ESSAYS IN ASSET SECURITISATION

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DECLARATION

ESSAYS IN ASSET SECURITISATION

ABSTRACT

The objective of this thesis is to consider the role of securitisation undertaken by firms in the financial sector by looking at five different questions related to securitisation.

The thesis begins with a comparison of the institutional and market characteristics of securitisation in the US and Europe. The wide gap in their respective securitisation growth rates may be attributed to the presence of US government subsidies to securitisation, and more restrictive aspects of banking regulation.

After a review of the theoretical and empirical work, the thesis addresses a key question: in the absence of subsidies, why do depository institutions securitise? Employing UK data, the validity of two hypotheses are tested. These are the "comparative advantage" hypothesis, which treats securitisation as evidence of disintermediation, and the "financing" hypothesis, which argues that depository institutions use securitisation to raise finance.

The third question is, which banks raise external finance by securitising assets, and what are the consequences for shareholder wealth? The role of securitisation in a bank's optimal capital structure is explored.

Fourth, the thesis looks at whether there are differences in the pricing behaviour of financial firms which originate assets to finance them through securitisation, and depository institutions which use a variety of funding sources.

Finally, the factors which influence the price of asset-backed securities at issue and in the secondary markets are examined.

The main findings from the econometric tests on UK data show the "financing" hypothesis to be superior. Firms with worse capital ratios, inferior performance and low quality assets are more likely to engage in securitisation. Also, the shareholders of firms with high agency costs of managerial discretion and poor investment opportunities experience a wealth loss as a consequence of the securitisation transaction. There is weak evidence that centralised lenders, which rely exclusively on securitisation finance, adjust mortgage rates faster to changes in money market rates. Lastly, mortgage-backed securities prices can be explained by the risks of the underlying mortgages, and the risks of the asset originator are not taken into account by the market.

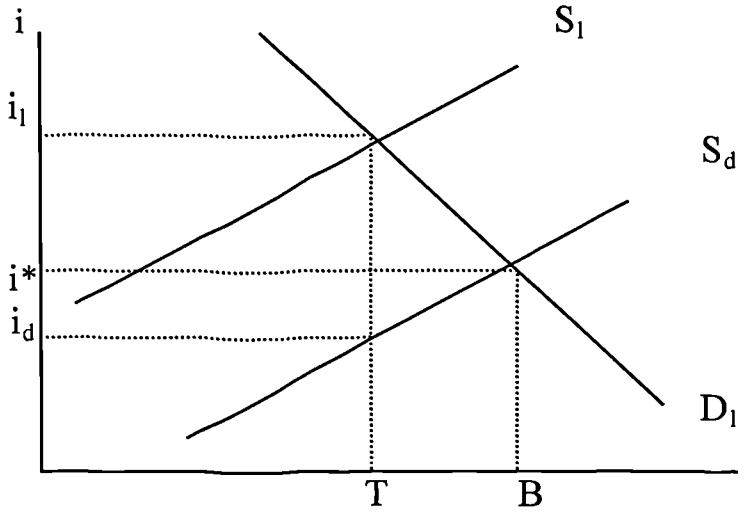
CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The intermediary role played by banks within a financial system evolves through time. According to Merton's (1995) functional perspective of financial intermediaries, the basic functions of a financial system are essentially the same in all the economies, but for a variety of reasons (regulation, technology, economic conditions, competition...) the most efficient financial structure changes over time and across geopolitical divisions. Different types of intermediaries and the capital market compete to provide financial products.

The traditional role of banks has been to take deposits from savers and loan them to borrowers with different liquidity preferences until maturity, that is, borrowing short and lending long (Heffernan 1996, among many authors). Banks earn "spread" income determined by the difference between the interest rates charged to borrowers and paid to savers, less administrative costs. Both activities, lending and deposit taking, are recorded on the bank's balance sheet.

Figure 1.1 Simple Model of the Banking Firm



Source: Heffernan (1996), page 16

Where,

i_l is the interest rate charged in banks' loans

i_d is the interest rate paid for banks' deposits

S_l is the banks' supply of loans curve

S_d is the public's supply of deposits curve

D_l is the public's demand for loans curve

Figure 1.1 above illustrates a bank' intermediation function. A bank's intermediation margin is the difference between i_l and i_d, and in equilibrium the volume of loans and deposits is OT. The intermediation margin represents the costs associated with bringing together savers and borrowers (Heffernan 1996).

The dominant position of banks as intermediaries for small firms and individual borrowers has been sustained by two advantages: they had better access to loanable funds, and they could resolve more efficiently asymmetric information problems typical of the intermediary function (Greenbaum and Thakor, 1995), thereby reducing intermediation costs. If there were not intermediation costs, the market clearing interest rate would be i* and the volume of deposits and loans would rise to OB (Heffernan 1996, pages 16-17). This competitive advantage in information processing was the source of profits for banks.

The intermediary role between providers and users of funds means the traditional function of banks is to banks bundle together the different processes related to making a loan. Banks gather information about prospective borrowers and make a decision on the loan (origination); they monitor and enforce the loan agreement (monitoring and servicing); they raise funds to finance the loan (loan funding); they manage the risks associated with the loan and its funding (risk management); and they retain the loan until maturity in the bank's portfolio (loan warehousing).

The emergence of securitisation may have a significant impact on global and domestic financial systems. This includes a different funding source for banks; a shift in the pattern of financial intermediation; a symptom of increased competition in lending and funding markets; shifting risks within the financial sector; and the integration of banks and the financial markets. The banking industry has changed dramatically during the last two decades. Increasing competition, regulatory changes and periods of volatile interest rates threatened the profits that banks could obtain from traditional activities. With reference to Figure 1.1, the increasing competition would narrow a bank's intermediation margin. Many argue that banks have been forced to diversify into new activities as a way of maintaining their role as financial intermediaries (e.g. Edwards and Mishkin 1995).

Structural changes in financial systems have blurred the established distinctions between the roles played by banks and capital markets in channelling funds from savers to borrowers. In some economies, asset securitisation has been one of the key financial innovations contributing more to the transformation of the banks' role.

When assets are securitised they are pooled together, transferred to a separate entity and financed by the issue of securities backed by their cash flow. Securitisation transforms illiquid and non-marketable assets into tradable securities. Not only is the funding function separated, so to are the other intermediary activities including: servicing, warehousing and risk management. The securitised loans are removed from the banks' balance sheet, although the bank keeps its relationship with the borrower and earns fee-income as the servicer of the securitised assets. The loans are no longer funded and held as an asset by the bank, instead, investors in capital

markets fund the loans. The separation of functions associated with securitisation means each function is allocated to the agent with a competitive advantage in its production.

There are two broad reasons why a bank might find securitisation attractive. The **first** is related to the general decline in banks' traditional functions described above. This thesis calls this the "comparative advantage hypothesis". Banks may no longer be the most efficient providers of some of the functions they traditionally performed. Securitisation would be part of the wider changes in the financial systems and structures which has brought the decline in the traditional activities of banks. This decline is associated with fundamental economic changes that affect both sides of banks' balance sheet: on the liabilities side, banks have lost their traditional sources of cheap funds due to a highly competitive environment. On the asset side, the technological advances in information management have made it possible for a broader spectrum of agents to evaluate credit risks and to access capital markets directly. In particular, asset securitisation permits non-depository financial intermediaries to originate assets for resale, entering in direct competition with banks. They are not permitted to raise guaranteed deposits from the public, and therefore, are exempt from regulatory requirements such as a minimum reserve ratio or a capital adequacy ratio. Depository intermediaries often see these requirements as a tax, meaning that they have to compete in unfavourable conditions against other financial intermediaries.

Securitisation permits banks to specialise in the originating function, for which they have a competitive advantage. Other agents assume the other functions traditionally bundled together on the lending process. Under this perspective, securitisation could have important implications for the banking industry and the financial systems as a whole.

The **second** reason is the greater flexibility of securitisation finance as compared to equity and debt finance. This thesis refers to this as the "financing hypothesis". In this case securitisation is considered an alternative funding source, the main attribute of which is that a specific pool of assets backs the securities. Securitised assets are isolated in an special purpose vehicle and the investor's return is a function of the

cash flow and risk of the assets. A bank will engage in securitisation because it may find it easier to communicate information about a specific pool of loans than about its whole balance sheet, or because with securitisation the bank can issue claims with different degrees of recourse to its capital.

These two aspects of securitisation are the focus of most of the investigation in this thesis. For purposes of this research the two perspectives are to be considered independent. This independence assumption is perhaps too strong; however, since the implications of the two hypotheses for the banking systems are so different it makes sense to be able to analyze them separately.

In the "disintermediation hypothesis" it is assumed that the banks' intermediation margin in Figure 1.1 has been eroded so much than traditional intermediation is no longer profitable. Securitisation is used to pass on to other agents some of the functions associated with intermediation for which banks have lost their competitive advantage. In this case, the role of banks in certain sectors or markets could be completely changed, with other intermediaries or the capital markets assuming some of the traditional banking functions.

On the other hand if the "financing hypothesis" holds banks engage in securitisation because it is a more flexible and cheaper funding source, securitisation would not bring about any major change in the structure of the financial sector. Banks' use of securitisation would be related to their own funding needs and the relative efficiency of securitisation funding with respect to alternative means of funding.

1.2 OBJECTIVES OF THIS THESIS

Securitisation was a financial innovation which originated in the US in the early 1970's, and it has grown at a rapid rate ever since. For example, 93% of the US residential mortgages originated during 1993 were securitised (Kolari, Fraser and Anari 1998). In Europe, securitisation is also growing, albeit at a slower rate, though securitisation has grown faster in the UK.

The longer history and widespread use of securitisation in the US means most of the research on securitisation has been focused on the US market. This body of literature covers many different aspects of securitisation, but some of their conclusions cannot be readily applied to other economies because they depend on characteristics specific to the US financial system. These include the regulatory restrictions that limited US banks' functional and geographical diversification opportunities. Also, the US government guarantees on residential mortgage securitisation is a key explanation for the vast difference in the degree of securitisation in the US compared to other countries. Even within the US, there are controversial issues regarding banks' uses of securitisation. Securitisation is an area of research in which there are few established facts: the theories have advanced different arguments to explain why financial firms engage in securitisation, but the empirical studies fail to conclusively prove any of the theoretical arguments.

Securitisation and its role in the financial sector can be analysed from different perspectives. In this thesis, which is entitled "Essays on Asset Securitisation", rather than focusing on just one aspect of securitisation, five different questions related to securitisation by financial firms are considered. Not only are these the most interesting issues, but they cover most aspects of securitisation. These five key questions are:

- What are the market and institutional characteristics of securitisation in US and Europe?
- Why do depository institutions securitise assets and what are the economic incentives? In particular, is securitisation a sign of "disintermediation" or is it just a tool used by financial firms to raise finance?
- Which banks raise external finance by securitising assets, and what are the consequences for shareholders wealth and the bank's investment?
- Are there differences in pricing behaviour of financial firms which originate assets to finance them through securitisation, and depository institutions which use a variety of funding sources?
- What factors influence the price of asset-backed securities at issue and in the secondary market?

This work contributes to the literature in various ways. The thesis:

- provides an extensive study of securitisation outside the US,
- undertakes a comprehensive comparison of institutional and legal characteristics of securitisation across different European countries and the US,
- attempts to identify the economic determinants of securitisation among UK depository institutions,
- tests the validity of a series of hypotheses on which type of banks are more likely to engage in securitisation and the effect of securitisation on shareholders' wealth,
- examines the differences in competitive behaviour by testing the degree of responsiveness to changes in market rates by UK centralised mortgage lenders (which finance loans through securitisation) and depository institutions, and
- conducts an econometric analysis of pricing behaviour in the UK mortgage-backed securities market.

The thesis is organised as follows: Chapter 2 examines the institutional and legal structure of securitisation across European countries and US. The chapter explains how securitisation works, and its main advantages and disadvantages. The comparison between US and European securitisation identifies a series of factors which are unique to the US and which might explain the rapid growth of securitisation in the US, and the positive effects of securitisation on its mortgage market.

Chapter 3 analyses the role of securitisation in the financial firms industry and why securitisation by financial firms differs from securitisation by non-financial firms. The chapter also reviews some of the current controversies in banking theory. The increasing use of asset securitisation by banks, and some of the economic models postulated to explain it are linked to some of these controversial issues.

Chapter 4 surveys the theoretical literature explaining the financial intermediaries' incentives for securitisation. As mentioned above, there are two basic arguments proposed by the literature to explain why banks engage in securitisation. The first is that securitisation permits banks to specialise on the originating function, for which

they have a competitive advantage. The theories based on this argument look at the causes which had led to banks' loss of advantage to explain why banks use securitisation. The second argument is the greater flexibility of securitisation finance which might reduce banks funding costs. The theories based on this perspective look at the ways securitisation solves banks funding needs. Differences across firms and through time and financial systems imply that one or the other group of theories would explain why banks engage in securitisation.

Chapter 5 reviews the empirical literature on incentives for asset securitisation. Most of the empirical work has attempted to test the theories reviewed in Chapter 4, but the results are not conclusive, which is due in part to the lack of a systematic approach in the tests. Most of the studies try to validate the hypotheses reviewed in Chapter 4 by comparing one or two possible aspects of the financing or the comparative advantage hypotheses ignoring all the other arguments which could support the hypotheses.

Chapters 6 and 7 attempt a more systematic approach to the empirical analysis of securitisation activities by banks by addressing, in consecutive order the "why" and "which" questions. In Chapter 6 the question "why banks securitise" is addressed by testing the validity of the financing and the comparative advantage hypotheses. Once the comparative advantage hypothesis is rejected, Chapter 7 addresses the question of "which banks engage in securitisation finance". This is done by examining the role of securitisation within a bank's optimal capital structure and investment decisions. Based on a sample of British banks which have engaged in securitisation, a series of hypotheses are tested. The data are used to test for wealth effects of securitisation, and the characteristics of banks, before and after securitisation.

Chapter 8 analyses the effects of securitisation on the pricing of UK mortgages. The advocates of securitisation in the US argue that one of the major advantages of securitisation is that it allows the separation of the functions associated and that it improves the integration between mortgage and capital markets. This has translated into a more competitive US mortgage market. In the UK the arrival of centralised lenders introduced a small degree of functional separation in the mortgage market since these lenders securitised their mortgages and also offer to service and

administer the mortgage portfolios of the traditional lenders. To check for differences in competitive behaviour among UK lenders, a simple model of mortgage rates is used. Lenders are divided into two groups: centralised lenders which securitise their mortgages and unbundle most of the functions related to the lending process; and depository institutions which keep their mortgages on balance-sheet and perform all the functions related with the lending process in-house. A series of hypotheses on competitive behaviour in the mortgage market are tested, including the way the two types of lenders set mortgage rates. To do so the responsiveness of mortgage rates set by the two types of lenders to changes in capital market rates is compared.

Chapter 9 introduces an econometric model of sterling mortgage-backed securities valuation. One of the benefits of securitisation funding is that the risk and return of the securities is a function of the securitised assets, not of the quality of the originator/seller of the assets. This chapter proposes and tests a valuation model for UK mortgage-backed securities. The price of mortgage-backed securities is a function of the securities' contractual features and risk of the underlying assets. The chapter also examines the pricing of sterling mortgage backed securities in the secondary market, and which factors related to the underlying assets affect the return on the mortgage-backed securities.

Finally, Chapter 10 summarise the major findings, notes the limitations of this study, and makes suggestions for future research.

CHAPTER 2: ASSET SECURITISATION. OVERVIEW AND INSTITUTIONAL CHARACTERISTICS IN US AND EUROPE[1]

2.1 INTRODUCTION

Securitisation as described in Chapter 1 and in section 2.2 below was first used in the US during the 1980's. It was associated with an expansion of the property sector and an increase in the risks faced by financial intermediaries, which spurred them to find new financing techniques to offset those risks. Securitisation was also employed to increase the funds available for mortgage credit. By repackaging the cash flow from a mortgage portfolio in a way that investors only receive that cash or a form of credit enhancement, the lender can expand its asset origination activities without expanding the liabilities portfolio (Diamond and Lea 1993).

The purpose of this chapter is to describe securitisation, and to explain its institutional characteristics, both in the USA and Europe, with special attention to the UK.

Institutional settings are an important part of the incentives to innovate. The legal and financial structure of each securitisation transaction is very complex. A country's regulation and market structure determines the costs and success of securitisation in each case. Most of the academic interest in securitisation is limited to the US, but there are important differences between the US financial system and those of other countries, which may render some of the US research findings non-applicable to other countries:

- in the US the financial markets play a more important role channelling funds than banks;

[1] Parts of this chapter have been published in Pais, A. (1998).

- US banking regulation restrains bank powers geographically and functionally: State bank laws until very recently, limited geographical diversification opportunities, and the Glass-Steagall act of 1933, though diluted in the recent years, restricts banking activities by separating commercial and investment banking;
- the US banking sector is less concentrated than European banking systems[2];
- the US residential mortgage-backed securities market is dominated by federally sponsored agencies. Agency mortgage-backed securities have a government explicit or implicit guarantee. The government guarantee, obtained in exchange for a small fee, makes this type of asset-backed securities default risk-free, hence the originators of the securitised mortgages obtain risk-free rate funding in a very cost efficient manner.

The chapter is organised as follows: section 2 and 3 explain how securitisation works, sections 4 and 5 analyse the effects of securitisation and its advantages and disadvantages, section 6 examines US securitisation, section 7 reviews asset securitisation in the UK, section 8 investigates other European asset-backed securities (ABS) markets and section 9 concludes.

2.2 DEFINITION OF SECURITISATION

There is no commonly accepted definition of securitisation. In broad terms, "securitisation" describes a system of direct funding from the capital markets, as opposed to more traditional "intermediation", by which funding is obtained through credit institutions. In narrow terms, "securitisation" involves the transformation of illiquid assets into marketable securities which can be sold in the capital market. This is achieved by creating a tradable instrument which is backed by the future cash flow of the assets.

[2] In 1993, the US had around 12000 banks. This means one bank per 15472 people or one branch per 4167 people. The United Kingdom has one bank per 81197 people or one branch per 2778. The main reason for this was the restrictive branching policy: banks could only branch within their state boundaries, so not only diversification opportunities were reduced but also the possibility to achieve economies of scale (Greenbaum and Thakor, 1995). Greater consolidation is expected to occur as branching across states by banking holding companies is eased by the Riegle-Neal Interstate Banking and Branching Efficiency Act, 1994 (Heffernan, 1996) (see Section 2.6.1.below).

In securitisation homogeneous assets are aggregated and transferred or sold to a special purpose vehicle (SPV). Their future cash flow is repackaged into liquid securities which are sold to investors. The sale of the assets to the SPV achieves a separation of the assets from the seller: securitisation is an off balance-sheet funding instrument. The transactions are generally credit enhanced, by using mechanisms which will ensure that investors receive timely payments of interest and principal even when the underlying borrowers default. Securitisation enables the issue of securities which are close to default risk-free, because of credit enhancement; and debt-like, without increasing the leverage of the seller.

The Financial Reporting Standard 5[3], UK accounting rules for securitisation, proposes a definition of securitisation which emphasises the investor perspective:

> "securitisation is a financing technique through which investors finance a specific pool of assets, rather than the general business of a company. Investors in asset-backed securities have recourse to the assets of the SPV but not to the assets of the securitising firm".

Securitised assets are isolated in the SPV, so that the risk and return of the securities backed from those assets entirely depends on the portfolio's risk and return, and not on the risk of the securitising firm. If the seller issues debt or equity instead of securitising assets, the investor acquires a claim on its entire portfolio and the sellers' cash flow would be the source of repayment. Securitisation is usually "non-recourse", that is the investor in asset-backed securities acquires a claim solely on the assets and their cash flow is the means of return for the investors. The credit risk of the securitised assets is passed on to the investors. However, diversification within the pool, and the use of credit enhancements means the pool risk is lower than the risk of investing in a single asset. The isolation of the assets in a SPV produces two effects: it protects the seller against future losses arising from a deterioration of the quality of those assets (thereby providing perfect funding to maturity), and it protects the investors from a seller's bankruptcy.

In the simplest securitisation structure, the asset-backed security cash flow would be equal to the payments (interest rate, and any principal payments) on the underlying

[3] Accounting Standards Board (1994): *Financial Reporting Standard 5*

pool of loans. This type of security is called a "pass-through", because all the payments made by the borrowers are passed on to the investors without any transformation, except the discount of a servicing fee. A pass-through gives a pro-rata ownership interest in the pool of assets backing the security. Asset-backed securities have become more sophisticated, and now it is normal to transform the pool cash flow before it reaches investors. New asset-backed securities may give an ownership interest on the pool of loans, or may be debt of the issuing institution collateralised by the loans in the pool, or by pass-through asset-backed securities. The latter can be a normal bond, or a pay-through bond, which is debt of the issuer but has the same payment characteristics of a pass-through security. The more sophisticated asset-backed securities are often known as derivatives[4].

2.3 STRUCTURE OF A SECURITISATION TRANSACTION

There are three main stages in structuring a securitisation transaction[5]. The preliminary steps include the selection and pooling of the assets to be securitised, the inspection of all the documentation related to those assets, the production of information about the assets, including historical information about default and losses in similar assets, and the continuous monitoring of the pool to identify any assets which become delinquent or default before the transfer. At this stage the securitising bank may need to upgrade its information technology to have the resources required to generate the necessary information and make it available to the other parties involved in securitisation.

The next stage consists of the establishment of the SPV, the transfer of the assets to the SPV and the issue of debt secured on the assets. If the assets themselves are secured and/or have insurance, like mortgage loans, the transfer also comprises the

[4] For example, US Collateralised Mortgage Obligations (CMO) are securities backed by agency mortgage-backed pass-through, introduced in the market in the early 1980's. They are very successful because they help investors to manage the prepayment and credit risks by tranching the securities and sequentially allocating the risks to each tranche. There are issues with up to 20 different security classes. Another US innovation is the stripping of the cash flow of asset-backed securities into "interest only" and "principal only" securities.
European asset-backed issues are usually divided into three security classes. Also the recycling of asset-backed securities is starting to be a common practice in Europe: Thames Asset Global Securitisation No 1 is a sterling floating rate asset-backed security backed by mortgage-backed securities.

