore, in order to capture any potential time-variant effects of prepayments on launch spreads, we include a measure of the interest rate volatility as a proxy for the price of the embedded options. This results in a basic three-factor setup similar to Duffee (1998).

At launch, each structured finance issue is priced on the basis of the information about prepayment assumptions, embedded call options and step-ups.[20] The combined effect of prepayment options and call options is expressed as the weighted average life (WAL)—the *expected* maturity calculated by the arranger given embedded options and prepayment assumptions.[21] Since WAL can be structured *per tranche*, in order to avoid the problem of endogeneity at this stage, we approximate the tranche-specific WAL with the issue-level WAL. We relax this approach in the structural model later.

Finally, prepayments might be correlated with general macroeconomic conditions and hence, indirectly, with the level of interest rates. Duffee (1998) points out that yield spreads vary more strongly with benchmark interest rates for callable versus non-callable bonds. We would expect this correlation to be weaker, however, than in the case of fixed-rate issues.

[20] Note that step-ups in the UK and other European markets are typically regulated by financial market authorities (the FSA in the UK case). Hayre, L. (ed.), 2001, Chapter 27, 28.
[21] Therefore, the nominal maturity is not a meaningful factor in structured finance issues—see Fabozzi (2001).

C. *Pricing controls*

The reduced-form pricing model for structured finance issues has a constant and five groups of controls:

$$P_{s(i),t,c}(spread) = \alpha_0 + \beta_1 \overline{\mathrm{M}}_{t,c}(market) + \beta_2 \overline{Y}_t(time) + \beta_3 \overline{L}_{i,t,c}(life) + \\ + \beta_4 \overline{Z}_{i,t,c}(size) + \beta_5 \overline{CR}_{s(i)}(rank) + \beta_6 \overline{R}_{s(i)}(rating) + \beta_7 \overline{\Pi}_{t,s(i)}(factors) + \varepsilon \quad [4.1]$$

This linear, cross-sectional model aims to explain the launch spread $P_{s(i),t,c}$ of a security s, structured as a part of issue i on the date t, and denominated in currency c. Pricing factors include both security- as well as market-specific controls: First, the model includes standard time- and currency-specific market controls aimed at capturing the impact of the prevailing market conditions at the date of issue on price ($M_{t,c}$). Second, it includes a set of time dummies (Y_t). Third, the model controls for two issue-specific characteristics: weighted average life (WAL: $L_{i,t,c}$) and size ($Z_{i,t,c}$), both in log form. Fourth, the model includes a tranche-specific seniority factor—the class rank ($CR_{s(i)}$)—which indicates the target seniority of a given tranche within the issue (ie, internal enhancement). This variable simply captures which tranche of a given issue was designated to be the most senior one, second ranked, etc.[22] Later, we also add a set of tranche-specific, credit rating controls—dummies ($R_{s(i)}$)—and a set of additional factors ($\Pi_{t,s(i)}$) that might have an impact on price. This second set can be divided into two subsets: (i) factors not taken into account by the credit rating agencies by definition, such as factors relating to market placement, and (ii) factors reported by the credit rating agencies to be a part of the credit rating process, but potentially imperfectly captured by the credit rating itself. The first subset includes mainly behavioural factors and market

[22] Tranches of the same seniority carry the same, average ranking, but same-rated tranches might differ in terms of both seniority and enhancement and, hence, have a different class-rank. The most senior tranche per issue always has the lowest rank (1 if unique).

factors, such as arranger's reputation and liquidity. The second subset includes exogenous pricing factors such as bankruptcy codes and creditors' rights.

For the basic market controls ($M_{t,c}$), we use the standard proxy for the level of interest rates (*interest rate*)—the 10-year government benchmark bond in the relevant currency—as recorded on the pricing date. We also use the standard proxy for the slope of the yield curve by calculating the '10-year minus 2-year' swap yield differential (*swap diff*) in the relevant currency of issue, on the date of issue. Finally, we measure the interest rate volatility with the implied volatility (*cap vol*) on the 5-year interest rate cap in the relevant currency of issue, on the date of issue.

For all issues with more than one tranche, we face the problem that our observations (tranches) are not completely independent since tranches belonging to the same issue are clearly correlated. This violates requirements for the OLS. In order to remedy this problem we use the Huber-White robust estimators of variance with specified clusters, which allow us to relax the independence assumption within clusters. For all our regressions, we specify groups (clusters) in the robust estimator of variance according to the distribution of tranches among different issues. We report our basic results in Table IV.

V. EXPLAINING SPREADS: MODEL CONTROLS, CREDIT RATINGS AND TIME EFFECTS

A. Testing basic model specifications

We start by testing the basic form of our pricing model (regressions I, II, and III in Table IV) excluding rating controls and additional pricing factors. We note that simple time factors are somewhat relevant (year and quarter dummies), especially with regards to pre- and post-1999 periods, but not otherwise. Next, we investigate market and issue factors independently of the time controls. Here, we estimate the model separately for

floating- and fixed-rate issues. Our initial results pass obvious reality checks: We find the coefficient on the interest rate benchmark to be negative and significant for floating rate issues, in line with results reported in other studies as well as theoretical predictions. For example, Longstaff and Schwartz (1995) argue that corporate spreads should vary inversely with the benchmark T-bill rate because a higher interest rate increases the drift of the risk-neutral process for the firm (asset) value. Others have argued that the interest rate level should be negatively correlated with the credit spread as it indicates the general level of financial performance among firms. Duffee (1998) finds that yield spreads should vary more with benchmark Treasury yields for callable than for non-callable bonds. Since many previous studies use non-callable bonds, while our issues have embedded options, we might expect the coefficient on the benchmark to be more significant than in other studies. However, Longstaff and Schwartz point out that:

> *credit spreads (...) can vary significantly if the assets of the firms [in the sample] have different correlations with changes in interest rates.*[23]

Our results are affected by the fact that values of prepayment options vary less with the interest rate level for floating rate issues (which constitute almost 90% of our sample) than for fixed rate issues.

Collin-Dufresne et al. (2001) argue that the slope of the term structure provides a measure of uncertainty in the economy. At the same time, a negative slope should indicate expectations of cuts in interest rates in the future associated with worsening economic climate and higher credit risk premiums. In line with the above predictions and results, and similarly to Campbell and Taskler (2003) among others, we find the coefficient on the slope of the swap curve to be strongly negative and very significant. This is important because similar results are reported by Boudoukh et al. (1997) for

[23] Longstaff and Schwartz (1995).

mortgage-backed securities only. In fact, this effect is highly robust to different model specifications.

We also report a consistently positive and almost always significant effect of the implied interest rate volatility (*cap vol*) on spreads. The coefficient on volatility becomes significant after we control for ratings and remains so after we add controls for the type of transaction and other controls (Tables IV, V, and VI). In general, increased interest rate volatility is predicted to make the embedded put options (prepayment options) more costly to write from the investors' perspective. This is predicted to be associated with the positive correlation between the '*cap vol*' proxy for volatility and the spread. This prediction is confirmed in our preliminary results: as expected, it is also larger in the case of fixed-rate issues. At the same time, the interest-rate volatility might be also related to uncertainty in the market. This might be even more important in our setup, since in the case of floating rate issues embedded options are likely to be less significant, after controlling for the predicted weighted average life (*issue life*).

The coefficient on the log of issue WAL (*issue life*) is positive and significant indicating that investors charge a premium for longer dated issues, as expected. At the same time, securities with longer expected maturities are likely to be characterised by greater uncertainty over their actual duration, given prepayment, which might be a source of additional risk to investors. In line with the existing bond pricing literature, we also include the issue size converted into US dollars at the date of issue, as one of our controls. Similarly to previous studies, we find the coefficient on the log of issue size to be negative and very significant. In general, the issue size is likely to act as a proxy for liquidity, but might be also related to tranching. We investigate the tranching effect on pricing in greater depth in sections VII and VIII below.

The key difference between our study and much of the earlier bond pricing literature is that all our securities are structured, which we need to control for. Structuring

is performed by creating separate tranches reportedly in order to achieve better pricing by exploiting and remedying market incompleteness and asymmetric information, or by circumventing the problems of market segmentation.[24] Since distinct tranches of the same issue differ by the degree of seniority of access to underlying collateral (among other characteristics), we create the '*class rank*' variable—an index of seniority of different tranches within each issue, as described above, which is exogenous to the model.

Our basic controls (without ratings) explain a similar or higher share of variation in spreads to those found in other studies. For example, Campbell and Taskler (2003) use pricing controls similar to ours, including a benchmark T-bill rate and a '10-year minus 2-year' T-bill differential as a proxy for the slope of the yield curve. They also control for the '30-day Eurodollar minus US$ T-bill' spread, the log of issue size, the number of years to maturity, the coupon level (used as a proxy for tax), the number of financial/industrial dummies, and a number of accounting controls; they also add the equity volatility. Their results are within the 25-41% range for R^2. By comparison, we obtain the R^2 of approx. 25% when controlling for the basic pricing controls discussed above.

B. Credit ratings as key price determinants

Given our pricing model, we can now test for the importance of credit ratings on prices. The security design literature explains creation of tranches with pre-specified credit ratings to match different levels of investors' sophistication. A credit rating of a particular tranche is achieved with the combination of internal and external enhancements. According to credit rating agencies, credit ratings reflect the probability that investors receive the interest and principal due in full *and* on time. In effect, credit

[24] See also the discussion in the previous Chapter.

ratings combine in a single index the overall assessment of multiplicity of different factors characterising each security from the perspective of risk to investors. Hence, we expect credit ratings to have the critical impact on launch spreads. When rating controls are included, our model takes the form of:

$$P_{s(i),t,c}(spread) = \alpha_0 + \beta_1 \overline{\mathrm{M}}_{t,c}(market) + \beta_2 \overline{Y}_t(time) + \beta_3 \overline{L}_{i,t,c}(life) + \beta_4 \overline{Z}_{i,t,c}(size) + \\ + \beta_5 \overline{CR}_{s(i)}(rank) + \beta_6 \overline{R}_{s(i)}(rating) + \varepsilon \qquad [5.1]$$

We find that credit ratings are indeed very important, as expected. In our sample they alone can explain a substantial portion of variation in launch spreads. For example, Moody's ratings alone (with *all* refinements) can explain as much as 42% of the total variation in launch spreads, whereas Fitch ratings can explain 34% (unadjusted for the actual number of issues rated). When credit ratings are considered on a sub-sample of all tranches rated jointly by all three credit rating agencies, markets seem to follow S&P ratings more than any other ratings in terms of initial pricing. This also indicates that there are important differences between credit rating agencies—S&P ratings explain the largest share of the total variation in spreads, followed by Moody's and Fitch (not reported).

In Table IV we report the results from testing the impact of composite credit ratings on launch spreads. In the composite rating variable we have seven rating categories (no refinements) including the N/R (non-rated) category, which is omitted. It is important to note that the composite rating measure is based on the combination of ratings from all three rating agencies. On one hand, therefore, we expect the composite variable to carry additional information vis-à-vis any individual ratings. On the other hand, however, refinements, which are lost in the case of composite ratings, might prove more important.

Our results indicate that in securitisations the composite rating is indeed more important than any individual ratings and very important overall. The composite rating variable can explain as much as 73% of the total variation in launch spreads for the floating rate and the fixed-rate issues (regressions III and IV). This clearly indicates that rating is crucial for pricing in structured finance: it also offers some evidence to support the assumption of our tranching model that a majority of investors might base their pricing decisions almost exclusively on ratings. However, we are also interested in exploring whether other factors, beyond rating, might be relevant. Finally, by comparing our results with those from earlier studies, we conclude that the importance of credit ratings in structured finance seems to be greater than in the case of corporate bonds.[25]

In the reduced form model, we use individual credit rating dummies for all credit rating measures (instead of a general credit rating index that we adopt later) in order to capture potential non-linearity of increasing the rating of a given tranche by one category (or approx. three notches). For example, a move from the AA rating to the AAA rating is reported to be associated with subtracting *circa* 30 bps of the launch spread, whereas the upgrade from the A rating to the AAA rating with a *circa* 60 bps gain. In comparison, a gap of two rating categories, between the A rating and the BB rating, is far greater than the proportional differential by two rating categories between a AAA and a single A rating (60 bps versus 350 bps). This is likely to be due to the investment grade threshold of the BBB rating level, which seems to be responsible for as much as 80% of the reported differential. In other words, achieving the minimum BBB-rated investment grade status is extremely important for pricing, whereas subsequent gains diminish substantially for each one rating category upgrade. This is further confirmed when we compare the below investment grade rating categories, which do not seem to differ from each other by more than twice the difference between the investment grade categories:

[25] One potential problem with our initial results is that in the reduced form model we do not control for endogeneity of credit ratings, which might be important in structured finance transactions. We address this issue in section VIII, although our key conclusions remain the same.

For example, B-rated securities are associated with a *circa* 60 bps discount from the BB-rated class. These results are remarkably consistent across all our regressions for floating rate issues.

C. Credit ratings, time controls, and the pricing model

Combining basic price controls with credit ratings explains 75% and 77% of total variation in launch spreads for floating- and fixed-rate issues, respectively (Table IV: regressions V-VIII). In comparison, John, Lynch and Puri (2003), who also explain launch spreads, but for corporate bonds, using a similar set of controls including the number of years to maturity (life), log of issue size, five rating dummies (composite rating categories) plus individual dummies for exchange trading, issuer's reputation, refinancing of bank debt, and collateral (which they concentrate upon), achieve R^2 of 86%. However, they do not include any market controls and their sample is considerably smaller than ours. Interestingly, the issue size never appears to be significant in their basic setup, which seems to be an exception rather than a rule in the bond pricing literature.

When we combine credit rating dummies with basic controls, all our coefficients on market factors are of similar magnitude as before, except for the class rank and the issue size coefficients, which are now substantially smaller, but still significant. This might be expected since Figure 2 clearly indicates that there is significant differentiation by size between the very risky and the almost riskless tranches. While the AAA-rated tranches tend to be very large, the junior tranches tend to be very small. This is in line with predictions of the security design literature that arrangers should aim to create large, riskless (AAA-rated) tranches.

Also, all our controls that were significant before remain significant now, including the class rank. Clearly, in the absence of rating controls, the class rank might

have acted as a proxy for ratings in as far as it reflected both the inter-rating as well as the intra-rating seniority ranking (and hence the level of enhancement) of tranches within each issue. The fact that it remains significant after the inclusion of credit ratings indicates that the intra-rating groups differentiation by enhancement is important for pricing. It also indicates that further rating refinements might be important and we should investigate them further.

The importance of ratings is consistent with the difference between our study and the results of those corporate bonds studies that have used component pricing factors, but not credit ratings, to explain spreads. For example, Collin-Dufresne, Goldstein and Martin (2001) explain changes in credit spreads with a 10-year Treasury benchmark rate, the slope of the yield curve (proxied by the 10-year minus 2-year Treasury note differential), and the implied volatility on the S&P index, as in our model. They also control for returns on the equity index, a 'jump' factor, and the issuer's leverage, but their R^2 at 20-30% is considerably smaller than for our results with ratings and in line with our results without the rating dummies.[26]

Next, we combine basic pricing controls, ratings, and time dummies (year and quarter) controlling for all the pricing factors that we investigated so far and, additionally, for any seasonal market conditions, which we might have not captured through our specification of the key market variables (Table 4: regressions VII, VIII). This is important since we might not be able to specify other time-variant pricing factors explicitly. Our results clearly indicate that time controls might indeed proxy for some important, other time-variant market characteristics, which we have not modelled explicitly: the coefficients on the year and quarter dummies are almost equally significant as before—see Table IV (regression I).

[26] Collin-Dufresne, Goldstein and Martin (2001) report a rise of R^2 up to 40% with changes in market liquidity and firm-specific equity returns, as well as non-linear and cross terms, Fama-French factors, and macro variables.

As anticipated, time controls have some impact on the magnitude and significance of coefficients on the key, daily market controls, but the overall effect is limited: all our explicit market factors remain significant, except for the interest rate, which loses some, but not all, significance. However, coefficients on proxies for the shape of the yield curve and for the market volatility are now more significant and larger than before. Moreover, for fixed-rate issues, the price at issue and the interest rate volatility are now significant, as expected, which clearly indicates an improvement in our model.

Given the significance of class rank beyond credit ratings as well as differences in significance between our results for composite ratings and for individual credit rating agencies' ratings, and the importance of ratings overall, we want to make sure that no important credit rating information is lost due to lack of refinements in the case of composite ratings, as reported before. Therefore, in order to test for the importance of credit rating refinements, we construct a new 'extended Moody's' credit rating index in the following way. We include all securitisation issues rated by Moody's with no adjustments to their original Moody's ratings (we incorporate all refinements—such as 'pluses' and 'minuses'—as separate rating categories).[27] Next, we add issues rated by the S&P, but not rated by Moody's, by translating their S&P ratings (again including all refinements) into Moody's classification according to standard translation tables provided by NERA. Finally, we repeat the same procedure for those issues rated by the Fitch, for which Moody's *and* S&P ratings are absent. Next, we decompose the so-constructed 'extended Moody's' rating index into individual rating dummies with the same model specification as before to compare against composite ratings (Table V: regression I).

[27] Recall that more securities in our dataset are rated by Moody's than by S&P or Fitch.

Despite the fact that our rating categories are now significantly more refined and include all available ratings' refinements, they still carry virtually the same explanatory power as composite rating categories with R^2 up by only 0.4%. There is also no substantial impact on the size of any of the coefficients on other control variables. Similar results are reported when the extended refinements are added after controlling for different transaction types and market segments—see further below (Table V: regressions VI, VII), but the coefficient on class rank remains significant and of the same magnitude as before. We conclude that there seems to be no significant, added effect of the credit rating refinements (beyond the information from composite ratings pooled from across different credit rating agencies) on prices of structured securities at launch.[28] We also interpret the significance of the class rank variable as indicating the importance of intra-credit rating seniority and enhancement distinctions, which are not correlated with refinements.

VI. ASSET TYPES, MARKET INCOMPLETENESS AND ARBITRAGE: THE IMPACT ON LAUNCH SPREADS

Unlike in the case of corporate bonds, backed by highly idiosyncratic cash flows, each ABS is not only secured by a pool of assets from one of the few, possible types of originators, but the assets within each category (type) also tend to be highly homogenous. Therefore, structured finance issues might be characterised by considerably less originator-specific 'noise'; however, they might also be critically dependent on the specific type of assets sold to the SPV, not least because different asset types are often associated with different transaction structures.

[28] This is an important observation in the context of our previous chapter discussion of the 'information frontier' in bond markets.

In this context, we test whether asset and transaction types have a significant impact on launch spreads, after controlling for the set of basic market characteristics, issue characteristics, time controls, and credit ratings. For credit ratings, we use the 'extended Moody's' rating index dummies, as explained above, to capture all possible refinements. We have ten basic asset types in our sample, as specified by the European securitisation classification, including auto-loans and leases, credit card receivables, CDO, CMBS, consumer loans (other than specified separately), equipment loans and leases, RMBS, whole-business securitisations, securitisations of government or public agencies obligations as well as the 'other' category for all other assets. Our results from the estimation where we include dummies for each asset type assets against the sovereign/agency category are reported in Table V.[29] Hence, our model becomes:

$$P_{s(i),t,c}(spread) = \alpha_0 + \beta_1 \overline{\mathrm{M}}_{t,c}(market) + \beta_2 \overline{Y}_t(time) + \beta_3 \overline{L}_{i,t,c}(life) + \beta_4 \overline{Z}_{i,t,c}(size) + \\ + \beta_5 CR_{s(i)}(rank) + \beta_6 R_{s(i)}(rating) + \beta_7 \Psi_{t,s(i)}(types) + \varepsilon \qquad [6.1]$$

The asset types prove to be highly significant jointly as a group and individually for some types of securitisations: auto loans, consumer securitisations, and RMBS transactions prove not to be significant as separate types. The coefficients are particularly significant for credit cards, CDOs, CMBS, whole business securitisations (WBS), and 'other' (unclassified) categories. Since the 'other' category includes many corporate issues not classified as WBS, the three asset types that are associated with the lowest relative spreads (vis-à-vis sovereign transactions) all involve corporate obligors.[30] The price differential between types of assets is substantially greater than the impact of a change in the credit rating by a single notch. Therefore, the coefficients on asset types do

[29] From this point onwards we only report results for floating rate issues because the inclusion of new dependent variables significantly limits the sample of fixed rate issues (for many fixed-rate issues we lack data on some explanatory variables).

[30] The whole business securitisations can be thought of as a special type of secured corporate bonds with uniquely protected collateral and high limits on managerial discretion imposed by financial and business covenants, whereas the balance sheet CDOs represent pools of underlying corporate bonds or loans.

not seem to reflect different quality of assets across types, unless credit ratings are not comparable across different types. In general, corporate securitisations might be expected to carry more risk or might be less transparent than transactions with consumer obligors because general corporate assets are less diversified and less homogenous. We interpret these differences as indicating a premium for greater opaqueness of general corporate assets. This finding is also reflected by the fact that the 'other' (unclassified) assets category contains a highly diversified group of non-standard corporate issues.

In order to better understand the differences between different types of transactions and different obligors, we estimate our model separately for each asset type. Any fundamental differences in our estimates with regards to the effect of type on price could indicate that important structuring differences exist between different types beyond pricing controls specified in the earlier version of our model and imply that different asset types should not be jointly tested. We report results for the comparison between RMBS, CDO and consumer loans: these three types of transactions jointly represent almost 80% of all our floating rate issues. We test the model under the same specifications as before, but in order to differentiate between different types of CDOs, we also include a dummy for the balance sheet versus cash flow (synthetic) CDOs.[31] Among different asset types, RMBS and CDOs probably exhibit the most significant differences vis-à-vis each other. RMBS feature consumer obligors, prepayment options, as well as highly homogenous, small, and numerous individual assets (real estate) with limited structuring. In contrast, CDOs typically feature corporate obligors, no prepayment options; they are also characterised by considerable structuring and include highly diversified assets with considerably larger and hence significantly fewer individual assets within each asset pool.

[31] See Chapter 1 for further discussion of the CDO market.

Despite these differences, the coefficients on all controls within our model, when estimated separately for each of the two categories, are similar and of the same sign (where significant) in all cases except for WAL (Table V: regressions III-V), as expected. The coefficient on WAL is negative and highly significant in the case of mortgages—presumably reflecting greater uncertainty and the cost of prepayment options for issues with shorter expected maturity—but positive and insignificant for CDOs. The other important difference concerns the coefficient on the level of interest rates since prices of CDOs do not exhibit the typical negative relationship characteristic of other types. Moreover, the synthetic CDOs demand a significant premium of approx. 30 bps according to our results vis-à-vis the balance sheet CDOs. We also report results for consumer issues, but these turn out to be largely insignificant on their own, probably due to a limited sample.

Finally, we turn to investigate the importance of time-specific, market characteristics, which vary by issue and might encourage the creation of particular tranches (Table V: regression VI, VII). More specifically, the hypothesis that we want to test is that particular tranche characteristics might be related to the degree of market segmentation at the time of issue. Some possible explanations include market incompleteness or valuable market niches that arrangers seek to exploit. In order to test the effects of any such lenient variables that we do not observe directly, we proxy these tacit market conditions with the number of tranches from the same 'family', where each 'tranche family' is defined as combining tranches of the same type, currency, rating, and WAL bucket, issued in the same month, in the previous month, or in the next month, from the date of issue. We find that the total number of tranches issued in the current month combined with the number of tranches issued in the lead and lag months has a weak, *positive* effect on price (*negative* effect on spread). When disaggregated, this effect proves to be associated primarily with the number of tranches of the same family issued

in the current and next month (not reported). This could be interpreted as indicating that arrangers are able to successfully exploit market incompleteness and market segmentation resulting in clustering of similar issues until relevant arbitrage opportunities in the particular market segment(s) are exhausted.

VII. TRANCHING AND PRICING AT THE TRANCHE LEVEL

We now turn to test the effect of tranching (as predicted by our tranching model) on pricing, using the reduced form model developed in section IV. In contrast to the analysis in the last section of the previous chapter, we now investigate the impact on price at the individual tranche level rather than at the issue level. In section VIII, we investigate the effect of tranche-structuring more fully by developing a model of structuring along several dimensions; here we limit ourselves to the investigation of the effect of the number of tranches on prices. We also investigate the impact of the disaggregated number of tranches—ie the *predicted* number of rating groups and market classes, which might be associated with asymmetric information and a degree of market incompleteness, as introduced in the previous Chapter.

First, we would like to test whether a higher predicted number of tranches is associated with a lower launch spread per tranche.[32] Since size is a key determinant of the number of tranches, we expect some of this effect to be accounted for by tranching. However, the issue size might also be important independently of tranching. First, if there is limited market segmentation then the issue size might be a proxy for liquidity; second, it might act as a proxy for originator's reputation or size, which could be independent of any structuring, as discussed before. However, we would expect the latter effect to be less important for securitisation issues than for corporate bonds, since pools

[32] Note that we are not testing here whether tranching is efficient or whether it adds value directly. As before, since our tranches within the same issue are clearly related, all our Hubber-White standard errors incorporate adjustments for clustering by issue.

of securitised assets are likely to be less idiosyncratic across originators than the originators themselves. Also, a positive coefficient on size would indicate that placing a large issue is associated with a discount *despite* tranching. For comparative purposes, we include a test using the *actual* rather than *predicted* number of tranches (regression II).

The new model specification now includes the tranche characteristics vector T:

$$P_{s(i),t,c}(spread) = \alpha_0 + \beta_1 \overline{\mathrm{M}}_{t,c}(market) + \beta_2 \overline{Y}_t(time) + \beta_3 \overline{L}_{i,t,c}(life) + \beta_4 \overline{Z}_{i,t,c}(size) + \\ + \beta_5 \overline{CR}_{s(i)}(rank) + \beta_6 \overline{R}_{s(i)}(rating) + \beta_7 \overline{\Psi}_{t,s(i)}(types) + \beta_8 \overline{\mathrm{T}}_i(tranches) + \varepsilon \quad [7.1]$$

The estimation results are presented in Table VII. We start by noting that the issue size has a significant and negative impact on the launch spread (regression I)—ie a positive impact on prices paid by investors. We also note that although the coefficient on the number of tranches is insignificant, the issue size remains very significant and of roughly the same magnitude as before. At the same time, other coefficients have the expected signs and magnitudes, although the coefficients on the interest rate level and WAL per tranche are no longer significant.[33]

We now predict the aggregate total number of tranches per issue using our model outlined in section IV of Chapter 3 (regressions III and IV), including all individual asset types (to proxy for the asymmetry of information and any other potential, type-specific characteristics) as well as the year index (to capture differences in investors' sophistication and market development) and the issue size (to capture tranching due to market segmentation, incompleteness, and liquidity effects). Our model also includes WAL and the quality of assets per issue (proxied by the weighted average rating per issue) as well as our standard set of market factors: the interest rate, a proxy for the slope of the yield curve, and the implied market volatility, which we use to proxy market

[33] Note that we are implicitly assuming that weighted average life *per tranche* is exogenous to the model. We relax this assumption in the next section.

segmentation and incompleteness, as explained before. For comparative purposes, we use the ordered logit as well as the least squares method.

Although the coefficient on the predicted total number of tranches is not significant in either case, it is consistently negative and considerably stronger as well as more significant in the case of predictions made using the ordered logit first-stage regressions (other differences between two models are relatively minor).[34] Note that, if significant, it would imply a positive relationship between the number of tranches and price. Under the assumption of the optimal number of tranches chosen by the arranger to maximize the value of assets, a positive correspondence between the predicted number of tranches and price could indicate that for issues with a higher optimal number of tranches arrangers are able to achieve a better price, controlling for other factors. That is, in circumstances predicted by our model to be associated with more tranching (at the optimum), the price effect of those circumstances *via tranching* is positive. This could also imply that, given arranger's access to structuring technology and hence 'ability' to tranche, greater market sophistication, asymmetric information, market incompleteness, and all other factors that our model associates with more tranching, would have the *cumulative* positive effect on price.

However, a negative relationship between the number of predicted tranches and price would not necessarily imply that tranching is inefficient or that it does not add value. Instead, it would seem to indicate that in issues with a higher optimal number of tranches arrangers are still achieving lower prices, *despite* the potential, positive effect of tranching, as explained above.[35] This would imply that factors such as asymmetric information or market segmentation, which we have associated in our model with a

[34] When using the OLS, we predict the log of the number of tranches (to avoid the problem of normal distribution and truncation of the sample at zero) and then convert our predicted logs into the actual number of tranches. We do not use the OLS for separate rating groups/additional same-rated market classes predictions as they contain 226/709 'zero' outcome observations, respectively.

[35] That is, in circumstances predicted by our model to be associated with more tranching, the price effect of those circumstances affecting the price via tranching would be negative.

higher optimal level of tranching, would have a net *negative* effect on price. In this case, tranching could be preventing investors from discounting those issues even further, but we do not find evidence to support this interpretation.

Our results also indicate that the impact of the issue size remains of consistently similar magnitude. This seems to confirm the hypothesis that: (i) either the market is less segmented than expected, or (ii) tranching is successful in remedying the problem of market segmentation in as far as the latter calls for more tranching. In other words, it indicates that tranching seems to be removing any potential downward sloping demand curve effect, which would imply a price discount on larger issues. This conclusion is consistent with the positive relationship between the predicted number of tranches and price, if tranching is indeed able to remedy the segmentation problem, while extracting additional benefits under the circumstances where a higher number of tranches is optimal.

To better understand these issues, we now independently predict the number of the uniquely-rated rating groups and the number of same-rated market classes per issue using an *ordered logit* model (regression V) and then add them up to get the composite, total predicted number of tranches. We suspect that the predicted composite number of tranches might be more precise than the total number of tranches where both groups are jointly predicted. However, the coefficient on the number of tranches is still insignificant while being of the same magnitude and direction as before. It is worth noting that the coefficient on size is no longer significant, but remains of the same magnitude and direction.

In order to capture potentially different relationships between prices of securities issued and market conditions in situations where (i) a higher number of rating groups is optimal, and (ii) a higher number of the same-rated market classes is optimal, separately, we now enter these measures of tranches independently, one-by-one, into our pricing

model (regression VI and VII), as specified before. The coefficient on the rating groups is now large, negative and significant (regression VI). This positive correspondence between the predicted number of rating groups and price indicates that, for issues with a higher optimal number of rating groups, arrangers are able to obtain better prices from the market. In other words, in circumstances predicted by our model to be associated with more rating groups being created—i.e. where there is greater investors' sophistication, more information asymmetry, and greater diversification across investors—the effect of those circumstances on price *via tranching* is positive (given arrangers' access and the optimal use of the structuring technology). It follows that tranching seems to be allowing issuers to exploit market factors such as asymmetric information to their advantage with the help of the structuring policy (in response to market and assets' characteristics of a particular issue).

In contrast, the coefficient on the same-rated market classes remains insignificant despite being consistently negative (regression VII). This is confirmed when we enter both groups of tranches together in regression VIII: the coefficient on the rating classes remains large and significant, but the coefficient on the same-rated market classes remains insignificant. This further supports the hypothesis that tranching might be successful in remedying the problem of market segmentation (where present) so that large issues associated with a higher number of market classes, when tranched, do not carry a negative impact on price. If the coefficient on the same-rated market classes were positive, tranching could still be adding value by diminishing any potential 'segmentation discount' on price, but the net effect would remain negative.[36] Instead, the observed relationship is positive (the coefficient is negative), but not significant.[37]

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[36] Assuming tranching is optimised to add value, a positive coefficient would indicate that although tranching might be able to remedy some effects of market segmentation, it cannot remedy it completely with a residual negative effect on price in the case of those issues where more market classes are optimal. Again, we do not find evidence to support this interpretation.

[37] Although the net effect on price seems to be positive or zero in this case, it could be due to factors other than the presumed successful response to the market segmentation problem. For example, insofar as our first-stage model is capturing tranching with the same-rated classes due to market incompleteness, the positive impact on price from

VIII. THE SIMULTANEOUS EQUATIONS MODEL OF TRANCHE STRUCTURING

A. A model of structuring

While a reduced-form model might be useful for broad investigations of general pricing factors in the bond markets, it might have three important disadvantages in the case of structured finance: (i) it can provide no insight into structuring *per se* because it effectively bypasses structuring in the model formulation, (ii) it cannot capture the demand and supply dynamics present in the bond markets and hence cannot fully account for endogeneity of supply, and (iii) they ignore all the available information about the conduct of the structuring *process* itself.[38]

In order to address these problems and develop a more complete model focused on structuring issues, as well as to conduct robustness checks with respect to our previous analysis, we develop a structural supply and demand model of price effects of ABS structuring at the individual tranche level, which consists of six simultaneous equations (see Table VII for the summary of model equations). The first, demand equation is an extension of the demand formulation from the reduced form model, but it now explicitly links two endogenous variables: (i) price (spread) $P_{s(i),c,t}$ and, (ii) quantity demanded $Q^{d}_{s(i),c,t}$ per tranche (tranche size). It also incorporates two other structuring variables now assumed endogenous to the model: the expected life per tranche $L_{s(i)}$ and the tranche rating $R_{s(i)}$. Another critical structuring characteristic—the *predicted* tranches vector T_i (which includes the number of *predicted* market classes MC_i and rating groups RG_i per issue)—now enters the model through: (i) the supply equation, in as far as it constraints arranger's choices regarding relative sizes of individual tranches, (ii) the

additional, same-rated tranches aimed to exploit market niches, might be neutralizing the negative effect of market segmentation, which tranching is unable to remedy completely.

[38] For example, in contrast to our analysis, a similar study of pricing factors in securitisations focused on the implicit recourse to originators in the credit-card segment—Gorton (2005)—does not correct for endogeneity, albeit acknowledging its presence.

subordination equation, since it determines the seniority sequence, and (iii) the demand equation, because the number of different tranches structured in a particular deal is hypothesised to influence the demand. This means that tranching might also have a direct effect on pricing in as far as it affects investors' choices by addressing the potential problems of asymmetric information, market segmentation, and incompleteness (clientele effects). Finally, we add exogenous controls including our standard time Y_t and market $M_{t,c}$ factors, the vector of asset type controls Ψ_i, and the vector of market segment characteristics $\Phi_{i,t,c}$.[39] Later, we also add a set of additional, issue-specific exogenous factors $\Pi_{i,t}$, which might be associated with structuring, and which we would like to investigate with respect to their potential impact on price.

As before, the market segment variables focus on alternative investment products—ie securities of the same 'tranche family'—representing market segments. These are assumed to be linked to exogenous demand factors, such as market incompleteness or market segmentation, as explained above, and hence might have an impact on the demand for security *s(i)* at time *t*. Again, we proxy these exogenous factors by calculating the cumulative number of other ABSs, characterised by the same currency, rating, and the (expected) maturity bucket, issued in the same month, in the month before, and in the month after the issue date. From the market incompleteness perspective, we expect the number of similar securities issued at the same time to have a positive impact on price (negative impact on spread) as the market segment offers arbitrage opportunities to structuring. However, in the absence of market incompleteness, but in the presence of market segmentation, a large number of similar securities should have a negative impact on price (positive impact on spread) akin to the effect of close substitutes. Overall, we estimate the following demand equation:[40]

[39] Our specification of market variables in this context also includes the square of interest rates term (Tables VIII and IX).

[40] A single bar indicates an exogenous variable; a double bar indicates a predicted variable from the first stage model.

$$\log P_{s(i),t,c}(price) = \alpha_0 + \beta_1 \log Q^d_{s(i),t,c}(demand) + \beta_2 R_{s(i)}(rating) + \beta_3 L_{s(i)}(life) +$$
$$+ \beta_4 \overline{\overline{RG}}_i(rating.groups) + \beta_5 \overline{\overline{MC}}_i(market.classes) + \beta_6 \overline{\Phi}_{s(i),c,t}(segments) + \qquad [8.1]$$
$$+ \mathrm{B}_7 \overline{M}(market)_{t,s(i)} + \mathrm{B}_8 \overline{Y}(time)_t + \mathrm{B}_9 \overline{\Psi}(types)_i + \mathrm{B}_{10} \overline{\Pi}(factors)_{s(i),c,t} + \varepsilon$$

The supply (tranche-size structuring) equation focuses on the decision by the arranger to determine the relative sizes of tranches, given the number of tranches determined at the issue level.[41] In Chapter 3, we estimated the number of tranches disaggregated into the number of rating groups within each issue differentiated by rating, and additional market classes differentiated within existing rating groups by factors other than rating, e.g. currency or maturity, according to different theories of security design. Specifically, we estimated the total number of tranches T_i per issue using the following model:

$$MC_i = \upsilon_0 + \upsilon_1 I(asymindex)_i + \upsilon_2 Y(yearindex)_i + \upsilon_3 L_i(issuelife) + \upsilon_4 R_i(issuerating) + \upsilon_5 Z_i + \varepsilon_i$$
$$RG_i = \upsilon_0 + \upsilon_1 I(asymindex)_i + \upsilon_2 Y(yearindex)_i + \upsilon_3 L_i(issuelife) + \upsilon_4 R_i(issuerating) + \upsilon_5 Z_i + \varepsilon_i \qquad [8.2]$$
$$T_i = RG_i + MC_i$$

Here, we use these predicted variables, same as in the previous section, as inputs into the structural model, by assuming that sizes of particular tranches are set by the arranger at the second stage of the structuring process, *given* the overall number of tranches to be issued (determined *a priori*). In other words, we assume that any decision about the overall number of tranches, as determined by factors outlined in Chapter 3, takes place prior to determining the relative sizes of particular tranches.[42] This two-step approach separates the issue-level structuring decision from the tranche-level structuring

[41] Note that the number of tranches, rating groups and market classes is predicted at the higher level of aggregation—the issue level—as per the analysis in Chapter 3.
[42] The decision about the number of tranches to be issued often takes place well in advance of any decision about the relative sizes of tranches. Therefore, we do not see this assumption as a limiting factor in our model.

decision. We assume that the first decision must be taken up-front before any specific quantities and other characteristics can be set.

The supply equation links the size of each tranche with its price (expressed in terms of the spread in basis points over a benchmark) at which $Q^s_{s(i),t,c}$—the amount of security *s(i)*—is supplied to the market by the arranger. The supply and demand equations determine the equilibrium quantity $Q^s=Q^d$ at price P. The critical exogenous factors that is assumed to determine the supply, but not the demand, for security s(i), is the overall size Z_i of issue i, to which a given tranche belongs, as well as the total number of tranches in the issue i. The above ensure identification of supply in the model. In effect, the arranger must divide the issue i into T_i tranches, given the overall size of the asset pool Z_i in issue i to be sold into the market. We assume that the issue size Z_i is set exogenously by the originator prior to the structuring process. Other exogenous variables in the supply equation include our standard controls with time and market factors and the vector of asset type controls. Hence, the overall supply equation we estimate is:

$$\begin{aligned}\log Q^s_{s(i),t,c}(Supply) &= \alpha_0 + \alpha_1 \log P_{s(i),t,c}(price) + \alpha_2 \overline{\overline{T}}_{s(i)}(tranches) + \\ &+ \alpha_3 \log \overline{Z}_i(size) + \mathrm{A}_4 \overline{M}(market)_{t,s(i)} + \mathrm{A}_5 \overline{Y}(time)_t + \mathrm{A}_6 \overline{\Psi}(types)_i + \varepsilon\end{aligned} \qquad [8.3]$$

Although the overall quality of assets in any issue is exogenous to the model, the rating *per tranche* is endogenous, because it results from the relative sizes of tranches chosen by the arranger. The seniority ranking of different tranches within each issue vis-à-vis each other constitutes the internal enhancement. In practice, the actual rating of each tranche is determined by the credit rating agency using a probabilistic model of default, given the tranche designated level of seniority and hence its subordination level within the issue (subject to sizes of other tranches) as well as the particular issue's overall

quality of assets. We use the calculated weighted average spread per issue S_i (based on the *actual* prices per tranche) to proxy for the quality of assets *per issue*:

$$\overline{\overline{S_{i,t}}}(asset.quality) = \sum_{s(i)=1}^{\overline{\overline{T_i}}} \left(Q_{s(i),t,c} \times P_{s(i),t,c} \right) \qquad [8.4]$$

For the level of subordination, we first calculate the actual level of subordination for each tranche based on the original data and then estimate the subordination equation [8.6] below by assuming that the level of subordination per tranche is endogenous. The true level of subordination per tranche (the actual 'internal enhancement') can be defined as the ratio of the total sizes of all tranches junior to the given tranche to the overall issue size (e.g. 70% for the US$30 million senior tranche of a US$100 million issue).[43] Hence, the true subordination level of tranche *s(i)* is:

$$SUB_{s(i),t} = \frac{\sum_{s=1}^{CR_s<CR^*} Q_{s,t,c}}{\overline{Z}_i} \qquad [8.5]$$

Our estimated subordination level in the model is the linear approximation of the actual subordination level. The approximated subordination level is calculated using the *predicted* number of tranches per issue T_i; issue size Z_i; designated seniority ranking of a given tranche—the 'tranche rank' $TR_{s(i)}$; and tranche size $Q_{s(i),t,c}$, where the latter is endogenous to the model.[44] The subordination level is the function of the tranche rank

[43] We assume that all *external* enhancement is incorporated into our proxy for the quality of assets in the pool at the issue level A_i.

[44] In contrast to the 'class rank', the 'tranche rank' is a relative rather than an absolute measure of designated seniority ranking within a given issue. For example, the mezzanie tranche of an issue with 3 predicted tranches will have the class rank of 2 and the tranche rank of 33%. The senior tranches within a given issues will always have the class rank of 1, but they are likely to have different tranche ranks, subject to the number of subordinated tranches.

(within the issue) because the latter determines the level of internal enhancement necessary to achieve the designated seniority rank vis-à-vis other tranches.[45] Hence:

$$SUB_{s(i),t}(subordination) = \varphi_0 + \varphi_1 \log Q_{s(i),t,c} + \varphi_2 \overline{Z}_i + \varphi_3 \overline{TR}_{s(i)} + \varphi_4 \overline{\overline{T}}_i + \varepsilon \qquad [8.6]$$

The tranche size-structuring process via tranche subordination determines the rating per tranche in all structured issues. While the quality of the asset pool and the type of assets might determine the overall, *implicit* rating per issue, each tranche is rated vis-à-vis other tranches in the same issue subject to its size and its designated seniority within the issue.[46]

However, modelling subordination explicitly, as we do, might still be insufficient to capture all internal and, in particular, external enhancements, especially with regards to the creation of the AAA-rated tranches, which might be uniquely important to the structuring process. Therefore, we use another structuring equation to estimate a dummy indicator for the AAA rating per tranche where we replace the number of tranches with the number of rating groups and add the class rank measure, as introduced before, to the tranche rank:

$$AAA_{s(i),t} = \theta_0 + \theta_1 \log Q_{s(i),t,c} + \theta_2 \overline{CR}_{s(i)} + \theta_3 \overline{TR}_{s(i)} + \theta_4 \overline{\overline{RG}}_{s(i)} + \varepsilon \qquad [8.7]$$

[45] Note that the process of designating seniority of individual tranches is taken up-front and hence must be exogenous to the model—it has no impact on the final equilibrium. This is because, given T tranches (rating groups) per issue, the arranger ranks tranches by seniority implicitly *prior* to determining other characteristics that will distinguish the tranches from each other. For example, if two tranches of a 2-tranche issue swap their respective ranks (prior to the structuring process), the result of the new structuring process would be the exact, mirror image of the old structuring process.

[46] Therefore, the tranche-rating process is largely pre-determined by the arranger's choices regarding enhancement levels per tranche. In practice, arrangers' models, although imperfectly, try to approximate the credit rating agency model in order to correctly anticipate the rating of each tranche up-front. During the consultation process, any potential differences are discussed and addressed.

The credit rating decision by the credit rating agency is therefore the function of the subordination level per tranche, the overall quality of assets at the issue level, the tranche size, and the probability of becoming a AAA-rated tranche (for example, given that a tranche has been designated to become the most senior in the issue).[47] In this model, we estimate a single rating variable—the rating index—to represent the overall rating, as introduced in section 2 of this chapter. The rating index allows us to estimate a single linear relationship for the tranche rating:

$$R_{s(i),t,c}(rating) = \rho_0 + \rho_1 \log Q_{s(i),t,c} + \rho_2 SUB_{s(i),t} + \rho_3 AAA_{s(i),t,c} + \rho_4 \overline{\overline{S}}_i + \rho_4 \overline{\overline{RG}}_i + \rho_4 \overline{\Psi}_i + \varepsilon \quad [8.8]$$

Finally, the second important structuring dimension of each tranche within each issue in addition to size (and hence rating) is the expected maturity or WAL of each tranche, as determined by both the level of subordination and the tranche size, in addition to exogenous factors. In a way analogous to the importance of the issue size on the size of each tranche within that issue, the key exogenous factor determining WAL per tranche is the expected maturity of the entire issue, which is exogenous to the model (it reflects the characteristics of the asset pool) and ensures identification:

$$\overline{\Lambda}_i(issue.life) = \sum_{s(i)=1}^{\overline{\overline{T}}_i} \left(Q_{s(i),t,c} \times L_{s(i)} \right) \quad [8.9]$$

Hence, the expected life per tranche must be longer the longer is the WAL of the entire issue and the lower is the level of subordination for the particular tranche under consideration, as junior tranches are prepaid first. The latter implies that the seniority ranking of the rating groups effectively determines ranking of the rating groups in terms

[47] The rating equation also includes control dummies for the type of assets in the pool.

of their expected lives. Therefore, the WAL (life) per tranche is estimated in the model according to:

$$L_{s(i)}(life) = \lambda_0 + \lambda_1 \log Q_{s(i),t,c} + \lambda_2 \overline{\Lambda}_i + \lambda_3 \overline{TR}_{s(i)} + \lambda_4 \overline{\overline{RG}}_i + \varepsilon \qquad [8.10]$$

Note that the model specification outlined in this section complies with the critical autonomy requirement for any simultaneous equations model since our structural equations represent economic decisions of different agents and they model actual causal relationships of the structuring process.

B. Testing model specifications

We estimate the simultaneous equations model described above using the three-stage least squares GMM estimator (3SLS), which is likely to be more efficient than the two-stage estimator in this context. The 3SLS model offers the additional benefits of not only allowing for numerous endogenous variables, but also for non-zero covariances between the error terms across structural equations, which are likely in this case, for some of the constituent equations. Our results are presented in Tables VIII and IX.

We start by inspecting the predicted causal relationships between the main variables. The model clearly passes obvious reality checks for a supply and demand model, as can be deduced from Table VIII (regression I). In the demand equation we note a highly significant, *negative* relationship between the quantity demanded and price (i.e. a *positive* relationship between quantity and spread)—indicating a downward sloping demand curve, as predicted by the market segmentation theory. Similarly, the supply equation exhibits a strongly significant, *positive* relationship between the quantity supplied and price (i.e. a *negative* relationship between quantity and spread), also as expected. Our results imply that arrangers would enlarge a given tranche by over US$1

million for approx. every 1 bps discount in the spread (i.e. an increase in the price of assets sold) in each, specific market segment. At the same time, investors charge a premium of just over 1 bps for every additional US$5 million, implying that the demand per tranche is relatively elastic with respect to price.[48] In contrast, in the case of perfect financial markets, we would expect an infinitively elastic demand in any segment, equivalent to no market segmentation.

A majority of our market controls are significant and of expected sign. In particular, there is a strong *negative* relationship between the interest rate level and the spread and a *negative* relationship between the spread and the proxy for the term structure of interest rates (the 'swap diff' term), as expected.[49] Although our proxy for volatility is not significant in the basic setup, it becomes significant and exhibits the expected sign in other model specifications discussed below. Overall, our model appears to correctly capture the expected relationships between the key market factors and the launch spread.

Recall that the subordination variable approximates the level of internal enhancement for a given tranche in the issue (subordination from other tranches), relative to the size of the entire issue. In this context, our results exhibit the expected, highly significant, *positive* relationship between the level of subordination and the tranche rank, implying that a given tranche enjoys greater (internal) enhancement from other tranches, if it is designated to be more senior (i.e. if more tranches are *a priori* designated to be of lower seniority), as expected.[50] Controlling for the tranche rank within the issue, any increase in the issue size offers greater enhancement for a given tranche—the issue size is *positively* correlated with the subordination variable. Also, *given* the tranche rank, a higher predicted number of tranches within the issue implies *more* tranches subordinated

[48] This result might be partly influenced by high elasticity of demand in the AAA-rated segment.
[49] We also report a negative relationship between the interest rate squared and the spread per tranche.
[50] Recall that the class rank starts from 1 for the tranche designated to be the most senior tranche in a given issue and *increases* for more junior tranches. At the same time, the rating index is 6 for AAA-rated tranches and *decreases* for lower-rated tranches.

to a given tranche, since extra tranches are typically added at the junior level—this is reflected in the *negative* sign of the estimated coefficient on the predicted number of tranches and the subordination level.

A higher level of subordination (enhancement) has a strong and *positive* impact on the rating per tranche, as expected, since subordination determines the allocation of losses in any issue.[51] Even stronger is the effect on price of the likelihood of a tranche becoming AAA-rated, which exhibits a very strong and *positive* impact on the rating index. This is expected, since AAA-rating is the key value level of the rating index that we estimate directly. Similarly, the overall quality of the asset pool within the issue, as proxied by the actual weighted average price per issue, has a strong *positive* impact on the rating (as exhibited by the *negative* relationship between the issue spread and the rating index). Finally, since the additional rating groups per issue are typically created at the mezzanine and junior levels of seniority, a higher number of rating groups per issue has the expected *negative* impact on the rating per tranche. It is also worth noting that the reported R-squares are positive and high for all equations in the model. This seems to indicate, not only that our structural model effectively captures the causal relationships between the key variables, as reviewed above, but also that it is quite successful at predicting the actual values of structuring variables and the resulting prices.

C. Tranching and structuring effects with the structural model

A higher number of rating groups has a strong, *positive* effect on price (*negative* effect on launch spreads) as can be seen from the estimated demand equation in Table VIII (regression 1). The effect of market classes is also positive, albeit barely significant. This could be interpreted as implying that arrangers are able to successfully exploit level of investors' (as well as markets') sophistication and their differentiation among

[51] Recall that the AAA rating is the equivalent of the rating index of 6 and diminishes with each rating downgrade.

themselves (asymmetric information), where present, via structuring, in order to obtain better prices. Moreover, the effect of market classes weakly supports the previous evidence on market segmentation and market incompleteness. Controlling for this positive effect of the overall tranche-structuring on price, via both the number of rating groups and the number of market classes—i.e. after taking into account the advantages of structuring—investors seem to be facing a downward sloping demand curve in each market segment. That is, an increase in the quantity per tranche, while holding structuring constant (a fixed number of rating groups and market classes), has a detrimental effect on price of assets sold. In other words, arrangers experience a discount for placing larger tranches without structuring.