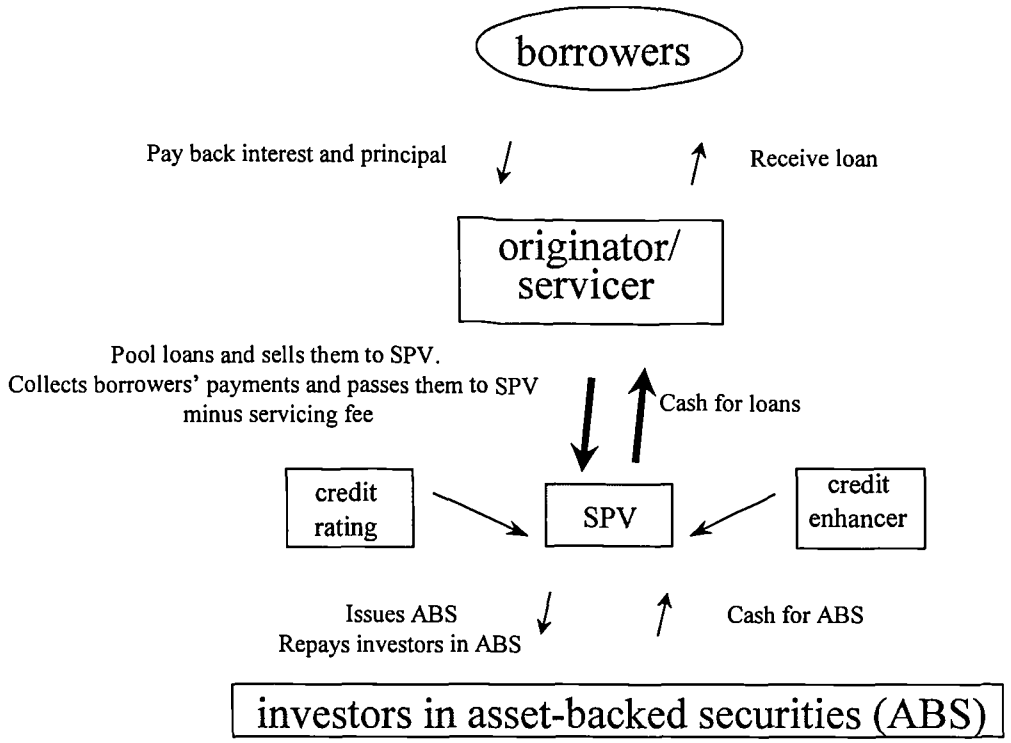
security and insurance. Before the securities are issued, the mechanism of credit enhancement and an agency credit rating is obtained. The legal and financial structure of the transaction is defined at this point. The transfer of the assets must be arranged such that it is considered a true sale from the accounting, banking and taxation points of view, because some of the benefits of securitisation would disappear if the SPV accounts were consolidated with the seller accounts. The financial structure of the transaction determines how the cash flows from the assets and the mechanisms of credit enhancement are transformed in the SPV to meet the obligations on the debt.

In the final stage the issuer negotiates the terms for servicing the pool of assets. The asset seller is usually appointed as servicer. The conditions and mechanisms that ensure that the cash flows from the pool reach the investors are established: normally a paying agent will be designated and a depository, to keep the securitised assets.

The structure will vary for different issues, but in general, Figure 2.1 describes the process:

[5] The generic structure described in this section applies to European and US securitisation.

Figure 2.1 Structure of a Securitisation Transaction.



2.3.1 Borrowers

Different types of assets have been securitised: residential first mortgages, credit card receivables, lease receivables, personal loans, auto and truck loans, business loans, and commercial mortgages are among the most frequently securitised assets, both in Europe and in the US.

The assets that integrate the pool are normally originated in the months prior to securitisation. The assets are earmarked and monitored before the actual transaction takes place. Some transactions allow "asset substitution" within the pool: these are "revolving structures", in which the cash flow generated by the securitised assets is reinvested in similar assets which are integrated to the pool.

The transfer or sale of the loan should not worsen the legal position and rights of the borrower. This has important consequences for securitisation. If the borrower has the right to negotiate better financial conditions for the repayment of the debt, the right must be kept in the event of securitisation. Sometimes the borrower has the right to set-off against the seller, that is the right to reduce the outstanding amount of the loan. Set-off rights reduce the cash flow received by the issuer, the SPV. If the borrowers have the right to further advances without having to pledge more collateral (a common lending practice in the UK mortgage market) the credit risk of the assets increases, because the value of the collateral is relatively smaller. The further advance also extends the life of the loan and it may affect the cash flows to the issuer. The terms of the securitisation transaction must state who advances the money, the seller or the issuer, and how to guarantee investor payments in the latter case.

In some jurisdictions[6] it is necessary to inform the borrowers that securitisation has taken place, and in some cases (explicit or implicit) consent by the borrower is required. The explicit consent can be very expensive to obtain[7]. To avoid this problem, some financial institutions include a clause in their standard contracts allowing for the transfer of the loan to another entity without need to further notify the borrower. The lack of compulsory notification weakens investors rights because the borrowers would fulfil their obligation by paying the lender (in this case the selling bank), and neither the investors nor the SPV would have a right to claim payment from the borrowers.

Some European jurisdictions do not allow the securitisation of arrears or default loans, or loans the life of which has reached a certain limit, for example 2 years.

2.3.2 Assets Seller/Servicer

This is the bank that wishes to engage in securitisation and owns the assets, because it has originated them or because it has acquired them from another bank.

[6] This applies to some European jurisdiction under Roman law.
[7] If notification must be done through notary, public officer or court bailiff.

In some cases more than one bank transfers assets to the same SPV; this is known as a "multi-seller conduit" and the objective is to reduce transaction costs by allowing different banks to use the same securitisation vehicle.

The seller usually services the assets in exchange for a fee. There are two reasons for this: the seller wishes to keep the relationship with the clients, and the SPV has no employees. In some European jurisdictions, it is compulsory for the seller to retain the servicing function. The duties as servicer of securitised assets may include unusual features such as providing a liquidity facility, reinvesting cash-flows until they are due to the security-holders, or providing periodic information to the trustees or management companies and rating agencies about pool performance.

2.3.3 The Issuer

The assets, and any collateral security, are transferred to the SPV, which finances the purchase of the assets by issuing the securities. Depending on the structure of the SPV, a trustee or a specialised management company will act as manager for the SPV, protecting the interest of the security-holders. In some European jurisdictions the SPV is established by a "depository institution" besides the management company, which keeps the assets on behalf of the SPV.

The SPV must be "bankruptcy remote[8]", so the transfer of the assets is protected from the bankruptcy of the seller. The SPV functions are holding the assets, issuing the securities and passing through any cash flow generated by the assets to the asset-backed securities holders.

2.3.4 Credit Enhancement

Asset-backed securities are passive investments: the majority of the investors do not investigate the underlying assets beyond the information contained in the offering prospectus. The use of rating agencies which analyse all the risks of the securities,

[8] The holder of the securitised assets (the SPV) is entitled to unconditional rights of separation in the event of insolvency of the seller.

and of credit enhancers which provide mechanisms to enhance the credit risk of the securities, substitute for the investors need to become informed.

The rating agencies require the assets to generate enough cash flow to timely repay the investors. However it is likely that some of the assets will not perform as expected. Different forms of credit and liquidity enhancement, as explained below, can be used to ensure that even when some of the assets default, investors receive the interest and principal due.

A third party can provide credit enhancement or it can be provided internally, within the securitisation structure. Overcollateralisation, spread accounts and senior/subordinated structures are examples of the latter. A bank or insurance company usually provides third party credit enhancement. The protection against losses would be total if the enhancer provides funds to pay investors when the borrowers fail to do so, whether the borrowers' default is temporary or permanent, interest or principal. The protection against losses is partial if the enhancer covers principal (and sometimes part of the interest) losses only after they have become irrecoverable.

When the issue is overcollateralised, the seller pledges excess collateral to the securities. In this case the provider of the credit enhancement is the securitising bank, which transfers to the SPV assets whose value is higher than the value of the asset-backed securities to be issued.

The senior/subordinated structures involve the issuance of different types of securities, with different seniority levels. The most senior security has a priority claim over all the cash flows; junior tranches are not paid off until the senior ones have been redeemed, and they have lower ratings to reflect their riskier nature. The effect of this type of credit enhancement is the redistribution of the credit and liquidity risk among the investors in the different type of securities: investors in junior (senior) securities face a level of risk higher (lower) than the pool average risk. The use of a senior/subordinated structure also helps to spread prepayment risk, since

prepayment can be allocated to the different tranches so that a certain average life for the securities can be guaranteed.

The SPV may open a reserve fund or a cash collateral account; normally the securitising institution makes a loan to the SPV, and the funds are deposited until they are needed. These are cash funds, which cover losses due to credit deterioration and supply a liquidity facility to protect investors against shortage in funds due to arrears. A similar form of enhancement is the use of a spread account, where any difference between the return of the assets and payment on the securities minus administrative costs is deposited and used as a reserve fund to meet liquidity shortages and losses.

The SPV can obtain an irrevocable letter of credit or standby facility. These can be used to protect the investors against both default risk and/or liquidity shortages.

The last type of credit enhancement is insurance. It can take various forms: pool insurance against asset default, or a guarantee from a "mono-line" insurance[9] company which covers timely principal and interest repayments.

2.3.5 Rating Agencies

The rating agencies assess the credit risk of the securities. Their main concerns are: the value of the collateral; the structure of the cash-flows, that is whether mismatches in time or amount between the cash-flow generated by the assets and the cash-flow due to the investors might result on the investors being exposed to default risk; and the legal risk, i.e. whether any defect in the legal structure might weaken the investors' position.

The analysis of the quality of the securitised assets includes the examination of all the documentation regarding the borrower and the loan contract, and the use of historic information to forecast asset performance. They will check the soundness of the originator and its lending criteria, its information management systems, the

adequacy of the asset servicer and management companies or trustees, and they examine the mechanisms of credit and liquidity enhancement

The rating agencies also judge the level of investor protection against the bankruptcy of the seller, issuer, servicer, management company or any other party involved in the securitisation structure. They continue monitoring the asset-backed securities until maturity, revising the original rating when necessary.

However, the rating agencies do not consider two substantial risks faced by investors in asset-backed securities. They ignore prepayment risk, i.e. the timing of the repayment of principal, which can be a very important determinant on the return of the securities if the underlying assets (e.g. mortgages) can be prepaid. Nor is interest rate risk considered, that is the effect of changes in market interest rate on the price/yield of a security.

The role of rating agencies is crucial to the securitisation process, particularly for public issues of asset-backed securities, since their analysis will determine the costs of securitisation. The credit rating and the credit enhancement are interdependent requirements, because the amount of enhancement is influenced by what the rating agency considers an acceptable level to achieve the rating wanted by the originator. The amount of credit enhancement required by rating agencies increases with the desired rating of the securities and decreases with quality of the securitised assets (Jackson 1999).

2.3.6 Issuance of the Securities

The SPV may issue different types of securities to finance the purchase of the assets. The most ordinary forms of debt are asset-backed commercial paper, asset-backed floating rate notes, asset-backed fixed rate bonds and syndicated bank loans.

The transaction can be structured as a "revolving" issue, where the cash flow from the assets is used by the SPV to buy similar assets extending the life of the securities;

[9] A mono-line insurance company guarantees the timely repayment of principal and interest on the

these structures have a lockout period during which investors receive only interest payments. Other issues are "bullet principal payment", so the providers of the finance receive a single lump-sum payment when the assets are sold or refinanced. The structure of the transaction is "amortising" if the cash flow from the assets is used to redeem the securities. The revolving structures are common for assets like credit card receivables because they have short life, whereas amortising structures are typical for long-term assets like mortgages.

The securities may be privately and publicly placed. In the first case the issuer must comply with the regulation of the exchange in which the securities are to be listed. The majority of the European asset-backed securities are Eurobond floating rate notes, which are listed in either the Luxembourg or the London International Exchange. A private placement allows more flexibility. The structure is normally negotiated with the investors (usually insurance companies, or banks), and there is no need to rate the securities[10].

For publicly placed securities the issuer must prepare an offering prospectus with detailed information about the securitised assets and mechanism of credit and liquidity enhancement. If the assets have prepayment risks, the issuer provides continuing information about the prepayment rate and the pool factor (outstanding value of the pool) through Reuters, Bloomberg or similar means. Hence, the transaction costs are higher for publicly placed securities

2.3.7 Costs of Securitisation

One of the characteristics of securitisation funding is that each transaction is unique. Although it may possible to achieve economies of scale and obviously the first transaction would be more expensive, the costs vary enormously from transaction to transaction. This is because the costs depend on the type of assets to be securitised, and on the legal and financial infrastructure of the jurisdiction where the transaction takes place.

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insured securities.

From the point of view of the seller, securitisation costs can be broadly divided in three groups: pre-securitisation expenses; structuring and issuing costs; and on-going costs.

The first group includes the costs associated with preparing the pool of securitised assets. Often the seller has to upgrade its information systems; and gather all the documentation, contracts and information required by the rating agencies, the credit enhancers, the auditors and the supervisory authorities. If the documentation and/or information are disseminated at branch level the costs will be higher. Sometimes the accounting systems have to be upgraded because the securitised assets are to be treated in a different manner. In general, the operation of the "back office" has to be adequate to support the demands of securitisation. These expenses also include the analysis of historical performance of similar assets and any improvements on the systems to monitor and enforce borrowers to ensure that third parties in the transaction, and investors, are comfortable with the value of the assets and of the securities.

The second category of costs includes those of setting-up the SPV, designing the financial structure of the transaction and issuing the securities. The establishment of the SPV carries legal fees. Depending on the country, a set of different contracts need to be drawn up: between the SPV and trustees, or between the SPV and the "management company" and the "depository institution", and the statutes of the SPV and associated entities establishing how securitisation will work. At this stage the transfer of the assets between seller and SPV is formalised. This contract must contain detailed descriptions of the securitised assets and the seller guarantees. The SPV contracts with a servicer (normally the seller) to service the assets.

In some European countries, the SPV and the "management companies" must be registered in special registers (normally the equivalent to the Securities Exchange Commission). Registration fees are an additional setting-up cost.

[10] Except in Spain where all asset-backed securities must be rated.

The expenses associated with designing the financial structure of the transaction can be very high. These include the provision of credit and liquidity enhancement, and the fees paid to independent rating and auditing agencies when necessary.

Other costs associated with the issue of the asset-backed securities include underwriting fees, appointment of a paying agent, production of an information prospectus for investors, and any expense incurred if listing the securities, which will depend on the regulation of the exchange[11].

The on-going expenses of securitisation consist of the fees which the SPV must pay to the trustees or the management company, the depository institution, the paying agent, and the assets servicer, if the servicer differs from the seller[12].

If the SPV life is limited to one issue or transaction, and/or the securitised assets have very short life, the SPV has less time to amortise the costs of securitisation which could render it uneconomical.

Another way of analysing the costs of securitisation is the one proposed by Trujillo del Valle (1996): securitisation implies the sale of the future cash-flows associated with a portfolio of assets in exchange for an immediate cash payment (usually an amount equal to the nominal value of the portfolio) and a sequence of payments in the form of fees or commissions, and excess spread. The cost of securitisation finance is the present value of the difference between the assets return and the securitisation return. This amount critically depends on current market interest rates and the assumptions about risk and uncertainty made by the bank. However one of the advantages of securitisation is that the amount which is subject to uncertainty is very small, the bulk of the return comes from the immediate cash payment, so it is only the remaining fees and excess spread which is risky.

[11] For instance the listing particulars of the London International Stock Exchange include providing the following descriptions of: the assets used to back the securities; the risks associated with the transaction and how those risks are addressed; the method, effect and date of the transfer of the assets; full explanation of the structure of the transaction and flow of funds; the name and address of the originator and servicer and proof of its suitability; information about the providers of the credit enhancement and about the banks where the assets and the accounts are held.

This cost is calculated as described above and divided by the amount raised through securitisation. It is then compared to alternative funding sources. One must also consider any benefits of securitisation in terms of releasing capital: if the opportunity cost of capital is very high the costs savings generated by securitisation funding may be considerable.

2.3.8 Extraction of Securitisation Profit

In any securitisation transaction, the seller wants to extract the profit remaining after repaying the providers of the finance. The securitisation profit will be the difference between the rate paid to the investors plus initial and ongoing expenses and the rate earned on the assets.

The seller can use different methods to extract the profit from the SPV. There are practical and legal restrictions on the possible ways to capture the securitisation profit. Since one of the objectives is to move the assets off-balance sheet, certain structures, like making the SPV a wholly owned subsidiary of the seller are ruled out. Boynton (1995) explains which are the most usual methods and their tax implications. The main issues in European transactions are to avoid the SPV paying value added tax (VAT), since it will be unable to recover it (SPV supplies are usually considered VAT exempt), and to achieve tax symmetry between the originator and the SPV to avoid double taxation of the profits.

The management or service fee can generally be deducted from the SPV's tax. However the SPV is liable for VAT on the fee; only if the originator and the SPV belong to the same VAT group the SPV would not pay VAT.

The broking fee is paid when the assets are sold, and depends on the spread on the portfolio. In general, the SPV will not be liable for VAT unless the fee is paid on instalments, because it could be regarded as a management fee. Nevertheless this fee will not be deductible as an income expense if the SPV is regarded as an investment company.

[12] Since the costs of securitisation are from the point of view of the seller, the servicing fee paid to the

Dividends are not tax deductible for the SPV, but they are not taxable for the seller, and dividends do not pay VAT. However the participation of the seller in the capital of the SPV means that the accounts of the SPV and the seller are consolidated, and therefore the benefits of obtaining off-balance sheet finance are lost because the securitised assets are brought back to the seller's balance.

When the profit is extracted through an interest rate swap, the SPV pays the seller the rate produced by the assets less a fee to cover expenses, and the seller pays the SPV the rate due on the securities. The spread between the flow of interest from the assets and the amount payable on the securities is the securitisation profit. A similar result is obtained by using "parallel or reciprocal loans" between the originator and the SPV, of equal principal but different rates of interest, where the interest charged to the SPV by the seller is the highest.

The profit can also be extracted though the pricing of the assets. The seller can sell the assets at a price above par value. Or use a deferred sale price: the purchase price has two components, an immediate payment and a deferred payment, which depends on the performance of the securitised assets.

Sometimes the seller grants a subordinated loan to the SPV to pay initial expenses or to use as a reserve fund. The SPV can obtain tax relief for the interest payments, whereas the interest received by the originator is taxed as income. The SPV is liable for VAT on interest payments. If the interest paid to the originator is very high, it may be regarded by the tax authorities as "distribution", and be treated and taxed as dividend.

2.4 ADVANTAGES OF SECURITISATION

There are several reasons why securitisation is attractive to the seller of the assets:

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seller/servicer is excluded.

- It is a new funding source. However, in contrast with other financing instruments it does not create a new liability on the balance sheet: the finance is raised by taking assets off balance sheet.
- The liquidity increases by the transfer of the risks. The liquidity could also be improved by selling assets, but if the seller has a comparative advantage[13] originating and servicing the assets, then securitisation would be preferred. The seller also keeps the customer relationship. And loans that are expensive and cumbersome to sell individually are easier to sell through securitisation. The marketability of the securities should ensure a better pricing and a wider range of prospective investors than those for the individual loans.
- The seller may be attracted by the non or limited recourse source of funds. Additional finance is procured because investors are exposed to the assets' risk as opposed to the firm's risk.
- There is a link between the seller and the securitised assets because the portfolio generates fee income from servicing, and the seller receives any remaining revenue after investors have been paid.
- Provided the cash from the sale of the assets, and the released capital, are used to create new profitable assets, the return on capital improves. There are two different streams of income, the securitisation revenue and the income from the new assets.
- Securitisation is a useful tool to manage risks. Credit, interest and prepayment risks are transferred to investors or other third parties involved in the transaction, such as insurance companies or other banks. For banks, securitisation reduces the risks of deposit funding: banks' balance sheets have assets and liabilities with different maturities and are therefore exposed to substantial risk. If the risks cannot be hedged in other ways or it is very expensive, securitisation provides a mechanism to fund assets to maturity.
- Securitisation can also be regarded as a diversification mechanism. If a bank considers its exposure to a certain sector or type of risks to be too high, securitising those assets reduces exposure. Securitisation can help to shed

[13] The term should be "competitive" rather than "comparative" advantage but the literature uses the latter one: according to the original formulation by David Ricardo, a country which can produce a good or a service more efficiently than other countries has a "comparative" advantage in the production of that good or service. A firm is said to have a "competitive" advantage in the production of a good or service when it produces it more efficiently than other firms do.

impaired assets, and hence improve the quality of the loan book. It can be also used to expand the customer base by recycling the existing capital base without assuming the risks of funding

- Asset securitisation encourages the seller to improve asset quality and the information management systems because the rating procedure focuses on the lending criteria, receivables origination, the adequacy of documentation and the collection mechanisms. Better information leads to an improvement in the general management of the bank's assets.
- There are also regulatory incentives associated with securitisation. Banks which are required to attain minimum risk capital asset ratios can use securitisation to reduce the amount of assets on their balance sheet. However most regulators required credit risk to be assumed by a third party. Although limited recourse to the asset seller is allowed[14].
- A bank securitising assets is revealing information about its asset portfolio. Hence markets have more information on the value of the bank, which helps to reduce information asymmetries between insiders and outsiders

2.5 DISADVANTAGES OF SECURITISATION

There are some risks and problems associated with the use of securitisation.

- When the bank securitising assets retains the servicing function, the bank has to manage new risks. Basis risk arises when the interest rate from the assets does not cover the interest rate due on the securities. One of the consequences of securitisation is that the seller keeps the customer relationship, borrowers are frequently unaware that securitisation took place at all. If customer relationships are important for the bank, it may be less willing to pass on the increase in interest rate required to repay investors, or if the market suddenly becomes more

[14]When the bank providing the credit enhancement (partial recourse) has previously owned the securitised assets, the Basle Agreement imposes an effective 100% (dollar-for-dollar) capital requirement for the partial recourse. As long as the securitised assets are of enough quality so that the required recourse is less than 8%, the bank capital ratio will improve even if the bank still keeps a substantial risk of the assets through the recourse. Usually a retained recourse of 4% is enough to grant investment grade to the asset-backed securities (Jackson et al 1999)

competitive, there may be pressure to reduce loan rates. Any consequent shortage of funds has to be covered by the seller/servicer.

- Servicing risk is also created. Servicing agreements between the SPV and the seller specify the servicer tasks and the minimum level of performance regarded as acceptable. The contract may contain a system of penalties for bad performance. The servicer would have to compensate investors in full for any losses due to its negligence or error. The income stream from the servicing fee may not be enough to cover these losses and penalties, leaving the selling institution exposed to a claim by investors.
- Another risk of securitisation is that of "moral hazard". This is a common concern for banking supervisory authorities across Europe and the US. Moral hazard arises if the seller bank feels obliged to support the asset-backed securities in order to protect its public image, or to maintain customers' relationships, even if the finance agreement was non-recourse. Effectively, the risks associated with funding the assets may still remain with the originating institution even though the amount of capital is not enough.
- Securitisation has the potential for adversely affecting the financial system as a whole, provided it had a substantially greater market share than it does now. Special purpose vehicles are entities with minimum capitalisation. The soundness of the SPV depends on the assets themselves and mechanisms for credit enhancement. If securitisation were to grow rapidly, these entities would manage a greater share of funds in the economy, and they would assume and re-distribute risks traditionally held by banks. Yet, in most countries, they escape prudential supervision. The risks remain within the financial markets, securitisation merely redistributes them, but the authorities no longer supervise the entities managing the risks.
- The soundness of the banking system could be at risk if banks are encouraged to securitise their higher quality assets and keep on-balance the riskier ones. Asset-backed securities need to have good ratings to attract investors. Credit enhancement is used for this purpose, but, obviously, the higher the quality of the securitised assets the lower the amount of credit enhancement required, and consequently the cheaper the finance.

- On the other hand, banks could also undertake excessive risks, and soften their lending criteria and quality standards when originating new assets because they know they can transfer those risks to investors in asset-backed securities.
- Governments are also concerned with the implications of securitisation for the implementation of monetary policy (Thompson 1995). Disintermediation and the transformation of banks' assets into securities weakens the link between monetary aggregates and real economic activity and inflation. The separation of the traditional banking functions and the surge of non-banking competitors in traditional banking areas partly caused by securitisation undermines the role of banks in the economy. The authorities may have to widen their domain to include non-banking institutions if they are to execute an effective monetary policy.
- An investor in asset-backed securities incurs two problems typical of these types of transactions. The seller, in exchange for a fee, services the securitised pool of assets. Securitisation separates the monitoring, done by the servicer, from the funding function. The adequate monitoring of a borrower increases the loan's return, but since the selling bank does not stand to suffer a loss if the borrower does not perform as expected its incentives to monitor are reduced. The problem is aggravated if investors are only able to measure the performance of the servicer ex-post. Although the seller has an incentive to monitor effectively if it wants to engage in future securitisation. There is also and adverse selection problem because the seller is the only one who knows with certainty the quality of the assets in the pool. If banks have incentives to securitise their worst assets, adverse selection would be exacerbated and the cost of obtaining capital through securitisation would increase.

2.6 SECURITISATION IN THE US

Today asset securitisation is one of the most important financing vehicles in the US. Securitisation finances around 60% of residential mortgages (Brendsel 1996), and by the end of 1993 20% of outstanding consumer debt had been securitised (Thompson, 1995).

Securitisation dates back to the early 1970's. It was introduced by The Housing and Urban Development Act of 1968. The aim was to increase the funds available to

finance the housing sector. One of the biggest problems of the American mortgage market was its "local" character. Thrifts[15] were the main providers of mortgages and were legally restricted to drawing and investing funds at a regional level. The consequence of this was an inefficient mortgage market in which funds could not flow from regions with excess supply to regions with excess demand. The supply of funds was dependent on the capacity of the thrifts to raise funds locally. The scarcity of funds for mortgages was exacerbated by two factors: the growing "disintermediation[16]" of the late 60's, partly induced by the imposition of ceilings on deposits rates; and the lack of interest of financial institutions (except thrifts) in fixed-rate mortgages[17] because they would incur interest rate risk in an inflationary environment (Fabozzi and Modigliani, 1992).

The objective of the 1968 Act was to create a liquid secondary market for mortgages, which in turn, would provide an elastic supply of funds to the mortgage market in two different ways: by reallocating funds from capital surplus areas to capital deficit areas, and by providing the market as a whole with a continuous source of funds from the capital markets. The channels to the capital markets were Government-owned and Government-sponsored agencies and private institutions:

GNMA (Ginnie Mae) is the Government National Mortgage Association. It guarantees the payment of interest and principal on securities backed by mortgages guaranteed or insured by the Federal Housing Administration (FHA), the Veterans Administration (VA) and the Farmers Home Administration (FaHA). The Government wholly owns it. If Ginnie Mae provides a full guarantee to the mortgage-backed securities, which are arranged by an institution, the mortgage-

[15] Saving and loan associations and mutual saving banks are collectively know as thrifts. They are depository institutions that specialised in mortgage finance. They must hold at least 70% of their assets in residential mortgages to be able to borrow from the Federal Home Loans Banks (Greenbaum and Thakor 1995).

[16] Disintermediation means the deposit outflows caused by the disparity between market rates and the rates banks were permitted to pay. Regulation Q (1933) imposed ceilings on the rates paid by banks on time and savings deposits. Every time Regulation Q was binding, 1969-70, 1973-74 and 1978-80 banks lost deposits to other financial institutions, mainly thrifts, which were allowed to pay 0.25% more than banks (Greenbaum and Thakor 1995). Then, as banks responded to the problem by product innovation, the thrifts found themselves losing savers, their main source of funding (Heffernan 1996). Regulation Q was phased out by 1986 under the 1980 Depository Institutions Deregulation and Monetary Control Acts (Heffernan 1996).

[17] Adjustable rate mortgages were not legalised until the 1980's (Greenbaum and Thakor 19950

backed securities are known as GNMAs. The issuer is the institution which originates, or buys, and pools the mortgages.

FNMA (Fannie Mae) is the Federal National Mortgage Association. A public corporation, it is listed in the New York Stock Exchange. Fannie Mae buys mortgages insured by FHA or guaranteed by VA. It also buys non-insured conventional[18] mortgages. Its key funding sources are the issue of mortgage-backed bonds (the collateral is Fannie Mae mortgage portfolio), and mortgage pass-through certificates (mortgage-backed securities). Additionally, Fannie Mae has a line of credit with the Treasury. The implied Government assistance, and the fact that Fannie Mae is regulated and supervised by the Housing and Urban Development Secretary is welcomed by market participants, which assign Fannie Mae a credit quality just slightly lower than that of the Government owned corporations.

FHLMC (Freddie Mac) is the Federal Home Loan Mortgage Corporation. It belongs to the 12 district Federal Home Loan Banks, and is supervised by the Federal Home Loan Bank Board. As with Fannie Mae, the market perceives the institution as a quasi-public, so its credit quality is very high. Freddie Mac buys FHA/VA and conventional mortgages. This activity is mainly financed by equity, securitisation, and by the sale of mortgage portfolios.

All the above named institutions operate in the secondary mortgage market in two ways. First they retain ownership of the mortgages and sell mortgage bonds to investors (collateralised by the mortgage portfolio). Alternatively, they pool the loans in a "mortgage conduit", reselling them to investors as mortgage pass-through securities.

The development of the secondary market resulted in a specialised mortgage industry. The thrifts, commercial banks and other financial institutions retain the mortgage origination function. The agencies buy and pool mortgages, and issue securities backed by the pool. They guarantee the full or partial repayment[19] of the

[18] A conventional mortgage is a mortgage which meets a set of criteria set annually by the government, including loan-to-value ratio and size of the loan.
[19] Depending on the type of issue and the Agency involved, the securities would be backed by the Federal Government, or the mortgage payments are insured by the federal agencies.

cash flow due on the securities which makes them a very attractive investment. For instance Fannie Mae AAA rated bonds trade at lower yields than other AAA corporate debt (Goodman and Passmore, 1992). The specialisation extends to firms that offer mortgage insurance or servicing. Even servicing rights are traded in the US.

The US mortgage market is divided into two sub-markets (Madrid Parra 1988):

The primary market, where mortgages are originated, insured and guaranteed. The principal originators are thrifts, commercial banks, mutual saving banks and mortgage banks. Mortgage insurance is undertaken by private insurance companies and by two federal Agencies: the FHA and the VA, respectively.

The secondary market is where mortgage loans are traded. Trading involves whole loans and securities backed by mortgages. Trading in whole loans is mainly done to create pools of mortgages to securitise. The main investors in whole mortgages are Fannie Mae, Freddie Mac, the commercial and the mutual saving banks, the saving and loans associations and insurance companies. Ginnie Mae holds mortgages only as collateral.

Trading in mortgage-backed securities is dominated in the issuing side by the federal sponsored Agencies (Fannie Mae, Freddie Mac) and by Ginnie Mae, which guarantees the issues. However the market for private mortgage-backed securities has become more important in recent years, being the main investors institutional investors, the commercial banks and the thrifts.

Private mortgage-backed securities are credit enhanced and rated because they are not guaranteed by government agencies. The private market is much smaller in volume, and is concentrated in the sector of the mortgage market not covered by the agencies. By the mid 1990's there were $800 billion outstanding agency mortgage-backed securities and $100 billion private mortgage-backed securities. Almost all the private mortgage pools consisted of non-conventional mortgages which exceed the purchase limit of the agencies. Goodman and Passmore (1992) cite a number of reasons for the lack of direct competition between private securitisers and the

agencies. These include lower funding costs for the agencies in terms of both borrowing costs and regulatory requirements[20]and lower administrative costs for the agencies because their size helps to achieve economies of scale; the agencies do not need to purchase credit enhancements, and the implied government guarantee is favoured by investors who demand a lower yield on agency's securities than on comparable private market securities.

Also lenders favour the Agencies over private arrangements. The "swap programme" of Fannie Mae and Freddie Mac permits lenders, in exchange for a fee, to replace their mortgage portfolio for mortgage-backed securities backed by that portfolio, and issued and guaranteed by the Federal Agencies. Besides the reduction in risk[21], a portfolio of agency's mortgage-backed securities carries a lower risk-weighted capital requirement than a mortgage portfolio.

The taxation on private mortgage securitisation has been reduced since 1986. Securities issued by a real state mortgage investments conduit and the sale of mortgages to conduits are exempt of federal taxes (Hill 1996).

The Government has also become involved in securitisation of commercial mortgages (Hill 1996) through the Resolution Trust Company, created in 1989 to liquidate the assets of thrifts which had gone bankrupt.

The development of non-mortgage securitisation started at the end of the 1980's. Issues of securities backed by auto loans (CARS) and credit card receivables (CARDS) (Fabozzi and Modigliani, 1992) are becoming increasingly common. The structure of these transactions is similar to that of mortgage-backed securities, but because there are no Government sponsored agencies involved in providing guarantees or issuing the securities, it is necessary to credit enhance and rate the issues.

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[20] Unlike banks the agencies do not have to meet capital adequacy requirements or reserve requirements and they do not pay deposit insurance. They are also exempted of some taxes (Hill 1996).

[21] The default risk of the mortgages is exchanged by the default risk of the Federal Agencies that guaranteed the securities. The mortgage-backed securities have lower liquidity risks than the original mortgages, and prepayment and interest rate risks are lowered by the use of senior/subordinated structures.

There has been extensive research on the effects that securitisation has had on the US mortgage market. An empirical study by Black, Garbade and Silver (1981) proved that the development of the GNMAs market has reduced the interest rate on mortgages insured by the FHA. These mortgages are susceptible to be securitised and guaranteed by Ginnie Mae. Hendershott and Shilling (1989) found that the expansion of securitisation has comparatively reduced the mortgage rate of conventional mortgages and of mortgages just above the conventional limit[22]. In both cases the authors link the decrease in mortgage rates to the increase in the likelihood that mortgages would be securitised, and therefore covered by government guarantee.

Gabriel (1987), and Hendershott and Van Order (1989) report that securitisation increases the integration between mortgage and capital markets. Integration increases the availability of funding but makes mortgage rates more vulnerable to fluctuations in the cost of capital. Securitisation has also moderated the effects of capital shortages and financing constraints on the housing sector. Roth (1988) documents a closer adjustment of mortgage rates to changes in capital market rates, and an increase in the volatility of mortgage rates.

Cantor and Demsetz (1993) showed that securitisation in three different lending categories, residential mortgages, consumer credit and business loans, helped to smooth the effects of the 1990 recession: over the two years after the recession, off-balance sheet credit grew by almost 30% in the mortgage market, by almost 70% in the consumer sector and by 15% in the business sector, while on-balance sheet lending continued to drop. Thrifts, mortgage companies and finance companies were more active than commercial banks in securitising their portfolios during the recession.

Ryding (1990) found that mortgage securitisation narrows the spread between mortgage rates and other interest rates. Furthermore the innovations in housing

[22] The government changes the criteria for conventional mortgages every year. A mortgage that is just below the criteria one given year might meet the criteria the following year. For example if the maximum size of the loan last year was $50000, and this year is $52000, loans between $50000 and $52000 can be bought and securitised by Fannie Mae this year.

finance make residential property demand less exposed to monetary tightening policies than in the past.

Sellon and Van Nahmen (1988) argue that the development of the Ginnie Mae pass-through programme has improved the geographical efficiency of housing finance, increasing the liquidity of the mortgage market.

2.6.1 Relevant US Banking Regulation

As will be shown in Chapter 4 and 5, these regulations have been considered as having some importance with respect to securitisation.

The US Banking Act of 1933, also known as the Glass-Steagall Act, is one of the landmarks of the US banking regulation. In addition to the separation of commercial and investment banking, it created the Federal Deposit Insurance Corporation to provide deposit insurance in exchange for a fixed deposit insurance premium, and regulated the interest paid by banks on deposits[23].

The ceilings on deposits interest rates have been progressively abandoned since the 1980's. Numerous attempts to revoke the separation between commercial and investment banking imposed in 1933 have failed, although in the last decade commercial banks have found ways around the legislation; for example, the use of overseas subsidiaries to provide investment banking services (Heffernan 1996).

In 1991, the Federal Deposit Insurance Corporation Improvement Act was passed. Its main objectives were to improve the safety and soundness of US banks and to reduce taxpayer exposure to banks' failures. It introduced two main changes with respect to the old deposit insurance regulation (Heffernan 1996): first, the introduction of a risk-based deposit insurance premiums, to be implemented by January 1994; and second, the use of a "least cost approach" to help banks in difficulty. The least cost approach means that regulators are required to ensure the problem is dealt such that the cost to the taxpayers is the lowest possible. For example if closure (as opposed to

[23] This was Regulation Q (see footnote 16).

further injections of capital or merger) is the least cost option, then the bank must be wound up.

The McFadden Act of 1927 imposed restrictions in bank branching. The States had the jurisdiction to determine the requirements for the expansion of branches of state banks[24]. In some states, the banks were only permitted to have one branch. The McFadden Act gave national banks the same branching powers as the state banks of the state where they had their head office. From the late 1980's several states had passed legislation to allow interstate branching, mainly through mergers of bank holding companies with financially weak state banks or thrifts. From 1994, through the Riegle-Neal Interstate Banking and Branching Efficiency Act, bank holding companies are permitted to consolidate their multi-bank multi-state operations in one single bank, with interstate branches (Heffernan 1996).

US banks have to meet capital adequacy ratios. Capital ratios were first introduced in 1978, the requirement was that banks have to have capital[25] equal to at least 5% of assets. In 1989 the Basle Accord which established an 8% risk adjusted capital ratio was agreed. US international banks have had to meet this requirement from 1992. However, US banks wishing to avoid regulatory intervention have to meet a higher capital requirement, at least a 10% total risk assets ratio[26].

2.7 ASSET SECURITISATION IN THE UK

The restrictions imposed on US banks, discussed in the previous section, were at the origins of securitisation. Such restrictions on the scope of bank's activities and expansion have not been observed in any European country[27]. European governments

[24] The prohibition of branching limited funding because banks could not collect deposits in states other than its own (Heffernan, 1996).
[25] Capital includes paid-in equity, retained earnings, general loan-loss reserves, limited amounts of permanent preferred stock, and certain long-term subordinated debt (Greenbaum and Thakor, 1995).
[26] The 1991 Federal Deposit Insurance Corporation Act classifies banks into five categories: "Well-capitalised"; "adequately-capitalised"; "under-capitalised"; "significantly under-capitalised"; and "critically under-capitalised". The regulators are required to take specific actions if a bank falls below the "well-capitalised" level. Well-capitalised banks must have a total risk assets ratio of at least 10%, a tier one (equity plus long-term funds) risk ratio of at least 6%, and a tier one leverage (tier one-to-total assets) of at least 5% (Heffernan 1996).
[27] Nor is European prudential regulation as narrow as the US regulation. Since January 1993, the European Solvency Directive extends the application of the Basle Agreement to all European credit

saw securitisation as a tool banks could use to improve their capital ratios and the quality of their balance sheets by selling off low-quality assets.

The UK has the largest European asset-backed securities market; however the size of the market is still very small when compared to the US market. The total volume of securitised assets up to January 1998[28] was $33.5 billion, compared to $900 billion outstanding mortgage-backed securities (private and agency's) and $300 outstanding non-mortgage asset backed securities in the US in the 1995. The UK legal system did not require the implementation of specific regulation to authorise the issue of asset-backed securities. The Bank of England and other supervisory authorities have played a passive role, meaning the development of securitisation has been industry led.

The mortgage market has been the leading sector in securitisation, around 87% of the UK issues are backed by mortgages, nearly 81% of which consists of residential first mortgages, and the remainder is backed by residential second mortgages, arrears mortgages and commercial mortgages[29]. Since 1990 more than $4.8 billion of other types of assets have been securitised; car receivables account for almost one third. Other assets which have been securitised are: lease, hire-purchase, swap and credit card receivables; and consumer (secured and unsecured), business, nursing home, student and housing association loans.

2.7.1 Structure of a Typical UK Securitisation Transaction

To grant off-balance sheet treatment to the transaction (Almoguera Gómez, 1995) the securitising bank establishes a company incorporated in UK or Scotland, the SPV, with the capital owned by a "holding company"[30]. To avoid consolidation of accounts, the capital of the holding company is held by a share trust on trust for

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institutions which are required to have a risk weighted capital assets ratio of 8%. In some countries banks have to comply with a minimum reserve requirement, and the Deposit Insurance Directive of 1993 imposes a minimum level of deposit insurance of Euro 20000 for all member states.

[28] This figure includes all public UK mortgage and non-mortgage securitisation since the first transaction in 1987. The private market, for which data are difficult to collect, is believed to represent around 5% of the public market.

[29] Source: ING BARINGS Structured Finance April 1996

[30] Normally, the holding company owns capital of more than one SPV.

charitable purposes (Ferran 1992). A trustee is appointed to represent the interest of the security holders and to supervise the fulfilment of all the obligations contracted by the issuer and seller with respect to the investors.

SPV's do not have employees, nor do they service the securitised assets. Their sole function is to hold assets, issue asset-backed securities, and repay the security holders, all of which is normally done through an appointed paying agent[31]. Generally, the seller retains the right to adjust the loan rates. This is very common for mortgages because the majority of securitised mortgages are variable interest rate. The seller also retains the servicing function: otherwise it is necessary to designate an administrator (Ferran 1992).

The SPV is often authorised to buy more assets after the securities have been issued (asset *substitution*). *The new assets are paid for by the proceeds of assets which are* redeemed early. If the seller makes a further advance on a securitised asset (very common for mortgages), the extended loan is transferred to the SPV, and it is financed in the same way as asset substitution (Ferran 1992). Investor preference for short maturities has made issues in which asset substitution is permitted unpopular (Walsh 1995).

The most popular types of credit enhancement have been pool insurance and senior/subordinated structures (Walsh 1995). The choice of credit enhancement has been determined by market characteristics. The 1991 downgrading of two pool insurers, Sun Alliance and Eagle Star meant the securities insured by them had been temporarily downgraded. Since then, investors have shunned pool insurance as credit enhancement because it carries event risk, in favour of senior/subordinated structures.

[31] If the securities are listed in the London Stock Exchange, there is obligation to appoint a paying agent

2.7.2 Financial Services Authority, Bank of England and Building Societies Commission Securitisation Regulation

Since January 1998, the Financial Services Authority (FSA) has taken over the Bank of England's role in banking supervision. The Building Societies Commission will also come under the auspices of the newly formed FSA[32].

In February 1989 the Bank of England published a notice stating the Bank's supervisory policy regarding loan sales and securitisation. The FSA's Guide to Banking Supervisory Policy, which incorporates the Bank of England approach to loan sales and securitisation, has recently (July 1998) replaced this notice. Loan sales and securitisation have in common the transfer of the asset to a third party. However, the Bank of England and the FSA consider, as it will be seen below, that the risks associated with securitisation are greater, hence securitisation requires separate consideration. The reason for the riskier nature of securitisation is that the seller's relationship with the assets is not ended when those assets are transferred. The FSA's rules on loan sales and securitisation apply to UK incorporated banks. The main points include:

- Loan transfers should not contravene the loan agreements; the seller should not have any residual benefit on the principal of the loan or obligation to repurchase the loan, and the buyer should not have recourse to the seller. If the terms of the loan are re-negotiated, the buyer is subject to the new terms. If the seller services the loan the seller is not required to advance funds to the buyer.

- The treatment given to a loan transfer for capital adequacy purposes[33] depends on the system used to operate the transfer of the loan. A *novation*[34] and a *duly notified assignment*[35] are considered a clean transfer and therefore the assets are taken off the sellers' balance sheet and are not part of the capital adequacy

[32] A new Financial Services Act is expected to be passed by Parliament in 2001.

[33] Since 1st January 1993 UK banks and building societies have to comply with the European Solvency Ratio Directive, hence all banks and building societies are required to have a minimum capital equal to 8% of their risk-weighted. However, the Bank of England had imposed a risk assets ratio on UK banks as early as 1980 (Heffernan 1986).

[34] In a novation the existing loan between lender and borrower is cancelled and a new loan between the borrower and the loan buyer is drawn up (FSA 1998a).

requirements. A *sub-participation*[36] is treated as a transfer, and therefore the assets are taken off the seller's balance sheet. A *silent assignment* in which the borrower is not informed of the transfer may be regarded as a clean transfer if the Bank has been satisfied that all the parties are aware of the higher risks of this type of transfer[37].

- Securitisation is considered riskier than the sale of a single loan for two reasons. There is an "operational risk" which refers to the guarantees given by the selling bank with respect to the quality of the loans in the pool. The selling bank must employ greater resources to examine the quality of the pool to avoid this risk. There is also a "moral risk" which arises when the selling bank feels compelled to support losses incurred by investors in the securitisation transaction to protect its own image because of continuing identification with the loans. In this case there is not a clean break with the transferred loans. Although these risks are not specifically treated in the risk assets ratio, the Bank takes them into account when negotiating the individual bank's minimum gearing ratio[38].

In 1994 the Building Societies Commission (BSC) published a prudential note on securitisation which addresses both the requirements set by the Commission regarding securitisation and the practical issues likely to arise if building societies securitise mortgages. The BSC has tried to accommodate the "mutuality" of building societies and their objectives[39] with securitisation. The BSC prudential note has created a framework which permits societies to engage in securitisation and to compete with other financial institutions (mainly banks) in similar conditions.

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[35] An assignment transfers all rights to principal and interest payments from seller to buyer (FSA 1998a).

[36] In a sub-participation, the loan is not transferred but the buyer acquires a covenant from the seller under which the seller passes to the buyer all payments made on the loan (FSA 1998a).

[37] If the borrower is not informed of the transfer the buyer does not have the right to claim payments from the borrower. The buyer is exposed to the risk of having to re-negotiate the conditions of the debt with the borrower.

[38] The gearing ratio is equal to : (deposit + external liabilities)/(capital + reserves) (Heffernan 1996)

[39] The Building Societies Act of 1986 establishes that a building society main purpose is to raise, primarily by the subscriptions of members, a stock or fund for granting members advances secured on residential property. The 1994 Prudential Note on Securitisation points out that this is the continuing purpose, and therefore originating mortgages with the objective of securitising them contravenes their main objective.

The main problem with building societies securitisation is how to deal with the ex-post securitisation position of the mortgage borrower: mortgage borrowers are members[40] of the building societies, and the transfer of the loan ends that membership. Members of a mutual, i.e. depositors-shareholders and borrowers, are the residual owners of the mutual accumulated reserves. It is the shareholders (as opposed to customers) of a stock-owned bank who hold the risky residual claims. The owners of a mutual because they are also customers, internalise risks of the firm that an investor could diversify. If building societies choose to securitise the mortgages of borrowers who are also members of the society, they may have to compensate the borrower for the costs of forfeiting his or her claim to the mutual reserves.