In order to confirm this finding we conduct the following robustness experiment. If market segmentation is unrelated to tranching, then removing the tranche structuring variable from the demand equation should not affect the observed segmentation effect. In Table VIII (regression II), we estimate our model again, but we now omit the effects of structuring on price by removing the predicted number of tranches as controls. Although all other relationships in the model remain the same and as expected, there is now a weak, *positive* relationship between quantity and price. This seems to be due to the omitted variable bias and can be interpreted as indicating that arrangers still face segmented markets, but now the model does not capture this relationship since the effect of structuring is not delineated from the effect of placing a larger tranche. In other words, with structuring now incorporated into enlarged tranche size (increased supply), arrangers no longer face a downward sloping demand curve. This result can be interpreted as further evidence that structuring removes the segmentation discount of a downward sloping demand curve.

D. Additional determinants of prices

Beyond the analysis of structuring, the fully specified structural model introduced above provides a useful platform for testing the impact of other potential factors on pricing. For example, since structuring seems to have a positive impact on the price of ABS issues at launch (ie a negative impact on the spread) it is natural to ask whether *better* structuring might have an *additional* positive effect on price. In order to investigate this issue, we employ the above model to test for the relative impact of engaging different arrangers on the prices of structured securities sold by them in the marketplace.

We start by approximating the quality of structuring with a simple proxy for arrangers' effort and sophistication—the number of arrangers involved per issue. Since in securitisations all arrangers (lead-managers) are remunerated and given the significant variation in the number of lead-managers per transaction in our dataset, we hypothesise that the quality of structuring and placement effort might be influenced by the number of lead-managers per transaction, after controlling for the issue size. Specifically, we would like to know whether additional lead-managers add value via eg better distribution and/or reputation. Another potential mechanism through which arrangers affect price might be that a higher number of arrangers can access a wider investors' base and can place a larger tranche in the same market segment without any negative effect on price, which is akin to better structuring.[52]

In this spirit, we develop a 'lead managers' variable equal to the total number of lead- and co-lead managers for each securitisation issue in the sample. When added to the demand equation in our model, the coefficient on the total number of lead managers is small, but has the expected negative sign and remains significant, albeit only at the 10% level (Table IX: regression III). This could be interpreted as weak evidence in support of the positive impact of better quality of structuring on price.

[52] In the case of corporate bonds, similar approach has been adopted by e.g. John, Lynch and Puri (2003), who control for the reputation of the underwriter by constructing the 'prestige' indicator: each corporate bond issue is considered 'prestigious' if it is underwritten by at least one of the top five underwriters.

E. Bankruptcy codes and market sophistication

Our dataset encompasses securitisation issues from 23 different jurisdictions, where 'jurisdiction' indicates the country of origin of securitised assets.[53] It is important, therefore, to ask whether and how the country of origin of the securitisation transactions affects prices?

One factor that might influence pricing *via* structuring and tranching in this context is the level of market sophistication.[54] In this context, the country of origin could serve as a proxy for market sophistication vis-à-vis other jurisdictions—the UK, Italy and Spain being the largest markets might also be the most sophisticated ones from the securitisation perspective. If market sophistication is indeed important, then the spreads on issues from those jurisdictions could be expected to be lower than in the case of issues from other countries indicating that creditors might require lower spreads in the more established markets. This phenomenon might be more important in the case of securitisation than in the case of ordinary bonds since structured finance issues than to be more sophisticated than in the case of plain vanilla bonds.

Nevertheless, the impact of the country of origin on pricing might also be associated with other factors, such as the bankruptcy regime and tax considerations. Bankruptcy codes in particular might be important since structured finance issues are said to be critically linked to the legal environment and creditors' rights. For example, it is well established that the UK 'creditor-friendly' bankruptcy regime facilitates securitisation transactions by allowing to achieve the 'true sale' status of the securitised assets in the SPV more easily than in some continental European countries. Since one of the critical features of securitisations is the ability to abstract from the bankruptcy

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[53] Circa 43% of all tranches in our dataset are composed of the UK assets. Five other countries—Italy, Spain, France, Germany, and the Netherlands—constitute more than 5% of the total issuance each (between 13% and 6% respectively).

[54] In the previous Chapter, we have associated the country of issuance with market sophistication and market development.

proceedings (the 'true sale' status ensures that in case of a credit event securitised assets are not part of the originator's bankruptcy proceedings), the bankruptcy codes across different jurisdictions might be the critical determinants of *whether* and *how* securitisation transactions are structured from the legal perspective and to what extent they truly secure creditors' rights. The bankruptcy codes might also have a significant impact on pricing insofar as investors perceive their ability (or that of an agent, such as the trustee) to foreclose on the assets to differ by jurisdiction. Nevertheless, it is important to note that the latter constitutes one of the rating criteria according to credit rating agencies and therefore should not be a significant pricing factor independent of the credit rating.

In general, it is difficult to establish a clear ranking of different bankruptcy codes by jurisdiction according to creditors' rights. For example, the cumulative measure of creditors' rights introduced by La Porta et al. (1996) differs significantly from the securitisation-specific ranking of different bankruptcy regimes by S&P, the largest credit rating agency of structured finance issues. Although the UK market represents the most 'creditor-friendly' regime according to both rankings, La Porta et al. (1996) put Italy and Germany ahead of Spain, the Netherlands and France, whereas S&P ranks the Netherlands, Germany and Spain ahead of France and Italy.

Despite these inconsistencies across different classifications, we have tested for the effects of a number of different, individual rankings of bankruptcy regimes incorporated each time as an exogenous variable in the structured model (demand equation). In general, the results of those tests were often insignificant and inconsistent across tests (not reported). When the index of creditors' rights (by jurisdiction), as estimated by La Porta et al. (1996), was incorporated into the model, we found a positive and significant coefficient on the index (Table IX: regression III) indicating that issues from more creditor-friendly regimes might be associated with higher spreads (lower

prices), contrary to our expectations. One potential explanation for this result is that since countries with securitisation-friendly bankruptcy codes (as measured by the La Porta et al. index), such as the UK, Italy or Spain, are also the largest jurisdictions for securitisation issues in general, greater market penetration of structured issues in these jurisdictions might imply a greater variety of assets being securitised. This could include assets that are generally more difficult to securitise, which are being in securitised in the UK market, , for example, but not in France.

In order to test this hypothesis, we have incorporated into the model 3 country-specific dummies for the 3 largest jurisdictions (the UK, Italy, and Spain) alongside the creditors' rights index. As shown in Table IX (regression IV), we found the coefficients on all three dummies to be large and negative. Moreover, the UK and Spain dummies were also highly significant. These results seem to reject the hypothesis that the more 'problematic' or more 'challenging' assets (from the securitisation perspective) increase the average securitisation spreads in developed securitisation markets. At the same time, the same results offer some support for the theory that more developed, securitisation-friendly jurisdictions and/or jurisdictions with more sophisticated securitisation markets offer a lower cost of financing to originators. Still, the coefficient on the creditors' rights index has remained positive and significant, even when dummies for the leading jurisdictions were included, indicating that it is likely to be capturing some other factors differentiating jurisdictions, independent of creditors' rights, such as, for example, tax regimes.[55] Unfortunately, the limited number of issues from jurisdictions other than the five leading jurisdictions, as well as differences in measuring 'friendliness' of bankruptcy regimes, as outlined above, renders the interpretation of these results somewhat

[55] We have also experimented with other measures of creditors' rights that differ by jurisdiction. For example, we have substituted the S&P index of securitisation laws per country for the La Porta et al (1996) creditors rights' index. Although the coefficient on securitisation laws is positive, as expected (lower value of the S&P rank indicates a more 'securitisation-friendly' legal regime), the coefficient on the index has remained weak and unstable (not reported).

problematic in a wider context. We recognise this as an important area for further research.

IX. SUMMARY AND CONCLUSIONS

Despite the fact that securitisations constitute a market of comparable size to corporate bonds, they have received relatively little attention in the academic literature to date. This research has aimed to address this gap by investigating determinants of prices of structured finance issues at launch. In the first part of our exploratory study, we have investigated the importance of credit ratings on launch spreads, subject to standard pricing controls. We have documented the fact that the relationship between price and the credit rating for each tranche is very strong indeed and consistent across all types of securitisations, although primarily concerns the main credit rating categories as rating refinements do not seem to carry much additional explanatory power. Moreover, due to the process known as structuring, where component tranche characteristics are contractually amended, this relationship seems considerably stronger than in the case of corporate bonds. We have also presented evidence that structuring seem to be at least partly driven by contemporaneous market characteristics with a positive effect of clustering on price that might be linked to time-bound periods of market incompleteness and arbitrage of specific market opportunities.

The second part of our analysis has focused on the price effects of structuring at the tranche level more explicitly. Here, we have proposed a supply and demand model of structuring and pricing, which uses the simultaneous equations estimation of price determinants controlling for endogeneity of the structuring process. With the help of the structured model, we have found evidence that arrangers seem to be able to successfully exploit investors' sophistication, general market development, as well as asymmetric

information in order to obtain better prices. Specifically, our results indicate that structuring seems to remove the negative effects of market segmentation in the form of a downward sloping demand curve. Moreover, we have also found some evidence that developed securitisation markets seem to offer advantageous prices to originators.

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TABLE I: THE LAUNCH SPREAD PER TRANCHE BY RATING AND TYPE OF ASSETS

Average launch spreads in bps above benchmark (standard deviations in brackets)
by securitisation type and composite rating

type (observations)	AAA	AA	A	BBB	BB	NR	average
agency (41/0 total/NR)	**18.6** (10.1)	**43.5** (34.8)	**43.6** (36.3)	-	-	-	**30.8** (27.9)
auto loans (146/5 total/NR)	**28.5** (12.4)	**42.0** (3.7)	**64.0** (23.6)	**151.9** (33.5)	-	**88.4** (45.8)	**49.0** (36.3)
cards (110/0 total/NR)	**22.0** (11.6)	-	**58.2** (17.7)	**144.7** (50.6)	-	**-**	**52.9** (52.0)
consumer (159/4 total/NR)	**31.8** (12.6)	**65.8** (28.1)	**77.5** (27.2)	**166.5** (59.4)	**400.0** (-)	**37.75** (12.71)	**70.3** (58.2)
equipment (79/7 total/NR)	**34.9** (15.5)	**59.0** (37.3)	**73.8** (26.6)	**197.1** (116.7)	**170.0** (183.8)	**96.4** (68.3)	**69.5** (70.5)
RMBS (1693/105 total/NR)	**27.8** (17.0)	**53.1** (25.2)	**80.2** (33.0)	**161.7** (58.4)	**366.9** (103.0)	**84.9** (97.7)	**74.0** (79.2)
other (231/8 total/NR)	**51.0** (38.4)	**78.4** (34.0)	**131.7** (53.3)	**260.2** (102.9)	**526.7** (155.6)	**203.9** (136.7)	**121.2** (118.6)
CMBS (416/16 total/NR)	**51.5** (33.9)	**72.8** (36.5)	**109.2** (50.6)	**206.9** (64.9)	**424.2** (170.6)	**168.9** (154.3)	**126.3** (119.8)
CDO (1032/32 total/NR)	**45.4** (47.8)	**74.1** (40.1)	**135.2** (74.6)	**247.3** (129.9)	**481.2** (203.3)	**250.6** (330.9)	**151.2** (171.3)
whole business (171/2 total/NR)	**57.0** (23.3)	**74.0** (-)	**112.7** (29.8)	**250.2** (63.4)	**585.6** (63.9)	**162.5** (109.6)	**165.1** (135.1)

TABLE II: THE LAUNCH SPREAD PER TRANCHE BY RATING AND TYPE

Average launch spreads (bps) by composite rating and tranche size (US$ million)

	size≤25	**25<size≤50**	**50<size≤150**	**150<size≤500**	**500<size**	**all**
AAA	49.1	43.6	40.3	35.3	26.7	35.5
AA	66.3	64.5	70.5	60.3	37.9	65.5
A	97.6	95.6	95.3	116.18	101.5	97.8
BBB	212.1	183.6	193.9	222.0	75.0	202.7
BB	458.1	500.0	-	-	-	433.3
NR	254.6	131.2	110.9	44.7	55.0	127.7
all	174.3	114.6	86.2	49.9	30.7	103.2

TABLE III: THE LAUNCH SPREAD PER TRANCHE BY RATING AND EXPECTED MATURITY

Average launch spreads (bps) by composite rating and expected maturity—WAL (years from launch)

	life < 5 years	**5 < life <10**	**10 < life <15**	**15 years < life**	**all**
AAA	28.5	41.0	51.2	78.3	33.9
AA	59.5	67.1	71.0	92.3	64.6
A	96.0	93.8	88.8	117.2	95.3
BBB	200.8	193.6	214.5	225.2	200.3
BB	438.2	446.6	519.6	500.0	452.6
NR	172.1	186.3	192.3	91.0	172.7
all	83.3	117.8	162.1	124.0	101.4

TABLE IV: REDUCED-FORM MODEL OF LAUNCH SPREADS IN EUROPEAN SECURITISATIONS

Note: the dependent variable is the launch yield spread (in bps) above LIBOR for floating rate issues or above the closest benchmark of matching maturity (vs. expected maturity of the issue) for fixed rate issues. Each observation represents a single tranche. Independent variables: irate is the yield on the 10-year government benchmark in the currency of issue on the day of issue; swapdiff (slope) is the difference between 10-year and 2-year swap yield in the currency of issue on the day of issue; capvol is the implied volatility of the 5-year interest rate cap in the currency of issue and on the day of issue; issuesize is the size of the issue (of which the tranche is a part of) in US$ converted from the issue currency at the FX rate at the date of issue; issue life is the expected weighted average life per issue (in years) as per assumed prepayment paths of individual tranches; class rank is the designated seniority rank of each tranche within each issue; price is the offer price for each tranche (=100 when sold at par); AAA to B are dummies for the respective composite credit rating categories of each tranche (vs. the non-rated category NR). The bold font with a star indicates significance at the 1% level; the bold font indicates significance at the 5% level; the bold italic font significance at the 10% level. All regressions include a constant (not reported). T-statistics, calculated from the Huber-White robust errors with specified clustering of tranches per issue, are reported in brackets. Coefficients on year and month dummies are not reported. The reference year for the year dummies is 2003. The reference month for month dummies is January.

Independent variable/regression	I	II	III	IV	V	VI	VII	VIII	IX
price (100=par)	-	-	-3.70 (-1.55)	-	-	-	0.39 (0.38)	-	**0.48** (0.44)
interest rate (10y gov)	-	**-12.73*** (-3.93)	-12.97 (-0.97)	-	-	**-10.40*** (-5.15)	***21.99*** (1.59)	0.65 (0.17)	***26.79*** (1.78)
swap diff (10y-2y swap)	-	**-15.93*** (-3.68)	-39.63 (-1.59)	-	-	**-9.15*** (-3.66)	-10.50 (-0.76)	**-15.52*** (-5.32)	-12.40 (-0.91)
cap vol (5y i/r cap)	-	0.77 (1.45)	1.07 (0.35)	-	-	**0.70** (2.09)	***3.23*** (1.78)	**1.32*** (3.49)	**6.56*** (3.22)
issue life log exp (years)	-	**12.05** (2.42)	-2.24 (-0.12)	-	-	5.48 (1.56)	15.57 (1.27)	4.31 (1.25)	16.19 (1.35)
class rank seniority	-	**22.56*** (9.72)	**24.40*** (3.06)	-	-	**3.73*** (4.13)	2.63 (0.65)	**3.47*** (3.89)	**0.69*** (2.72)
issue size log US$ mil	-	**-30.34*** (-11.27)	**-49.96*** (-3.96)	-	-	**-12.68*** (-7.30)	-8.46 (-1.03)	**-12.94*** (-7.54)	-11.14 (-1.41)
AAA rating (d)	-	-	-	**-153.1*** (-5.12)	**-33.14*** (-8.25)	**-136.3*** (-4.69)	**-33.87** (-2.38)	**-136.8*** (-4.74)	-7.01 (-0.41)
AA rating (d)	-	-	-	**-124.9*** (-4.17)	8.42 (0.78)	**-114.4*** (-3.92)	-7.67 (-0.47)	**-115.3*** (-3.97)	21.83 (1.28)
A rating (d)	-	-	-	**-93.43*** (-3.13)	**13.42*** (2.58)	**-85.83*** (-2.95)	7.41 (0.53)	**-86.15*** (-2.98)	***31.56*** (1.79)
BBB rating (d)	-	-	-	4.83 (0.16)	**126.55*** (10.72)	10.84 (0.37)	**116.75*** (8.39)	9.62 (0.33)	**139.1*** (8.04)
BB rating (d)	-	-	-	**225.38*** (8.63)	**422.75*** (6.45)	**226.8*** (6.76)	**416.6*** (6.39)	**226.0*** (6.79)	**444.1*** (7.18)
B rating (d)	-	-	-	**292.38*** (10.31)	-	**297.6*** (10.65)	-	**304.2*** (9.56)	-
year 2002 (d)	10.50 (1.40)	-	-	-	-	-	-	-4.32 (-0.82)	***25.47*** (1.67)
year 2001 (d)	3.56 (0.45)	-	-	-	-	-	-	***-8.49*** (-1.57)	**35.64** (2.21)
year 2000 (d)	0.37 (0.04)	-	-	-	-	-	-	**-14.22*** (-3.25)	15.30 (0.66)
year 1999 (d)	**-15.42** (-1.97)	-	-	-	-	-	-	**-19.07*** (-3.25)	8.91 (0.51)
year 1998 (d)	**-37.54*** (-4.08)	-	-	-	-	-	-	**-49.22*** (-6.40)	-9.79 (-0.50)
year 1997 (d)	**-40.49*** (-3.67)	-	-	-	-	-	-	**-61.87*** (-4.45)	**-106.5** (-2.20)
year 1996 (d)	**-75.08*** (-11.65)	-	-	-	-	-	-	**-45.33*** (-3.22)	-
year 1995 (d)	**-66.61*** (-8.49)	-	-	-	-	-	-	**-43.94*** (-3.05)	-
quarter dummies	yes	no	no	no	no	yes	yes	yes	yes
issue rate	float	float	fixed	float	fixed	float	fixed	float	fixed
clusters (issues)	1226	809	124	809	127	809	124	809	124
R^2	2.4	23.5	24.2	73.2	73.7	75.0	77.3	75.4	78.0
no. of observations	3664	2535	243	2535	250	2535	243	2535	243

TABLE V: LAUNCH SPREADS, CREDIT RATINGS, AND ASSET TYPES

Note: the dependent variable is the launch spread (in bps) above the same currency LIBOR; all tranches are floating rate; each observation represents a single tranche; all regressions include year and month dummies (not reported) with 2003 and January omitted, respectively. Independent variables: irate is the yield on the 10-year government benchmark note, swapdiff (slope) is the difference between the 10-year and the 2-year swap yield, capvol is the implied volatility of the 5-year interest rate cap (all in the currency of issue and on the day of issue); issue life is the expected weighted average life per issue (in years) as per assumed prepayment paths of individual tranches; issue size is the log of the size of all tranches combined, in US$ million, converted at the FX rate on the date of issue; class rank is the designated seniority rank of each tranche within each issue; balance is a dummy=1 if the issue is a balance sheet CDO (=0 otherwise); segment is the total number of tranches of the same rating, currency, type and the life bucket issued in the previous, current, or the next month following the month of issue; the asset types include: auto-loans, credit card loans, cdo, cmbs, consumer loans, equipment leases, other, rmbs, whole business, and government/agency securitisations (omitted) as explained in the text. Aa1 to Ba3 are dummies of the constructed, combined Moody's, S&P and Fitch credit rating category of each tranche. NR is a dummy =1 if the tranche is not rated. The reference rating for credit rating dummies is AAA (results for category rating B are omitted). The bold font with a star indicates significance at the 1% level; the bold font indicates significance at the 5% level; the bold italic font significance at the 10% level. All regressions include a constant (not reported). T-statistics, calculated from the Huber-White robust errors with specified clustering of tranches per issue, are reported in brackets.

independent variables / regression	I	II	III	IV	V	VI	VII
interest rate $_{(10y)}$	0.92 (0.24)	-0.94 (-0.24)	**-9.03*** (-2.68)	14.18 (1.02)	4.35 (0.92)	-1.39 (-0.35)	-1.64 (-0.41)
swap diff $_{(10y-2y)}$	**-15.70*** (-5.49)	**-14.51*** (-5.30)	**-16.87*** (-6.83)	-5.91 (-0.39)	1.65 (0.37)	**-13.49*** (-4.61)	**-13.34*** (-4.42)
cap vol $_{(5y\ i/r\ cap)}$	**1.34*** (3.63)	**1.26*** (3.30)	***0.56*** (1.85)	3.33 (1.15)	0.70 (0.92)	**1.06** (2.41)	**1.06** (2.35)
issue life $_{log\ (WAL)}$	3.32 (0.97)	-2.88 (-0.72)	**-13.61*** (-2.93)	11.54 (0.91)	-0.50 (-0.19)	-3.20 (-0.79)	-2.49 (-0.62)
class rank	**3.17*** (3.60)	**3.11*** (3.59)	**1.96*** (3.12)	**8.14** (2.50)	-3.30 (-1.20)	**3.08*** (3.55)	**3.42*** (3.85)
issue size $_{log\ (size)}$	**-12.40*** (-7.07)	**-11.49*** (-6.37)	**-11.16*** (-7.64)	-2.63 (-0.54)	**10.01*** (2.65)	**-11.58*** (-6.77)	**-11.94*** (-7.20)
balance (d) $_{cdo\ only}$	-	-	-	**-34.23*** (-3.21)	-	-	-
segment $_{(-1m,0,+1m)}$	-	-	-	-	-	-0.17 (-1.56)	***-0.19*** (-1.74)
auto (d)	-	-2.50 (-0.33)	-	-	-	-3.31 (-0.43)	-3.96 (-0.49)
cards (d)	-	***-14.52*** (-1.87)	-	-	-	***-15.45*** (-1.97)	***-17.17*** (-2.08)
cdo (d)	-	**16.43** (2.01)	-	-	-	***15.57*** (1.89)	***14.28*** (1.65)
cmbs (d)	-	***13.31*** (1.67)	-	-	-	12.24 (1.52)	11.06 (1.34)
consumer (d)	-	3.16 (0.39)	-	-	-	2.78 (0.34)	2.13 (0.25)
equip (d)	-	6.60 (0.61)	-	-	-	6.04 (0.55)	7.07 (0.64)
other (d)	-	**35.20*** (3.64)	-	-	-	**34.41*** (3.54)	**32.75*** (3.30)
rmbs (d)	-	0.23 (0.03)	-	-	-	-0.59 (-0.09)	-1.68 (-0.23)
whole bus (d)	-	**54.2*** (-4.49)	-	-	-	**53.56*** (5.09)	**53.85*** (4.99)
Aaa (AAA)	**-159.9**	**-154.9**	**-163.1**	**-198.8**	**-83.0**	**-151.9**	-
Aa1 (AA+)	**-150.0**	**-153.1**	**-147.5**	**-193.9**	**-52.2**	**-152.3**	-
Aa2 (AA)	**-136.3**	**-135.0**	**-138.7**	**-176.9**	**-59.5**	**-134.4**	-
Aa3 (AA-)	**-136.9**	**-130.4**	**-137.3**	**-173.9**	**-56.8**	**-129.7**	-
A1 (A+)	**-113.9**	**-105.4**	**-115.7**	**-135.6**	**-53.5**	**-104.2**	-
A2 (A)	**-110.3**	**-107.4**	**-112.3**	**-142.7**	**-54.0**	**-106.3**	-
A3 (A-)	**-85.4**	**-88.6**	-97.6	**-111.3**	-38.7	-87.7	-
Baa1 (BBB+)	-28.2	-25.8	-50.3	-80.1	20.5	-24.8	-
Baa2 (BBB)	-15.3	-11.1	-24.2	-45.1	25.1	-10.1	-
Baa3 (BBB-)	9.11	6.8	-11.3	-34.1	-26.7	7.9	-
Ba1 (BB+)	**180.6**	**180.1**	**178.7**	**168.3**	-	**180.0**	-
Ba2 (BB)	**214.7**	**214.5**	**189.8**	**172.5**	**239.1**	**214.7**	-
Ba3 (BB-)	**192.8**	**188.8**	**218.1**	**100.7**	-	**189.0**	-
AAA $_{composite}$	-	-	-	-	-	-	**-129.1**
AA $_{composite}$	-	-	-	-	-	-	**-112.3**
A $_{composite}$	-	-	-	-	-	-	**-82.3**
BBB $_{composite}$	-	-	-	-	-	-	13.4
BB $_{composite}$	-	-	-	-	-	-	**224.9**
asset type categories	all	all	mortgage	cdo	consumer	all	all
clusters (issues)	809	809	461	124	140	809	809
R^2	75.9	77.2	82.5	73.3	84.2	77.2	77.0
no. of observations	2535	2535	1466	472	314	2535	2535

TABLE VI: TRANCHING AND PRICING AT THE TRANCHE LEVEL

Note: the dependent variable is the launch spread (in bps) above LIBOR; all tranches are floating rate. Each observation represents a single tranche. Independent variables: tranches is the predicted number of tranches from the 1st stage regression as specified (actual in regression II); 'issue size' is the size of the issue (of which the tranche is a part of) in US$ converted from the issue currency at the FX rate at the date of issue; 'irate' is the yield on a 10-year government benchmark in the currency of issue on the day of issue; 'swap diff' (slope) is the difference between the 10-year and the 2-year swap yield in the currency of issue on the day of issue; 'cap vol' is the implied volatility of the 5-year interest rate cap in the currency of issue on the day of issue; 'life' is the expected weighted average life of the security in years according to the assumed prepayment path (where relevant); the asset types include: auto-loans, credit card loans, cdo, cmbs, (other) consumer loans, equipment leases, other, rmbs, whole business, and government/agency securitisations (omitted); 'lead managers' is the total number of the lead and co-lead managers (arrangers) for each transaction. AAA to BB are dummies for the respective composite credit rating category of each tranche (t-statistics omitted). The bold font indicates significance at the 1% level; the bold italic font indicates significance at the 5% level, significance at the 10% level is not reported. All regressions include a constant (not reported). All regressions include year and month dummies (coefficients not reported). All fixed-rated tranches are omitted; all tranches in issues for which at least one pricing factor/control is not specified for at least one tranche are omitted; t-statistics, calculated from the Huber-White robust errors with specified clustering of tranches per issue, are reported in brackets.