To avoid the membership problem, the BSC recommends the use of a subsidiary to originate mortgages that are going to be securitised since these mortgages would not confer membership to the borrower.

On the other hand mutuality may have a positive influence on the incentives to securitise. Unlike public corporations, mutual firms cannot raise capital in the stock market[41]. Their "core capital" is very much limited to past and current profits, accumulated as reserves. Securitisation finance could be an efficient mechanism to grow. However the large up-front costs of securitisation may discourage its use by small societies unless they use multi-seller structures.

Like the FSA, the BSC is concerned with the "moral hazard" risk which arises if building societies feel under obligation to support investors losses in securitisation transaction to maintain their reputation, and/or to protect customer relationships. The BSC computes the "moral hazard" risk for capital adequacy purposes in an individual basis with each institution. The risk of "moral hazard" can be reduced if building societies inform possible borrowers of the likelihood of their mortgages being securitised, and of the likely effect of securitisation on their membership rights.

[40] The Building Societies Act of 1986 establishes that at least 50% of societies' funds must be in the form of shares owned by members of the society. Building societies make advances secured on land to members; all the mortgage borrowers of the society and the majority of investors are society members (Boleat et al., 1992).

[41] Although UK building societies can issue "permanent interest bearing shares", which is a hybrid between debt and capital.

An additional problem for building societies wanting to raise finance through securitisation is the choice of credit enhancement. There are regulatory limits to the type of activities that building societies can do to support other companies. When the other company is a "lending body", i.e. a company allowed to originate, buy, hold and sell mortgage debt, building societies must be shareholders of the company to be able to "support" it with loans, guarantees, etc. However being a shareholder of the SPV eliminates the possibility of off-balance sheet funding. Servicing the securitised mortgages is not considered as "supporting" the SPV, so there are no limits on this activity.

The treatment of the securitised assets for capital adequacy purposes depends on whether they are considered off-balance sheet from an accounting point of view. Building societies structure securitisation in three ways that have different accounting implications:

- The first structure involves the use of a separate SPV to which the mortgages are transferred. This transaction is regarded as off-balance sheet from an accounting point of view and the mortgages are dropped from capital adequacy computations. The finance would not add to the wholesale funding limit. The securitised mortgages are excluded from class 1 or class 2 assets[42].

- The second technique is the use of an "associated body" (through minority shareholding) as SPV, although the finance is non-recourse to the building society. This structure does not remove the assets from the balance sheet. If the shareholding participation is less than 15% of the associated body capital, the funding is computed for the wholesale funding limit. The same rules apply to the computation of the assets as class 1 and class 2: if the participation is greater than 15%, the assets must be included.

[42] Building Societies are restricted on the composition of assets and liabilities on their balance sheet. At least 90% of their assets must be residential mortgages (Class 1). Class 2 assets are other types of mortgages and they cannot exceed 10% of commercial assets. Class 3 assets can be any asset but the may not exceed 5% of total assets. In the liabilities side, the amount of wholesale funding cannot exceed 50% of total liabilities (Heffernan 1996).

- The third method is the use of a "sub-participation" agreement. The finance is non-recourse and by means of a conditional deposit, the repayment of which depends on the performance of the mortgages. This deposit is included in the deposit limit of 50% of all the society's liabilities. The mortgages remain on the balance sheet.

2.8 OTHER EUROPEAN ASSET-BACKED SECURITIES MARKET

2.8.1 France

The legal structure for asset securitisation was introduced in France in 1988[43]. The Government attempted to achieve different objectives with the introduction of asset securitisation. There was a need to expand funding sources and to provide cheaper loans by reducing intermediation costs. The authorities were also concerned about the banks' ability to meet capital adequacy requirements of the Solvency Ratio Directive (effective from 1st January 1993). Securitisation could be used to remove assets from banks' balance sheets.

France, like other Roman-law countries, did not have a judicial equivalent to the Anglo-Saxon "trust". A law enabling the creation of SPV for securitisation transactions, with trust-like characteristics, was approved. There were also legal reforms to facilitate the transfer of receivables. The most important reform was revoking the requirement to notify each individual borrower prior to the transfer.

The SPV is called Fond Commun des Creances (FCC); it is a debt fund, a co-ownership for which the sole function is to purchase assets (loans and other kind of receivables), to hold them, and to issue securities backed by those assets. The FCC is not a legal entity, so it is unregulated.

The FCC is set up by a "management company" and a "depository institution", who acts as custodian, keeping the securitised assets on trust. Both are responsible for the management of the debt fund. They write the statutes setting out the legal and

financial structure of the securitisation. These statutes must be approved by the Comission des Operations de Bourse, which takes advice from Bank of France.

Management companies take any form, and their main function is to manage the debt fund (FCC). To guarantee independence and to protect investors, the seller of the assets cannot hold more than one third of the management company's capital. The depository institution must be an authorised financial institution. In most cases it is a subsidiary of the securitising bank, so the assets are kept with the seller. Its main duties are managing the cash flows generated by the assets, and monitoring the activities of the management company.

The growth of securitisation has been very slow. Slow asset origination (due to the recession) alleviated capital adequacy pressures on banks. French banks are very decentralised, with the decisions over loan applications and subsequent enforcement and servicing done at branch level. Information about assets is scattered through the branch network. Inadequate documentation and lack of homogeneity in the contracts make it difficult to gather the information required for successful securitisation in a cost-effective manner. Moreover some of the assets best suited for securitisation, like mortgages, had very low interest rates, because of subsidisation, making securitisation uneconomical[44]. The yield on asset-backed securities depends on the yield of the underlying asset plus risk. If the yield on the underlying asset is too low compared to investments of similar risk, securitisation is an unattractive investment. Finally, shortcomings arising from the 1988 regulation further contributed to the lack of initial success of securitisation[45].

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[43] Law no 88/1261 of December 23, 1988

[44] The French mortgage market is divided in three segments (Jaffee and Renaud, 1995): "free market loans" make up half of the market. "Subsidised loans" represent a third of the market, and they are the instrument used by the government to implement its housing policy. The remaining loans are "regulated loans", which are loans conforming a set of criteria established by the government; borrowers of regulated loans are eligible for government subsidies.
Subsidised loans are financed by an specific type of saving accounts, called "livret A", which are a very cheap source of funds for lenders. Mortgages have traditionally been a loss-leader for French banks. As a result, interest rates in the French mortgage market had been historically low, and therefore difficult to securitise without making a loss (Thompson, 1995).

[45] The original regulation only permitted the securitisation of assets with initial maturity of more than 2 years, thereby excluding credit card and other short-term receivables. The securitised assets could not be in arrears or default prior to securitisation. Securitised assets had to be originated by credit institutions or the Caisse des Dépôts et Consignations, which is the financial group that lends to local and regional government. The assets of insurance companies could not be securitised. The debt fund was not allowed to acquire more assets after its establishment, a burdensome requirement because the

In 1993, a new law was enacted that attempts to make securitisation more flexible. The new regulation allows the transfer of the servicing function, so firms which could not use securitisation before may do so now. Asset substitution is also permitted and the FCC can contract mechanisms of credit enhancement after the issuance of securities. The range of assets eligible for securitisation has been expanded and the need to obtain authorisation to create debt fund has been revoked.

The rating of the securitisation transaction by an specialised credit rating agency is compulsory. French law permits only three types of credit enhancement: pool insurance by an insurance company or bank, overcollateralisation and senior/subordinated structures. Originally the selling bank always provided the credit enhancement. This was because the French banking authorities imposed an 8% capital ratio on the recourse portion, instead of 100% as established in the Basle Agreement. This situation was corrected in 1993.

There have been three types of securitisation transactions: single loan issues, which consist of repackaging a single large bank loan into bonds to sell them in the capital markets, normally with zero-coupon bonds. Their main purpose was to use securitisation to by-pass the less flexible regulation of bonds issue. The second type of transactions involved the repackaging of unusual assets, such as claims on local authorities or stockbrokers. The last type of transaction is securitisation of a pool of loans. Single loan issues dominate the market, up until 1994, 87 issues are backed by single interbank loans, 3 by loans to local authorities, 16 by consumer loans, 2 by business loans and 6 by mortgages (Thompson 1995).

The French assets-backed securities market has not developed as the authorities had expected, especially in the mortgage sector. Since 1994 the volume of mortgage securitisation has been increasing due to the changes in regulation and the fall in market interest rates which has permitted banks to securitise some of their low rate

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FCC would have to amortise the costs and expenses of securitisation over the average life of the original assets. Most of the securitised assets were consumer loans, which had average life between 1.5 and 2.5 years, so the amortisation of costs had to be done over a very short period of time. Each debt fund was limited to one securitisation.

mortgages. However securitisation is increasingly used by French banks to move impaired assets off their balance sheet (Jaffee and Renaud 1995).

2.8.2 Spain

Until 1981, mortgage credit was provided by the Banco Hipotecario de Espana (state owned), which funded mortgages through the issue of mortgage bonds, and by saving banks, which financed through retail deposits. In 1981, the Government sanctioned a new framework for the mortgage market which permitted all financial institutions (commercial banks, saving banks, co-operative credit institutions and mortgage lenders) to finance through the issue of three different types of mortgage securities[46]. Again the objective was to increase the supply of funds for mortgage lending. However the system failed because (Almoguera Gómez, 1995): there was neither an increase in the liquidity of mortgages nor an increase of funds from non-traditional sources. The system did not reallocate the risks associated with mortgage finance; and mortgages remained on the balance sheet of the originator, meaning no capital was released. The volume of mortgage credit increased from 2 billion pesetas in 1981 to 11 billion pesetas in 1992, but only around 6% of this volume was financed through mortgage securities. The tax and accounting rules for mortgage bonds made them unattractive, and the use of mortgage shares was hindered by the excessive formalities and some legal problems related to the transfer or assignment of assets (Almoguera Gómez 1995).

In 1991, just before the time the legal structure for securitisation was approved, Spain had one of the lowest volumes of mortgage debt per capita amongst the developed countries. The Spanish Government regarded the development of asset securitisation as the instrument that would help to modernise the mortgage market. Law 19/1992 governing Companies and Property Investment Funds and Mortgage Securitisation Funds states in its legislative purpose that the objective of introducing securitisation in the Spanish financial system is to help financial institutions to

[46] There were three types of mortgage securities: "cedulas hipotecarias" (mortgage certificates), which are bonds collateralised by all the mortgage portfolio of the issuing institution; "bonos hipotecarios" (mortgage bonds), which are bonds collateralised by an specific mortgage portfolio; and "participaciones hipotecarias" (mortgage shares), which represent a pro-rata ownership in an specific mortgage loan. Mortgage shares transfer ownership of an specific mortgage loan.

mobilise mortgages, increase competition and specialisation amongst lenders, and thus help to reduce the cost of borrowing.

As in France, it was necessary to pass a law to create a specific legal framework for securitisation, allowing the establishment of trust-like SPV, called Fondo de Titulizacion Hipotecaria (FTH). In addition the requirements for the transfer of assets was simplified. It must have net assets equal to zero and asset substitution is allowed in the event of early repayment of the mortgages. The FTH is a close-end debt fund. which owns mortgage shares, and issues securities collateralised by those mortgage shares. Mortgage shares are protected from the bankruptcy of the issuing institution. This is an important difference with respect to mortgage securitisation in other European countries. The FTH buys mortgage shares (not mortgages) issued by the financial institutions. They are able to securitise their mortgage portfolios and move the mortgages off the banks' balance sheet. The bank selling the mortgage shares must service the mortgages. The standard is for one mortgage share to represent 100% of the underlying mortgage.

If a bank wants to securitise assets other than mortgages, the debt fund, in this case called Fondo de Titutlizacion de Activos (FTA), buys the whole assets.

The FTH or the FTA are established by the institution wishing to securitise the assets and a "management company". Debt funds are bankruptcy remote vehicles, and must be administered and legally represented by management companies since they are not themselves legal entities and do not have employees. Management companies are permitted to negotiate any form of credit and liquidity enhancement on behalf of the fund. The statutes of the debt fund and supplementary documentation[47] must be approved and recorded with the "Comision *Nacional del Mercado de Valores*" (CNMV). All securitisation transactions, publicly or privately placed, must be rated and the securitised assets have to be audited. Asset-backed securities have to be listed in an official or organised market, including the subordinated tranches.

[47] The statutes contain detailed information about the securitised assets and the type and characteristics of the asset-backed securities. Additional documentation to be supplied includes all the relevant contracts between the selling institution and the management company, rating and auditing reports, and contracts drawn by the management company with the providers of credit and liquidity enhancements.

Debt funds are wound up when all the assets are repaid. When less that 10% of the pool value is left the management company may sell the remaining assets and wind up the fund.

Management companies are only allowed to administer and represent debt funds for securitisation purposes. They are permitted to manage more than one debt fund, and can take any legal form, although the common practice has been to establish the management company as a public limited company (Sociedad Anonima).

New regulation is expected to introduce the following improvements in the securitisation framework: open-end debt funds which can implement more than one securitisation transaction; removal of the requirements of rating and listing for private placements; less demanding auditing requirements; and the right to transfer the servicing function to another party.

The first issues of Spanish asset-backed securities took place before the 1992 securitisation law was approved[48]. Since then to 1997 there have been 13 more issues (which amount to $1.6 billion), all backed by residential first mortgages[49]. The securities are competitively priced: those who pay floating rate coupons linked to 3-month LIBOR have margins similar to those of mortgage-backed securities issued in the more mature UK market.

The large lenders, banks and "cajas de ahorros" (the equivalent to "saving and loans") are willing to use securitisation. Most of them have established "management companies" for FTH to securitise their assets.

2.8.3 Sweden

Traditionally Swedish mortgage finance was provided by mortgage bonds. However, the housing credit institutions (the main mortgage lenders and the largest mortgage

[48] There were five issues by different banks which used offshore structures and subsidiaries.
[49] Goldman Sachs, European Asset Backed database, February 1996, Moody's Investor Services-various issues, and Almoguera Gomez 1995

bonds issuer) and the commercial banks have been securitising mortgages since 1990. Jaffee and Renaud (1995) argue that the imposition of Basle capital requirements from 1990, and rising interest rates in the mortgage bond market due to credit quality concerns have made securitisation more attractive to Swedish banks. Securitisation is seen as a way improve capital ratios, and to remove impaired assets from bank's balances (Thompson, 1995).

In Sweden the Government has taken a "laissez-faire" approach and it has not created an specific regulatory framework for securitisation. However, every issue (there have been four issues) has been discussed with the authorities and, although the SPVs are located offshore, they have obtained official authorisation (Jaffee and Renaud, 1995).

2.8.4 Other European Emerging Asset-Backed Securities Markets

Belgium changed its regulatory framework to meet the requirements of securitisation in 1992[50] (Thompson, 1995). The Government allowed the establishment of entities which could act as SPV in securitisation transactions. The SPV is regulated within the context of Collective Investment Undertakings. The system is very similar to the French and Spanish ones. The SPV must be managed by a "management company", and a "depository" in charge of keeping the assets. The securities issued by the vehicle must obtain a rating. Only non-subordinated debt can be marketed to the public. The entities are only authorised to invest in debt, and they can take two possible legal forms: debt fund (receivables investment fund); or statutory entity (company for receivables investment) structured either as a limited liability corporation or a partnership limited by shares (Paul, Zagon and Scalais, 1991). The Banking and Finance Commission must approve the statutes of the SPV and the structure of the securitisation transaction. The requirements regarding debt transfer for securitisation purposes have been simplified.

In Italy, the Government has not, to date, introduced a securitisation law. Only a few transactions have taken placed so far, and they have used offshore structures to avoid

[50] Act of August 5, 1992, developed by Royal Order of November 23, 1993.

a number of problems related to the Italian regulatory and market infrastructures. The large banks are increasingly putting pressure on the authorities to enable the legal changes that would make securitisation easier.

Banks in other European countries have started engaging in securitisation. There have been a few issues by Dutch, German and Irish banks. However in Germany securitisation is still considered more expensive and less efficient than alternative funding sources, notably mortgage bonds[51]. The publication of guidelines by the German Banking Supervision authorities is expected to encourage the use of securitisation by banks, especially to finance personal loans and second mortgages.

2.9 CONCLUSION

This chapter has reviewed the main characteristics of securitisation and analysed its origins and expansion in different European countries and US. Securitisation is a growing trend. After the US, the UK has the second largest securitisation market but the difference in the relative importance of securitisation in both countries is still very large.

The institutional settings and market characteristics are often considered an important incentive to innovate (Allen and Gale 1994). This chapter has demonstrated that the institutional and market characteristics are very different across Europe and US. The regulatory restrictions that limited US banks' functional and geographical diversification opportunities were at the origins of securitisation. The Housing and Urban Development Act of 1968 specifically attempted to reverse the "local" character of the US mortgage market, in which funds could not flow from regions with excess supply to regions with excess demand. The banks' lack of opportunities to geographically diversify the composition of their assets and liabilities was a consequence of the McFadden Act of 1927 which tied the fate of

[51] Securitisation is seen as more expensive because of the lack of standardisation in the issues, the need to obtain a rating and credit enhance the securities, and the risk weight of mortgage-backed securities being higher than that of mortgage bonds, currently at 10% (Bernt Rohrer, "Pfandbrief and Mortgage-Backed Securities, European Mortgage Bond Conference, EC Mortgage Federation, April 1994). Nevertheless in 1995 there was the first mortgage securitisation in Germany (ING BARINGS Structured Finance April 1996).

banks to that of their local communities. These restrictions do not apply to European banking.

This has two important implications. First, a bank's incentives to engage in securitisation may depend on the country on which it is located. Second, research on securitisation has been largely US based (because of the paucity of data in other countries) and therefore the findings may not be applicable to other countries.

The difference on institutional settings and the relative importance of securitisation are more evident in the mortgage market. US government guarantees on residential mortgage securitisation is a key explanation for the vast difference in the degree of securitisation on the US compared to other countries. The US government effectively assumes the credit risk of securitised mortgages. This form of credit enhancement is cheaper and preferred by the market investors to private arrangements. Some European countries have encouraged the use of securitisation by implementing regulatory changes to simplify it and make the process less costly. However, the system of implicit subsidies by the US government has no equivalent in any European countries.

The advocates of securitisation allude to higher competition and the resulting benefits to the borrowers as some of the advantages of securitisation. US research studies conclusively show that mortgage securitisation, through specialisation on the functions for which the institutions have a competitive advantage, better allocation of funds and openness of the market, has improved competition in the US mortgage market and narrowed the difference between mortgage rates and capital market rates. Unfortunately this type of studies have been limited to the US residential mortgage market, where the government subsidies to securitisation are so important. For a small fee, US thrifts can substitute their mortgage portfolios with agencies' mortgage-backed securities (which carry no credit risk because of the implicit or explicit government guarantee), and the capital requirements on the agencies' mortgage-backed securities are lower than capital requirements on private mortgage-backed securities or whole mortgages. Furthermore, government agencies securitisation prevents the development of private mortgage securitisation because the government agencies have the competitive advantage of the government

guarantee, which reduces the profitability of the private arrangers of securitisation. Therefore the influence of securitisation on the US mortgage market cannot be separated from the government subsidies to securitisation.

The popular belief in the UK is that the entry in the mortgage market of centralised lenders which finance exclusively through securitisation increased competition in the mortgage market, because they separated the functions associated with intermediation. However this issue has never been empirically demonstrated. Chapter 8 investigates the effect of securitisation on the UK mortgage market by examining the competitive behaviour of depository institutions and centralised mortgage lenders.

Another aspect of securitisation which may have contributed to the different development of US and European securitisation is risk sharing. Diamond and Lea (1993) argue that the improvements in risk sharing obtained from securitisation depend on the market characteristics. Initially US securitisation was used to reallocate the risks of holding fixed rate mortgages, particularly the interest rate risk. This was a particular US problem: in the UK the majority of the mortgages are variable rate. Other European countries such as Germany, Denmark, France and Spain had markets for mortgage bonds which helped to reduced the risks of holding fixed rate mortgages.

Diamond and Lea (1993) identified two market characteristics which significantly reduce a bank's incentives to engage in securitisation: subsidised funding sources and lack of complete contracts because certain risks are not present. For example, in France, low interest rate subsidised mortgages are funded by government subsidised deposits. These mortgages cannot be securitised without realising a loss, and the low cost of these deposits means that banks do not need to seek a cheaper funding source. In Germany and Nordic countries, the prepayment of mortgage loans is not permitted, so the banks take on less risk than banks in other countries. Hence there is less need to improve risk sharing by securitisation.

The next chapter explains the role of securitisation in the financial sector and why it could be different to securitisation in other industries. Chapter 4 reviews theoretical

models which explain banks' economic incentives to securitise assets. All except one model focuses on securitisation in the US. Virtually all the models are based on securitisation with US institutional characteristics. For example US banks' lack of diversification opportunities and poor risk sharing, which are factors not widely applicable to Europe. Other issues such as the banks' use of securitisation to improve capital ratios or avoid having to meet regulatory requirements are common to most countries. Hence some of these models are applicable, others are not. The same can be said of the econometric tests reviewed in Chapter 5.

CHAPTER 3: SECURITISATION AND FINANCIAL FIRMS

3.1 INTRODUCTION

Securitisation and loan sales raise important questions about the role and uniqueness of banks. They both imply fundamental changes in banking, which might significantly affect the future role of banks or even cause their extinction. Securitisation links borrowers and investors while threatening to eliminate the need for bank intermediation and financing. Securitisation unbundles the set of functions associated with lending. Traditional theories of intermediation postulate that the role of banks in an economy depends on banks having an advantage in solving information frictions and in reducing transaction costs. The traditional functions of banks include producing information about the prospective borrower and loan concession (loan origination or underwriting); ex-post monitoring and enforcement of the loan agreement (loan servicing); and finally, loan financing (loan funding) and keeping the loan until maturity in the bank's portfolio (loan warehousing). These functions have typically been integrated vertically within the same institution.

With the introduction of securitisation in the early 1980's, the role of banks has been radically altered. In particular, securitisation separates the underwriting and servicing functions from the funding function. This chapter examines the role of securitisation within the financial industry and why securitisation by financial firms is different to securitisation by non-financial firms.

This chapter is divided into four sections. Section 3.2 examines the role of securitisation in the banking industry The third section introduces the current controversies in banking theory and how securitisation can be linked to these issues. And Section 3.4 concludes.

3.2 ASSET SECURITISATION AND THE BANKING INDUSTRY

Banks are not the only firms that engage in securitisation. Non-banking firms, able to produce a large volume of homogeneous receivables, can isolate them in a special-purpose vehicle and borrow against their future cash flow[52]. These structures are arranged as asset-backed commercial paper. The firm sells receivables to the SPV, which issues commercial paper backed by those receivables to finance the transfer, and the structure is credit enhanced by a bank, normally through a letter of credit.

There has been little research on why non-financial firms use securitisation[53]. Securitisation among non-financial firms is seen as a mechanism to raise funds. The use of securitisation as a funding mechanism can be relevant to banking firms as well. However, there is one aspect of securitisation that makes it different for financial firms, especially depository institutions. Securitisation permits financial firms to specialise on receivables origination and to transfer the funding function. What differentiates depository institutions from other firms is that depository institutions offer deposit and loan products: they take in deposits and lend them out as loans, to be held in the institution's portfolio until maturity (Heffernan 1996). Thus, in contrast with other firms which use securitisation to raise funds, depository institutions may also engage in securitisation to move away from some of their core business, thereby changing the depository institutions' role in the economy.

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[52] In the US, firms in the airline, automobile, and retail industries use securitisation. These firms securitise receivables from credit card and instalment sales, or lease contracts. Some more unusual assets have been successfully securitised like electricity bills, lottery winnings, airline ticket receivables, mutual fund fees, or health club membership fees.
In Europe, GPA, the Irish aircraft-leasing company, has securitised aircraft leases. The French car company Renault has securitised automobile loans. And the British Canary Wharf has issued asset backed-securities backed by the rental income from offices.
In the UK securitisation also is becoming increasingly common for project and infrastructure finance, acquisition finance and leverage buy-outs. The securities are serviced with the revenue from the asset to be built or re-financed. Securitisation may be cheaper than bank borrowing or equity, and it provides an efficient way to exit the investment, since the risks of the investment have been passed to investors.

[53] Minton, Opler and Stanton (1997) and Hill (1996) investigate securitisation among industrial firms, Lockhood, Rutherford and Herrera (1996) consider the wealth effects of securitisation among financial and non-financial firms. There are some practitioners' books which explain practical issues of securitisation by non-financial firms: Kendall L.T. and Fishman M.J. (Eds.) (1996): *A primer on Securitisation,* MIT Press, Cambridge, MA, US; and Schwarcz, S.L. (1993): *Structured Finance: A Guide to the Fundamentals of Asset Securitisation*, Practising Law Institute, 2nd Edition.

To understand why securitisation by depository institutions is different to securitisation by other firms it is useful to consider the Merton approach to financial intermediation. According to Merton (1995), financial intermediaries can be viewed from an institutional or a functional perspective: the institutional perspective takes the financial intermediaries as given and asks policy makers to create an adequate environment that will enable current intermediaries to survive. The functional perspective takes the economic functions performed by financial intermediaries as given and tries to establish which is the most efficient institutional structure to perform those functions. There are some useful insights to be gained by taking the latter perspective. The basic functions of the financial system are essentially the same in all the economies, but for a variety of reasons (regulation, technology, economic conditions, etc.) the most efficient financial structure changes over time and across geopolitical divisions. Different types of intermediaries and the capital market compete to be the providers of financial products and services. The functional perspective underlies the different ways of performing those basic functions and looks at which one is the most efficient in a given economy at a given moment of time. It also attempts to determine the causes of changes in the institutional structure that delivers a specific function. The important conclusion of the functional approach is that the institutional structure through which the functions are delivered is not essential to the functions and it can change over time.

Similarly, Thakor (1996) argues the design of the financial system determines the division between intermediated and non-intermediated sources. It can be affected by the diversity (structure) of the financial system, for example whether the financial system is dominated by the financial markets or by financial intermediaries, since the incentives to innovate are different. Regulatory limits on banking activities might also distort financial innovation incentives.

Financial intermediaries provide a variety of services that can be broadly divided into brokerage and asset transformation activities (Greenbaum and Thakor 1995):

The *Brokerage Function* comprises gathering sellers and buyers of financial claims with complementary needs. The broker's compensation for this function is a fee. The matching of buyers and sellers does not imply the broker buying or selling the asset.

The ability of buyers and sellers to find the most appropriate counterpart on their own is reduced by the presence of information costs[54]. The broker has an advantage in information production because the broker can reduce transaction costs. Assume that there are fixed costs of evaluating financial claims equal to c, and that there are x potential buyers and sellers. In the absence of a broker, the cost of everybody becoming informed would be cx^2, and there would be an unnecessary duplication of information when information is kept private, or free rider problems when information is made public. However, the broker can reuse the information across many users and through time, hence the broker only needs to examine each participant once. The cost of becoming informed with the broker would be $2cx$. And the savings from using the broker are $S= c\ (x^2-2x)$ (Greenbaum and Thakor 1995).

The *Qualitative Asset Transformation (QAT) Function* consists of transforming asset attributes like duration, denomination, liquidity, or credit risk. Intermediaries purchase risky assets like mortgages or personal and corporate loans, and finance them with demand deposits. Usually, there are not secondary markets for intermediary assets, and because of information frictions these assets are very illiquid. On the contrary, the intermediaries' liabilities, the demand deposits, have low risk, infinitesimal maturity and are very liquid. The liquidity and the reduction in deposits' risk is achieved through the transformation of asset attributes and through the regulatory safety net (deposit insurance and lender of last resort) (Greenbaum and Thakor, 1999). The depositors can also benefit from investing in a diversified portfolio of assets, which they could not achieve by themselves unless they were prepared to invest large amounts.

The transformation of asset attributes requires a mismatch with respect to those specific attributes on the balance sheet of the financial intermediary. There will always be some sort of exposure or risk associated with the QAT function. The financial intermediary has to manage the risk by diversifying it or by shifting part of it to other parties. The financial intermediary puts its own capital at stake to assure

[54] Heffernan (1996) indicates that there are four information costs: search costs, verification costs, monitoring costs and enforcement costs.

investors, depositors, and the Government[55] that it will perform adequately this risk management.

Financial intermediaries specialise in the provision of one or more of these functions. Depository institutions have traditionally provided all the services associated with both, the brokerage and the QAT function, and they also administer the payments system. If a financial intermediary transfers all the risks of an asset to other parties, then it stops performing the QAT function and it becomes a broker (Greenbaum and Thakor 1995).

Securitisation, by transferring the funding and the risks of the asset to a third party alters the typical dichotomy between brokers and depository institutions: a depository institution that securitises assets behaves like a broker with respect to those assets or markets. It redistributes the risks associated with intermediating the assets or markets, instead of assuming them.

Historically, depository institutions had a competitive advantage in providing credit to firms and individual borrowers because they had better access to loanable funds, and they could resolve more efficiently private information and moral hazard problems associated with this function (Greenbaum and Thakor, 1995). The conventional view on the depository institutions' role in the economy depends on the market being less efficient in solving problems related to information asymmetry. Depository institutions gather information about investment projects (they minimise transaction costs associated with monitoring and signalling in an asymmetric information environment), provide delegated monitoring services and liquidity, and permit risk-sharing amongst the depositors. Diamond (1984) argues that banks reduce agency costs associated with outside finance because of economies of scope involved in controlling and monitoring. Because depository institutions can act as delegated monitors they can provide finance to borrowers with information frictions who would find it difficult to obtain funds in capital markets. The traditional role of depository institutions has consequently been the transformation of deposits into loans that require monitoring by the institution.

[55] The Government, as partial insurer of some financial intermediaries' deposits, has a direct interest in their activities.

Traditionally, depository institutions financed loans with cheap (and in some cases subsidised) deposits and were protected from competition because of tax advantages and regulated entry into the banking industry. In turn depositories' assets were regulated[56]. Edwards and Mishkin (1995) argue that over the last years the easy access to funds has been eroded. The competition from less regulated non-depository financial intermediaries, more expensive regulatory requirements[57] and scarcity of funds meant that the depository institutions dominance in the savings market declined. In the UK the fall in the predominance of depository institutions in the domestic savings market is also notable. Building societies share of total personal financial assets has fallen from 15% in 1984 to 10% in 1997. The banks' share has remained at around 10% (despite an increase in the early 1990s that reflects the conversion of Abbey National)[58]. However, the share of personal assets invested in company securities has increased from 10% to 15%, notably since the beginning of the 1990s.

Improvements in information technology and financial innovation have made possible the design of new securities that can be used by firms to raise funds in the capital markets, solving at the same time private information and moral hazard problems (hence reducing the need to monitor the borrower). Asset securitisation provides a similar development for individual borrowers. In the US investors in mortgage-backed securities provide more than 40% of the funds for residential mortgage[59]. Even the information advantage that the depository institutions had on evaluating prospective borrowers has declined with the public access to information about borrowers, collateral valuations and other credit risks issues facilitated by the rating agencies involved in securitisation. Moreover, if loans can be securitised, any broker can originate a pool of loans and fund them by the issuance of asset-backed securities.

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[56] Chapter 2 details the most significant regulatory requirements imposed on banks and other depository institutions, as well as the subsidies received by banks in the form of underpriced deposit insurance or interest rate ceilings.

[57] The most significant regulatory requirement was the introduction of minimum capital ratios (see Chapter 2). Because debt is considered as a cheaper source of finance than equity, banks see the imposition of minimum capital ratios as a tax.

[58] Source: DataGraph Bank of England Monetary Statistics.

[59] In 1995 there was $800 billion outstanding balance of agency-guaranteed mortgage-backed securities and $100 billion private insured mortgage-backed securities (Greenbaum and Thakor 1995).

Greenbaum and Thakor (1995) point out that there is a growing rivalry between intermediation and securitisation in the US, and that the latter might end up substituting deposit funding. The US mortgage industry is an example of the declining role of depository institutions as traditional intermediaries. The industry has evolved from one made of depository institutions that performed all the roles included in the QAT function to one made of a variety of financial intermediaries (originators, servicers, rating agencies, insurers) that act more like brokers, bringing together the final sellers and buyers of mortgages.

Schmidt, Hackethal and Tyrell (1999) investigate the presence of a general trend towards disintermediation and a decrease on the importance of the banking industry amongst three European countries (France, UK and Germany) between 1981 and 1996. They found out that although the trend towards disintermediation is not general (i.e. not common to the three countries and all *types of financial* intermediaries), the non-bank financial intermediaries are becoming *more important* in channelling funds relative to banks.

Schmidt, Hackethal and Tyrell (1999) report that intermediation ratios[60] in Germany and the UK are constant for the period between 1981 and 1996, but there is a decline in the French intermediation ratios over the same period. However, when the intermediation ratios are break down to distinguish between bank financial intermediaries and non-bank financial intermediaries, the results are quite different.

The volume of assets and liabilities intermediated by banks has decreased in the three countries, particularly in the UK and France. The trend towards a reduction in the role of banks was found to be stronger in the liability side of the banks' balance sheet. Banks intermediated funding sources (deposits) have diminished relative to securitised sources[61]. In the three countries, but notably in France, there is also a growing increase in the volume of securities held by households relative to their

[60] The intermediation ratio is measured as the ratio of "financial claims (liabilities) of the non-financial sector on the financial sector –to– total financial assets (liabilities) of the non-financial sector.

[61] The authors treat stocks, bonds, notes, money market instruments, investment certificates and certificates of deposits as securitised sources.

holdings of intermediated assets. The authors consider these findings an indication of the declining role of banks as intermediaries relative to non-bank financial intermediaries, and of a division of functions between banks and non-bank financial intermediaries. Non-bank financial intermediaries have become more involved in the collection of funds from the public, whereas banks are specialising in originating assets and monitoring borrowers.

Schmidt, Hackethal and Tyrell (1999) also relate the drop in banks' profitability observed during the period (especially in France) to the disintermediation of banks' liabilities. Banks reliance on non-bank financial intermediaries and securitised funding sources, which are more competitive, force banks to pay market interest rates for the funding. Banks' endowment income, which is the income earned from non-interest bearing deposits and the intermediation margin (Heffernan 1996), has fallen as a consequence of stronger competition in the liability side of their balance sheet.

3.3 THEORY OF THE BANKING FIRM

In their comprehensive 1993 paper, Bhattacharya and Thakor present a review of the current state of banking research. They identify a series of controversial issues in banking theory. The increasing importance of asset securitisation, and some of the economic models explaining it, can be linked to some of these issues in banking theory.

The first important question which can be addressed from the perspective of asset-securitisation is a recurrent one in banking literature: **why do banks exist?**

As seen above the existence of banks relies on banks playing a unique part in the process of channelling funds from savers to investors which can not be performed by capital markets or other type of institutions.

Banks act as delegated monitors, however since a bank's portfolio is typically risky and with unobservable returns, the depositors have to be satisfied that banks are

adequately screening and monitoring borrowers. This raises a different problem, and that is who monitors the monitor. Diamond (1984) argues that portfolio diversification reduces the depositor's need to monitor the bank performance. This is because diversification decreases the volatility of a bank's portfolio return, and hence the probability of default. The depositor's need for monitoring the bank, and therefore the costs of monitoring, is reduced. When perfect diversification is not feasible an additional guarantee for the depositors is obtained when the owner/manager holds a claim (equity capital) that is junior to that of the depositors; the latter requires the bank keeping the asset until it matures because that is the only way the bank's capital can buffer possible losses related to the asset performance: capital provides a cushion to absorb losses, and with the bank capital at stake the bank is more careful when taking on risks.

Traditionally, bank's assets have been considered as non-marketable. Banks kept the assets until maturity in their balance sheets, and accordingly, also the risks associated with the assets. If banks sell or securitise their loans, there is less incentive for them to continue monitoring and screening borrowers.

Also banks' role implies the market is less efficient in solving problems related to information asymmetry. Securitisation would have two different implications: first, if the level of information asymmetry is the same, there is a moral hazard problem related to securitisation since the loan buyers cannot be assured that the banks will be as diligent in monitoring after the loans have been sold. Second, if the level of information asymmetry has been reduced or the banks have lost their competitive advantage in producing information about certain borrowers in an asymmetric information environment, securitisation is a threat to the banks' core activities.

As seen in Chapter 2, the information asymmetry problems in securitisation are addressed by employing mechanisms which guarantee the performance and the quality of securitised assets.

Securitisation unbundles the traditional package of services performed by the banks. The loan originator, servicer and financier are not necessarily the same agent. Securitisation, as opposed to intermediation, implies that funding comes from capital

markets. A traditional intermediary funds loans by raising deposits from the public, while securitised loans are funded by investors in the capital markets[62]. Securitisation might affect the survival of banks, reduce their size, or even make them disappear. For example, Follain and Zorn (1990) argue that the increase in mortgage securitisation is the most important factor affecting the unbundling of residential mortgage finance. The success of the secondary mortgage market in the US proves that separating the functions related to the provision of mortgage credit can be less expensive than engaging in traditional intermediation.

The second issue to be considered is the banks' role in **liquidity transformation.** Banks finance illiquid assets with non-traded liquid liabilities, normally in the form of deposits. One of the main attributes of securitisation is that it transforms illiquid assets into liquid and tradable securities. Securitisation must have deep implications for the banks because it redefines the liquidity of the banks' loans, lowering liquidity risk. Securitisation lessens the need for deposit insurance[63] because it makes banks' assets more liquid, reducing the probability and cost of banks' runs. However if banks securitise loans for which information frictions are low, and keep on balance loans with a high degree of information asymmetry, there would not be a substantial change in the banks' liquidity.

Securitisation can be seen as a funding mode which increases the sources of finance available for banks, an alternative to deposit funding and a different way to access capital markets funding[64]. Follain and Zorn (1990), Jaffee and Rosen (1990) and Cantor and Demsetz (1993) argue that mortgage securitisation has demonstrated that there is no requirement for a deposit funding system to support the provision of mortgage credit. Securitisation has helped to bridge the gap in mortgage finance caused by a reduction of savings allocated to traditional deposits; and it has contributed to smooth the effect of capital shortages and funding constraints at banking and non-banking mortgage lenders.

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[62] In the US, more than 40% of the residential mortgages are sold in the secondary mortgage market to be financed through the issuance of mortgage-backed securities; a large part of mortgage credit funding has been transferred from banks and thrifts to capital markets. In the UK, mortgage-backed securities have provided between 6 and 10% of mortgage funding in the last 10 years.

[63] Most economist argue that information asymmetries related to deposit funding makes the banking system very exposed to bank runs, and hence the need for a deposit insurance scheme.

[64] Securitisation as opposed to debt and equity finance.

The third issue examined in banking theory is the role played by banks in **maturity transformation**. Banks finance long-term assets with short-term liabilities. The compensation for maturity transformation is a premium for bearing interest rate risk, and the creation of liquidity. Maturity mismatch and liquidity creation are related because the latter depends on the former. Liquidity depends on the bank properly monitoring its actual and prospective borrowers in order to maintain a certain asset quality. The information related activities are enhanced when the liabilities are shorter than the assets since the mismatch imposes market discipline. The liabilities portfolio is repriced many times over the life of the assets portfolio, and pricing depends on the market perception of the amount of screening and monitoring performed by the bank.

Banks operate with high leverage. High leverage negatively affects the investment incentives of firms, reducing their value[65]. To alleviate the reduction in value there are some contracting mechanisms. Flannery (1994) demonstrates that the unusual high leverage of financial institutions and the short-term nature of their debt is their optimal capital structure given the characteristics of the banking industry, and not a consequence of the incentives to undertake excessively high liquidity risk due to the existence of a "safety net"[66]. Financial intermediaries are specialised in financing illiquid and non-marketable assets, with information frictions, and they sustain long customer relationships (repeated lending or repeated deposits contracts) in which the level of monitoring by the bank is important because it affects the asset return. There is also an opportunity to earn extra rents because the banking industry is not always competing under perfect competition. At the same time the quality of the loans in a bank's portfolio is not observable by outsiders and there is large scope for changes in the composition of the portfolio. These features make it very costly for banks to employ some of the mechanisms traditionally used to avoid investment distortions like covenants, secured debt or low leverage. However, the use of short-term debt

[65] Known in finance literature as the underinvestment problem, it occurs when firms which have risky debt outstanding pass up new investment opportunities with positive net present value. The new investment, which would reduce the risk of the outstanding debt transfers wealth from shareholders to debtholders, because debt cannot be repriced to reflect the lower risk.

[66] The 'safety net" is provided by a deposit insurance and a lender of last resort.

provides exceptional opportunities because debt is frequently repriced to reflect the current riskiness of the banks' liabilities.

Some of the papers reviewed in the next chapter argue that asset securitisation can contribute to reduce the underinvestment problems associated with banks' high leverage and the risks of maturity mismatch.

In general, with regard to liquidity and maturity transformation, securitisation has been considered as an optimal contracting response to the problems related to deposit funding (Bhattacharya and Thakor 1993).

The fourth problem is **banking regulation**[67]. A traditional bank finances non-marketable assets with putable debt. Regulators consider the problems associated with systemic risk in the banking industry, as the industry is subject to "panic runs"[68]: depositors cannot be convinced of the value of bank' assets because they are non-marketable. Regulators also require banks to hold minimum capital, as any other uninsured creditor would do. Yet, as Miller (1995) affirms, bank capital regulation can be a source of friction between banks and regulators: the "one-size-fits-all" regulation cannot achieve the same satisfactory results which could be achieved by private contracting between debtor and creditor.

Securitisation makes assets more liquid and marketable; and it helps to solve one of the problems related to implementing deposit insurance and capital requirements: how to price these requirements correctly and measure a bank's assets risk. Since securitisation transforms a bank's assets in actively traded securities, their price and risk could be more easily established.

Another problem related with banking regulation is the 'moral hazard" associated with fixed rate deposit insurance which, some experts argue, encourages banks to become riskier. In most countries the deposit insurance premium does not adjust to

[67] Banks prudential regulation in the US and across Europe is examined in Chapter 2.
[68] Information asymmetry is always prevalent in the banking sector. Hence the failure of a bank can cause a "panic run" in other liquid, but solvent, banks; uninsured depositors withdraw their money in the belief that the shock which affected the failing bank might as well affect their bank.

reflect reductions in assets risk[69]; risky projects produce high returns if successful, while imposing losses to the deposit insurer in case of default. Securitisation could be used by a bank to increase its portfolio risk by securitising its safest assets, maximising the value of the deposit insurance.

Berger, Herring and Szegö (1995) argue that the imposition of fixed minimum capital standards could have influenced the expansion of securitisation; the expansion of off-balance sheet activities in general was used by banks to bring together regulatory and market capital requirements[70]. They consider both, the relationship between loan securitisation and capital requirements and the relationship between other off-balance-sheet activities and capital regulations: loan securitisation lowers the regulatory and market capital requirements of the loan seller, but it increases those requirements in the loan buyer. Loan securitisation generally reduces a bank's risk[71] and therefore the capital requirements. In this case, the potential to decrease the effective capital requirements through loan securitisation should not promote inefficiencies since loan securitisation transfers the risks of investing in the loan to the buyer.

On the other hand the adoption of minimum risk-based capital requirements may result in some banks engaging in "capital arbitrage" to boost capital ratios. Banks use capital arbitrage to exploit the deviations between the economic risk of certain assets and the level of risk allocated to those assets by the Basle Agreement.

Risk-based capital regulation establishes a negative relationship between the amount of leverage permissible and the level of risk of the individual loans in the bank's portfolio. To increase leverage (i.e. decrease the required amount of capital) the insured bank has to reduce assets risk. Capital arbitrage is used to increase leverage without reducing risk, bringing the real amount of capital supporting a portfolio of assets to less than the nominal amount of 8% indicated by the Basle Agreement.

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[69] See Chapter 2 for details. In the US, the 1991 Federal Deposit Insurance Corporation Improvement Act introduced risk-based deposit insurance premiums, to be implemented by January 1994.

[70] For example, the use of off-balance sheet guarantees (not subject to regulatory capital requirements) would reduce the effective regulatory capital requirement but would increase the market capital requirement.

[71] Because the risks associated with the securitised asset (default risk, interest rate risk, liquidity risk and so on) are passed onto third parties.

Two major shortcomings of the Basle Agreement make capital arbitrage possible. The first is that the asset categories defined in the Basle Agreement are very broad, therefore within the same Basle category class, with the same minimum proportional capital charge, a bank can hold assets of very different risk. In this sense the risk-weightings assigned by the regulators are inefficient because the economic and regulatory capital requirement differ. Second the original Agreement includes only credit risk[72] equivalents, which reduce its accuracy. Other risks such as interest rate risk, which can considerably alter a bank's risk profile, are monitored by the banks and respective regulators but are not a explicit part of the Basle Ratio.

Therefore banks could use asset securitisation as a means of arbitrage between the "economic" and the "regulatory" level of risk of certain assets or activities. For example, a bank might securitise the lowest risk assets within each risk-weight category (Jackson 1999): after the securitisation, the "regulatory" risk profile of the bank would be the same, but the "economic" risk of the bank would be higher, since the bank has kept the riskiest assets of each category. Banks also use securitisation to reduce their "regulatory" capital requirement while keeping constant (or reducing by a lower amount) their "real" risk. For example, they might provide the credit enhancement for their own securitisation transactions: the capital requirement for the credit enhancement is lower than the capital requirement for holding the loans on balance, however the amount of risk retained by the bank is the same in both cases.

Some of the theoretical and empirical models reviewed in next two chapters explain securitisation as the bank's solution to the perverse effects of regulation because it allows the banks to remove some assets from the balance-sheet, and thereby avoiding "regulatory taxes". The use of securitisation to engage in capital arbitrage has just recently started to be the focus of research (see Jackson 1999). A major problem is the difficulty of gathering data to test for the presence of significant capital arbitrage[73].