regression	I	II	III	IV	V	VI	VII	VIII
1st stage model	-	actual	ols	ologit	ologit	ologit	ologit	ologit
predicted variable	-	all tranches (all)	all tranches (jointly)	all tranches (jointly)	all tranches (RC+MC)	(RC) rating classes	(MC) mkt classes	all tranches (RC+MC)
all tranches	-	-0.026 (-0.03)	-0.822 (-0.17)	-3.228 (-0.92)	-3.256 (-0.75)	-	-	-
rating groups (uniquely-rated)	-	-	-	-	-	***-13.768*** (-2.33)	-	***-14.674*** (-2.26)
market classes (same-rated)	-	-	-	-	-	-	-1.205 (-0.19)	-1.514 (-0.23)
interest rate $_{10y}$	-5.209 (-1.20)	-5.199 (-1.20)	-0.575 (-0.14)	-0.547 (-0.14)	-0.619 (-0.15)	-1.463 (-0.37)	-0.502 (-0.12)	-1.594 (-0.40)
swap diff $_{(10y-2y)}$	**-14.067** (-4.67)	**-14.064** (-4.67)	**-14.924** (-4.84)	**-15.399** (-5.10)	**-15.280** (-5.05)	**-15.797** (-5.30)	**-14.871** (-4.90)	**-15.741** (-5.25)
cap vol $_{(5y\ i/r\ cap)}$	**1.764** (4.17)	**1.766** (4.18)	**1.561** (3.89)	**1.559** (3.72)	**1.583** (3.67)	**1.251** (3.03)	**1.606** (3.14)	**1.190** (2.19)
issue size	**-0.009** (-5.63)	**-0.009** (-4.22)	**-0.007** (-2.76)	***-0.005*** (-2.18)	-0.005 (-1.61)	***-0.005*** (-2.46)	***-0.007*** (-1.99)	-0.006 (-1.85)
life $_{exp\ (WAL)}$	-0.473 (-0.87)	-0.474 (-0.86)	-0.419 (-0.79)	-0.530 (-1.01)	-0.504 (-0.95)	-0.719 (-1.37)	-0.402 (-0.75)	-0.723 (-1.37)
class rank	4.817 (4.77)	**4.835** (5.14)	**4.037** (3.65)	**4.067** (3.63)	**4.061** (3.62)	**3.951** (3.52)	**4.060** (3.60)	**3.927** (3.42)
lead managers	**-4.291** (-2.90)	**-4.288** (-2.92)	***-3.106*** (-2.03)	***-3.071*** (-1.96)	***-3.122*** (-2.01)	-2.832 (-1.83)	***-3.131*** (-2.07)	-2.774 (-1.86)
AAA $_{rating}$ (d)	**-140.45**	**-140.40**	**-155.99**	**-156.79**	**-157.47**	**-155.94**	**-156.33**	**-155.15**
AA $_{rating}$ (d)	**-120.32**	**-120.29**	**-134.88**	**-135.81**	**-136.48**	**-135.12**	**-135.20**	**-134.32**
A $_{rating}$ (d)	**-87.55**	**-87.53**	**-106.24**	**-106.81**	**-107.53**	**-105.99**	**-106.58**	**-105.28**
BBB $_{rating}$ (d)	**11.53**	**11.55**	**-10.39**	**-11.09**	**-11.81**	**-10.04**	**-10.77**	**-9.25**
BB $_{rating}$ (d)	**242.22**	**242.22**	**200.30**	**200.09**	**199.17**	**201.65**	**199.81**	**202.43**
9 asset type dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8 year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11 month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
clusters (issues)	953	953	802	802	802	802	802	802
fixed / floating	float only	float only	float only	float only	float only	float only	float only	float only
R^2	76.2	76.2	76.3	76.3	76.3	76.4	76.3	76.4
# of observations (tranches)	2985	2985	2519	2519	2519	2519	2519	2519

TABLE VII: SPECIFICATION OF THE SIMULTANEOUS EQUATIONS MODEL OF ABS STRUCTURING AT THE TRANCHE LEVEL

Note: each row represents a separate structural equation from the simultaneous supply and demand model of asset-backed security design; additional control variables added in latter regressions.

	equation estimated	dependent variable	endogenous variables	exogenous variables	estimated at the issue level	other controls
1	demand (market investors)	$price_{s(i),c,t}$ (log)	$quantity_{s(i),t,c}$ (log) $rating_{s(i)}$ $life_{s(i)}$	$segments_{s(i),c,t}$ $issue\ types_i$	$rating\ groups_i$ $market\ classes_i$	$market\ var_{t,c}$ $time\ def_t$
2	supply (structuring by arranger)	$quantity_{s(i)}$ (log)	$price_{s(i),c,t}$ (log) $life_{s(i)}$	$issuesize_i$ (log) $issue\ types_i$	$total\ tranches_i$	$market\ var_{t,c}$ $time\ def_t$
3	expected maturity (structuring by arranger)	$life_{s(i)}$	$quantity_{s(i)}$ (log) $AAA(d)_{s(i)}$	$issue\ life_i$ $trancherank_{s(i)}$	$rating\ groups_i$	-
4	subordination level (credit model)	$sub_{s(i)}$	$quantity_{s(i)}$ (log)	issue size $(log)_i$ $tranche\ rank_{s(i)}$	$total\ tranches_i$	-
5	AAA rating (d) (credit model)	$AAA(d)_{s(i)}$	$quantity_{s(i)}$ (log)	issue size $(log)_i$ $class\ rank_{s(i)}$ $tranche\ rank_{s(i)}$	$total\ tranches_i$	-
6	credit rating index (rating agency)	$rating_{s(i)}$	$quantity_{s(i)}$ (log) $subordination_{s(i)}$ $AAA(d)_{s(i)}$	$issue\ quality_i$ $issue\ types_i$	$rating\ groups_i$	$market\ var_{t,c}$ $time\ def_t$

TABLE VIII: ESTIMATION OF THE SIMULTANEOUS EQUATIONS SUPPLY AND DEMAND MODEL OF ABS STRUCTURING AT THE TRANCHE LEVEL I

Three-stage least squares regression; each observation represents a single tranche; endogenous variables are: price (log of launch spread), quantity (log), rating index, weighted average life (WAL), subordination level and a dummy for the AAA rating; the number of rating groups and market classes estimated from the reduced form model at the issue level; all variables are as defined before; bold font with a star indicates significance at the 1% level; bold indicates significance at the 5% level; bold italic indicates significance at the 10% level; all equations include a constant (not reported); t-statistics are reported in brackets.

REGRESSION I

(1) demand: dependant variable = spread (log), $R^2 = 0.56$; (coefficients on time and type controls not reported); N=2507

quantity (log)	*rating index*	*WAL*	rating groups	market classes	segment total	segment + 1m	interest rate	interest rate^2	swap diff	cap vol
0.221*	**-0.865***	**-0.026***	**-0.466***	-0.026	-0.001	-0.004	**-0.497**	***0.045***	**-0.200***	-0.002
(6.62)	(-26.87)	(-3.23)	(-7.16)	(-1.57)	(-0.47)	(-0.88)	(-2.02)	(1.83)	(-6.61)	(-0.36)

(2) supply: dependant variable = quantity (log), $R^2 = 0.41$; coefficients on time and type controls not reported

spread (log)	issue size (log)	tranches	interest rate	swap diff	cap vol
-1.185*	**0.463**	**-0.122***	-0.079	**-0.242***	**0.034***
(-32.33)	(8.24)	(-2.63)	(-1.15)	(-4.25)	(4.38)

(3) rating: dependant variable = rating index, $R^2 = 0.67$; coefficients on type controls not reported

AAA (dummy)	*subordination*	ave launch	rating groups
2.521*	**0.594***	**-0.003***	**-0.305***
(43.15)	(5.08)	(-8.11)	(-7.25)

(4) subordination: dependant variable = subordination, $R^2 = 0.52$

quantity (log)	tranche rank	issue size (log)	tranches
-0.009	**0.639***	**0.00002***	***-0.005***
(-2.35)	(42.95)	(6.37)	(-1.69)

(5) AAA tranche: dependant variable = AAA (dummy), $R^2 = 0.56$

quantity (log)	tranche rank	class rank	rating groups
0.188*	**0.388***	**-0.031***	**-0.033***
(25.27)	(13.14)	(-10.15)	(-3.32)

(6) weighted average life: dependant variable = life (tranche), $R^2 = 0.47$

quantity (log)	tranche rank	issue life	rating groups
-0.550*	**-1.864***	**0.610***	**0.154***
(-11.96)	(-10.47)	(47.91)	(2.69)

REGRESSION II

(1) demand: dependant variable = spread (log), $R^2 = 0.55$; (coefficients on time and type controls not reported); N=2507

quantity (log)	*rating index*	*WAL*	segment total	segment + 1m	interest rate	interest rate^2	swap diff	cap vol
-0.094*	**-0.581***	-0.007	-0.0006	-0.003	**-0.463**	**0.042**	**-0.191***	**0.013***
(-5.16)	(-28.13)	(1.29)	(0.31)	(-0.98)	(-2.41)	(2.23)	(-6.87)	(3.05)

(2) supply: dependant variable = quantity (log), $R^2 = 0.40$

spread (log)	issue size (log)	tranches	interest rate	swap diff	cap vol
-1.247*	**0.411***	-0.065	-0.095	**-0.253***	**0.032***
(-34.48)	(8.21)	(-1.60)	(-1.39)	(-4.44)	(4.16)

(3) rating: dependant variable = rating index, $R^2 = 0.67$; coefficients on type controls not reported

AAA (dummy)	*subordination*	ave launch	rating groups
2.475*	**0.676***	**-0.004***	**-0.265***
(42.35)	(5.80)	(-9.14)	(-6.41)

(4) subordination: dependant variable = subordination, $R^2 = 0.52$

quantity (log)	tranche rank	issue size (log)	tranches
-0.009	**0.632***	**0.00002***	***-0.005***
(-2.36)	(42.54)	(6.23)	(-1.76)

(5) AAA tranche (dummy): dependant variable = AAA (dummy), $R^2 = 0.56$

quantity (log)	tranche rank	class rank	rating groups
0.186*	**0.394***	**-0.031***	**-0.033***
(24.85)	(13.35)	(-10.06)	(-3.26)

(6) weighted average life: dependant variable = life (tranche), $R^2 = 0.47$

quantity (log)	tranche rank	issue life	rating groups
-0.564*	**-1.741***	**0.611***	**0.151***
(-12.26)	(-9.77)	(47.98)	(2.62)

TABLE IX: ESTIMATION OF THE SIMULTANEOUS EQUATIONS SUPPLY AND DEMAND MODEL OF ABS STRUCTURING AT THE TRANCHE LEVEL II

Three-stage least squares regression; each observation represents a single tranche; *endogenous variables* are: price (log of launch spread), quantity (log), rating index, weighted average life (WAL), subordination level and a dummy for the AAA rating; the number of rating groups and market classes estimated from the reduced form model at the issue level; all variables are as defined before except for 'creditors rights', and country dummies including: 'UK', 'Italy', and 'Spain'; bold font with a star indicates significance at the 1% level; bold indicates significance at the 5% level; bold italic indicates significance at the 10% level; all equations include a constant (not reported); t-statistics are reported in brackets.

REGRESSION III

(1) demand: dependant variable = spread (log), $R^2 = 0.58$; (coefficients on time and type controls not reported); N=1972

quantity (log)	*rating index*	*WAL*	rating groups	market classes	segment total	interest rate	interest rate^2	swap diff	cap vol	lead managers	creditors rights
0.231*	**-0.938***	**-0.035***	**-0.381***	**-0.080***	0.002	0.252	**0.018**	**-0.089***	**-0.006***	***-0.02***	**0.088***
(6.16)	(-24.71)	(-4.36)	(-5.66)	(-4.48)	(0.76)	(-0.95)	(0.68)	(-2.57)	(-1.12)	(-1.88)	(5.82)

(2) supply: dependant variable = quantity (log), $R^2 = 0.45$; coefficients on time and type controls not reported

spread (log)	issue size (log)	tranches	interest rate	swap diff	cap vol
-1.262*	**0.345***	**-0.037***	-0.092	**-0.208***	**0.029***
(-30.08)	(5.35)	(-0.63)	(-1.24)	(-3.51)	(3.68)

(3) rating: dependant variable = rating index, $R^2 = 0.70$, type controls are not reported

AAA (dummy)	*subordination*	ave launch	rating groups
2.446*	**0.425***	**-0.003***	**-0.240***
(41.95)	(3.81)	(-7.20)	(-5.32)

(4) subordination: dependant variable = quantity (log), $R^2 = 0.52$

quantity (log)	tranche rank	issue size (log)	tranches
-0.002	**0.626***	**0.00002***	0.0003
(-0.52)	(37.81)	(5.96)	(0.09)

(5) AAA tranche: dependant variable = quantity (log), $R^2 = 0.58$

quantity (log)	tranche rank	class rank	rating groups
0.188*	**0.371***	**-0.032***	**-0.030**
(22.43)	(11.24)	(-10.15)	(-2.48)

(6) weighted average life: dependant variable = quantity (log), $R^2 = 0.45$

quantity (log)	tranche rank	issue life	rating groups
-0.576*	**-2.080***	**0.583***	0.085
(-10.62)	(-9.90)	(40.28)	(1.18)

REGRESSION IV

(1) demand: dependant variable = spread (log), $R^2 = 0.63$; (coefficients on time and type controls not reported); N=1972

quantity (log)	*rating index*	*WAL*	rating groups	market classes	swap diff	cap vol	lead managers	creditors rights	UK	Italy	Spain
0.201*	**-0.893***	**-0.024***	**-0.300***	**-0.086***	**-0.118***	-0.002	-0.009	**0.122***	**-0.182***	-0.04	**-0.345***
(5.56)	(-24.56)	(-2.91)	(-4.59)	(-4.96)	(-3.33)	(-0.33)	(-0.83)	(5.05)	(-2.88)	(-1.04)	(-7.85)

(2) supply: dependant variable = quantity (log), $R^2 = 0.45$; coefficients on time and type controls not reported

spread (log)	issue size (log)	tranches	interest rate	swap diff	cap vol
-1.234*	**0.343***	-0.036	-0.086	**-0.202***	**0.030***
(-29.83)	(5.34)	(-0.62)	(-1.16)	(-3.41)	(3.76)

(3) rating: dependant variable = rating index, $R^2 = 0.70$, type controls are not reported

AAA (dummy)	*subordination*	ave launch	rating groups
2.427*	**0.480***	**-0.003***	**-0.242***
(41.76)	(4.31)	(-6.95)	(-5.36)

(4) subordination: dependant variable = subordination, $R^2 = 0.52$

quantity (log)	tranche rank	issue size (log)	tranches
-0.0005	**0.624***	**0.00002***	0.0006
(-0.11)	(37.77)	(5.88)	(0.16)

(5) AAA tranche: dependant variable = AAA (dummy), $R^2 = 0.58$

quantity (log)	tranche rank	class rank	rating groups
0.186*	**0.377***	**-0.032***	**-0.030**
(22.56)	(11.39)	(-9.47)	(-2.51)

(6) weighted average life: dependant variable = life (tranche), $R^2 = 0.45$

quantity (log)	tranche rank	issue life	rating groups
-0.626*	**-1.958***	**0.584***	0.070
(-11.60)	(-9.33)	(40.31)	(0.96)

DO SECURITISATIONS ADD VALUE?[1]

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ABSTRACT

We investigate abnormal returns to equity around securitisation pricing and issue dates, and explore how different factors influence the size and the direction of the potential effects. We find significant, positive, and consistent abnormal returns to equity on the pricing dates, over longer event windows, and prior to the issue dates, but not on the issue dates. Our results indicate that the pricing information and the successful placement of the issue implied by pricing captures the key impact of securitisations on their originators. We find support for the theory that equity holders in well-capitalised banks and firms with low gearing benefit from the issuance of asset-backed securities; we also find some evidence supporting the agency cost rationale for securitisations. We show that developed securitisation markets, larger issuers, and banks in particular all benefit from securitisations. Moreover, we find support for the hypothesis that ratings serve as a signalling tool for the quality of originators' assets, and some evidence of the beneficial effects of structuring.

JEL classification: G14, G21, G32

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I. INTRODUCTION

The purpose of this paper is to investigate whether securitisations create value for the originators by studying the impact of securitisations on originators' equity. This is of interest because, first, there has been little research into the effects of securitisations, despite the latter becoming one of the most significant avenues of raising financing. Second, our complete set of European securitisation transactions offers a potentially fertile ground for testing different theories of securitisations for financials and industrials alike. European securitisation markets, characterised by a multiplicity of originators and a variety of assets, might potentially offer greater insights into securitisations than US markets dominated by repeated, weekly offerings from a smaller group of very large issuers. Therefore, it might be expected that any potential gains or losses to originators of US securitisations might have been already discounted by the market at the early stage of their adoption of the securitisation technology. Third, the rapid development of structured finance in general towards increasingly complex structures as well as the relatively high costs of conducting such transactions, renders better understanding of securitisations' advantages and disadvantages particularly important, especially from the originators; perspective.

Our study investigates the impact of securitisations on the price of originators' publicly quoted stocks.[2] It also explores factors influencing the size of the potential impact, where significant, as well as firm and market characteristics that might render securitisation transactions particularly successful from the issuer's perspective. More

[2] This research follows up on an earlier version of this paper (June 2003) based on a small sample comprising 99 European asset-backed securities transactions by publicly quoted, first-time originators, selected from the dataset of all asset-backed securities transactions in Europe between 1987 and 2002 made available to us by Merrill Lynch International Securitisation Research Desk in London. In our preliminary analysis, we used the reported issue date as our event date and employed the market model to calculate abnormal returns. The earlier study also used an alternative event date of the first press announcement for each issuer's reported intention, plan, or implementation of a securitisation, as reported by the Lexis-Nexis database. In the preliminary study, we found no significant abnormal returns for either set of dates used.

specifically, we would like to test the null hypothesis that financial structuring and packaging of assets during the structuring process has no impact on equity returns to originators, in line with the Miller Modigliani Irrelevance Hypothesis. Moreover, we are interested in testing different suggested reasons for securitisations, including the agency rationale, market segmentation and incompleteness theories, and financial distress. We also speculate that the timing of market reaction to the news of securitisation might indicate the sources of value in structured finance transactions, if any. Therefore, we test various hypotheses concerning securitisations at different possible event dates.

In a typical securitisation transaction, a group of assets from an enterprise, typically a bank or another financial institution, is pooled and transferred to an external legal entity—a special purpose vehicle (SPV). This SPV buys assets from the enterprise (the originator) with funds raised from investors who purchase securities—the asset-backed securities (ABS)—issued by the SPV and backed by the pool of assets acquired from the enterprise. Since the SPV is a passive investment vehicle, the selection, characteristics and uses of these assets are governed by a detailed legal contract, which aims to specify in detail all foreseeable contingencies regarding future cash flows from such securitised assets. Cash flows arising from these assets are used to pay interest and eventually repay the principal to the financial investors.[3]

The core of our analysis employs the event-study methodology, which enables testing for the impact of a particular event, taking place on a particular day or over a specified window of time, on prices of securities of a given firm. We test for abnormal returns over the event window, where the event window is defined as the moment of the arrival of new information in the market about the successful placement of a securitisation issue in the market and about the price of securities issued. We are interested in the event window that corresponds with the market reaction to the news of

[3] A more detailed description of the securitisation process is presented in section IV.

the confirmation of issuance of ABS by the originator in each case. Most importantly, we might expect the price revelation mechanism during the book-building process to reflect any value creation for the issuer's different claimants.

We investigate abnormal returns to equity around securitisation pricing and issue dates calculated using several methodologies for all reported structured finance transactions in Europe since 1987 as classified by JP Morgan and Bloomberg. We also investigate both the pre- and post-event periods and patterns of abnormal returns over marketing and placement phases of securitisation issues. Furthermore, we explore how the size of abnormal returns varies for different securitisations by the same originator and for different types of assets. This is important since separate securitisation events might be related and produce a cumulative as well as case-specific effect. In section six of this chapter, we employ a cross-sectional analysis to investigate factors influencing the size of abnormal returns. We also explore factors related to contemporaneous market conditions, characteristics of originators and of particular transactions, while conducting a variety of robustness checks to test our initial results.

Overall, we find significant, positive, and consistent abnormal returns to equity at the time of securitisation. On the pricing date, we find the average abnormal return to equity of approximately 0.3%, and over a 14-day period around the pricing date – the average abnormal return of 2%. Our results are consistent and very similar across different methodologies for calculating abnormal returns that we employ. Our cross-sectional results indicate that equity holders in well-capitalised banks and cash-flow rich firms benefit more from the issuance of ABS. We also find some evidence to support the hypothesis that securitisations might be helpful in reducing agency costs by limiting free cash flows.[4] At the same time, our findings also indicate that equity claimants in poorly capitalised institutions suffer from negative abnormal returns from securitisations, where

[4] We discuss different theories we test in the next section.

the latter can be interpreted as last-resort financing.

In general, our results tend to be more systematic, more statistically significant, and more consistent across different sub-samples than those reported in the US context. This could be explained by the observation that more differentiated European securitisation markets with a higher relative number of originators are likely to be more conducive to delineating the effects of structured finance transactions. Our results are also likely to be stronger because securitisation events in Europe tend to be larger as a proportion of the originator's balance sheet than in the US.

We proceed as follows: the next section reviews the existing literature concerning securitisations relevant to our analysis. The third section presents the data and introduces some stylised facts. The fourth section describes the methodology used in the context of securitisation practice. We present and discuss our results in section V. Section VI presents the analysis of factors influencing returns to securitisations and section VII concludes.

II. RELATED LITERATURE

A. Theoretical explanations of securitisations

There are several theoretical models that suggest differing rationales for the issuance of asset-backed securities. Early explanations for securitisations from the security design literature have focused on structured finance as a solution to the problems of asymmetric information between different groups of investors and between investors and managers. Examples of this line of thought include Riddiough (1997) or Boot and Thakor (1997). A parallel and related thread in the literature has linked security design in general to problems of liquidity and pointed at structuring as a potential solution. The latter is based on the process of packaging or 'pooling' multiple assets and later

'tranching' claims issued against such pools of assets. In this context, the security design literature has concentrated on liquidity gains from turning portfolios of loans into tradable securities and delineating information-sensitive and information-insensitive claims to separate informed and uninformed investors in order to lower the cost of financing as, for example, in DeMarzo (2005). Related liquidity rationales for security design have been suggested earlier by DeMarzo and Duffie (1999) or Myers and Rajan (1998).

Other explanations have focused on market segmentation and market incompleteness, as discussed by e.g. Gaur, Seshadri and Subrahmanyam (2004), or both, as in the case of Duffie and Rahi (1995). Separately, securitisations have been linked to regulatory arbitrage by e.g. Ambrose et al. (2003) or Calomiris and Mason (2004), who discuss securitisations as a means of regulatory arbitrage, especially with respect to capital requirements for banks. These theories suggest that banks might benefit more from securitisations than other financial intermediaries due to minimum capital requirements. However, in so far as securitisation can be seen as a flexible technology allowing any finance company with a relative disadvantage in funding to concentrate on origination, as suggested by some authors, securitisations might be predominantly important for financial institutions as an alternative to on-balance-sheet funding through public deposits.

Among the most recent studies of securitisations are those that have focused on the latter as a solution to agency problems via limits on managerial discretion, as suggested by Cuchra (2002). Iacobucci and Winter (2005) also discuss the agency rationale for securitisations, although from the legal perspective.[5] They list five mechanisms through which agency costs might be reduced by securitisations: (i) enhanced monitoring, (ii) reputation, (iii) corporate control, (iv) explicit incentive pay, and (v) limits on free cash flows, but point to the latter as the most important. Similarly,

[5] Cuchra (2002).

Cuchra (2002) shows that financial contracts based on limits on managerial discretion over the use of funds and cash flows as well as legal separation of distinct groups of assets (based on non-recourse provisions and ring-fencing) can remedy agency costs and add value for certain firms and assets. These agency costs, which cannot be addressed by standard debt, make securitisations optimal for low-return, NPV-positive assets. According to the author, securitisations are optimal in this framework, providing that the costs of eliminating active management and severing cross-subsidisation linkages between different parts of the firm are not too high. In general, the agency rationale for the issuance of ABSs in corporate securitisations, based on limiting free cash flow *à la* Jensen (1976), could imply that firms with low leverage, weak controls over management, and a large proportion of cash-flow-generating, low-return assets, might benefit from securitisations more than highly leveraged firms with limited agency problems.