[72] Attempts are ongoing to improve the measure of other risks, such as market risk.
[73] This thesis does not investigate the link between securitisation and arbitrage (see Chapter 10, Section 10.2)

The fifth issue frequently examined in banking literature is **capital allocation**. Transparent borrowers with established credit reputations usually can access capital markets, while banks best serve more dubious borrowers. On the other hand, even the lowest risk borrowers will use a bank as a signal to the market that it is creditworthy (James 1987). This is because banks are able to screen and monitor borrowers more efficiently. However a bank's role as a delegated monitor is changed with securitisation because investors directly hold securitised assets. Some of the theories considered in the following section emphasise this perspective, pointing out that the improvements in information technology have allowed new borrowers to access capital markets through securitisation.

Another aspect of capital allocation is integration between markets. Empirical studies on the US mortgage market reviewed in Chapter 2 illustrate that securitisation improves the integration between the mortgage and capital markets.

Finally, there is a growing body of literature which focuses on banks' **incentives to innovate and design new types of securities**. New securities and new forms of financial contracts have flooded the financial markets in the past two decades. For example over-the counter (OTC) derivatives, tailored to meet the needs of particular clients have emerged since the 1980's: interest rate swaps and currency swaps in 1981, equity-linked debt in 1986, equity swaps in 1989, and from 1989 onwards "exotic" options with extremely flexible structures (Collins 1999).

Two of the main attributes of securitisation are that it increases liquidity and redistributes the risks associated with the securitised assets. Pooling loans and issuing securities against their cash flow may achieve better pricing for the loans than if sold separately because diversification within the pool reduces risk.

In the context of financial innovation, one must differentiate amongst three types of activities (Finnerty, 1988): the development of first, new securities; second, new financial processes; and third, creative financial strategies. Asset-backed lending, meaning by this both securitisation and whole loans sales, has become an increasingly important financial strategy for banks. Securitisation permits issuers to maximise revenue by pooling bundles of assets and designing securities with

different claims over the bundle. It is also possible to isolate a pool of assets and fund them independently from the rest of the issuer's balance sheet. Asset-backed securities risk and return depends exclusively on the underlying assets' cash flow and not on the originator's cash flow. Low quality banks might be able to finance cheaply by using securitisation if they are able to originate a pool of good quality assets. Chapter 9 of this thesis considers the pricing of UK asset-backed securities and whether their price is effectively determined by factors affecting the underlying asset.

3.4 CONCLUSIONS

This chapter has examined the role of securitisation within the financial industry. For non-financial firms securitisation is a mechanism to raise funds, which, under certain circumstances, can be more efficient than traditional forms of finance. Besides the financing role, securitisation permits financial firms to specialise on receivables origination and to transfer the funding function. This is even more important in the case of depository institutions because depository institutions offer deposit and loan products: they take in deposits and lend them out as loans, to be held in the institution's portfolio until maturity (Heffernan 1996). In this sense, some of the attributes of securitisation pointed out in Section 3.3 question the banks' traditional role in the economy.

This duality in the roles of securitisation is important because financial firms' incentives to engage in securitisation are explained by one of these roles. As it will be seen in the next chapter a bank's incentive to securitise assets can be related to its financing needs, or to the lost of the comparative advantage it had in providing the intermediary function. Cross sectional differences between banks and financial systems, and also differences through time may contribute to the relative importance of one securitisation role with respect the other. For example it could be argued that in the US residential mortgage market thrifts had lost their comparative advantage in holding mortgages because the US Agencies can manage the credit risks of mortgage better, hence the size of residential mortgage securitisation.

CHAPTER 4: SECURITISATION INCENTIVES. REVIEW OF THEORETICAL LITERATURE

4.1 INTRODUCTION

This chapter examines the main theoretical models predicting why banks use securitisation. A bank's incentive to securitise assets is linked to two characteristics of securitisation. The first is that securitisation permits banks to specialise on the originating and servicing functions, for which they have a comparative advantage. The second is the greater flexibility of securitisation finance as compared to equity and debt finance. In the early days securitisation was seen both as a way to alleviate the binding effects of capital requirements and deposit insurance (regulatory taxes), and also as a response to competitive pressures, which had reduced banks comparative advantage in funding certain types of loans. Non-bank institutions, which are not under the same banking regulations (so would not benefit from these securitisation incentives), have recently started using securitisation. These, together with important changes in the regulation since the first theories were born, makes it difficult to assess why banks would securitise its assets.

This chapter is divided into three sections. Next section presents a review of the main theoretical securitisation models. The last section concludes with a critical overview of the literature and points out unsolved issues.

4.2 THEORETICAL MODELS

Despite the growing importance of securitisation in the last 20 years, there is little theoretical work in the area, especially in modelling banks' incentives to securitise assets. Most of the work does not distinguish between asset securitisation and loan sales. Asset securitisation goes one step further than pure loan sales since the asset is

not only sold, but also pooled and repackaged as a new security. Asset securitisation implies a qualitative asset transformation, whereas a loan sale does not. Nevertheless, from the financial intermediary point of view the incentive mechanism is the same for both of them, because in both cases the bank originates the loan but no longer funds it or holds it until maturity. Normally securitisation is used for the sale of small loans, like mortgages, which are more difficult to sell on individual basis; while loan sales is more frequent for large loans. A loan sale has normally another bank as investor, while loan securitisation also attracts non-bank investors.

A bank's incentives to securitise assets is related to its financing needs or to the loss of the "comparative advantage" it had in providing all the functions associated with lending. All the theoretical models reviewed in this section follow one of the two approaches. Therefore, some models explore the characteristics of securitisation as opposed to traditional intermediation, which is regarded as the main role performed by financial institutions, and the influences of regulation in the origins of securitisation. Other models that emphasise the funding aspects of securitisation consider market based capital requirements (as opposed to capital regulations), transaction costs, underinvestment problems, signalling and information asymmetries. Some of the research is more elaborate, with more formal models and conclusions.

The models have been grouped into six major categories according to a model's key theme; this means that some could be classified under more than one heading. Some of the models extend the research to other off-balance sheet activities, apart from securitisation and pure loan sales. Their results are not reported here[74].

4.2.1 Cost Savings

The first group of models reviewed appear early in the literature. They have in common the emphasis on the cost savings of securitisation compared to traditional

[74] There is a growing body of research which analyses the possible explanations for the use of other (than securitisation) off balance sheet activities, mainly loan commitments and stand-by letters of credit. The main explanations advanced in the literature are the avoidance of regulatory taxes, the trade off between financial and reputational capital, the improvement on risk-sharing and the avoidance of borrower's moral hazard (Greenbaum and Thakor 1995).

intermediation. The incentive to securitise assets appears as a very simple one: banks have lost their comparative advantage in intermediation because of high costs of intermediation in terms of risk management and intermediation taxes.

Pavel (1986) focuses on the cost-analysis of securitisation. Banks and other intermediary institutions would securitise assets when benefits from securitisation outweigh costs. The seller benefits from the transfer of interest rate risk, a cheaper source of funds, increased liquidity in the portfolio, and new sources of funding. Holding different types of mortgage-backed securities instead of locally originated mortgages also provides the advantage of portfolio diversification.

Pavel cites high "intermediation taxes" for certain types of loans as another possible explanation for securitisation. If deposit regulation and capital requirements are not risk sensitive, financing low-risk loans might be more expensive "after-tax" than they should be. When loans are sold they are removed from the balance sheet, so the bank does not support "intermediation taxes" on them. In this case banks would securitise low risk-assets. Correct risk pricing of capital requirements, deposit insurance or other forms of intervention in place should eliminate the need for securitisation.

Cumming (1987) focuses on the differences between traditional financial intermediation and securitisation to explain the economic forces driving asset securitisation. Cumming indicates three major factors which have contributed to the growth in securitisation: the increased costs of financial intermediation, mainly driven by the imposition of capital requirements; greater financial risk, particularly interest rate risk[75] due to an increase in volatility; and a more competitive environment.

Cumming focuses on two questions: whether the cost of maturity and liquidity transformation has risen so much as to make depository institutions unprofitable and whether such an increase would promote the proliferation of different forms of securitisation. Assets sales carry potential gains for the bank if they result on funding

[75] Interest rate risk was an issue in the US mortgage market at that time because the majority of the mortgages were fixed rate. When loans have variable interest rate, the interest rate risk is passed to the borrower. From the lender perspective, the interest rate risk can become credit risk if in a rising interest rate scenario if the borrower with variable rate loans cannot afford the higher interest rate.

cost savings. Increases in the regulatory capital requirements promote assets sales to other agents with no or lower requirements. Another factor which has contributed to the profitability of asset securitisation is the reduction in the costs of pooling and servicing assets.

4.2.2 Regulatory Taxes

The avoidance of the effects of "regulatory taxes"[76] is seen as the main incentive for securitisation in the models discussed below. Regulatory requirements is a disadvantage for depository institutions competing with other non regulated financial firms. Securitisation without recourse removes the assets from the balance sheet, so the securitising bank does not have to meet any regulatory requirements with respect to those assets. Costs associated with those requirements are eliminated for the sold assets.

Some of the theories relate the increase in securitisation to changes in regulation, which have affected banks' optimisation behaviour. In a given environment the bank optimisation problem generates a certain outcome in the form of a portfolio of assets and liabilities; a change in regulation means the outcome is no longer optimal.

The effect of "capital adequacy" requirements seems to be the single most important reason to securitise. Capital adequacy regulation requires banks to hold a minimum capital against the balance-sheet assets. The Basle Agreement introduced risk-based capital regulations from 1993 which required international banks to keep an equivalent to 8% of their risk weighed assets in form of capital[77]. There is an incentive to securitise assets for which the capital requirement is too high for a given asset risk; and to keep on balance assets for which the opposite is true. Capital requirements might be driving good assets off banks' balance sheet, causing banks to become riskier.

[76] Regulatory taxes are reserve and capital requirements and deposit insurance premium.
[77] US and UK banking authorities introduced measures similar to those adopted in the Basle Agreement as early as 1980's (Jackson et al 1999), see Chapter 2.

The models reviewed below consider "market" as well as "regulatory" capital requirements, risk-based capital requirements and the moral hazard problems associated with selling assets.

Pavel and Phillis (1987) consider bank regulation to be the primary reason of securitisation of loans: by removing assets from the balance sheet, securitisation reduces the effects and the costs of regulatory taxes such as minimum capital requirements and deposit insurance. Banks use securitisation to bring regulatory measures of equity in line with the true value of the bank. They have a comparative advantage in originating and servicing loans, but a disadvantage in funding and warehousing low risk loans because of risk insensitive regulatory taxes. Another determinant of securitisation is the degree of diversification of the bank's portfolio.

Pennacchi (1988) argues that loan sales permit banks to raise finance in a less costly way compared to using debt or equity. The securitising bank can avoid costs related with required reserves and capital. However, the extent of loan sales is limited by moral hazard: banks have fewer incentives to effectively monitor and service loans after they are sold. Banks can solve this problem by designing optimal contracts with loan buyers.

In this model, Pennacchi assumes banks can improve the uncertain return on loans by spending resources in information production and screening. The bank's objective is to maximise shareholders' wealth. The bank decides on the amount of loans to originate, the monitoring level[78] and the means of financing, either deposits or equity. Deposits and equity markets are assumed perfectly competitive. The banking sector is assumed to be subject to regulation in the form of a reserves/deposit ratio, minimum capital requirement and Government deposit insurance, which charges a risk-related premium.

The optimisation program results in a bank choosing the maximum deposits/equity ratio (hence the capital requirement is binding). This determines the optimal

[78] The model assumes that the bank can employ a certain monitoring technology which increases the uncertain return on loans. This is particularly true for small borrowers, like consumers and small firms. For well-known borrowers, and the Government for example, the effect of banks' monitoring on the expected return is 0.

investments[79]: loans which require the bank to perform information and monitoring activities which unregulated investors cannot perform so effectively[80]. If competition for deposit finance is increasing and there are regulatory constraints, banks cannot just make profits from holding a portfolio of marketable assets, but must provide other services, such as information gathering and monitoring activities.

The next step in the model is to analyse the equilibrium implications of loan sales. The banks' objective is the same, but now it is assumed that a fraction of the return of each loan is sold. The optimal volume of assets is that one for which the marginal return equals the marginal cost, which in this case includes the possible savings from loan sales. It is reasonable to infer that those savings are positive; banks can obtain funding from selling loans at the same price as deposits, but do not have the added cost of the regulatory taxes. Therefore the bank can reduce its funding costs by selling loans, because it does not have to pay "regulatory taxes" on them.

However the sale of loans poses the additional problem of moral hazard, unless the loan buyer can observe the banks' level of monitoring. Banks can improve loan returns by monitoring borrowers. A rational loan buyer understands that once the loan is sold the bank has less incentive to monitor, so the buyer would expect a smaller return for the loan and would be willing to pay a lower price for the loan. The solution is to design an optimal contract which optimises the loan sales contract and the level of monitoring.

If loans are sold without recourse to the originator bank, the optimal contract assigns the seller the entire loan return when the loan defaults and gives the bank a fraction of the return only when the loan does not default. Therefore the bank has a large share of the loan risk: the bank is penalised when the borrower defaults (no return), and only obtains a positive return in the succeeding case, which acts as an incentive for the bank to continue monitoring the borrower. These structures are very common in European mortgage securitisation, where often the bank retains the junior class of

[79] The bank optimal asset volume is the volume that equalises the uncertain return received from the marginal investment to the cost of that marginal investment.

[80] Banks do not specialise in investing in assets for which monitoring does not improve the expected return. Furthermore, if deposits are fairly priced, the return in banks' non-marketable assets should be larger than the return on marketable securities because of the added cost imposed by the regulation.

the mortgage-backed securities and sell the rest to investors[81]; and also in securitisation of other assets (for instance the banks usually sell short-term strips of long-term loans). If there are no benefits from monitoring the loan (i.e. the loan return does not improve from monitoring) the loan will be fully sold.

If loans are sold with recourse to the originating bank, banks can sell the totality of the loan and there still exists an incentive to monitor the borrower since the buyer has a claim over the bank assets in the case of loan default. However, sales with recourse are treated as deposits for some regulatory purposes (they are subject to capital requirements but not to reserve requirements), so there is less savings in funding cost.

Pennacchi also analyses the characteristics of the buyer. He indicates that banks with large market power in deposit finance, but with limited loan origination opportunities may choose to hold marketable assets like loan shares, thereby enhancing the liquidity of their portfolio and diversification. Finally he argues that the recent growth in securitisation might have been triggered off by the decline in banks' power of deposit financing (loss of some subsidies and increased competition).

Flannery (1989) analyses the effect of risk-based capital regulation on an insured bank's choice of assets. Risk-based capital regulation prevents banks from compensating decreases in asset risk with increases in financial leverage.

Merton's formulates deposit insurance as a put option: $V(\sigma_p, R_f(D/K))$, whose exercise price is the face value of the outstanding debt, $R_f(D/K)$; bank's shareholders maximise their expected return ($E(R_e)$) by using the largest possible leverage (D/K) and selecting the riskiest assets (σ_p):

$$E(R_e) = R_f + V(\sigma_p, R_f(D/K)), \quad V_{\sigma p} > 0, \text{ and } V_{Rf(D/K)} > 0 \tag{4.1}$$

[81] Mortgage backed securities are structured in ways which try to minimise prepayment and credit risk associated with the underlying mortgages. A very common way of doing this is to issue different security classes: senior and junior; the junior class absorbs the risks of the senior class.

Risk-based capital regulation establishes a negative relationship between the amount of leverage permissible and the level of risk of the individual loans in the bank's portfolio: in order to increase leverage (and therefore increase the exercise price of the put option) the insured bank has to reduce asset risk (σ_p). Increases in assets risk do not have a clear impact on the value of the put option since they reduce the attainable level of leverage and therefore the exercise price of the put option.

The shareholders' maximisation problem is solved by selecting a unique risk class (all the loans in the portfolio have the same default risk) which maximises the value of the option. Furthermore, banks have a comparative advantage in financing loans within the risk class that maximises the value of the deposit insurance, so changes in risk-based regulation (total leverage permitted and/or influence of asset risk on total leverage) would affect the selected level of risk and therefore the optimal asset portfolio. This provides an incentive for loan securitisation: banks can efficiently[82] originate loans of a risk class for which they do not have a comparative advantage in financing, and sell those loans to other lenders, so they can effectively exploit their underwriting expertise.

Differences in the preferred risk class can be caused by differences in regulation, for example, different capital standards for different types of financial intermediaries; but also by differences on bank size; or market characteristics specific to the type of loans which the bank can profitably finance. Changes in the regulation through time affect the type of loans banks will be willing to sell as well.

Jaffee and Rosen (1990) consider the factors which contributed to the growth in securitisation in the 80's in the US market. They single out four factors as having a positive influence in banks' securitisation activities: a rising mortgage credit gap, due to a reduction in national savings allocated to deposits, which forced mortgage lenders to sell mortgage loans to have funds available for more credit; the need to improve interest and credit risks management; the development of new mortgage derivative products, like Collateralised Mortgage Obligations, which were better tailored for the management of interest risk in a highly volatile interest rate

[82] Flannery argues that if banks are the most efficient originators of a certain risk class assets, they will also be amongst the most efficient originators for other risk class assets.

environment; and the active role of the federal agencies subsidising the secondary mortgage market.

Jaffee and Rosen (1990) argue that the introduction of risk-based capital requirements for banks and thrifts is going to be the driving force of securitisation in the 1990's. They notice the impact of higher capital requirements imposed on thrifts institutions by the Financial Institutions Reform, Recovery and Enforcement Act of 1989. One third of the thrifts failed to meet the new requirements, and they planned to securitise assets to boost their capital ratios. Another third hardly met the requirements so growth would have been limited unless asset size was reduced by securitisation.

Risk based capital requirements for banks and thrifts, to be introduced in the 1990's further contribute to the expansion of securitisation; capital constrained banks and thrifts can substitute agency securitised mortgages for whole mortgages. Agency securitised mortgages either require zero capital or 20%, whereas whole residential mortgages require 50% capital.

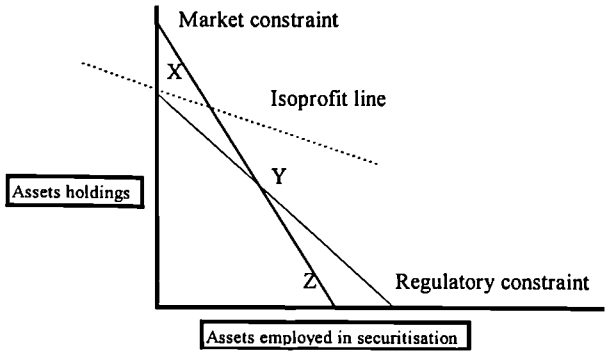
Donahoo and **Shaffer (1991)** examined the relationship between the decision of securitisation and capital requirements, both, regulatory and market requirements.

A profit maximising bank faces the problem of how to allocate a given amount of capital between loan securitisation and loan holding, subject to regulatory and market capital requirements. The profit from the loan holding is interest income; while the profit from loan securitisation is both interest income (the assets are held in the balance for a short interval before being securitised)[83], servicing, and other fees received once the assets are sold. The turnover rate, i.e. the rate at which assets can be securitised, given a volume of balance-sheet loans, is an important component of the return to securitisation because it increases the amount of fee generated by a fixed stock of assets. The model does not consider the costs associated with loan holding or securitisation in a specific way, but embeds the cost of capital and other liabilities in the return terms.

The bank problem is to find an optimal capital allocation between the loan holding and loan securitisation which maximises profit subject to the binding capital constraint. The regulatory capital requirement is set as follows: a fixed proportion of capital k must be held against balance-sheet assets. The market capital requirement has two components: a proportion of capital c to be held against balance-sheet assets and a proportion c_o to be held against securitised loans. By definition $c < k$.

There are three possible outcomes. If the regulatory constraint is binding the bank allocates all the resources to loan holding (X). If the market and regulatory constraint are both binding the optimal strategy implies that the bank holds a portfolio of loans while securitising the rest (Y). If the market constraint is binding the bank securitises all the assets (Z). Graphically:

Figure 4.1: Asset Allocation Between Securitisation and Loan Holding



(Source: Donahoo and Shaffer (1991))

The authors point out that the choice between different strategies is based almost entirely on profitability considerations (and not on capital requirements), especially when selecting between the loan holding and a mixed (holding and securitising) strategy. A bank chooses the loan holding over the mixed strategy only because the profit from loan holding is larger than the profit from engaging in both activities; therefore if holding is initially the optimal strategy a change in market or capital regulations would not alter this. The authors notice that the recent boom in banks' securitisation activities would not be related to increasing pressure from capital

[83] Interest income from assets who are in the pipeline for securitisation is assumed to be lower than interest income from assets held in the portfolio. This is due to transaction costs and to the transformations which the assets might endure in the process to securitise them.

regulations, but to larger profits from securitisation. These profits could be related to a larger turnover rate, driven by banks (better management of information thanks to technological advances) or exogenously caused.

The election between a mixed strategy and pure securitisation depends on whether the profit from securitisation compensates for the additional market capital requirement associated with securitisation (c_0).

The effect of a change in capital requirements in this environment is as follows: if the bank initial choice is a mixed strategy, an increase in the cost of meeting regulatory requirement will induce the bank to expand securitisation and reduce holding. An increase on the securitisation component of the market capital requirement will make the bank reduce securitisation activities in both cases: mixed strategy and pure securitisation, and even can cause a change in the optimum strategy from pure securitisation to mixed.

Changes in the balance-sheet component of the market requirement do not have clear consequences because they depend on the slope of the isoprofit line. A tightening of the market requirement without changing the relative size of balance sheet and off-balance sheet components would cause a parallel movement to the left of the market constraint, with a reduction in securitisation in both pure and mixed strategy.

Donahoo and Shaffer conclude that the decision to securitise is independent of any capital requirement considerations and based almost exclusively on relative returns. A bank would not engage in securitisation if that is not profitable. However, once a bank has decided to engage in securitisation, changes in regulatory and market capital requirements might affect the volume of securitisation. The introduction of risk-based capital requirements increases, in the case of regulatory requirements, the incentive to securitise.

The authors also analyse the behaviour of large financial companies subject to market requirements but not to regulatory requirements. They assume that these firms are large enough to affect returns to securitisation, meaning the isoprofit line is curved and convex to the origin and increases in the volume of securitisation increase

returns on securitisation less than proportionally. Their decision to securitise depends on relative returns and can be influenced by changes in the relative size of the components of the market capital requirement.

Passmore (1992) models the funding decision of a profit maximising depository institution which grants fixed-rate mortgages. He concludes that funding mortgages with deposits is unprofitable because of capital regulations and the costs of hedging the risks associated with mortgage lending. On the contrary, mortgage securitisation can increase the profits of the bank.

Passmore identifies six different costs associated with funding mortgages using retail deposits: interest and non-interest cost of using retail funds; servicing costs; and costs associated with intrinsic mortgage risks, prepayment, credit and maturity mismatch[84]. An efficient institution would incorporate all this costs into the mortgage rate.

To hedge against the maturity mismatch risk, the bank executes a swap agreement. The bank tries to maximise the expected utility of the return on equity with respect to the dollar amount of the swap agreement. The bank is risk-averse: the more risk-averse, the larger the volume of the swap agreement.

When mortgages are securitised, the risks associated with their funding are passed to the mortgage-backed securities investor, and to a government-sponsored agency (in US) or some financial intermediary. Moreover, the capital adequacy requirements from securitised mortgages are either none (if there is no recourse to the bank), or lower than when the mortgage is funded on-balance sheet.

Twinn (1994) develops a simple one-period model in which the decision to securitise is based on the banks' incentive to avoid the distortions created by the capital adequacy requirements.

[84] Credit risk arises from borrower default or arrears. Prepayment risk results in a drop of yield due to the borrower prepaying when mortgage rates are lower. Maturity risk results form using short-term funds to finance long-term assets.

In Twinn's model, the bank invests in two kinds of assets: loans and gilts; gilt prices are competitively determined, the bank is a quantity taker in the gilt market. There is a minimum capital requirement associated with loans. Funding can be raised by issuing asset-backed securities, deposits or equity. The banks' objective is to maximise shareholder's excess return, defined as the difference between the rate earned on the assets and the interest paid on the liabilities.

Banks have limited power to set prices in deposit, loan and assets-backed securities market. By solving the maximisation problem with respect to that set of prices, Twinn arrives to a set of equilibrium conditions. Banks expand their balance until the marginal rate paid on funding equates the marginal rate received on assets; and they reallocate the liabilities (deposits, capital and assets-backed securities) and the assets (gilts and loans) portfolios until the marginal costs and returns between different classes are equal.

The optimal interest rate paid on asset-backed securities is a weighted average of the extra cost of funding the loans on balance sheet (the capital adequacy requirement) and the rate paid on gilts. A higher minimum capital requirement increases the optimal rate on securitisation and hence the quantity of assets to be securitised. The same happens as capital becomes relatively more expensive than gilts (and thus the relative cost of expanding the balance sheet activities is larger).

4.2.3 Information Theories

These models postulate different aspects of information frictions between bank and borrowers as the incentive to securitise, but the role of securitisation is different in both models Greenbaum and Thakor (1987) focus in maximising the borrower' utility by choosing the lowest possible loan rate. In this setting securitisation is a better funding tool because it enables the borrower to convey information about loan quality and therefore to reduce the loan interest rate. Berger and Udell analyse the extent to which reductions in information asymmetries and improvements in information technology, have reduced the comparative advantage banks had in

monitoring certain borrowers who now can move to the capital markets through securitisation.

One of the pioneering formal models of loan securitisation is due to **Greenbaum and Thakor (1987)**. In their paper, signalling information regarding loans quality might be easier when loans are securitised. Asset securitisation is a sorting mechanism by which borrowers signal the quality of their projects. Information is signalled by the amount of credit enhancement employed in the securitisation process.

Their model is set in a perfect competitive market in which banks design contracts to maximise borrower's expected utility.

They analyse the bank's choice of funding. There are two possibilities: raising deposits, or selling loans to investors (securitisation). If loans are funded with deposits, borrowers pay a loan rate which consists of the rate paid by the bank on the deposits plus the spread earned by the bank. Both, the deposit rate and the spread are a function of loan quality. When the loan is securitised, the borrower can purchase partial backing for the loan from the bank. This guarantee implies that if the borrower defaults, the bank pays a fraction of the loss. In this case the loan rate depends on borrower quality and the amount of coverage chosen, plus a premium for the credit enhancement provided by the bank.

In a world with symmetric information and no regulatory intervention, the only difference between the utilisation of deposits and securitisation is the type of contract. Since all information is symmetric, the use of securitisation does not provide any information advantage. In this model, the depositor/investor is risk-averse, making the optimum where the bank fully enhances the securitised loan, so securitisation becomes equal to deposit funding; the bank's capital fully backs the loan in both cases.

Greenbaum and Thakor introduce asymmetric information in an unregulated environment: the borrower has private information about its own succeeding probability, or loan quality (δ), which investors cannot access. However the

investor/depositor knows what would be the loan payoff for the successful outcome. To partially deal with the information asymmetry problem, uninformed agents (banks and depositors) screen borrowers. The borrowers pay screening costs.

When deposits fund loans, the borrowers are screened by the bank and by the depositors. When loans are securitised the bank produces information about borrowers' δ; it then designs a partial insurance mechanism which will ensure the amount of covering chosen by the borrowers correctly communicates their succeeding probability to investors. This avoids investors having to collect information about borrowers. The cost difference between deposit and securitisation funding is monitoring costs in deposit funding and bank's signalling costs in securitisation.

However, savings on screening are offset by the fact that some borrowers will provide investors with less insurance through the bank guarantee than under deposit funding. Since the investors are risk-averse, there is a risk-sharing loss for them that borrowers must pay for in equilibrium. Consequently, in a world without regulation the election of funding mode depends on the trade off between the savings in screening costs and the loss in risk sharing. Losses in risk sharing mean high quality borrowers would suffer the least under securitisation. High quality borrowers with high δ choose larger bank insurance; risk sharing between the bank and the risk averse investors is closer to the optimum, so the yield in the securitised loan will be lower. A borrower of low quality would suffer such a high loss in large risk sharing relative to deposit funding, that deposits as the funding source would be preferred.

Banks would securitise high quality loans, and fund the others with deposits. Bank screening costs have to be low enough as to make screening beneficial, so a drop in information costs would increase securitisation.

In the case of a regulated environment (deposit insurance, tax subsidies and capital requirements) with asymmetric information, deposit funding is still the preferred alternative for the borrowers of lowest quality. However, it will not always be the case that the best assets are securitised: if complete deposit insurance makes deposits riskless there is no need to screen borrowers. The deposit rate would be independent

of δ. High regulatory subsidies and low capital requirements might explain why there was no securitisation in the past. A reduction in the size of these subsidies in the recent years could explain the growth of securitisation.

The introduction of a third party would alleviate the securitisation losses caused by suboptimal risk sharing: for instance, a mortgage insurance company can increase the banking insurance capability facilitating securitisation. Also, the magnitude of information costs plays an important role; the lower the information costs the greater the scope for securitisation. Thus improved information related technology is a partial explanation for the recent trend in securitisation.

In **Berger and Udell's (1993)** monitoring technology hypothesis, innovations or changes in the technology of monitoring drive disintermediation-type securitisation.

Borrowers are seen as lying in a information continuum: low quality borrowers are located in the left extreme of the line, and high quality borrowers in the opposite side. The need for intermediation derives from the information asymmetries between borrowers and lenders: since monitoring by individual lenders would be either prohibitively expensive or susceptible to free riders, banks, acting as delegated monitors, provide the best solution.

Thus, in the information continuum described above, high quality borrowers (with few information problems) would borrow directly form the capital markets; at the other extreme, very low quality borrowers (with very acute information problems) would use insider debt because the amount of monitoring required cannot be provided in a cost-effective manner by an intermediary. In between the two types there are the borrowers who get funds from banks, i.e. intermediated debt.

Changes in monitoring technology affect banks in two ways. First, high quality borrowers might shift from intermediated debt to direct investor debt. Second, low quality borrowers might shift from insider debt into intermediated debt. In any case, banks will continue to specialise in lending to borrowers with information problems, who require being monitoring by banks because the cost of individual investors' monitoring is too high.

Berger and Udell argue that monitoring technology and therefore, information has improved in the last years[85]; high quality borrowers have moved, through securitisation, to direct investor debt because the banks' monitoring cost advantage is lower than signalling costs for those borrowers. At the same time, previous "unbankable" borrowers have gained access to intermediated debt. As a result banks still continue to fund through deposits and keep in their portfolios loans that are difficult to securitise because of information asymmetries which are expensive to monitor. If loan sales are caused by the "monitoring technology hypothesis", then securitisation would be independent of bank risk and liquidity. Banks have not become riskier or more illiquid because they lend to riskier borrowers because the improvements in monitoring technology also applies to borrowers who can be better monitored and screened by banks.

4.2.4 Risk Reallocation

The desire to make risk-sharing more efficient is the driving force of securitisation in the following models. Securitisation is considered a better financing tool because it enables banks to issue tailor-made securities to suit the needs of investors with different degrees of risk aversion, and to shift risk from risk averse to risk neutral agents.

Benveniste and Berger (1987) analyse securitisation with recourse. This type of securitisation improves risk allocation by providing debt holders with sequential claims. Through securitisation with recourse, the investors have a general claim on the bank should the asset default and if the bank defaults the investor has the right to keep the asset. Risk allocation is improved because the most risk averse investors are assigned the securitised assets. Benveniste and Berger also show that this risk allocation is Pareto improving with respect to the use of deposit funding. So securitisation funding with credit enhancements is profitable for the bank and more efficient for risk management.

[85] Berger and Udell support their argument by noting the remarkable development in the use of statistical techniques, data processing and communications applied to the valuation of credits during the last decade.

The model has two periods in which the bank manager maximises shareholders expected utility. To finance the assets, the bank can use equity and two types of deposits: insured (assuming fairly priced risk-based deposit insurance) and uninsured. The insured deposit contract is exogenously determined[86].

The manager can only design the contract for the risk averse uninsured depositors, and this contract is contingent on the assets' portfolio. The optimal contract is one in which the bank pays the uninsured depositor first, thus minimising the risk premium. This solution is Pareto optimal because by minimising the risk premium the manager maximises the return to stockholders and to other insured depositors.

If senior "claims" are not allowed on the banks balance sheet, then the optimal design for the contract implies that should the bank go bankrupt, the uninsured depositors and the insured depositors divide the banks' assets, and receive a quota of them that is proportional to the size of their deposits. This means that the bank has to pay a large risk premium to the uninsured depositor, so this contract is Pareto inferior compared with the previous one.

Benveniste and Berger introduce securitisation with recourse in the model: they allow for a part of the bank assets to be funded off-balance sheet, by selling them. In this case management sells uninsured depositors a securitised bond, backed by the assets, and with recourse, so that the buyer has a senior claim over the assets' cash flows. Recourse gives the buyer extra protection; if the cash-flow from the asset is not enough to pay the promised amount, the buyer can trade in the senior claim on the asset for that of a balance-sheet creditor.

The optimal design for this contract is similar to the former one but has the extra option for the default states of retaining the asset if that is larger than the proceeds of the division of the banks' assets. This solution is Pareto superior to the preceding case if there are states under securitisation funding for which the proceedings from

[86] Competition and institutional factors determine this contract, so the manager of the bank cannot freely design it.

the securitised assets are larger than the proportionate share of the balance-sheet assets.

Fixed-rate deposit insurance does not alter the results, but broadens the range of states under which securitisation is beneficial for the bank.

The model also suggests which type of banks will engage in securitisation and the type of assets to be securitised. Riskier banks obtain the greatest benefits form securitisation[87], and they would probably securitise low risk assets, so that a bank on and off-balance sheet portfolio are well diversified. Then if the on-balance sheet portfolio performs poorly and the bank defaults, the holder of the securitised assets will still obtain a good return on the investment.

Securitisation also reduces moral-hazard problems associated with fixed-rate deposit insurance, while encouraging diversification and higher standards of origination. If a securitising bank fails, the securitised assets are separated from other assets claimed by the deposit insurer. The bank would internalise the returns from that safe securitised portfolio, even in the case of failure.

Hess and Smith (1988) reviewed different forms of mortgage securitisation and analysed securitisation demand. They conclude that the use of securitisation by depositories which fund mortgages with short-term liabilities is related to an increase in interest rate volatility. Mortgage securitisation improves the allocation of interest rate risk between the participants in the mortgage business, borrowers and debtors.

Financial intermediation can be divided into three main activities: origination, servicing and holding (i.e. funding and ownership of the assets cash flows). The costs of intermediation would be at its lowest when the cheapest supplier provides these services. Hess and Smith argue that local financial intermediaries are the cheapest suppliers of mortgage origination because of better information production[88]. Servicing is also cheaper if provided by a local intermediary through its local branch

[87] This is because the benefits from securitisation come from the reduction in the risk premium of uninsured deposits. The larger that risk premium the larger the benefits from securitisation.
[88] The mortgage market is very local and very dependent on geographically specific knowledge due to the existence of the underlying security given by right over the real estate.

network; though mortgage holding must entail the management of interest rate risk[89]. Furthermore, mortgage and deposit markets depend on local economic conditions because local financial intermediaries are not well diversified which increases the risk and costs of intermediation[90].

Interest rate risk management is more complicated for fixed rate mortgages because of the options embedded in the mortgage contract: prepayment and default. These options reduce the gains to the mortgage lender associated with declines in interest rate and increase the losses related to rises in interest rate[91].

Hess and Smith analyse securitisation as a hedging strategy used by a value-maximiser mortgage lender to transfer interest rate risk to parties willing to take it. Securitisation provides hedging opportunities including the reduction of assets duration, the elimination of prepayment risk, and the reduction of capital and reserve requirements.

Securitisation, as a hedging policy, would affect the value of the firm if it affects the tax liability, contracting costs or investment decisions.

If income taxes are treated as an option (the government owns a call), reduction in the volatility of taxable income reduces the value of the call, therefore increasing the firm after tax cash flow and the value. Hence, securitisation reduces the volatility of taxable income through reduction in the exposure to interest rate risk. Securitisation also helps to alleviate the underinvestment problem because reducing the volatility of the value of the firm reduces the probability of passing up positive net present value projects. On the other hand, if the costs of hedging are fixed, the higher interest rate volatility of the last decades increases the profits derived from securitisation.

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[89] Mortgage lenders have traditionally finance fixed rate mortgages through short-term deposits; increases in interest rate risk increase the cost of intermediation.

[90] In the US regulatory constraints stop the growth of "national" banks (see Chapter 2), so banks diversification opportunities are very limited.

[91] When the interest rate increases the market value of fixed rate mortgages drops. The opposite happens when interest rate falls. If borrowers can prepay without penalty their mortgages as interest rates decline, the lender gains only on the mortgages which have not being prepaid. Losses related to increases in interest rates are larger because the reduction in prepayment lengthens the duration of the mortgage portfolio.

Hess and Smith point out that the need to insure or guarantee against mortgages default risk provides an incentive for the originator to securitise the best quality mortgages, and thus reduce the costs of securitisation (or at least the fee to the insurer).

4.2.5 The Underinvestment Hypothesis

The models discussed below consider the "underinvestment problem" in the context of the banking firm, and how securitisation finance might mitigate its effects. The central point of these theories is that banks are not allowed to issue collateralised debt (deposits secured on assets), which would reduce underinvestment incentives; however, they can securitise assets and obtain the same results.

James (1988) analyses two types of off-balance sheet activities used by banks, standard-letters of credit and loans sale. He demonstrates that one reason for loan securitisation and the use of other off-balance sheet instruments is to avoid the underinvestment problem which arises when a bank has risky debt outstanding.

James shows that banks will not undertake some profitable new investment opportunities if constrained by fixed[92] rate deposit finance and undertaking the project benefits existing depositors. The problem is more acute the larger the likelihood of the bank defaulting on the existing depositors because depositors benefit from either a reduction in the probability of default, or an increase in the cash-flow in the event of default. These benefits are at the expense of shareholders, who see a reduction in the return they receive from the assets, thereby reducing their incentive to invest.

Some off-balance sheet activities reduce the underinvestment problem by permitting banks to sell claims to a portion of the payoff of new loans which would otherwise accrue to existing depositors. This is known as the "collateralisation hypothesis".

[92] The underinvestment problem can be mitigated with the use of short-term debt which is frequently repriced to reflect the characteristics and riskiness of a bank's assets. However information

Underinvestment in banks is also exacerbated by capital regulation which prevent banks from compensating decreases in assets risk with increases in financial leverage.

James shows that the payoff characteristics of sold loans (with and without recourse) are the same as those of deposits secured by loans; the loan buyer has priority access to the loan cash flow, as it would happen with a secured deposit. If the bank fails, the loan buyer receives the minimum of the contracted rated or the cash flow from the loan plus a general claim on the bank's other assets (if the loan is sold with recourse); the secured depositor obtains the same. If the loan is sold without recourse, the loan is the only payment source. In the absence of transaction costs, James demonstrates that secured debt and sold loans should have the same yield.

Wealth transfers from shareholders to depositors can be reduced if the contracted rate on funding through securitisation is less than the rate on new deposits. For states without default, the payoff to depositors is the same with deposit and securitisation funding. However, for default states, the payoff to loan buyers is larger than the payoff to depositors, so that existing depositors receive less than when the loan was funded by deposits[93]. Thus, the wealth transfer is lower when new loans are financed through securitisation.

James' model postulates securitisation of best assets because fixed rate deposits do not reflect changes in portfolio risk. He also argues that banks with binding capital requirements and higher levels of risk (higher probability of default in the existing deposits) will use loan sales more frequently.

Flannery (1994) argues that selling newly originated low-risk loans[94] which shareholders do not wish to finance on balance sheet, is a way to limit the distortions created by high leverage. Flannery's model goes beyond James', because it differentiates between securitising newly originated loans and securitising existing

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asymmetries between managers and outsiders means there is still a problem of underinvestment (James, 1989).

[93] This does not mean that depositors are worse off with securitisation that if the loan was not granted at all.

[94] The bank originates the assets with the objective of securitising them.

loans. Only the securitisation of newly originated loans contributes to solve the underinvestment problem.

However, underinvestment distortions would remain when a bank sells existing assets to finance new ones; shareholders would be willing to invest in negative projects if they sufficiently add to portfolio volatility, or to pass up low risk positive net present value investments. Other problems likely to discourage the large scale use of securitisation are moral hazard between loan seller and buyer, and the complications of securitising assets which have "availability options" like prepayment because of the additional cost imposed on the investors. Gorton and Haubrich (1990) argue that sold loans are designed in ways which eliminate the long-term relationship between borrower and originator to make them more similar to traded debt.

4.2.6 Market Segmentation and Information Asymmetries

The model presented here argues securitisation and loan sales exist because of segmented markets with different capital availability. This model especially applies to the US banking system in which banks have limited opportunities for functional and geographically diversification. Banks are considered to have a comparative advantage in operating in their functional or geographical area. Loan sales and securitisation occur because banks which operate in unconstrained[95] markets are willing to invest in good projects in constrained markets. Nevertheless the extent of information asymmetries makes it difficult for those banks to originate those assets themselves.

Carlstrom and Samolyk (1995) proposed a market based approach for loan sales without recourse; information asymmetries create the incentives for restricted banks to originate loans and sell them to unconstrained banks rather than finance them with deposit liabilities.

[95] Banks are defined as unconstrained (constrained) when they have enough capital (not enough capital) to meet all the investment opportunities existing in their respective markets.

In their model, "local information" is the reason why some banks originate loans and sell them to other banks. Market-based capital constraints make banks forgo investment opportunities. This happens because depositors have to monitor banks; monitoring is assumed to be very expensive, and a bank's risk is limited to the extent that its capital can cover losses. Loan sales are the mechanism to alleviate the effect of the constraints.

Banks have a comparative advantage in originating and screening borrowers within their locality[96] (locality can be understood not only in a regional manner, but also as a specific type of borrowers). However, because of the prohibitive costs of depositors' monitoring, banks can only fund risky projects in their portfolio to the extent that their capital can absorb potential losses. The inability of banks to diversify their 'localised' portfolios may result in some regions being capital constrained[97]. The observed yield differentials between banks are caused because some banks have more profitable opportunities than others, but they are in a region where capital constrains are binding. Therefore, a banker in a market with excess capital might be willing to buy projects originated by another bank. A loan sale enables this type of investment by separating the project return from the performance of the originator's portfolio.

Two things drive loan sales: the short-run differences in the profitability of investment projects and the local nature of information. Loan sales equalise the expected return on investments across different markets. A secondary market for loans allows banks having adequate capital to acquire profitable projects originated by banks whose own capital is insufficient to support the additional risk. The unconstrained bank would be willing to buy loans from the constrained bank when the best not funded project[98] of the constrained bank yields at least the risk-free rate. A sufficient condition for this to happen is the number of investment opportunities to be large relative to the local bank's capital.

[96] Locality in the geographical sense and in terms of a specific type of borrowers.
[97] Undiversified portfolios are riskier so they need more capital to buffer losses.
[98] The depositors are willing to supply their endowments (in the first period) to their local banks only if the projects undertaken by the bank yield at least the risk-free rate in the second period. However if the capital constraint is binding the bank cannot fund all the risky projects on-balance sheet.

There is one unsolved issue with the model and that is how the loan buyer evaluates the quality of loans originated by the other bank: loan buyers demand at least a risk-free rate, but they can only observe loan quality through ex-post performance[99]. The loan market is exposed to "adverse selection".

4.2.7 Financial Innovation and Security Design

Finally, securitisation can be seen from the point of view of optimal financial innovation and security design. The models reviewed in this section are based on the idea that firms issue different types of securities to maximise revenue when raising finance. Some of the models are supply-driven in the sense that the issuer receives the benefits from the introduction of optimal securities.

Boot and Thakor (1993) examine the design of optimal securities. They present a model based on information asymmetry with three types of traders: liquidity uninformed traders; informed traders; and uninformed discretionary traders, who could become informed if they wish, but otherwise act as market clearers and set the price of the security to clear the market and leave them with expected zero profits. Two types of firms, good and bad, issue securities. Investors who become informed can distinguish between the two type of firms.

Since investing in information by some traders reduces their level of information asymmetry, a "good" firm can maximise revenue by splitting assets cash flow into different type of securities, rather than issuing a single security. The idea is to divide the asset cash flow into two securities: an information insensitive security (the security is riskless) to be sold to the liquidity uninformed traders; and an information sensitive, a higher value security, which is sold to informed traders[100].

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[99] Only the bank that originates the loan and has localised information can screen the ex-ante quality of the loans, and it does it only for the loans that remain in their balance sheet.

[100] The informed traders who had spent money on information are better rewarded by investing in the information sensitive security, for which there is a large difference between the true value and the value that uninformed traders would have given to it. At the same time investment by informed traders moves the security price to equilibrium, i.e. to its fundamental value, and that increases the issuer's revenue. The assumptions are that information production is profitable, better information and

A good firm wants as many informed traders investing in the information sensitive security as possible in order to increase revenue. A bad firm profits from mimicking the behaviour of "good" firms, so in equilibrium all the firms issue the two types of securities.

Boot and Thakor extend the analysis to explain asset securitisation, i.e. why banks pool assets and then issue a variety of claims against the pool cash flow. The starting point is that if there are multiple securities (instead of the two above) and the information acquired by the informed traders is noisy, then it is better to pool securities to diversify the noise in the information, and to issue different claims against that portfolio than to split the individual securities. Boot and Thakor demonstrate that although the signal is noisy it is still profitable for the informed traders to invest in information. However, the benefits from becoming informed, and the issuing firm's expected revenue decreases with the level of noise. This implies that if it is possible to create a portfolio of securities with uncorrelated noise[101], the portfolio variance of the noise can be reduced. In this case investing in information becomes more profitable and there is higher demand by informed agents, which in turn brings prices closer to the fundamental (and higher) value, increasing issuer revenue. The securities portfolio can then be seen as an individual security (in the limit, portfolio noise variance becomes zero), so the issuer has scope to further increase the revenue by issuing different types of claims against it.