Securitisations have also been previously linked to Myers (1977) underinvestment problem in so far as firms in a weak financial position or facing the debt overhang problem might engage in securitisations to raise financing for new projects, which could not otherwise be funded. More generally, Berkovitch and Kim (1990), Stultz and Johnson (1985) and James (1988) show that any secured debt can be used to address the underinvestment problem. These theories imply that highly indebted firms could benefit from securitisation, providing investors are confident that new projects will be NPV-positive. Another suggested rationale for securitisations is avoidance of the agency costs of debt, including the Jensen and Meckling (1976) asset substitution problem, since securitised debts are ring-fenced and securitised debt holders do not capture gains from future projects. However, securitisation transactions typically require a high degree of costly monitoring, impose strict covenants on business operations, as well as reduce future strategic choices and might therefore be associated with greater agency costs of

debt. For example, for banks, they might significantly alter lending rules to make all loans compliant with standardisation requirements for securitisations, whereas for non-financials they could hinder innovation and prevent major reforms to operations. The above factors combined with high setup costs could make securitisations unattractive or even value-destroying for some originators. Another set of rationale for securitisations focuses on limiting bankruptcy costs, which could be particularly important for firms close to financial distress. For example, Gorton (2005) suggests that off-balance-sheet financing involving the creation of external vehicles might be justified by the avoidance of bankruptcy costs. A similar rationale has also been provided by Skarabot (2001), among others.

B. Empirical studies of securitisations

As far as we know, no empirical studies of securitisations in Europe to date have employed rigorous statistical methods. Specific issues, including patterns in spreads, modelling of loss rates, and legal and structuring issues, have been discussed in the market literature, including the case-specific analysis as well as broad overviews.[6] Similarly, only a few econometric studies of the US securitisation markets have been completed so far and these typically concern pricing of securitisation bonds. For example, Boudoukh, Richardson and Stanton (1997) investigate pricing of mortgage-backed securities (MBS) in a multifactor interest rate environment. Securitisation activities by banks *per se* have been investigated by Benveniste and Berger (1987), Berger and Udell (1993), as well as by James (1988), who find evidence that riskier US banks with higher bad loans portfolios and lower capitalisation tend to securitise more. Minton, Opler and Stanton (1997) analyse the decision to securitise by comparing a sample of approximately 50 US industrial companies engaging in securitisations between 1987 and 1994 with a

[6] See, for example, Fabozzi and Goodman (2001), Fabozzi (2003); Deacon (2004); or Davidson (2003).

large group of peers that did not engage in securitisations. They find issuers to be, on average, larger and to have a relatively higher proportion of receivables to assets than their non-securitising peers, while being closer to financial distress.

Several studies investigate specific hypotheses regarding rationale behind securitisations. For example, Ambrose et al. (2003) investigate whether securitisations are driven by capital arbitrage or by asymmetric information by investigating whether less-risky loans are securitised more. The authors interpret findings of the security design literature as implying that informational asymmetries render sales of relatively good assets unattractive due to the lemons discount, but assume that securitisations of less-risky assets should offer greater potential gains from capital arbitrage.

In the US context, an early event study by Lockwood et al. (1996) focuses on wealth effects of 294 ABS securitisations for banks and other investors. The authors study the effect of the securitisation announcement on the equity of the issuer and report positive abnormal returns from a sample comprising of, among others, 41% banks, 16% finance companies and 25% car manufacturers.[7] However, their results prove highly variable across different time periods. Although the authors find positive and significant abnormal returns on the event (announcement) date, they also find that the pre- and post-event date periods often exhibit significant negative abnormal returns and that all of their results exhibit significant variations across sectors. For example, banks—the most common issuers—suffer from negative abnormal returns, while finance companies exhibit the most significant, positive returns. The authors also find that banks with capital slack (i.e. excess capital) gain most from securitisations, whereas those with high leverage perform worst. They interpret these results as an indication that weak banks do not gain from securitisations.

[7] Lockwood et al. (1996) estimate the full market model.

Thomas (1999) and (2001) represent research similar to ours, but are based on the US data. These analyses employ the event-study methodology to test the impact of securitisations on prices of originators' debt and equity securities, but their results are largely inconclusive. The first study of these studies, based on 236 ABS transactions in their full sample (issued 1991–1996), reports limited, yet significant, positive abnormal returns—the highest for manufacturers. However, since this study reports only a limited set of results (e.g. it only reports results for longer event windows around the event date and not for the event date alone, or for the pre- and post-event periods separately) and employs very few robustness checks, limited inferences can be made. In the follow-up paper, Thomas (2001), the same constant-return methodology is employed, but with a much larger set of 1416 transactions issued in the US between 1986 and 1995. The author uses the day of issue (rather than the announcement day) as the event date, and reports practically no significant results. For example, the author finds no statistically significant returns for the entire sample, or for any constituent sub-samples selected according to the type of securitisation. The author also finds no consistent and statistically significant results for any periods of up to 30 days after the event date, or for periods of up to 70 trading days prior to the issue date. Similarly, abnormal returns to debt are found to be insignificant based on a substantially reduced sample of originators with publicly traded debt securities. Despite no findings of significant abnormal returns, Thomas (2001) conducts an extensive cross-sectional analysis of the reported, insignificant returns: his results prove to be highly variable and significantly driven by year dummies.[8] A major limitation to this study is the employment of methodology based on excess returns above the general CRSP index only, since the reported results are likely to include any sector-

[8] Thomas (2001) provides no clear explanation as to why the inclusion of year dummies uniformly shifts the sign of reported coefficients on all key explanatory variables from negative to positive. Furthermore, the author excludes years 1987, 1988, 1989, (1990) and 1994 from the original sample on the grounds of poor performance of the banking sector and the collapse of the CMO (collateralised mortgage obligations) market, which is reported to result in dampening negative and reinforcing positive abnormal returns.

and company-specific effects. However, Thomas (2001) confirms the results from Lockwood et al. (1996) that high levels of capital are associated with more positive returns to equity, and reports large, positive returns to first-time issuers, but also increasing abnormal returns from later securitisations in the case of repeated issuers.

III. DATA DESCRIPTION

A. Dataset

Our dataset includes all securitisation issues in Europe as recorded by the JP Morgan Securitisation Research Desk in London and the Bloomberg database between 1987 and the end of 2003. In the original dataset, there are 5161 tranches representing 1546 separate securitisation transactions, which closely match IFR records of securitisation transactions for the same period. Each transaction in our dataset is identified chronologically by the pricing date, but not by the issue date.[9] Therefore, for each transaction, we collect the pricing date and the issue date from Bloomberg. For all bonds classified by Bloomberg as 'corporate' rather than 'mortgage', the issue date is the same as the pricing date since Bloomberg reports a single date for all corporate bonds. In 73% of cases, the pricing date from our the JP Morgan dataset is the same as the pricing date from Bloomberg, and the mean difference is 0.11 days.[10] Table I presents data on the number of transactions and securities issued in each transaction in the original dataset by type of collateral.

We clean up our dataset in the following way. First, we eliminate all transactions by US originators issued in the European market. We then check whether a given

[9] See section IV for a detailed review of the securitisation process including the explanation of the relationship between pricing and issue dates.

[10] Discrepancies are generally small: in some cases, Bloomberg lists the same date for pricing and issue, which is different from our pricing date. This is typically because no information about the true pricing date is publicly available.

originator is a publicly quoted company. If it is not, we investigate its ownership on Orbis, Banscope and Amadeus (as provided by Van der Bijk's respective services) and identify its largest institutional shareholder that has a traded equity. If the immediate parent is a subsidiary of another company and it is not publicly quoted, we repeat the process for the parent until we can trace it to the closest, publicly traded owner with the largest stake in the company. If the company is private and no parent can be found with publicly traded equity, or no publicly traded company owns more than 50% of the company, we eliminate it from the sample. As a result of this procedure, we can identify the originator's or its parent's publicly traded equity, at the time of issue, for 768 out of 1546 transactions (circa 50% of the total). In 76% of those cases, it is the originator itself that is publicly quoted. Equity prices over the window of +/-300 days for each equity and the corresponding (national- and sector-specific) market index are available for 727 out of 768 securitisation cases, with an average of just over 3.6 tranches issued in each transaction.

In the final sample we have 162 different originators with 727 deals. Banks constitute the largest sector, which is represented in the sample by 495 deals. This is followed by consumer finance with 39; life insurance with 26, and other insurance with 29; automobile with 18; investment banks with 15, and other financial institutions with 12; restaurants and pubs with 11; real estate development with nine; and asset managers with eight—the same number as transport—as well as numerous other, smaller sectors. Our average originator has a debt to assets ratio of 39%. The average issue size is large - US$740 million (converted from the local currency on the date of issue with no adjustment for inflation) – in comparison with originator's assets, while our median issuer is a large bank with assets of US$32 billion and an equity market capitalisation of US$8.3 billion.

The most frequent direct originators, or parents of originators, are: BNP Paribas (45 deals); Royal Bank of Scotland (43); Paragon Group (38); Banco Santander (27); and Deutsche Bank (26). These institutions jointly represent 24% of our sample. No other originators have more than 20 securitisations, and only a few have between 15 and 20. Over 30% of issues are from originators with not more than five (and over 50% from not more than eight) completed transactions over the entire sample period. The average time between transactions for the same originator is 90 days; this is due to the fact that some transactions are issued in series closely following each other. However, there are only 100 pairs of transactions separated from each other by less than 100 trading days. Therefore, although we face the problem of overlapping event windows for windows of more than 100 trading days, the problem is largely limited to only a few firms.

B. Other characteristics

The first securitisation in our sample (from the Royal Bank of Scotland) was priced on 1st April 1987, and the last one was Findomestic Banca SpA's transaction on 9th December 2003. There is a clear increase in the number of securitisations after 1999. Just over 35% of all our observations are from 1999 or before, whereas in the final sample we have 89 securities issued in 2000, 134 in 2001, 132 in 2002, and 141 in 2003. The main categories of transactions by type of asset are: residential mortgage-backed securities (RMBSs) with 299 transactions; collateralised debt obligations (CDOs) with 202; consumer loans with 58; commercial mortgage-backed securities (CMBSs) with 42; auto loans with 38; whole business securitisations with 28; and equipment securitisations with 27. In terms of the country of issue, the UK represents over 30% of the sample with 226 transactions, followed by Italy with 101, France with 60, and Germany with 43. We also have 63 transactions classified as 'European', with assets originated across different

countries. Almost all of our deals are denominated in either Euro (403 transactions), British pounds (193), or US dollars (71).

IV. METHODOLOGY

A. The practice of securitisation issuance

Securitisations are structured and sold on a book-building basis, which means that investors are lined up before the issue date. There is no underwriting commitment and the final transfer of assets is only made on the date of issue or the 'closing date'. This means that any transaction is known to the market for some time before the issue date, since all disclosure requirements come into force on the date of issue. Sometimes, originators announce the transaction early and hence report the 'announcement date'. Although the market's expectation of the transaction based on the arranger's approaches to investors could potentially emerge as early as several months in advance of the closing date, a period of several weeks tends to be more common. However, until the closing date, the ultimate success of the transaction remains uncertain—the deal can be called off or postponed right up until that date, and this does happen occasionally. As a result, there is a clear element of uncertainty over the closing of the securitisation transaction, even in circumstances in which the company makes public at an early stage its intention to securitise a portion of its assets. Rumours and speculation, which could prose problems to the definition of the event window, occasionally precede larger issues for longer periods of time, but early public announcements of specific securitisations are rare.

Following the initial structuring and consultation process involving the issuer, the arranger and the credit-rating agencies negotiating the ramifications of the transaction structure, a 'road show', which could last up to several weeks, is conducted by the arranger. During this road show, securities are advertised to a limited, specialised group

of investors on a preliminary basis, and a marketing presentation with limited details about the structure, assets and terms of the transaction are distributed to investors. This process typically includes some indicative pricing. The proposed terms of the transaction are usually scrutinised at this stage, with investors in the so-called 'equity tranche' and junior tranches leading the way. In the process, it is not uncommon for smaller tranches to be provisionally assigned to a single investor in their entirety. More senior tranches are often distributed more widely, but below distribution levels typical of corporate bonds.

Following the so-called 'quiet period', lasting approximately two weeks after the end of the road show, a set of proposed prices of all tranches is sent out by the arranger to investors on the 'pricing date', on average *circa* seven days prior to the closing date, although this time differential varies significantly between transactions. In reality, the pricing date is uncertain and there is no prior information that pricing will occur on that particular date, although it is likely to be expected within a broader timeframe. The pricing date is usually an indication that the arranger has been able to close the book at the advertised set of prices. Although no transaction is 100% certain until it is closed at the issue date, the pricing date tends to be more uncertain than the issue date according to market specialists. Indeed, a transaction is typically identified in the market by the pricing date and hence assumed to be executed.[11] In contrast, in the US context, the closing date occurs typically within one to two days of the pricing date, or on the same day. At the 'issue' or 'closing' date, property rights over all funds and assets are transferred, while contracts concerning governance of assets and cash flows come into force.

A pre-sale report/preliminary prospectus with many details of the transaction, but without prices, is available for up to two or even three weeks before the pricing date

[11] For example, Bloomberg always lists the pricing date for identifying a given ABS. Both pricing and issue dates, but no other dates, are listed in the description of the transaction. On the pricing date, the arranger informs all interested parties of the proposed prices by sending emails/Bloomberg messages and making telephone calls to leading investors, including the leading asset managers.

(three to four weeks before the issue date) and posted on the rating-agency website. This could provide new information about a company's assets and other details about the originator.[12] Informal details of the transaction in the form of earlier versions of the pre-sale report might be circulated among investors prior to this. Rating agencies typically scrutinise the issuer as a whole in addition to the securitised assets portfolio. The official (also known as 'black') prospectus with all details of the transaction finalised (including pricing) is only issued on the closing date or the announcement date. For some securitisations, the issue date is the same as the pricing date and the differential is largely a European phenomenon—the result of exchange registration requirements, the Luxembourg exchange being the most popular registration venue. Despite registration at the exchange, most issues remain rather illiquid and arrangers often act as market makers in the secondary market.

B. Securitisations and the event study methodology

Given the process described above, the choice of the event day poses several problems. Since investors might expect a typical securitisation transaction a few weeks before the closing date (or earlier), and a substantial amount of information about the originator and its assets might be revealed prior to that date, the principal impact on equity is likely to occur before the issue date. While not all uncertainty is resolved prior to the issue date, the placement of assets and what is most likely to be the final set of prices has been known at that time typically for around seven to ten days. Thomas (2001) uses the issue date as the event date and finds no significant impact on equity on the event date.

[12] The path of information dissemination to equity investors prior to the posting is unclear since investors in securitisations are often specialised and contacted privately. Moreover, as many as 75% of equity analysts surveyed claim not to understand securitisations (*Financial Times*, 11th June 2005).

Our study investigates both the pricing date and the issue date as event dates. In general, the choice of the pricing date as an event date offers several advantages in this framework. First, price announcement on the pricing date confirms that the issue has been successfully placed, although not formally closed, and the book-building process has ended. Second, the announcement provides information about prices at which assets will be sold. Third, the pricing date is not known in advance to investors. In fact, there is a degree of uncertainty about the completion of the transaction over the period immediately prior to the pricing date. For example, it is not uncommon for the pricing date to be postponed by the arranger several times, although this fact might not be publicly known.

We investigate the pricing date as an event date independently of the issue date. In our final sample, the pricing date occurs, on average, 5.7 working days prior to the issue date, as shown in Fig. 4 below:

[Fig. 1 – insert here]

In 37.5% of cases, the pricing date is the same as the issue date according to Bloomberg (35% according to JP Morgan's original dataset). In a further 56% of cases, the issue date occurs no later than 15 days working days after the pricing date. Therefore, closure is expected within three weeks of the pricing date, and a gap of more than three weeks occurs in only 6.5% of cases. While the pricing date can be associated with new information, the issue or closing date can be seen as the irrevocable 'confirmation date' for each securitisation transaction.

C. Abnormal returns and the event window

The choice of methodology for measuring abnormal returns is likely to be important in any event study. Although Brown and Warner (1980) and (1985) indicate

that the choice of methodology might not significantly influence the power of the test, they also point out that the choice of the evaluation period, or the employment of the market-adjusted model instead of the market model, might have important repercussions for their findings in some circumstances.

To ensure the consistency and robustness of our results, we measure abnormal returns in three ways. First, we calculate the market-adjusted abnormal return by subtracting the daily return on the leading local market index R_{ml} from the originator's daily return on that market over the event window $[-t_1, t_2]$.[13]

$$AR_{i,t} = R_{i,t} - R_{ml,t}$$

The mean abnormal return is:

$$\overline{AR_t} = \frac{1}{N_t}\sum_{i=1}^{N} AR_{i,t}$$

The cumulative abnormal return for a single name is:

$$CAR_i = \sum_{t=-t_1}^{t=t_2} AR_{i,t}$$

The mean cumulative abnormal return across names is:

$$\overline{CAR} = \frac{1}{N}\sum_{i=1}^{N} CAR_i$$

The test statistic for the event window becomes in this case:

$$\tau = \left(\sum_{t=-t_1}^{t=+t_2} \hat{\sigma}^2\left(AR_{i,t}\right)\right)^{-1/2}\left(\sum_{t=-t_1}^{t=t_2} AR_{i,t}\right) \quad \text{where} \quad \hat{\sigma}^2\left(\overline{AR_t}\right) = \frac{\sum_{-t_1}^{+t_2}\left(\overline{AR_t} - \left(\frac{1}{(t_1+t_2)}\sum_{-t_1}^{+t_2}\overline{AR_t}\right)\right)}{(t_1+t_2)}$$

σ^2 is the variance of the mean abnormal return.

The test statistic for the event date is simply:

$$\tau_0 = \frac{\overline{AR_{t=0}}}{\hat{\sigma}\left(\overline{AR_t}\right)}$$

[13] A similar methodology is employed by Thomas (1999) and (2001).

Second, we calculate the market-adjusted return again, but now using the local market *sector* index for the sector of which the given originator is part. In other words, for an Italian bank, this would imply the abnormal return over the daily return on the Italian banking sector index in Milan (if the bank were quoted in Milan). Third, in order to check whether our results could be influenced by restrictions imposed on alphas and betas by our versions of the market-adjusted model, we calculate abnormal returns using the full market model without any restrictions on either parameter (α, β).[14]

$$AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \beta_i AR_{ml,t}\right)$$

We estimate each stock's alpha and beta parameters using the ordinary least squares (OLS) over a 200-day estimation period from 400–200 days prior to the event date. The mean abnormal return is the same as before and the rest follows the methodology outlined above:

$$\overline{AR_t} = \frac{1}{N_t}\sum_{i=1}^{N} AR_{i,t}$$

We also test robustness by using monthly alphas and betas as reported by Datastream after Worldscope, since results of alpha estimation prove highly variable depending on the choice of the evaluation period.[15]

Since some casual information and/or speculation about pricing might be available to the market towards the end of the road show, there is a possibility of an impact on equity in the period of several weeks prior to the pricing date. Success or failure of the road show and that of the entire book-building process is also likely to be known in advance. Since in most cases the issue date in our sample occurs three to ten days following the pricing date, we expect a significant impact on equity also to occur in

[14] A similar methodology is employed by Lockwood et al. (1996).

[15] When estimating alphas from Datastream securities' prices, our findings are unstable when we vary the reference period and/or frequency of estimation. On average, however, the estimated alphas are not significantly different than those reported by Worldscope. Different sources of beta estimates have no material impact on our results.

the period immediately after the pricing date, as this period will typically include the issue date. This suggests that the basic event window might be set at 20–40 days around the pricing date. However, we might also expect significant effects on pricing and issue dates themselves. Finally, since there is some indication that information about securitisation can reach the market long before the pricing and issue dates, we also investigate periods of up to 50 days around the event date. Mean cumulative abnormal returns for an event window of ten days around the event date, and ten days prior to it, are in this case, respectively:

$$\overline{CAR_i^{t+/-10}} = \frac{1}{21}\sum_{t=-10}^{t=+10} AR_{i,t} \qquad \text{or} \qquad \overline{CAR_i^{t-10}} = \frac{1}{10}\sum_{t=-10}^{t=-1} AR_{i,t}$$

Cumulative abnormal returns for other reported periods are calculated in an analogous way.

V. RETURNS TO SECURITISATIONS: ANALYSIS OF BASIC RESULTS AND DISCUSSION

A. Abnormal returns

Table II presents the summary of the first set of our results. We record a strong and positive effect of European securitisation transactions on returns to equity of originators on the pricing date equal to approximately. 0.3%. This rises to around 1% within the 20-day event window. Moreover, the estimated effect is very similar regardless of the methodology employed for calculating abnormal returns. Our results indicate that the pricing announcement is largely viewed as good news, with a relatively stable and consistent differential of 14–18% between the number of positive and negative reactions across different methodologies on the sample of approximately 700 separate transactions. In contrast, we do not observe a statistically significant abnormal return on the issue date, but record positive and significant abnormal returns in the few days around the pricing

date, and prior to that date in particular (Tables III and IV). This result is robust to the exclusion of cases when the pricing date and the issue date are in fact the same.

The effect on equity on the pricing date can be associated, first, with confirmation of a successful book-building process and hence a successful sale of securitised assets. Second, it can be seen as a positive signal about the quality of assets sold; and third, as a response to the realised price of assets. Above all, however, this can be associated with a successful execution of a securitisation *per se*, viewed positively by the market due to factors seen as the main rationale for securitisations, as discussed in Chapter 1. In general, there is evidence that good news is absorbed by the market, not just on the event date, but also, although less significantly, over the one-to-three-month event window around the event date. Moreover, the issue date following the pricing date clearly contributes to the identified positive effect, especially if the effect on the pricing date is positive (Table IV [3–4]). That is, the market response from the pricing date is confirmed on the issue date.

The effect of both the pricing date and the issue date can be seen clearly in Table V, which shows daily AR and CAR over a 41-day event window around the pricing date according to different methods of calculating abnormal returns. Although the mean AR on the pricing date of 0.25–0.38% is particularly strong, there is also a significant, positive effect on equity around seven to eight days following the pricing date, which is likely to correspond with the time around the issue date. The actual one-to-two-day CAR around the issue date varies from 0.31% to 0.51% and is clearly significant. This can be interpreted, as suggested before, as the confirmation of the effect of securitisation issues on originators' equity prices, when all details are finalised, the transaction closed, property rights transferred, and the final rating assigned. However, a delayed issue date, and hence the delayed implied 'confirmation', are associated with significantly negative returns, as can be seen in Table IV. For example, the +/–10 days CAR around the issue date is positive and equal approximately 0.8% for transactions with the issue date no later

than 15 days after the pricing date, but it becomes negative and equal 2.1% (and strongly significant) for transactions with the issue date of more than 15 days after the pricing date. The cumulative abnormal returns over a period of 100 days around the event date are shown in Figures 1 and 2 below for sector-index-adjusted and market-model-adjusted returns.

[Fig. 2 – insert here]

[Fig. 3 – insert here]

Since securitisations are offered to investors up to several weeks prior to the pricing date—although with only indicative pricing or no pricing information, and subject to successful completion of the book-building process—one would expect a significant abnormal effect on equity to take place in the period prior to the date of issue. There is some evidence confirming this effect, especially for repeated originators, when investors might be more familiar with assets' origins, as well as for CDOs (see Tables III and IV). We also record significant, positive returns to originator's equity five to six days before the pricing date.[16] Nevertheless, the CAR over the period of 20 days around the pricing date is clearly most significant. There is no consistent evidence of a statistically significant effect over the period of 10–20 days prior to the pricing date, despite uniformly positive abnormal returns. However, with an issue date two weeks after the pricing date, there seems to be a significant positive effect around the closing date. Again, this is evident regardless of the methodology used for calculating abnormal returns. Cumulative abnormal returns over a period of 100 days around the issue (closing) date are shown in Figure 3 below for sector-index-adjusted.

[16] We suspect that, in some cases, when the reported pricing and issue dates are the same, the actual pricing date is earlier, but is not recorded. If this is the case, we would observe an early pricing effect possibly around one week prior to the reported pricing and issue dates. However, we have no explicit evidence to support this supposition.

[Fig. 4 – insert here]

It is therefore clear that the news associated with securitisations is absorbed by the market over a period of a couple of weeks following the pricing date. The strongest evidence is for a period of five to ten days immediately following the issue date, but it is also evident for ten days subsequently. Over a long event window of 100 days, there is evidence of a positive, cumulative abnormal effect of 2–5%, subject to the type of issue and originator's prior securitisation experience. There is no evidence of market reversals, although, in most cases, there are no abnormal returns beyond day 20 following the event date, as expected.

B. Repeated issuers and multiple securitisations

For repeated originators, there is evidence that, for initial transactions, the *ex post* effect is considerably stronger than the *ex ante* effect. However, for subsequent securitisations, brought to the market by well-established originators engaging in their third or fourth securitisation, the relative size of these effects is reversed—i.e. the *ex ante* effect becomes stronger than the *ex post* effect. This could be seen as an indication of the fact that investors react positively to early news of securitisations by established originators, but are more cautious in the case of first- or second-time originators prior to the successful pricing of these issues. Therefore, the effect of earlier securitisations seems to 'spill over' to the short period immediately following the pricing date, whereas for established originators, equity investors react favourably to early news of a securitisation transaction.

The first securitisation that the originator brings to the market is reported to have an effect on equity that is almost twice as large as that of an average securitisation in the

sample. This confirms similar results found by Thomas (2001) in the case of the US market, but our differential is of smaller magnitude, and hence seems more realistic given the relative sizes of securitisation issues to total assets and equity.[17] The average positive effect associated with second securitisations by the same originators is typically smaller over the event window and insignificant on the event date. This could be explained in part by the fact that the second securitisation from the same originator occasionally represents the second series of the same issue as the first securitisation. It could also be associated with repeated originators not having acquired the status of established originators, while the positive effect of being an originator is fully discounted at the first transaction.[18] However, since the largest relative and absolute decrease in the number of originators occurs between the first and second securitisation, one might not expect the second securitisation to be fully predictable.

Although second securitisations are not significantly different from the sample average in terms of their timing relative to the previous transaction by the same originator, their size, or the year of issue, they are characterised by the highest spreads of all groups and the second-lowest average ratings. Indeed, second securitisations' mean launch spread is as much as 37% higher then the mean launch spread for the entire sample at 46.5 bps. First securitisations are characterised by the second-highest spreads (56 bps on average), and no other sequential group with ten or more observations is characterised by a mean spread above 45 bps. This suggests that portfolios securitised first by any given originator are judged most risky—possibly due to the lack of information and no track record. This might suggest that the price obtained for the assets at the first securitisation reduces the positive impact on equity due to uncertainty about the true quality of assets.

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[17] Thomas (2001) reports a surprisingly large mean CAR of 11% for first-time issuers.

[18] This effect does not appear to be associated with any other characteristics of second securitisations—for example, neither the overlap with other securitisations nor the concentration of second securitisations in any particular year can be significantly associated only with second securitisations.

When the same originator returns to the market for the third time, the positive effect on its equity is again large and even more significant. For a 100-day event window, the third securitisation is associated with as much as 6% CAR. This seems to indicate that by the third, or fourth, securitisation (which is also associated with a strong, positive impact on equity), the originator might be considered an established user of securitisation technology. After the fourth securitisation, the effect slowly diminishes and appears to be largely discounted in the price of equity early on as the market forms expectations regarding current and future securitisations from the same originator. This contrasts with results from Thomas (2001), who finds that a higher number of previous securitisations by the same originator results in a positive boost to abnormal returns.[19] In our sample, the average time between two consecutive securitisations by the same originator diminishes with the number of securitisations completed. This pattern of rewards indicates clear benefits to a successful, first securitisation, as well as to being subsequently established as a consistent originator of securitised assets, with the market anticipating subsequent securitisations from the same originators. This supports the findings of Minton, Opler, and Stanton (1997), who find "*persistence in use of securitization*". However, it is important to note that any analysis of repeated securitisations might suffer from limited explanatory power and robustness given a significant reduction in the number of observations for each subsequent securitisation; this results in larger variability in the data.

These effects are mirrored in the results for the issue date. On one hand there is a clear, positive effect before and after the issue date for transactions by originators that have not completed four deals prior to the current transaction (where four transactions roughly corresponds with the median number of transactions by an originator in the

[19] These results are difficult to explain since it is unclear why the effect persists (or even increases) despite rational expectations that a given issuer would engage in securitisations in the future.

sample). On the other hand, established originators with four or more deals are characterised by a comparatively small effect on equity just around the issue date. The positive experience prior to the issue date is confirmed for transactions that are the first in a series of transactions over a short period of time, with subsequent transactions discounted by the market at an early stage.

C. Robustness checks

Since our sample contains some outliers, we would like to investigate whether our results are driven by extreme cases. This is important since eight out of our top and bottom ten cases (in terms of CAR over the event window) are early securitisations by Paragon Group of the UK, with a highly volatile stock at the time around some of the corresponding event dates. In general, over the period of +/–ten days around the event date, all outliers in our sample exhibit exceptionally high abnormal returns, both positive and negative, of above 20% CAR. Hence, we conduct robustness checks by: (i) eliminating the top ten and the bottom ten observations, as well as, alternatively, (ii) eliminating the top and bottom 5% of observations. As can be seen from Table II, this actually strengthens rather than weakens our results. For example, eliminating just ten extreme positive and ten extreme negative observations increases sector-index-adjusted CARs by up to twofold, and local index-adjusted CARs by up to 50%. This provides evidence that extreme cases in our sample dampen our overall results.

Next, we address the issue of the potential overlap of our event windows. There are 206 transactions in our sample that come to the market within less than 100 days of the previous securitisation by the same originator. Altogether, there are 311 transactions for which there is another securitisation within the +/–100 days time window by the same originator. Therefore, we would like to see whether our results are influenced by this overlap of some of the event windows. In Table III [1–5], we report CAR over different

event windows, while separating the overlapping and 'stand-alone' securitisations into two groups. We define stand-alone transactions as those where no other securitisation by the same originator has taken place within 100 days around the event (pricing) date—there are 384 such transactions (416 for local index-adjusted returns).

When all overlapping events are eliminated, mean abnormal returns become significantly higher than previously reported for the entire sample. Indeed, as can be seen from Table III [1–5], abnormal returns on the pricing date, as well as cumulative abnormal returns over the event window around the pricing date, are stronger for the restricted, stand-alone sample than for the entire sample, regardless of the method used for calculating abnormal returns. Moreover, mean sector-adjusted abnormal returns in the stand-alone sample are over twice the size of the abnormal returns in the entire sample. Similar patterns can be detected for the issue date, as can be seen in Table IV [9]. Otherwise, the pattern of daily abnormal returns is rather similar to that reported for the entire sample. At the same time, overlapping securitisations, when analysed separately, are associated with no significant abnormal returns on the pricing date (4–5).

Finally, we analyse 'first-of-the-series' securitisations, defined as transactions where no securitisation from the same originator has occurred within the past 100 days, but where at least one another securitisation from the same originator has come to the market within the subsequent 100 days. Such first-of-the-series deals are characterised by significant and positive abnormal returns to equity over the event window, rising significantly with the length of the event window, as expected. This is shown in Table III [3] and in Table IV [12–13]. These results can be explained by the fact that, in the case of a series of securitisations from the same originator, further transactions in the near future might be expected on the event date. Hence, the combined effect of several series might be discounted to the first securitisation in the series. The occurrence of a series can sometimes indicate that the entire original pool of assets could not have been placed at

one time, possibly due to limited market capacity or a downward-sloping demand curve. This would imply adverse market conditions. In these cases of overlapping transactions, one could expect a reduced, positive effect on equity compared with the stand-alone deals. In addition, some series of securitisations by the same originator, while appearing within a short period of time, might in fact be originated by two distinct subsidiaries of the same parent. In these cases, the positive effect on equity might be less adversely affected by their time proximity than in the case of the same originator.

D. Asset types and timing

Different types of securitisation are likely to be associated with different effects on the price of equity. In order to investigate these differences, we next divide our sample by category of assets and investigate one category at a time. Our results from this exercise are reported in Table III [6–10]. Although variability of mean abnormal returns among different categories is not large—all assets exhibit significant, positive returns—CDOs appear to be associated with the strongest positive effects (except for the 'other', unclassified category). Furthermore, CDOs are associated with the most established originators. Corporate securitisations also exhibit strong positive effects, up to 2.5%, in the period immediately following the event date. This is likely to be associated with the fact that many corporate securitisations are one-off events. Evidence for RMBS and CMBS over longer event windows is largely inconclusive, but they still exhibit significant, positive abnormal returns on the event date and over the event window of +/– ten days around the pricing date. It is interesting to note that, in these cases, originators are typically underperforming the market prior to the successful placement. As with the analysis of repeated securitisations discussed above, the sample division and the drop in the number of observations has an important effect on the significance of these results, particularly for longer event windows.

Abnormal returns do not differ substantially across the past four years in the sample—this period represents approximately two-thirds of the entire sample—but there is general evidence that more recent years are characterised by higher abnormal returns, especially in comparison with very early years. This might be related to market development—for example, as highlighted by Cuchra and Jenkinson (2005), there is evidence from the structuring analysis of significant development in securitisation technology in Europe over the past few years. Most significantly, only the years from 1991 to 1993, associated with the recession in the UK, exhibit significant negative abnormal returns. Although this period is represented by only 22 transactions, mostly originated by five British and French banks, these originators underperform the market by a very significant margin during this period.

VI. EXPLAINING ABNORMAL RETURNS TO SECURITISATIONS

A. Cross-sectional results

Next, we investigate factors influencing the size and the direction of CAR in the cross-section. In order to investigate drivers of abnormal returns, we run OLS regressions of CAR over the event window on a set of time-, originator-, and issue-specific factors. We start by investigating time effects. As a first step, we regress the +/- 50 days CAR on a set of year dummies. No individual year dummies are significant except for the year 1991 (not reported), confirming our results from the previous analysis. We also investigate different possible dummies for different periods within our sample and find the pre-/post-2000 dummy indicator to be positive and highly significant (Table VI). This result can be associated with the combined effects of the year 1991, the increase in the number of securitisations from 2000 onwards, and the end of the 'dotcom' bubble in

2000. In general, we might expect securitisations to become more important during market downturns as spreads widen and creditors seek additional security.

We also expect the timing of each securitisation issue to be important in terms of the price that the originator receives for its assets, even though simple pricing effects might be difficult to capture due to variety of factors influencing spreads.[20] For example, although the coefficient on a proxy for the relative price of assets—the ratio of the weighted average launch spread per issue to that issue's weighted average rating across tranches—is consistently positive and large, as expected, (possibly indicating greater equity returns to assets sold at better prices relative to their quality), it is never significant (not reported).[21] Since the issue timing might have significant effects on the relative price of assets, we would like to capture the relative attractiveness of the market at the time of issue.[22] In a related study, Cuchra (2004) shows that higher spreads on securitisation tranches are associated with a greater number of similar assets being already offered on the market over the period under consideration. There is also some evidence that markets for AA– or lower-rated tranches might not be large.[23] Therefore, we might expect that the increased number of similar issues offered in any particular year could put downward pressure on such placements and result in lower securitisation payoffs to originators. Indeed, we find this to be an important factor: the coefficient on the number of issues of the same 'type' (where 'type' category is measured by the asset class and maturity) is strongly negative. That is, a 10% increase in the number of transactions of the same 'type' in any given year leads to, on average, a decrease in abnormal returns to equity (or gains from the sale of assets) of approximately 1%. This seems to confirm the market-

[20] See Cuchra (2005).
[21] We have also experimented with a number of alternative, relative-value measures (independent variables), including excess launch spreads above the average launch spread (or the price paid by investors) of issues of the same rating, type of asset, and within the same maturity bucket (see definition in Chapter 3), but no such measures are significantly associated with cumulative abnormal returns around the event date.
[22] No obvious market characteristics such as the interest rate level, the shape of the yield curve, or the level of implied volatility appear to have a significant effect on price.
[23] See Fabozzi and Choudhry (2004).

segmentation theory of structuring and results reported by Cuchra (2004) and Cuchra and Jenkinson (2005), indicating the possibility of a downward-sloping demand curve for junior tranches in securitisations.

In general, we suspect that, for each securitisation, a delay between the pricing date and the issue date might be indicative of problems with closing the deal. In this context, we seek to confirm our results in Table IV, which indicate that delayed closing is associated with a negative impact on equity. Indeed, as can be seen in Table VII, we find that the coefficient on the number of days between pricing and issue dates is usually negative and significant, although weakly, after controlling for a variety of factors (regressions IV–VII).[24]

B. Effects of structuring

Since structuring is a critical part of the securitisation process, it is of interest to investigate the use of structuring techniques in light of their effects on returns to originators. Cuchra and Jenkinson (2005), for example, find evidence that tranching and structuring might serve the purpose of addressing potential asymmetries of information among investors, broadening the investors' base, and exploiting market incompleteness with clientele-tailored features structured into each tranche. For example, the creation of information-sensitive and -non-sensitive tranches might aim to remedy the potential discount due to such information asymmetries, as argued by the security design literature.[25] Beyond information asymmetry to be addressed by differently rated tranches aimed at different audiences, additional, same-rated tranches constructed by dividing core rating categories might be necessary in order to broaden the investors' base to place the issue successfully, or might be used simply to exploit specific, temporary market niches.

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[24] Note that the period between the pricing and the issue date is included in over 90% of cases for the event window around the issue as well as around the pricing date. This explains the similarities between regressions IV and V.

[25] See, for example, DeMarzo (2005).

In general, the direct value effect of structuring on equity might not be observable, if the structuring process is assumed to be optimised with respect to the value of assets as paid to originators. For example, a greater number of tranches might be optimal and present in some transactions, but not in others, reflecting, for example, asset and market characteristics that render a particular transaction more difficult to place (negative effect on equity), or contemporaneous positive market opportunities associated with some arbitrage value vis-à-vis other transactions for which such opportunities are not present.

In our sample, the overall effect of a greater number of tranches per transaction is only occasionally significant, although consistently positive. The coefficient on the number of tranches is significant for CDOs, which feature the highest number of tranches. In other words, structuring might be particularly important in the case of CDOs that feature repackaging of portfolios of loans. Also, the coefficient on the relative proportion of additional market tranches created by splitting rating categories into sub-groups differentiated by expected maturity, currency or by other features, to the total number of tranches, is often significant, large and consistently negative. This might indicate that such additional tranches are expensive to create, but necessary when facing difficulties with the placement; they are also bad news for the originator. More often than not, therefore, the creation of such tranches might be driven by a necessity of market conditions rather than by a profitable, arbitrage opportunity. As Cuchra and Jenkinson (2005) assert, this is likely to be linked with the effort of placing larger issues on the market.

In terms of particular features of individual tranches constituting an issue, ratings are likely to be most important due to their role in setting benchmarks and communicating asset quality. Credit ratings have been linked to informational asymmetries in the past, but they might be of particular importance in securitisations, where assets are sold instead of financed on the corporate balance sheet. We find that the

top rating of the most senior tranche in each transaction has an important positive and significant effect on CAR, after controlling for the ratings spread, where the ratings spread is calculated as the difference in composite ratings between the most senior and most junior tranches.[26] In addition, issues with a smaller equity tranche are likely to be characterised by a lower rating of the most junior tranche, indicating a smaller share of risk being retained or placed privately. This is significant since low-rated tranches are rarely structured unless necessary due to insufficient equity. For example, securing an increase in the rating of the most senior tranche by one rating category (e.g. from AA to AAA) is associated with, on average, approx. 1% increase in CAR over the event window. This might be partly explained by the positive signal about the quality of assets from the particular originator associated with a higher rating of assets being securitised, and hence directly supports the 'signalling' theory of securitisations. Also, greater rating dispersion might be associated with a smaller equity tranche, as explained above.

C. Originators' characteristics and returns to securitisations

Following the development of a set of controls, we can now turn to link originators' characteristics to their returns from engaging in a securitisation. Our results from the relevant multivariate, cross-sectional tests are presented in Tables V, VI, and VII. Our findings indicate, first, that the impact of the first securitisation is critical, confirming results from the previous section. More generally, *initial* securitisations—i.e. those that are placed before the originator is well known to the market *as* an originator—are particularly significant in terms of their positive effect on equity, possibly because future engagement in securitisations is expected and hence discounted early. On average, later transactions from the same originator are typically associated with abnormal returns

[26] In other words, our results indicate that, for issues with the same top- versus bottom-tranche rating differential, those transactions that can achieve the highest rating for their top tranche might be effectively signaling the better quality of assets to the market and might be, thus, associated with higher returns to equity.

per securitisation being *circa* 0.7% *lower* than in the case of early transactions, confirming our previous findings. Nevertheless, repeated originators, on average, appear to earn higher returns to securitisations, despite their returns diminishing with each new transaction.[27] These results are in line with earlier findings by Thomas (2001) in the case of US securitisations; Thomas, nevertheless, finds constant, *increasing* gains from future securitisations.[28]

In terms of originators' profile of activities, on one hand, banks might benefit more from securitisations if they are viewed as tools for regulatory arbitrage since, as deposit-taking institutions, banks face more significant regulatory requirements than other financial firms. On the other hand, other financial intermediaries might have a greater comparative advantage in origination over funding than banks, since they lack primary channels of funding such as deposit-taking. Hence, securitisation technology might be particularly important to them. More generally, according to Cuchra (2004), we might expect companies with a greater share of assets characterised by a low return on managerial discretion, such as receivables, to particularly strongly benefit from securitisations. Our results show that banks consistently benefit more from securitisations than other types of originators. This supports the regulatory arbitrage theory of securitisations. The indicators for other types of originators are not significant, possibly due to limited number of observations.

In line with the results from Minton et al. (1997) and Thomas (2001), who find the securitisation issuers to be larger than the average corporation, we not only find that the issuers with large market capitalisations exhibit greater positive equity response to the securitisation events, but also that the positive CAR is more significant and more consistent for those cases than for smaller issuers. We interpret this result as a universal

[27] Despite this result, it could be argued that banks with greater potential to gain from securitisations might actually engage in more frequent securitisations.
[28] Thomas (2001), p. 316.

size factor: Minton et al. (1997) suggest that the size factor is likely to be related to the fixed cost of setting up an SPV, since some (master) trusts could be used for multiple issues.

It might be expected that larger securitisations (relative to the originator's balance sheet) would have a larger, proportional effect on the abnormal returns to equity, although very large issues might be associated with greater difficulties in defining the appropriate event window (they might be known to the market in advance) and might be associated with other corporate actions, which could diminish the effect of securitisation on the pricing date and/or make it more difficult to delineate its effects. When we test for the effect of the relative size of the securitisation issue (the size of the securitisation issue relative to assets) on equity returns using the entire sample, we find the coefficient to be positive, as expected, but very small and never significant, which is surprising given the potential importance of issue size (Table VI [VIII-XIId]; Table VII [I-V]). However, since our sample contains a large number of cases where the ultimate parent of the originator is quoted (rather than the originator itself), the size effect might be largely dependent on the effective share of equity in the issuing entity held by the ultimate parent, which varies significantly by company.

When we use a reduced sample of 299 securitisation issues, for which we have the data on the number of shareholders (and hence the size of the average shareholding), the coefficient on the relative size of the issue remains positive and becomes significant—Table VII[VI–VIIb].[29] Since the average securitisation in our sample represents approx. 9% of issuer's total assets, the coefficient on the relative size of the issue (versus originator's total assets) might be expected to equal approx. 11, if the effect of size on CAR was assumed to be linear. In other words, securitising the entire balance sheet should then result in the increase in CAR that is 11 times greater than securitising only

[29] We use the average shareholding to proxy for the agency costs—see the next section.

9% of the balance sheet. In fact, we report the coefficient on the relative size of securitisation to equal 14 in the reduced sample, indicating increasing returns to scale when securitising assets, as expected. Since the average +/-50 days CAR in our sample is approx. equal to a 3% abnormal return, when the relative size of the issue doubles from the average of 9% of the total assets to 18%, it is predicted to result in 7.2% (rather than 6%) increase in equity returns. The order of magnitude of this effect is preserved when we replace the +/-50 days CAR with the +/-10 days CAR. As reported in Table 2, the latter is approximately equal to 40% of the former in the full sample. Therefore, we would predict the coefficient on the relative size to decrease to 5.6 in the case of +/-10 days CAR—the estimated coefficient from our tests in this case is in fact 6.06 (Table VII [VIIb]). We also obtain the results of similar magnitude (and significance) when we test for the impact of the relative size of securitisations on equity returns for transactions with positive and negative returns separately (not reported).

Since Cuchra (2003) reports that country-specific effects, and legal rights in particular, might affect the pricing in securitisations, we would also like to check whether the country of origin of the assets might have a significant effect on equity. We find that securitisations bring highest abnormal returns in countries where they are most popular. In particular, the UK effect seems particularly significant: securitisations by UK originators appear to result in cumulative abnormal returns of as much as 4–6% higher than those issued in other countries. This is important since the UK represents around one-third of all securitisations in our sample, and around 50% of the total volume. Other countries with a high number of securitisations, such as Spain and France, are also associated with higher than average returns (although Italy is not). However, the significance of these results is limited (except for the UK).

D. Leverage, balance-sheet management, and agency costs

In so far as securitisations serve the purpose of managing the originator's balance sheet, while potentially increasing leverage and the effective total capital employed, the composition of liabilities at the time of issue is of interest as a factor influencing abnormal returns. We find that a decreasing share of total debt as a percentage of total assets is associated with increasing equity returns to issuers. Hence, our results indicate that companies with a relatively low level of 'debt leverage', after controlling for the total market capitalisation and the relative size of the transaction versus the originator's assets (in addition to a set of other factors as presented in Table VI), exhibit greater benefits from structured finance transactions. Since securitisations might increase the *effective* leverage, regardless of the accounting treatment, if proceeds are not fully utilised to retire existing liabilities but invested in new assets, firms with lower levels of debt might exhibit greater securitisation potential. To investigate this finding further, we test the effect of originators' ratios of total capital to assets on abnormal returns to equity, as identified earlier. We find the level of capitalisation for banks to have a significant and positive effect on abnormal returns.[30] At the same time, a high level of debt and weak capitalisation is associated with negative returns to securitisations in our sample.

Our results confirm the findings of Lockwood et al. (1996), for a smaller sample of US banks, that:

> *(...) are consistent with the hypotheses that weak banks must provide costlier means of credit enhancement, incur additional costs originating new loans, or experience decreases in loan portfolio sizes. Moreover, weaker banks perhaps are more likely to securitize their best assets leading to a deterioration of quality on their balance sheets.* (p. 160)

In this context, Bernstein and Siegel (1979) argue that negative effects of securitisations for weak banks include the decrease in the quality and stability of earnings. In particular, weak banks might lack alternative sources of financing and

[30] This effect is reversed in the case of CDOs.

securitise their best assets at a discount to their true value. This 'financial distress' rationale behind securitisations is also suggested by Minton et al. (1997), who find that:

> *Firms that securitize assets tend to have considerably weaker credit quality than other firms* (...), [while also being] *both more leveraged and less profitable than their industry counterparts.* (...) [This could point to the] *possibility that firms securitize with an eye towards reinvesting proceeds in negative NPV projects (e.g. continuation of non-viable firms).* (p. 16)

According to the authors, this is consistent with the profile of their sample of US companies in the period 1987–94. Our findings strongly support the view that poorly capitalised companies tend to exhibit significant *negative* returns to securitisations. Similarly, Lockwood et al. (1996) point out that the argument in Greenbaum and Thakor (1987) regarding asset deterioration due to informational asymmetries may apply to weak banks, but not to all banks. Moreover, results from Thomas (2001) indicate that:

> *the pattern of excess returns is most explained by one variable, the capitalisation of the asset seller: securitisation gains are more available to well-capitalised asset sellers.*[31]

Benvenite and Udell (1993) also claim that a higher capital to assets ratio is associated with greater positive returns from securitisations.

Since the total debt can be seen as a disciplining tool for management, a low level of debt might indicate greater potential for correcting agency problems, *ceteris paribus*. This could be seen as supporting the agency cost rationale for securitisations as proposed by Cuchra (2004). To test this prediction more directly, we proxy the level of potential agency problems at each firm with the inverse of a measure of the degree of shareholders' control over management. We measure shareholders' control using the average size of

[31] Our results, Lockwood et al. (1996) and results from Thomas (2001) all contradict results of Thomas (1999), who finds that gains from securitisations increase in the creditworthiness of the originator, but Thomas (2001) attributes these differences to different sample periods corresponding to specific problems present in the US banking industry in late 1980s.

shareholders' stake in the company equal to 1/(number of shareholders), as reported by Datastream from Worldscope, implicitly assuming that the presence of large shareholders limits agency problems. Once our shareholder's power measure is plugged in to our model, alongside all other independent variables, some of the latter lose their significance, whereas the coefficient on the average shareholding is strongly negative and very significant. That is, originators with highly dispersed share-ownership, which is typically associated with more managerial discretion and hence potentially greater agency costs, clearly benefit more from securitisations. This result is also highly robust to different specifications and controls. For example, although we already control for market capitalisation, we want to ensure that this effect is not due to large originators that bring many transactions to the market. To eliminate this possibility, we add controls for both originator size and origination frequency, although these do not alter our results. At the same time, narrowing our event window actually strengthens our findings. In fact, our proxy for potential agency costs is more significant in explaining abnormal returns than any other variable we have tested, albeit on a significantly reduced sample. Other studies have also found support for the agency cost explanation of securitisations (e.g. Iacobucci and Winter 2005).[32]

[32] Iacobucci and Winter (2005) measure the likelihood of a firm engaging in a securitisation, given a relatively high-powered CEO incentive contract—the underlying assumption being that firms with high potential agency problems, and which could benefit most from securitisations, also adopt highly incentivised managerial contracts. However, arguably, it is unclear why such firms would have lower potential for eliminating agency costs than those that have not adopted highly incentivised contracts.

VII. SUMMARY AND CONCLUSIONS

This study tests the effects of structured finance issues on originators' equity, using available records of all European securitisation transactions since 1987 by employing the event study methodology. We report consistent, positive effects of securitisation events on issuers' equity returns on the pricing date, as well as over longer event windows inclusive of both the pricing date and the issue date. Our findings are robust to the choice of the methodology and different controls. The robustness checks include different methods of calculating abnormal returns, incorporating controls for overlapping and correlated events, elimination of outliers, and time effects, among others. We show that returns from early securitisations are particularly high, while repeated originators earn greater abnormal returns than occasional issuers, although returns to the former also decline over time as expectations of future deals appear to be formed. Our study incorporates the analysis of events in the process of structuring and issuing of securities and we document the negative influence of potential delays in completing transactions following the pricing date, but report no additional, significant abnormal returns on the issue date alone—the date used in previous studies which provided inconclusive evidence.

In the second part of our paper, we study possible determinants of abnormal returns from securitisation events, which we delineate in the course of the analysis, including market and investor characteristics. Our results support the theory that equity holders in well-capitalised banks and firms characterised by low leverage derive greater benefits from the issuance of ABS. In this context, we find evidence supporting the agency cost rationale for securitisations. However, our findings also seem to support the conclusion that equity claimants in poorly capitalised institutions with high leverage suffer from negative abnormal returns, possibly due to a lack of alternative sources of

funding or overpricing of assets sold under circumstances close to financial distress. We further show that developed securitisation markets, as well as larger issuers and banks in particular, benefit strongly from securitisations. We also find support for the ratings as a signalling tool for the quality of originators' assets and some beneficial effects of structuring.

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TABLE I

Securitisation transactions and average number of securities (tranches) per transaction issued in Europe 1987–2003 by type of collateral.

Type of collateral	**Number of issues (transactions)**	**Mean number of tranches per issue**
Unclassified mortgages	573	3.10
Collateralised debt obligations	407	4.25
Commercial mortgages	113	4.16
Unclassified consumer loans	80	2.35
Credit cards	73	1.73
Other assets (unclassified)	68	1.53
Whole business (corporate)	51	3.51
Auto-parts	47	1.91
Standard equipment	40	2.38
Auto-leases	32	1.97
Non-performing loans	26	2.81
Non-confirming mortgages	23	5.48
Sovereign or public agency obligations	19	2.16
Trade receivables	11	2.00
Aircraft leases	9	2.33
Student loans	8	2.13
Project financing	8	1.25
Future flows	7	1.71
Floor plans	3	1.00
Catastrophic insurance	2	3.00
Health sector	2	1.00
Credit cards (other)	1	2.00
Heavy equipment	1	2.00
Shop credits	1	2.00
Total	**1605**	**3.22**

TABLE II: CUMULATIVE ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987–2003 (RESULTS FOR PRICING DATE: PART I)

Mean abnormal returns are calculated from market-adjusted returns with a sector-specific local index (sector index), except for market-adjusted returns calculated with a general local index (local index) and abnormal returns from the market model, as indicated. 'Exc. top/bottom 5% (local)' are market-adjusted returns calculated using a general local index, but excluding top and bottom 5% observations according to the AR on the event date. 'Exc. top/bottom 10 (sector)' indicates market-adjusted returns calculated using a sector-specific local index and excluding top and bottom 10 observations according to the AR on the pricing date. Abnormal returns on the event date are reported under the 'pricing day'. Cumulative abnormal returns are calculated for periods as shown, where 't +/–10' indicates the mean CAR for ten days prior to the event date, the event date, and ten days following the event date. 't –50' indicates the mean CAR for 50 days prior to the event date. '1st (subsequent) securitisation' category reports mean CAR for the first (subsequent) securitisation by a given originator ('ave. days since last' indicates the average number of days since the previous securitisation transaction by the same originator for securitisations in a given category); 'inc. AAA tranche' indicates that returns are calculated only for observations such that at least one AAA-rated tranche is part of the transaction. Corresponding t-statistics are shown in round brackets; the percentages of positive and negative abnormal returns on the pricing day are shown under AR>0 and AR<0, respectively. Significance at the 10% level is indicated in bold and italics; at the 5% level in bold; and at 1% in bold and '*'.

		pricing day	t +/–10	t +/–20	t +/–50	t –50	t –20	t –10	t +10	t +20	t +50	day 0 AR>0	day 0 AR<0	obs. #	days since last
1	market (local index)–adj.	**0.28*** (3.63)	**1.16*** (3.26)	**1.50*** (3.02)	**2.82*** (3.63)	**1.17** (2.15)	0.31 (0.91)	0.34 (1.40)	**0.53** (2.18)	**0.90** (2.61)	**1.36** (2.49)	58%	40%	727	–
2	market (sector index)–adj.	**0.25*** (3.46)	**0.96*** (2.88)	0.64 (1.38)	0.82 (1.13)	0.25 (0.48)	0.05 (0.15)	0.28 (1.22)	***0.43*** (1.86)	0.34 (1.06)	0.33 (0.64)	54%	42%	678	–
3	market model	**0.23*** (3.28)	**0.82** (2.55)	**0.96** (2.10)	***1.28*** (1.79)	0.49 (0.97)	0.19 (0.60)	0.23 (1.04)	0.35 (1.56)	***0.53*** (1.67)	0.56 (1.11)	57%	43%	726	–
4	exc. top/bottom 10 (sector)	**0.27*** (4.31)	**0.85*** (2.93)	**1.20*** (2.98)	**1.97*** (3.12)	**0.93** (2.09)	***0.49*** (1.74)	0.30 (1.51)	0.27 (1.37)	0.44 (1.56)	***0.77*** (1.73)	54%	41%	658	–
5	exc. top/bottom 5% (local)	**0.32*** (4.33)	**1.18*** (3.38)	**2.03*** (2.63)	**3.98*** (3.19)	**1.51*** (3.02)	**0.67** (2.09)	0.32 (1.39)	**0.54** (2.35)	**1.04*** (3.25)	**2.14*** (4.28)	59%	40%	651	–
6	1st securitisation	**0.48*** (6.58)	**1.36*** (4.08)	**1.03** (2.22)	***1.34*** (1.84)	0.36 (0.72)	0.20 (0.63)	0.14 (0.61)	**0.74*** (3.22)	0.35 (1.09)	0.51 (1.02)	57%	39%	146	–
7	2nd securitisation	–0.05 (–0.68)	**0.76** (2.28)	**1.40*** (3.01)	***1.32*** (1.81)	0.54 (1.08)	0.13 (0.41)	–0.11 (–0.48)	**0.93*** (4.04)	**1.32** (4.13)	***0.83*** (1.66)	49%	50%	84	347
8	3rd securitisation	**0.30*** (4.11)	**1.99*** (5.98)	**2.89*** (6.22)	**6.51*** (8.92)	**3.60*** (7.20)	**1.41*** (4.40)	**0.90*** (3.91)	**0.79*** (3.43)	**1.18*** (3.69)	**2.61*** (5.22)	54%	38%	61	262
9	4th securitisation	**0.41*** (5.62)	**1.20*** (3.60)	**1.56*** (3.35)	**1.92*** (2.63)	**1.04** (2.08)	**1.39*** (4.34)	**1.04*** (4.52)	–0.25 (–1.09)	–0.24 (–0.75)	0.48 (0.96)	57%	39%	49	204
10	5th securitisation	0.09 (1.23)	**1.06*** (3.18)	0.52 (1.12)	–0.48 (–0.66)	0.70 (1.40)	**0.78** (2.44)	**1.22*** (5.30)	–0.25 (–1.09)	–0.35 (–1.09)	**–1.24** (2.48)	50%	42%	40	151
11	6th securitisation	**0.64*** (9.14)	0.33 (1.00)	***0.84*** (1.79)	**3.13*** (4.29)	**1.21** (2.42)	0.39 (1.18)	–0.18 (–0.78)	–0.14 (–0.61)	–0.19 (0.58)	**1.27** (2.54)	50%	47%	36	148
12	inc. AAA tranche	**0.26*** (3.70)	**1.08*** (3.24)	**1.62*** (3.48)	**2.17*** (2.97)	***0.93*** (1.86)	***0.57*** (1.73)	0.34 (1.48)	**0.48** (2.09)	**0.78** (2.36)	***0.97*** (1.94)	56%	41%	510	–

TABLE III: CUMULATIVE ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987–2003 (RESULTS FOR PRICING DATE: PART II)

Abnormal returns are calculated from market-adjusted returns with a sector-specific local index (sector index) except for market-adjusted returns with a local index-adjusted returns (local index), where indicated. Abnormal returns at the event date are reported under the 'pricing day'. Cumulative abnormal returns are calculated for periods as shown, where 't +/–10' indicates the mean CAR for ten working days before the event date, the event date, and ten days after the event date; 't –50' indicates the mean CAR for 50 working days prior to the event date and the event date'; 'no overlap sample' indicates that returns are calculated only for observations such that no other transaction by the same originator has been brought to the market (according to the pricing date) within 100 days around the current pricing date; 'first in a series only' indicates that returns are calculated only for observations such that there was no transaction for the same originator in the last 100 days (according to the pricing date), but there were transactions by the same originator within 100 days after the pricing date. RMBS & CMBS are residential-mortgaged backed securities and commercial mortgaged-backed securities; CDO are collateralised debt obligations and include CLOs; CONSUMER are securitisations of consumer loans and obligations; CORPORATE are securitisations of corporate assets and OTHER are other otherwise unclassified securitisations. Type- and year-specific results include observations only from the particular period (years) or of particular type. Significance at the 10% level is indicated in bold and italics; at the 5% level in bold; and at 1% in bold and '*'; the number of observations is reported in the last column.

		pricing day	t +/–10	t +/–20	t +/–50	t –50	t –20	t –10	t +10	t +20	t +50	# obs
1	market (local index)–adj. [no overlap sample]	**0.40*** (5.19)	**1.32*** (3.77)	**2.31*** (4.66)	**3.94*** (5.07)	**1.41** (2.56)	0.48 (1.37)	0.12 (0.50)	**0.80*** (3.33)	**1.43*** (4.09)	**2.13*** (3.87)	416
2	market (sector index)–adj. [no overlap sample]	**0.38*** (5.43)	**1.24*** (3.72)	**1.67*** (3.55)	**2.41*** (3.30)	0.79 (1.55)	0.25 (0.76)	0.10 (0.43)	**0.76*** (3.30)	**1.04*** (3.15)	**1.24** (2.43)	384
3	market (local index)–adj. [first in a series only]	**0.15** (1.96)	**1.73*** (4.89)	**2.11*** (4.26)	**5.86*** (7.54)	**1.97*** (3.60)	0.21 (0.61)	**1.00*** (4.10)	**0.58*** (2.37)	**1.75*** (5.06)	**3.74*** (6.84)	105
4	market (local index)–adj. [overlap sample only]	0.12 (1.56)	**0.94*** (2.69)	0.40 (0.80)	***1.31*** (1.69)	0.86 (1.56)	0.09 (0.26)	**0.64*** (2.67)	0.17 (0.71)	0.19 (0.54)	0.33 (0.60)	311
5	market (sector index)–adj. [overlap sample only]	0.08 (1.14)	***0.59*** (1.77)	–0.70 (–1.51)	***–1.25*** (–1.71)	–0.46 (–0.90)	–0.22 (–0.67)	**0.52** (2.26)	–0.01 (–0.04)	***–0.57*** (1.73)	***–0.87*** (–1.71)	294
6	RMBS & CMBS	**0.23*** (3.15)	**1.24*** (3.72)	–0.34 (–0.73)	**–1.45** (–1.99)	**–1.32*** (–2.64)	**–0.78** (–2.36)	0.31 (1.35)	**0.69*** (3.00)	0.21 (0.64)	–0.36 (–0.72)	291
7	CDO	**0.27*** (3.70)	**0.93*** (2.79)	**1.60*** (3.44)	**2.96*** (4.05)	**1.98*** (3.96)	**1.10*** (3.33)	**0.46** (2.00)	0.20 (0.87)	0.23 (0.70)	0.70 (1.40)	198
8	CONSUMER	**0.18** (2.47)	0.22 (0.66)	**1.05** (2.26)	***2.60*** (1.90)	**1.46*** (2.92)	0.33 (1.00)	0.02 (0.09)	0.02 (0.09)	***0.54*** (I.64)	***0.97*** (1.94)	90
9	CORPORATE	**0.18** (2.47)	**0.65** (1.95)	**2.20*** (4.73)	2.41 (1.37)	–0.10 (0.20)	–0.42 (1.27)	**–0.49** (–2.13)	**0.96*** (4.17)	**2.45*** (7.42)	**2.36*** (4.72)	58
10	OTHER	**0.57*** (8.14)	**1.22*** (3.70)	–0.07 (–0.15)	0.57 (0.78)	***0.84*** (1.68)	**0.87*** (2.64)	**0.85*** (3.70)	–0.19 (–0.83)	**–1.52*** (–4.61)	***–0.85*** (–1.70)	40
11	year 2003	**0.21*** (3.00)	**0.99*** (3.00)	**1.98*** (4.21)	**3.34*** (4.58)	**2.69*** (5.27)	**1.22*** (3.70)	**0.63** (2.74)	0.15 (0.65)	***0.54*** (1.64)	0.44 (0.86)	133
12	year 2002	**0.15** (2.14)	**1.31*** (3.97)	0.74 (1.57)	1.18 (1.62)	–0.08 (0.16)	–0.34 (–1.03)	–0.06 (–0.26)	**1.21*** (5.26)	**0.93*** (2.82)	**1.11** (2.18)	121
13	years 2000–2001	**0.42**	**1.56**	**1.98**	**2.22**	0.61	0.54	**0.62**	**0.52**	**1.02**	**1.19**	199
14	years 1994–99	**0.34**	**0.75**	**1.29**	**2.66**	**1.17**	0.52	0.32	0.10	0.44	1.16	168
15	years 1991–93	**–0.93***	**–5.63***	**–25.72***	**–46.30***	**–23.74***	**–12.91***	**–2.74***	**–1.96***	**–11.88***	**–21.63***	22
16	years 1987–90	***0.14***	**1.32**	1.14	**2.92**	0.70	0.03	–0.13	1.31	**0.97**	**2.08**	35

TABLE IV: CUMULATIVE ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987-2003 (ISSUE DATE)

Abnormal returns are calculated from market-adjusted returns with a sector-specific, local index. 'Exc. top/bottom 10 (sector)' indicates market-adjusted returns excluding top and bottom ten observations according to the AR on the issue date. Abnormal returns on the issue date are reported under the 'issue day'. CAR are calculated for periods as shown, where 't +/–3' indicates the mean CAR for three days before the event date, the event date, and three days after the event date. 't –50' indicates the mean CAR for 50 days prior to the event date; 'px date' is the pricing date; 'px date AR>0' indicates that returns are calculated for observations with a positive AR on the pricing date only; 'px date < 15 days earlier' indicates that results are calculated only for observations such that the pricing date occurred at least 15 working days prior to the issue date; 'px date ≠ issue date' indicates that returns are calculated only for observations such that the pricing date is earlier than the issue date; 'no overlap for +/–100 days' indicates that returns are calculated only for observations such that no other transaction by the same originator has been priced within 100 days around the pricing date; 'at least 4 deals completed' indicates that returns are calculated only for transactions such that the same originator has already completed at least four transactions to date; 'first in a series' indicates that returns are calculated only for observations such that there was no transaction for the same originator in the last 100 days, but there were transactions by the same originator within 100 days after the pricing date. Corresponding t-statistics are shown in round brackets; percentage of non-negative abnormal returns is shown in square brackets. Significance at the 10% level is indicated in bold and italics; at the 5% level in bold; and at 1% in bold and '*'; the number of observations in each category is shown in the last column.

		issue day	t +/–3	t +/–10	t +/–20	t +/–50	t –50	t –20	t –10	t +10	t +20	t +50	day 0AR>0	day 0AR<0	obs. #
1	market (sector index)–adj.	0.08 (1.11)	**0.52** (2.74)	***0.59*** (1.80)	***0.79*** (1.72)	0.85 (1.19)	0.41 (0.82)	0.46 (1.46)	0.31 (1.36)	0.20 (0.90)	0.24 (0.76)	0.36 (0.71)	47%	45%	712
2	exc. top/bottom 10 (sector)	0.01 (0.14)	**0.40** (2.12)	**0.67** (2.05)	***0.87*** (1.91)	**2.00*** (2.79)	**1.35** (2.68)	**0.79** (2.48)	***0.43*** (1.91)	0.23 (1.02)	0.08 (0.25)	0.64 (1.27)	46%	45%	640
3	px date AR > 0	**0.36*** (5.05)	**0.99*** (5.25)	**1.79*** (5.48)	**2.08*** (4.56)	**3.03*** (4.23)	**1.24** (2.46)	**1.17*** (3.67)	**0.88*** (3.90)	**0.55** (2.44)	***0.55*** (1.72)	**1.44** (2.86)	65%	34%	364
4	px date AR < 0	**–0.37*** (–5.19)	–0.04 (–0.21)	–0.49 (–1.50)	–0.52 (–1.14)	–0.23* (–0.32)	0.50 (0.99)	–0.11 (–0.34)	–0.27 (–1.20)	0.15 (0.67)	–0.03 (–0.09)	–0.36 (–0.71)	30%	67%	284
5	px date < 15 days earlier	0.11 (1.54)	**0.53*** (2.81)	**0.83** (2.54)	***0.89*** (1.95)	***1.28*** (1.79)	0.74 (1.47)	***0.54*** (1.69)	***0.38*** (1.69)	0.34 (1.51)	0.24 (0.75)	0.24 (0.48)	48%	44%	650
6	px date > 15 days earlier	**–0.14** (–1.96)	0.06 (0.32)	**–2.12*** (–6.49)	–0.24 (–0.53)	**–3.29*** (–4.59)	**–3.40*** (–6.74)	–0.35 (–1.10)	**–0.81*** (–3.59)	**–1.17*** (–5.19)	0.25 (0.78)	0.25 (0.50)	43%	51%	49
7	px date > 10 days earlier	–0.08 (–1.12)	***0.36*** (1.91)	–0.30 (–0.92)	–0.32 (–0.70)	**–1.70** (–2.37)	–0.75 (–1.49)	0.44 (1.38)	0.13 (0.58)	–0.35 (–1.55)	**–0.69** (–2.16)	***–0.87*** (–1.73)	44%	47%	133
8	px date ≠ issue date	–0.02 (–0.28)	**0.42** (2.23)	***0.63*** (1.93)	**1.10** (2.41)	0.95 (1.33)	0.76 (1.51)	**0.94*** (2.95)	**0.51** (2.26)	0.14 (0.62)	0.18 (0.56)	0.21 (0.42)	45%	46%	455
9	no overlap for +/–100 days	***0.12*** (1.68)	**0.39** (2.07)	**1.03*** (3.15)	**1.27*** (2.78)	**2.34*** (3.27)	**1.08** (2.14)	***0.58*** (1.82)	**0.45** (2.00)	**0.46** (2.04)	***0.57*** (1.79)	**1.14** (2.26)	49%	42%	408
10	at least 4 deals completed [where 4 ~ the median]	**0.14** (1.96)	**0.70*** (3.71)	0.22 (0.67)	0.29 (0.64)	–0.70 (–0.98)	–0.59 (–1.17)	0.00 (0.00)	–0.04 (–0.18)	0.12 (0.53)	0.14 (0.44)	–0.25 (–0.50)	48%	45%	349
11	less than 4 deals completed [where 4 ~ the median]	0.02 (0.28)	**0.37** (1.96)	**0.95*** (2.91)	**1.27*** (2.78)	**2.34*** (3.27)	**1.38*** (2.74)	**0.91*** (2.85)	**0.64*** (2.84)	0.28 (0.53)	0.34 (1.07)	***0.94*** (1.86)	46%	44%	363
12	first in a series	–0.11 (–1.54)	**0.60*** (3.18)	***0.61*** (1.87)	**2.18*** (4.78)	**2.90*** (4.05)	**1.51*** (3.00)	**1.55*** (4.86)	**0.75*** (3.33)	–0.02 (–0.09)	**0.74** (2.32)	**1.50*** (2.98)	41%	51%	102
13	not first in a series	0.11 (1.54)	**0.50*** (2.65)	***0.58*** (1.78)	0.55 (1.20)	0.51 (0.71)	0.23 (0.46)	0.28 (0.88)	0.23 (1.02)	0.24 (1.06)	0.16 (0.50)	0.17 (0.34)	48%	44%	610

TABLE V: DAILY ABNORMAL RETURNS AROUND THE SECURITISATION PRICING DATE

Abnormal returns (AR) are market-adjusted returns calculated using the sector-specific local index daily returns (columns II–III); using the general local index daily returns (columns IV–V); using the full market model (columns VI–VII); and using the sector-specific local index daily returns, but excluding all transactions such that another securitisation from the same originator is placed on the market within 100 days before or after (columns VIII–IX). Abnormal returns at the event date are reported as day 0. Cumulative abnormal returns (CAR) are also shown.

	Local market–adjusted abnormal returns		**Sector index–adjusted abnormal returns**		**Market model abnormal returns**		**Sector index–adjusted excl. overlap cases[1]**	
Day	AR	CAR	AR	CAR	AR	CAR	AR	CAR
– 20	– 0.090	– 0.090	– 0.045	– 0.045	– 0.109	– 0.109	0.028	0.028
– 19	– 0.099	– 0.190	– 0.072	– 0.117	– 0.117	– 0.225	0.052	0.080
– 18	– 0.079	– 0.268	– 0.050	– 0.167	– 0.060	– 0.285	0.033	0.113
– 17	0.111	– 0.157	0.031	– 0.136	0.091	– 0.194	0.063	0.176
– 16	0.140	– 0.017	0.025	– 0.111	0.092	– 0.102	0.066	0.242
– 15	– 0.123	– 0.140	– 0.096	– 0.206	– 0.063	– 0.165	– 0.126	0.116
– 14	– 0.066	– 0.206	– 0.040	– 0.246	– 0.053	– 0.218	– 0.060	0.056
– 13	– 0.027	– 0.233	– 0.026	– 0.272	– 0.031	– 0.248	0.032	0.088
– 12	0.130	– 0.103	0.044	– 0.228	0.121	– 0.127	0.082	0.114
– 11	0.073	– 0.030	– 0.004	– 0.232	0.085	– 0.043	– 0.015	0.099
– 10	0.111	0.081	0.106	– 0.126	0.105	0.063	0.125	0.224
– 9	– 0.054	0.027	– 0.004	– 0.130	– 0.043	0.020	0.058	0.282
– 8	0.146	0.173	0.120	– 0.010	0.084	0.104	0.042	0.324
– 7	0.030	0.203	– 0.070	– 0.080	0.012	0.116	–0.192	0.132
– 6	0.126	0.330	0.086	0.006	0.134	0.250	0.015	0.147
– 5	0.119	0.448	0.183	0.189	0.110	0.360	0.263	0.410
– 4	– 0.069	0.379	– 0.047	0.141	– 0.066	0.293	– 0.057	0.353
– 3	0.050	0.429	0.036	0.177	0.017	0.310	0.016	0.369
– 2	– 0.071	0.358	– 0.063	0.114	– 0.082	0.229	– 0.083	0.286
– 1	– 0.044	0.314	– 0.066	0.048	– 0.038	0.191	– 0.089	0.197
0	**0.281**	**0.594**	**0.251**	**0.299**	**0.234**	**0.424**	**0.381**	**0.578**
1	0.024	0.618	– 0.010	0.289	– 0.006	0.419	– 0.038	0.540
2	0.092	0.710	0.079	0.368	0.086	0.504	0.072	0.612
3	0.084	0.794	0.089	0.458	0.069	0.573	– 0.052	0.560
4	0.046	0.840	0.018	0.476	0.036	0.610	0.044	0.604
5	– 0.056	0.784	– 0.042	0.434	– 0.034	0.575	– 0.047	0.557
6	– 0.008	0.776	– 0.041	0.393	0.024	0.599	0.133	0.690
7	0.166	0.941	0.089	0.482	0.111	0.710	0.174	0.864
8	0.180	1.121	0.221	0.703	0.138	0.848	0.327	1.191
9	0.000	1.121	0.010	0.713	– 0.072	0.776	0.050	1.241
10	0.005	1.126	0.014	0.727	– 0.001	0.775	0.098	1.339
11	0.094	1.221	0.020	0.747	0.053	0.828	0.066	1.405
12	0.021	1.242	0.007	0.754	0.034	0.862	– 0.008	1.397
13	– 0.021	1.221	– 0.005	0.749	– 0.027	0.835	0.110	1.507
14	0.079	1.300	0.025	0.773	0.034	0.869	0.004	1.511
15	0.096	1.397	0.097	0.870	0.049	0.918	0.093	1.604
16	0.096	1.492	0.046	0.917	0.090	1.008	– 0.028	1.576
17	0.043	1.535	– 0.073	0.844	0.024	1.032	0.035	1.611
18	– 0.113	1.422	– 0.192	0.652	– 0.130	0.902	– 0.066	1.545
19	– 0.063	1.359	– 0.067	0.586	– 0.061	0.841	– 0.056	1.489
20	0.138	1.497	0.058	0.644	0.117	0.958	0.128	1.617

TABLE VI: FACTORS ASSOCIATED WITH ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987–2003 (PART I)

The dependent variable in regressions I–XII and XIId is the cumulative abnormal return CAR (excess return above sector-specific local index for I–XII and above the overall local index for XIId) for +/–50 days around the pricing date (+/–20 days for regression XIIb; post-event 50 days for regression XIIc). Independent variables are: 'after 1999' is a dummy = 1 if transaction was completed in 2000 or later; 'which securitisation' is the number of previous securitisations by the same originator + 1; 'debt leverage' is the originator's ratio of debt to assets according to the last annual report; 'log of market value' is the log of originator's market capitalisation in US$ on the date of issue; 'rating spread' is the differential between the top and bottom tranche rating index, where AAA = 6 and not rated issues NR = 0; 'top rating' is the rating index of the top tranche; 'UK' is a dummy = 1 if assets are originated in the UK; 'sec issue share of assets' is the ratio of the sum of all tranches to originator's total assets at the last annual report; 'sec type share of annual' is the share of the particular transaction in the total annual issuance for all European transactions of the same type, the same rating and the same weighted average life; 'rel no of extra tranches' is the share of additional tranches with the same rating as other tranches to all tranches for each transaction; 'top/bottom 5%' is a dummy = 1 if the transaction is in the top or bottom 5% of all transactions according to CAR' 'banks' is a dummy = 1 if the originator is a bank; and the number of tranches represents the total number of tranches issued per transaction. All regressions include a constant as reported; significance at the 10% level in bold and italics; at the 5% level in bold; and at 1% in bold and '*'.

regression	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIIb (local)	XIIc (+/–20)	XIId (post 50)
after 1999 dummy	**4.36*** (2.59)	**4.72*** (2.81)	**5.00*** (2.96)	**3.36** (1.96)	2.84 (1.62)	1.38 (0.75)	1.84 (1.00)	0.93 (0.49)	1.09 (0.57)	1.09 (0.58)	1.32 (0.70)	0.86 (0.45)	**4.54** (2.25)	0.92 (0.64)	0.26 (0.20)
which securitisation		**–0.52** (–2.33)	**–0.48** (–2.17)	**–0.79*** (–3.47)	**–0.83*** (–3.59)	**–0.73*** (–3.13)	**–0.81*** (–3.44)	**–0.69*** (–2.84)	**–0.69*** (–2.86)	**–0.64*** (–2.65)	**–0.73*** (–2.99)	**–0.73*** (–3.00)	**–0.62** (–2.38)	**–0.39** (–2.13)	–0.24 (–1.43)
debt leverage			**–16.60*** (–4.59)	**–8.05** (–1.99)	**–8.20** (–2.03)	**–10.26** (–2.50)	**–9.52** (–2.31)	**–10.45*** (–2.52)	**–9.74** (–2.34)	**–8.97** (–2.16)	***–7.95*** (–1.91)	**–8.61** (–2.06)	**–8.71** (–1.99)	–4.78 (–1.54)	***–5.53*** (–1.92)
log of market value				**2.40*** (4.46)	**2.31*** (4.27)	**1.79*** (3.12)	**2.16*** (3.57)	**2.08*** (3.35)	**2.21*** (3.53)	**1.79*** (2.83)	**1.63*** (2.56)	**1.54** (2.40)	1.00 (1.52)	0.72 (1.51)	0.31 (0.70)
ratings spread					0.76 (1.24)	0.64 (1.04)	0.74 (1.20)	0.91 (1.46)	***1.06*** (1.68)	***1.16*** (1.85)	**1.22** (1.96)	***1.05*** (1.65)	0.80 (1.16)	0.75 (1.58)	0.36 (0.81)
top rating (AAA=max)						**1.18*** (2.62)	**1.36*** (2.95)	**0.99** (2.01)	**0.96** (1.96)	***0.93*** (1.90)	***0.93*** (1.91)	0.70 (1.36)	0.80 (1.52)	***0.64*** (1.67)	0.40 (1.11)
UK dummy							***3.88*** (1.89)	**4.49** (2.16)	**4.95** (2.36)	**5.61*** (2.68)	**6.51*** (3.07)	**6.15*** (2.88)	**8.23*** (3.71)	***2.80*** (1.76)	**3.62** (2.46)
sec issue share of assets								1.04 (0.25)	2.08 (0.50)	1.54 (0.37)	2.98 (0.71)	3.09 (0.74)	***2.21*** (1.76)	0.99 (0.32)	0.23 (0.08)
sec type share of annual								**–9.66** (–2.08)	**–10.01** (–2.16)	**–11.61** (–2.50)	**–12.30*** (–2.65)	**–13.11*** (–2.80)	**–11.11** (–2.26)	–5.66 (–1.64)	**–8.76*** (–2.72)
rel no of extra tranches									–5.36 (–1.58)	–4.35 (–1.29)	–4.78 (–1.42)	***–8.61*** (–1.91)	–0.21 (–0.05)	–4.74 (–1.41)	***–5.75*** (–1.84)
top / bottom 5% dummy										**–8.45*** (–3.20)	**–8.15*** (–3.09)	**–8.20*** (–3.11)	**–10.92*** (–3.87)	–3.04 (–1.55)	***–3.11*** (–1.71)
banks dummy											**4.26** (2.25)	**3.89*** (2.03)	**6.44*** (3.33)	0.85 (0.60)	1.85 (1.40)
number of tranches												0.56 (1.28)	0.10 (0.22)	0.40 (1.25)	0.43 (1.42)
constant	–2.09	0.38	6.15	–15.46	–14.68	–14.78	–20.22	–14.35	–14.91	–10.57	–12.34	–10.47	–9.45	–7.66	–0.88
R^2	0.00	0.02	0.05	0.07	0.08	0.08	0.09	0.09	0.09	0.11	0.11	0.11	0.10	0.05	0.05
no. of observations	678	678	653	653	653	653	653	653	653	653	653	653	699	653	653

TABLE VII: FACTORS ASSOCIATED WITH ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987–2003 (PART II)

The dependent variable is the cumulative abnormal return CAR (excess return above sector-specific local index) for +/–50 days around the pricing date (px date) or the closing date (issue date). Independent variables are: 'after 1999' is a dummy = 1 if the transaction was completed in 2000 or later; 'which securitisation' is the number of previous securitisations by the same originator + 1; 'debt to assets' is the originator's ratio of the total debt to total assets according to the last annual report (Worldscope) prior to the date of issue; 'log of market value' is the log of originator's market capitalisation in US$ on the date of issue; 'rating spread' is the differential between the top and bottom tranche rating index, where AAA = 6 and not rated issues NR = 0; 'top rating' is the rating index of the top tranche; 'UK' is a dummy = 1 if assets are originated in the UK; 'sec issue share of assets' is the ratio of the sum of all tranches to originator's total assets at the last annual report; 'sec type share of annual' is the share of the particular transaction in the total annual issuance for all European transactions of the same type, the same rating and the same weighted average life; 'rel no of extra tranches' is the share of additional tranches with the same rating as other tranches to all tranches for each transaction; 'top/bottom 5%' is a dummy = 1 if the transaction is in the top or bottom 5% of all transactions according to CAR' 'banks' is a dummy = 1 if the originator is a bank; 'number of tranches' represents the total number of tranches issued per transaction; 'issue after pricing' is the number of days between the pricing and the issue date; 'average shareholding' is equal to 1/(number of shareholders) as reported by Datastream. All regressions include a constant as reported; significance at the 10% level is indicated in bold and italics; at the 5% level in bold; and at 1% in bold and '*'.

	I	II	III	IV	V	VI	VIIa	VIIb
event date:	px date	issue date	px date	px date	issue date	px date	px date	px date
event window:	+/–50 days	+/–50 days	+/–50 days	+/–50 days	+/–50 days	+/–50 days	+/–50 days	+/–10 days
after 1999 dummy	0.86 (0.45)	1.08 (0.60)	1.96 (0.35)	1.10 (0.56)	1.38 (0.74)	–0.75 (–0.57)	1.49 (1.03)	***1.34*** (1.65)
which securitisation	**–0.73*** (–3.00)	**–0.70*** (–2.98)	**–0.75*** (–2.99)	**–0.76*** (–3.02)	**–0.71*** (–2.96)	–0.07 (–0.38)	**–0.72*** (–2.76)	–0.19 (–1.31)
debt to assets	**–8.61** (–2.06)	**–9.94** (–2.53)	**–14.26*** (–2.71)	**–13.61*** (–2.59)	**–13.58*** (–2.84)	3.38 (0.66)	3.52 (0.70)	1.16 (0.41)
log of market value	**1.54** (2.40)	**1.05** (1.78)	**1.96*** (2.88)	**1.93*** (2.84)	**1.34** (2.16)	0.80 (1.47)	0.73 (1.36)	***–0.53*** (–1.76)
ratings spread	***1.05*** (1.65)	***0.91*** (1.50)	***1.11*** (1.71)	0.93 (1.42)	0.77 (1.23)	0.44 (0.92)	0.52 (1.09)	–0.30 (–1.11)
top rating (AAA=max)	0.70 (1.36)	0.75 (1.54)	0.62 (1.19)	0.73 (1.38)	0.81 (1.62)	–0.36 (–1.06)	–0.12 (–0.34)	–0.10 (–0.51)
UK dummy	**6.15*** (2.88)	**5.68*** (2.85)	**5.68** (2.30)	**5.14** (2.22)	**4.64** (2.16)	0.09 (0.06)	–0.36 (–0.25)	–0.88 (–1.10)
sec issue share of assets	3.09 (0.74)	–0.002 (–0.00)	1.64 (0.38)	1.36 (0.31)	0.00 (0.00)	**14.06** (2.37)	**14.36** (2.47)	***6.06*** (1.84)
sec type share of annual	**–13.11*** (–2.80)	**–14.30*** (–3.25)	**–11.72** (–2.43)	**–10.63** (–2.19)	**–11.81** (–2.56)	2.80 (0.84)	1.29 (0.39)	1.02 (0.55)
rel no of extra tranches	***–8.61*** (–1.91)	***–6.72*** (–1.60)	–8.73 (–0.64)	**–9.42** (–2.03)	***–7.59*** (–1.76)	1.56 (0.44)	2.57 (0.73)	–2.34 (–1.17)
top / bottom 5% dummy	**–8.20*** (–3.11)	**–9.11** (–2.51)	**–7.92*** (–2.96)	**–7.66*** (–2.87)	**–8.69*** (–3.41)	**–7.40*** (3.02)	**6.51*** (2.69)	1.57 (1.15)
banks dummy	**3.89** (2.03)	**1.62*** (2.64)	**5.88** (2.27)	**5.42** (2.37)	**5.68*** (2.75)	0.76 (0.38)	–0.20 (–0.10)	–0.83 (–0.74)
number of tranches	0.56 (1.28)	0.41 (1.07)	0.58 (1.32)	***0.74*** (1.64)	0.62 (1.45)	0.05 (0.16)	0.05 (0.17)	**0.43** (2.52)
total capital % total assets			***0.11*** (1.73)	***0.10*** (1.62)	0.08 (1.41)	*0.02* (0.42)	0.03 (0.54)	0.02 (0.69)
issue after pricing (days)				***–0.20*** (–1.85)	***–0.20*** (–1.91)	*–0.01* (–0.12)	0.01 (0.06)	–0.01 (–0.03)
average shareholding (%)						**–11687** (–2.56)	**–11241** (–2.51)	**–13537*** (–5.36)
number of deals per originator							**0.26*** (3.56)	**0.08** (2.02)
constant	–10.47	–5.82	–16.19	–2.04	–10.06	–0.93	–7.28	3.93
R^2	0.11	0.13	0.14	0.14	0.14	0.10	0.14	0.15
no. of observations	653	686	633	633	666	299	299	299

TABLE VIII: FACTORS ASSOCIATED WITH ABNORMAL RETURNS TO EQUITY IN EUROPEAN SECURITISATIONS 1987–2003 (PART III)

The dependent variable is the cumulative abnormal return CAR (excess return above sector-specific local index) for +/–20 days around the pricing date. Independent variables are: 'after 1999' is a dummy = 1 if transaction was completed in 2000 or later; 'which securitisation' is the number of previous securitisations by the same originator + 1; 'debt leverage' is the originator's ratio of debt to assets according to the last annual report; 'log of market value' is the log of originator's market capitalisation in US$ on the date of issue; 'rating spread' is the differential between the top and bottom tranche rating index, where AAA = 6 and not rated issues NR = 0; 'top rating' is the rating index of the top tranche; 'UK' is a dummy = 1 if assets are originated in the UK; 'sec issue share of assets' is the ratio of the sum of all tranches to originator's total assets at the last annual report; 'sec type share of annual' is the share of the particular transaction in the total annual issuance for all European transactions of the same type, the same rating and the same weighted average life; 'rel no of extra tranches' is the share of additional tranches with the same rating as other tranches to all tranches for each transaction; 'top/bottom 5%' is a dummy = 1 if the transaction is in the top or bottom 5% of all transactions according to CAR' 'banks' is a dummy = 1 if the originator is a bank; and the number of tranches represents the total number of tranches issued per transaction. All regressions include a constant as reported; significance at the 10% level in bold and italics; at the 5% level in bold; and at 1% in bold and '*'.

regression:	**I**	**II**	**III**	**IV**	**V**
sample:	ALL	CDO	MORTGAGE	CORPORATE	OTHER
event window	+/–20 days	+/–20 days	+/–20 days	+/–20 days	+/–20 days
after 1999 dummy	0.95 (0.64)	**5.06*** (2.73)	–0.66 (–0.19)	–1.92 (–0.43)	4.81 (0.99)
which securitisation	**–0.38** (–2.03)	–0.21 (–1.42)	–0.37 (–1.05)	0.44 (0.55)	–0.35 (–0.46)
total debt to assets	**–8.13** (–2.07)	5.19 (1.41)	–12.49 (–1.51)	0.97 (0.07)	11.72 (1.09)
log of market value	***0.92*** (1.81)	–0.59 (–1.23)	**2.51** (2.06)	1.07 (0.79)	1.37 (1.18)
ratings spread	0.65 (1.33)	–0.22 (0.78)	**3.16** (2.28)	**4.07** (1.99)	0.93 (0.32)
top rating (AAA=max)	***0.67*** (1.71)	***–0.62*** (–1.69)	0.40 (0.40)	–0.39 (0.37)	1.04 (1.03)
UK dummy	1.66 (0.96)	2.46 (0.64)	–0.70 (–0.20)	–2.01 (–0.41)	0.91 (0.15)
sec issue share of assets	–0.30 (–0.09)	***14.20*** (1.90)	46.71 (1.33)	–4.07 (–0.44)	20.47 (1.59)
sec type share of annual	–3.86 (–1.07)	**–18.67** (–2.03)	2.15 (0.16)	–67.03 (–0.64)	93.96 (1.56)
rel no of extra tranches	–4.90 (–1.42)	***–4.20*** (–1.65)	0.06 (0.01)	–3.98 (–0.48)	2.57 (0.29)
top / bottom 5% dummy	–2.76 (–1.39)	**6.49** (3.60)	**–9.54** (–2.35)	**10.18** (2.41)	–2.01 (–0.46)
banks dummy	1.97 (1.16)	**–2.28** (–1.73)	**10.48*** (2.79)	***–13.47*** (–1.79)	**–9.61** (–2.45)
number of tranches	0.52 (1.54)	**0.65** (2.93)	0.23 (0.27)	0.62 (0.50)	**–3.27** (–2.39)
total capital % total assets	0.07 (1.54)	**–0.14** (–2.81)	**0.23** (2.36)	–0.12 (–1.00)	**–0.15** (–2.09)
issue after pricing (days)	–0.14 (–1.70)	–0.04 (–0.87)	–0.22 (–1.26)	0.05 (0.11)	0.25 (1.30)
constant	–1.64	12.32	–1.82	0.58	–1.15
R^2	0.08	0.22	0.17	0.32	0.61
no. of observations	633	190	271	54	37

FIGURE 1: SECTOR INDEX-ADJUSTED CUMULATIVE RETURNS (100 DAYS AROUND THE EVENT DATE)

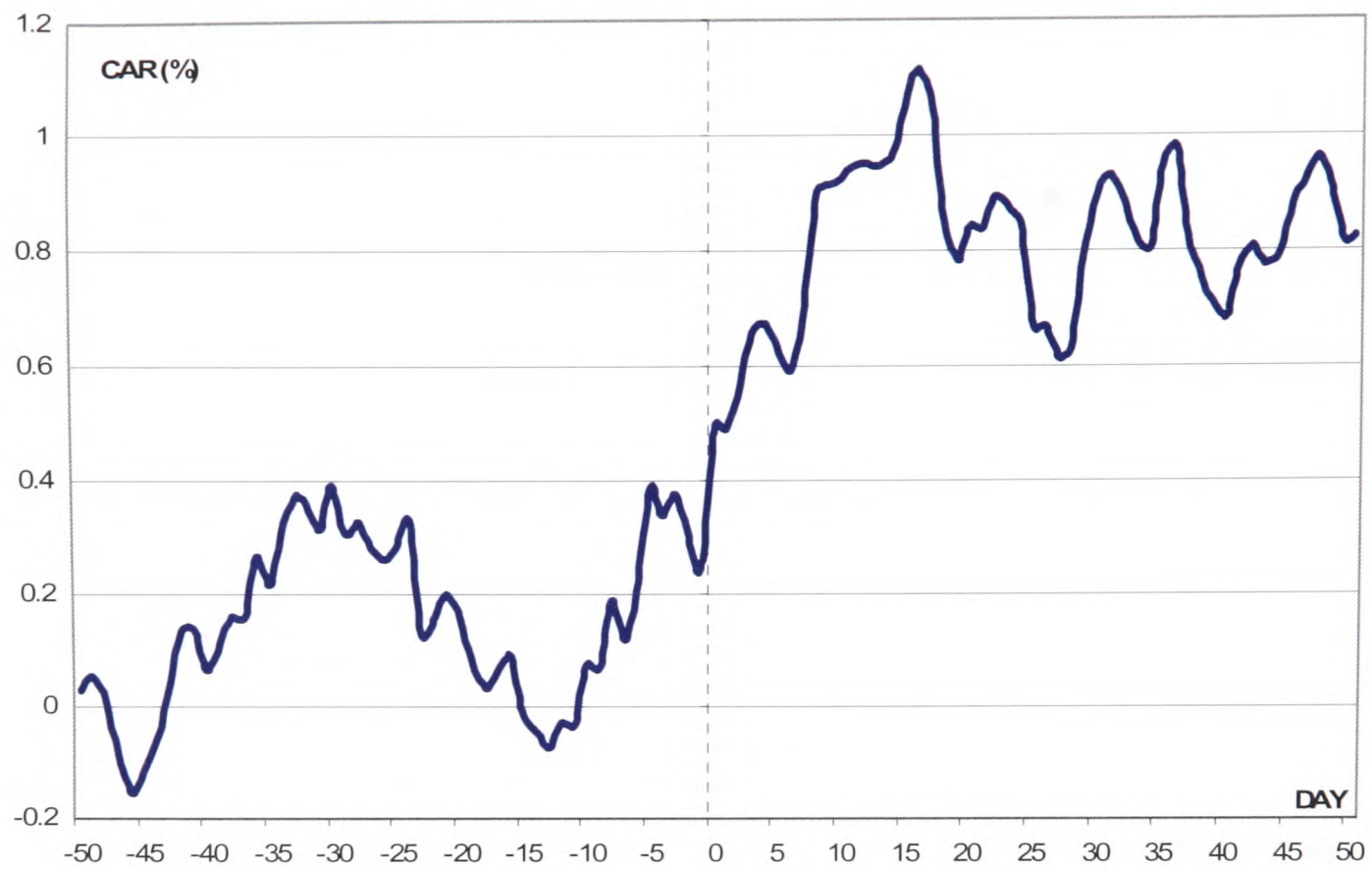


FIGURE 2: MARKET-MODEL ESTIMATED CAR (100 DAYS AROUND THE EVENT DATE)

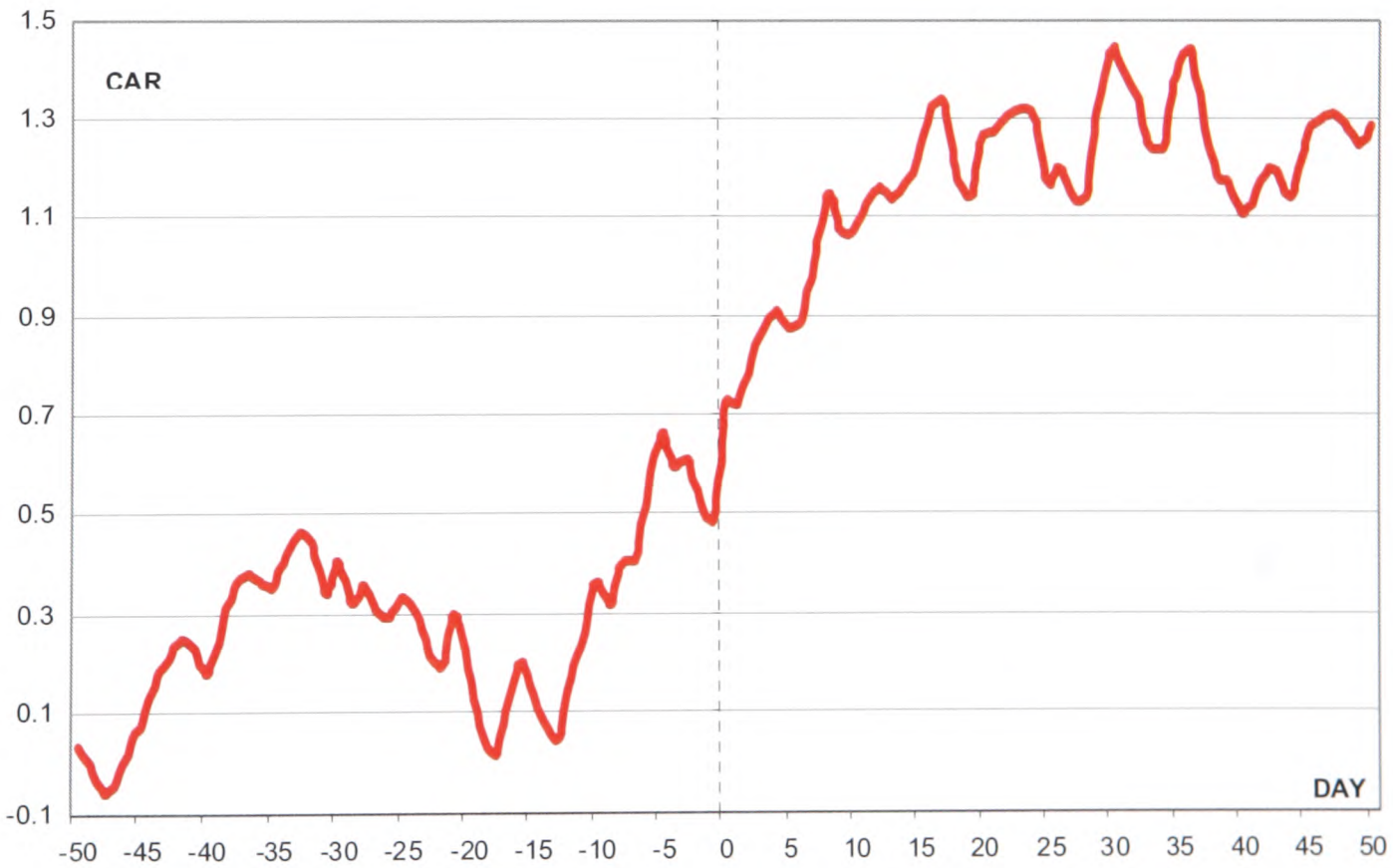


FIGURE 3: ISSUE DATE: SECTOR INDEX-ADJUSTED CUMULATIVE RETURNS (100 DAYS AROUND THE EVENT DATE)

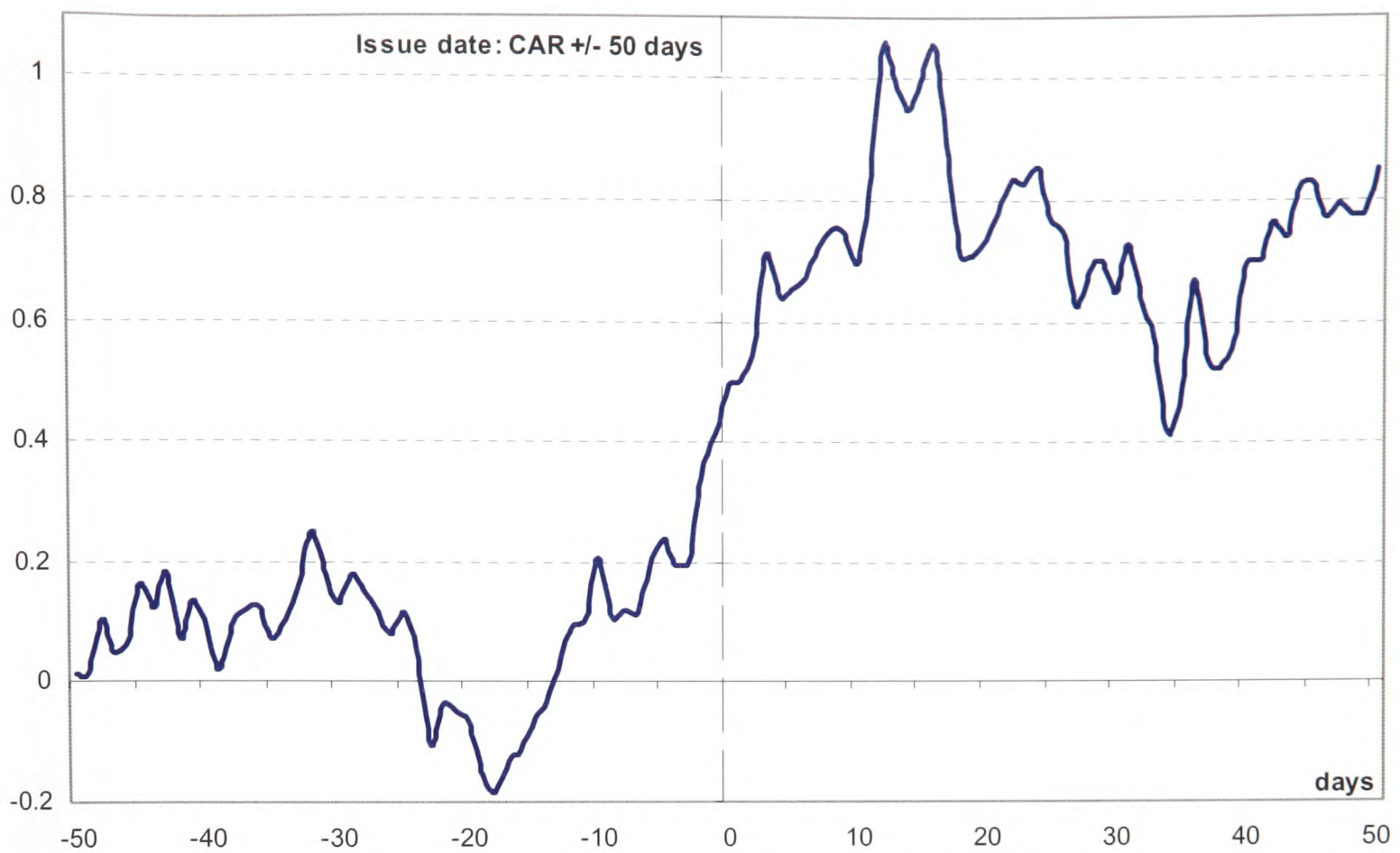


FIG. 4: NUMBER OF DAYS BETWEEN PRICING AND ISSUE DATES: EUROPEAN SECURITISATION TRANSACTIONS 1987-2003