The authors used mortgage-backed securities as example. The riskiness of individual mortgages is difficult to evaluate, however when they are pooled and securitised most of the risk is diversified away and the resultant securities have an easy to understand cash-flow pattern. Once mortgages are pooled, a variety of securities with different seniority (and hence different information sensitivities) are issued against the pool cash flow. The issuer, who is the bank that originated the mortgages, increases its revenue by pooling mortgages; and issuing different types of securities (such as US Collateralised Mortgage Obligations, or the senior/subordinated structures seen in the UK).

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subsequent trading by informed agents increases the price of the information sensitive security and a higher price increases issuer's revenue.

[101] The noisy signal is derived from a random variable equal to the true value plus a white noise ε. The error of the signal increases with the variance of ε.

Riddiough (1997) proposes a supply driven model of securitisation. He compares the sale of whole loans with securitisation[102]. In the case of whole loan sales, the selling price will be lower than the fundamental value because of adverse selection. However, when securitising assets, debt cash flows can be reengineered into a risky and a riskless security. If the issuer retains the risky security and sells the riskless one to outsiders, the selling price will be closer to fundamental value. Bundling imperfectly correlated assets reduces cash-flow variance, which may replace to some extent the need for information in markets affected by adverse selection. Even if the issuer has to sell some of the risky securities to outsiders, securitisation will dominate the whole loan sale, since the issuer internalises some of the adverse selection associated with whole loan sales.

Glaeser and Kallal's (1997) investigate the relationship between information asymmetry and the optimal design of securities backed by illiquid assets. A revenue maximiser issuer pools and securitises illiquid and information asymmetric assets; these assets are sold in the market through an intermediary, and it is in the interest of the issuer to limit information disclosure in order to increase liquidity of the pool and hence revenue. The market has less information about the pool of assets than the intermediary. The liquidity function is decreasing in the support of the intermediary's valuation of the asset: if the valuation has a low variance, the pool is more liquid. The liquidity function is convex, therefore an slightly overpriced asset is less likely to be sold in a short period of time.

The issuer can narrow the range and variance of the intermediary's valuation by pooling assets and limiting information disclosure. Asymmetries in the information between the intermediary and the market which affect liquidity (and therefore price) can be reduced by pooling and further limiting information disclosure. Pooling smoothes extreme values and limited information makes the intermediary's valuation of the pool closer to its prior fundamental value because the intermediary is forced to

[102] The issuer is motivated to liquidate a portion of his assets portfolio. Outsiders cannot verify neither the motives for such liquidation nor the quality of the assets to be sold.

sell the assets at the intermediary's true price, thereby reducing its variance. The model specially applies to the US TBA market of new mortgage-backed securities[103].

DeMarzo and Duffie (1996) examine the optimal design of securities backed by a pool of assets. However, in contrast with the previous model, the issuer's private information may cause illiquidity and lower expected revenue: investors anticipate that the larger the quantity of assets for sale the worse the private information about those assets and therefore the lower the price they are willing to pay[104]. The illiquidity problem is reduced if the issuer retains a fraction of the assets cash flow: this is a credible signal of the quality of the pool because the issuer prefers cash to holding the assets, so retention is expensive. However retention is not used as a signal of the issuer's private information, but to maximise revenue given asymmetric information and illiquidity. Illiquidity costs increase with the sensitivity of the security to the issuer's private information[105]: reducing the informational sensitivity of the security would increase revenue.

4.3 CONCLUSIONS

This chapter has examined theoretical explanations for why banks' engage in securitisation. The theoretical literature suggests securitisation activities by banks are influenced by different factors. Hellwig (1991) points out that securitisation can be understood as a deepening in financial intermediation because it improves banks' risk-sharing, funding and diversification opportunities; or it can be understood in the opposite sense since it distorts the banks' incentives for monitoring and screening.

There are two main problems with the existing literature. The first one is that the vast majority of the theoretical research was conducted using the US banking system as

[103] The To Be Announced market is the market where newly originated mortgages are securitised by government agencies. The agencies pool mortgages acquired from banks and thrifts around the country. The pools have mortgages of same duration, but the rest of the characteristics (location of the property, borrower risk, loan-to-value ratio...) are not disclosed to the intermediaries who sell the mortgage-backed securities to investors.

[104] The asset-backed securities demand function is downward sloping.

[105] Information sensitivity is measured as the ratio between the realised private valuation by the issuer and the lowest possible private valuation by the issuer.

the institutional framework[106]. Allen and Gale (1994) point out that institutional settings are an important factor in determining the incentives to innovate and which type of institutions act as innovators. The main differences between the US and European banks are the "local" nature of many US banks, the functional restrictions on banks which reduce their diversification opportunities, and the provision of government subsidies to mortgage securitisation, which explains the vast use of securitisation in the US mortgage market as opposed to other countries. This means the outcome of some models is not directly applicable to other countries' banking systems. For example, Carlstrom and Samolyk (1995) model is based on the local nature of US banks. Passmore (1992) and Hess and Smith (1988) argue that the use of mortgage securitisation by US thrifts is related to the excessive risk of holding fixed rate mortgages, which is not such a problem in European banks.

The second problem is that existing theories, by focusing on specific aspects of securitisation, provide partial explanations to the securitisation puzzle[107]. For example, James' (1988) and Flannery's (1994) underinvestment theories, are just one aspect of the use of securitisation as a funding source. And Berger and Udell's (1993) "monitoring technology hypothesis" is just one of the reasons why banks might have lost their comparative advantage in intermediating certain types of assets.

It was mentioned in Chapter 3 that securitisation by banking firms is different to securitisation by non-banking firms. A bank can engage in securitisation to raise finance, or it can engage in securitisation because the unbundling of the traditional lending functions caused by the securitisation process permits the bank to specialise on the functions for which it has a comparative advantage. A more systematic approach to securitisation should address two main questions:

- The first one is why banks securitise. The answer to this question can be linked to Hellwig's dichotomy in understanding securitisation; either a bank securitises certain assets because intermediation is no longer profitable, or a bank securitises assets because securitisation is an efficient financing source. The first alternative would imply that banks have lost their comparative advantage in intermediation, and they use securitisation to focus in the activities for which they retain a

[106] The exception is Twinn (1994) who uses the UK banking system as the institutional framework.
[107] This problem becomes more evident when reviewing the empirical literature in the next chapter.

comparative advantage. The loss of comparative advantage can be caused by different factors such as intermediation costs higher than the costs faced by non-bank competitors, or improvements in monitoring technology. On the other hand, securitisation could be an efficient funding source, which is attractive because it reduces information costs about some of the bank's loans, so it might for example help to reduce the underinvestment problem, or it might help low quality banks to obtain cheaper funding.

- The second question is which banks securitise. Here the issue is the quality of securitising banks, along with their ex-ante and ex-post characteristics. If the purpose of securitisation is to "disintermediate", the empirical implication would be large scale securitisation, with the involvement of most of the banks in a sector, which effectively becomes "disintermediated". If securitisation is just a financing tool the amount of securitisation would vary across time and individual banks; and it would be necessary to explore the role of securitisation within banks' optimal capital structure to assess which banks would find it more attractive and why.

These two questions are considered in Chapters 6 and 7 of this thesis. The hypotheses addressing these questions are subject to econometric tests for a sample of UK depository institutions.

The next chapter reviews the existing empirical literature on securitisation incentives. The mixed findings are due, in most cases, to the absence of a clear theory to be tested. For example there is virtually no attempt to answer the "which" question in the literature, a gap to be rectified in Chapter 6.

CHAPTER 5: EMPIRICAL EVIDENCE ON SECURITISATION INCENTIVES

5.1 INTRODUCTION

Chapter 4 presented theoretical models explaining securitisation incentives and their empirical implications. The purpose of this chapter is to review existing empirical evidence on the relationship between securitisation and banks' characteristics. Some of the tests attempt to validate some of the hypotheses proposed in Chapter 4.

The empirical literature on securitisation by banks is not very extensive. Most of the studies explore the relationship between measures of banks' risk, capital strength and liquidity, and securitisation activities. Two recent papers adopt a different approach. Jagtiani, Saunders and Udell (1995) model securitisation as a financial innovation which follows a specific diffusion pattern; once the pattern is established they test for the influence of capital requirements and bank's characteristics in speed of adoption. And Lockwood, Rutherford and Herrera (1996) test for changes on the wealth of firms, including banks which securitise their assets.

Other empirical models of securitisation take a broader approach and examine other types of off-balance sheet activities as well: standard letters of credit, loan commitments and swaps among others. Unfortunately most of the empirical analyses have concentrated on these activities rather than loan securitisation. For these reasons, these test results are not reported here.

Another problem with the empirical studies is that most of them specifically exclude mortgage securitisation because of the sources of data used (the Reports of Income and Condition). Mortgage securitisation is by far the largest type of securitisation, both in the US and Europe. However it is possible to compare the results presented in this chapter with those obtained in the following chapters because European

mortgage securitisation is more like US non-mortgage or private mortgage securitisation. As explained in Chapter 2, the US mortgage-backed securities market is subsidised by the government through participation of Federal Agencies which assume the default risk of securitised mortgages. In European securitisation there is no public subsidy.

The next section surveys the existing empirical literature and their major findings. Section 3 uses a table to summarise the models presented in Chapter 4 and the empirical results presented in this chapter. Section 4 concludes.

5.2 REVIEW OF EXISTING EMPIRICAL LITERATURE

5.2.1 The Data Source

All but one[108] of the studies in US securitisation by banks employ the Call Report Data.

> "Federal Financial Institution Examination Council (FFIEC) Call Reports are filed by all insured commercial banks (national banks, state member banks, state non-member banks) and by state-chartered savings banks that are supervised by the FDIC, branches and agencies of foreign banks, and New York State Investment Companies. Call Reports are quarterly reports of condition and income based on information as of the close of business on the last calendar day of each calendar quarter (March 31, June 30, September 30, and December 31). Specific reporting requirements for each institution depend upon its asset size and whether it has any foreign offices"[109].
> "These reports consist of a balance sheet, income statement, and supporting schedules. The Report of Condition schedules provides details on assets, liabilities, and equity capital accounts. The Report of Income schedules provide information on the sources and disposition of income on a net interest margin basis, changes in equity capital, charge-off and recoveries, changes in allowance for loan and lease losses, and income taxes".[110]

The Call Report data are the only publicly available source of information regarding the status of U.S. banking system. Loan sales must be reported in the Call Report only when the seller retains no risk of loss from the sale of the assets and has no

[108] Lockwood, Rutherford and Herrera (1996) employ data from the Asset Sales Report.
[109] Federal Deposit Insurance Corporation (http://www.fdic.gov)
[110] US Department of Commerce, National Technical Information Service (www.ntis.gov/yellowbk/1nty198.htm)

obligation to any party to pay interest or principal due on the asset, i.e. there is no recourse to the seller. In this case the sold asset need not be included in the computation for capital adequacy requirements. If these conditions are not met the sale is reported as a borrowing by the purchaser, and the asset must be included for the computation of capital adequacy requirements (Greenbaum and Thakor, 1995).

The dependent variable for the studies reviewed in the following section was obtained from the memo item in Schedule L of the Report, "Loans originated by the reporting bank that have been sold or participated to others". The types of loans reported under Schedule L exclude residential mortgages and consumer instalment loans. This omission creates a serious problem for these empirical studies. A bank securitising only residential mortgages and/or consumer instalment loans would not be considered as using securitisation at all if the dependent variable in the econometric study is a binary variable. Alternatively, if the dependent variable is the volume of securitised or sold assets, the volume of securitisation would be underestimated. It could be argued that US mortgage securitisation is unique because of the government subsidies, and that the incentives to engage in non-mortgage securitisation could be different, hence the two activities should be considered independently. However this argument does not apply to consumer instalment loans. Also some of the theoretical models reviewed in the previous chapter focus on the incentives for mortgage securitisation[111]. These models cannot be tested unless data on mortgage securitisation are used.

Another problem with the Call Report data is that the Report measures flows, so if the duration of the loans sold is short[112], the quantity that those flows values would represent in stock terms is larger, suggesting a volume of loan securitisation higher than it should be.

Table 5.1 summarises the studies discussed in Section 5.2.2 below, which employ the Call Report data. The number of observations in each study varies because it depends

[111] Jaffe and Rosen (1990), Passmore (1992), Hess and Smith (1988), Boot and Thakor (1993) and Glaeser and Kallal (1997) specifically consider banks ' incentives to engage in mortgage securitisation.

[112] Berger and Udell (1993) estimate that the average duration of commercial and industrial loans sold is one month.

on the number of banks which have filed a full set of information to the Call Report, and the type of banks chosen for the econometric analysis. The reader is referred to this table to check the period and type of banks covered by each study.

Table 5.1 Studies on Securitisation Incentives Using Call Report Data

Authors	Year	Model	Type of Banks	Number of Banks
Pavel and Phillis (1987)	1983-85	Logit and Tobit	Commercial Banks	13763
Pavel (1988)	1984-85	Difference of means	Bank Holding Companies	117
Hassan (1993)	1984-85	OLS	Bank Holding Companies	32
Gorton and Penacchi (1990)	1987-88	OLS and Tobit	Money Center Bank	1
James (1988)	1984-86	OLS	Commercial Banks	58
Berger and Udell (1993)	1983-91	OLS	Commercial Banks	12000
Jagtiani, Saunders and Udell (1995)	1984-91	OLS	Large Commercial Banks	86

5.2.2 The Empirical Models

Pavel and Phillis (1987) test several hypotheses concerning banks' securitisation activities. They estimate the probability of a bank selling assets using two logit models. The first one determines the probability of a bank never selling assets,

selling assets sometimes or selling assets all the time[113]. The second one establishes whether a bank selling loans would do it all the time, or periodically. They also use a tobit model to identify the optimal assets sales.

Each bank establishes its strategy at the beginning of the year. Banks are classified into three categories: "loan merchants" which sell loans every quarter; "part-time vendors" banks which occasionally sell loans, and "non-sellers".

For each model, the dependent variable is regressed on a set of independent variables which include:

- Regulatory taxes: this includes reserve requirements, capital ratio and a premium for deposit insurance. There are also two dummy variables to measure how binding are the capital constraints. The premium for deposit insurance is measured by the ratio of total domestic deposits to total insured deposits. The dummy variables, the reserve requirement and the premium for the deposit insurance are expected to have a positive influence on the decision to sell loans. The coefficient for the capital ratio is expected to have a negative sign.
- Diversification risk: the level of diversification is measured as the sum of the squares of the loan-to-asset ratio for every loan type divided by 1000, so the higher the value of the fraction, the lower the level of diversification. This ratio is expected to have a positive coefficient.
- Funding or liquidity risk: this is proxied by the growth in loans. This ratio is expected to have a positive coefficient.
- Asset quality: loan charge-off as a percentage of total loans proxies for the quality of the bank assets. Pavel and Phillis make no prediction on the sign of this ratio.
- Comparative advantage: a bank's comparative advantage in originating loans is measured by the ratio of non-interest expenses to total loans. The lower this ratio the higher the bank's comparative advantage and the more likely the bank will engage in securitisation to exploit that advantage. By securitisation the bank can expand its origination activities without having to tie capital or assume that same risks it would if the originated loans were financed in the balance sheet.

[113] A bank that "sell assets all the time", i.e. every quarter is called a "loan merchant". They regard loan merchants as 2investment banks", i.e. banks which are in the business of selling loans.

- Control variables: the volume of total assets, which tries to identify if loan sales respond to overlines sold to avoid going over the lending limits; and whether the bank belongs to a multinational company or not to investigate if loan sales are taking place between affiliate banks. Both control variables are expected to have positive coefficients.

The logit and tobit models yield a number of interesting results. The first logit model, which estimates the probability of a bank selling loans, predicts that the average bank has just over 60% probability of selling loans. Bank size and diversification risks are the main factors explaining banks sale of loans, followed by the premium per dollar of deposit insurance. These results suggest that large banks with poorly diversified portfolios, and exposed to high regulatory taxes are more likely to engage in securitisation. The level of non-interest expenses, which measures the bank's comparative advantage, is statistically significant with a negative coefficient, meaning that banks with a comparative advantage in originating loans exploit that advantage by using securitisation.

The second logit regression estimates the probability of a seller bank being a "loan merchant", i.e. engaging in securitisation activities every period. The model predicts that a bank selling loans in one period has over 40% probability of being a "loan merchant". Large banks with low capital ratios and banks with a comparative advantage in loan origination are more likely to be loan merchants. Other variables found to be statistically significant and with the expected sign include the insurance premium, the level of diversification and funding risk, the capital constraint dummies and the multinational dummy.

The tobit regression attempts to estimate which is the optimal volume of asset sales. In this case the dependent variable is the dollar volume of loans sold as a percentage of total assets. The model predicts that the average bank sells 5.5% of its assets. The diversification and funding risk, size, premium for deposit insurance and the bank's comparative advantage in originating loans have the largest impact on the percentage of loans sold by a bank.

Pavel and Phillis conclude that the desire to avoid regulatory taxes is only one of the incentives behind asset sales and securitisation. They argue that banks engage in those activities to diversify and exploit their comparative advantage in originating loans, and that large banks are more likely to securitise. They conclude that once a bank has tested the securitisation and loan sales market for the reasons mentioned above, its use of securitisation would increase if the costs of regulatory requirements increase.

In a later paper, **Pavel (1988)** examines the effect of loan sales on banks' risk to establish which factors determine securitisation and loan sales. If the reason for loan sales is to diversify the portfolio, then a bank's risk should decline after the loans are sold. If the incentive is to avoid regulation requirements, banks would sell high quality assets (keeping the most unprofitable assets), making banks riskier after the loans are sold.

If the reason behind loan sales is the use of alternative funding sources, the relationship between banks' risk and loan sales is less clear. A bank that is riskier than its loan opportunities may not originate loans unless it could sell them, and therefore transfer the funding to another agent[114]; thus riskier banks would be expected to sell more loans. However if the bank uses loan securitisation because it is cheaper than deposits, the bank's risk would not play a role in the decision to sell loans and it would be unaffected by the bank securitisation activities.

The data includes 117 *bank holding companies* whose stock was actively traded[115] in the New York Stock exchange, American Stock Exchange or over the counter.

To measure the relationship between loan sales and a bank's risk profile, Pavel divides the sample attending to different criteria and examines differences in means between samples.

The bank's asset risk is calculated using the Ronn-Verna risk-based deposit *insurance* premium. The premium is considered as a put option on the bank's assets, and is

[114] Banks cost of funding (deposits or equity) reflects the bank's risk: this rate would be higher than the rate charged on the low risk loan; this is the underinvestment hypothesis.

computed using the Black-Scholes model for option pricing[116]. The calculation of its value takes into account the "bail-out" policy of the FDIC, i.e. the FDIC does not liquidate the bank as soon as it enters default state, rather it tries to strengthen the bank's financial situation at first[117].

Pavel divides banks into two samples, risky and safe banks. She finds evidence that riskier banks sell more loans, which is supportive of the underinvestment hypothesis. The underinvestment hypothesis states that some banks will not undertake a profitable new investment opportunity if the benefits of that investment accrue to the depositors rather than the shareholders. The problem is more acute the larger the probability of the bank defaulting on the existing depositors because depositors will benefit from either a reduction in the probability of default, or an increase in the cash-flow in the event of default. These benefits are at the expense of shareholders. Pavel's results show that the riskiest banks sold as much as 3 ½ times more loans than the low risk banks.

If banks use loan sales as a funding tool, the bank's risk will not be affected by securitisation. Pavel examines changes in banks' risk after selling loans. She compares the change in risk experienced by risky banks which sold loans to the change in risk experienced by risky banks which did not sell loans. She finds that the difference between the decrease in risk experienced by both types of banks was significant only at the 10% level and only when the risk measure included off-balance sheet activities. She considers this result as supportive of the funding hypothesis: banks sell loans as a funding source, hence selling loans has little effect on banks' risk.

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[115] An stock is defined as actively traded if it traded an average of three times per week

[116] The Ronn-Verna premium is a put option on the assets of the bank. To calculate the market value of the bank assets and the rate of return on those assets (necessary to calculate the deposit premium) the value of the bank's equity needs to be calculated. The equity of a bank holding company is a call option on the assets of the bank with the same maturity as the debt and with striking price equal to the maturity value of the debt. The value of both options is calculated using the Black Scholes formula. Solving both equations simultaneously yields values for the assets of the bank and the standard deviation of the return on those assets.
Two insurance premiums were calculated for each bank. One that includes only on balance-sheet assets and another one that includes off-balance-sheet activities (standby letters of credit, loan commitments and commercial letters of credit). Both premiums produced the same results.

[117] This policy has now changed. The Federal Deposit Insurance Corporation Improvement Act of 1991 requires the FDIC to use a "least cost to the tax payer " approach to resolving bank failures. This means that sometimes, immediate liquidation of the failing bank is the policy to be applied (Heffernan1996).

To investigate the diversification theory, Pavel employs the same diversification measure used in her paper with Phillis. Banks are divided into two groups: selling banks with diversified portfolios, and non-selling banks with similarly diversified portfolios. Annual changes in risk profile between both groups are compared. It is assumed that selling banks achieve diversification by selling loans, while non-selling banks achieve diversification by other means. Banks selling loans experienced a 40% drop in risk; on the contrary non-selling banks saw their risk increase by more than 40%. However the difference between changes in risk in the two samples was not statistically significant. Pavel concludes that despite the fact that diversification risk appears to be an important reason to sell loans it does not significantly change a bank's risk profile.

The relationship between loan sales and capital requirements could not be established either. Pavel divides the sample between banks that increase their primary capital ratios over the period analysed and banks that decreased them, and compares the loan sales of both samples. Although banks that increase their capital ratio sold more loans, the difference between sample means is not statistically significant. Banks appear to sell low risk high quality loans to improve their capital ratios, however that strategy did not change the bank's risk profile.

In a similar study, **Hassan (1993)** investigates the relationship between bank risk and off-balance sheet activities. He employs three alternative risk measures: systematic risk (Beta), the standard deviation of a bank's equity return, and a bank asset's risk (Ronn-Verna risk premium). He regressed these risk measures on a set of different off-balance sheet measures (including loan sales) and other control variables (leverage, level of diversification, size, credit risk, interest rate risk and dividend payout ratio).

He could not find any statistically significant relationship between the different measures of risk and volume of loan sales or loan participations.

Gorton and Pennacchi (1990) focus on the "moral hazard" problem associated with securitisation and loan sales. They test for the presence of implicit contractual

features which would make loan sales incentive-compatible. They argue that without recourse to the seller, guarantees or credit enhancement, the sale of loans is not incentive-compatible because once the loan is sold, the seller, who usually remains as servicer, has no incentive to monitor the borrower.

If the buyer had implicit recourse to the lender, or the lender had retained part of the loan, the correct incentive to monitor the borrower would be restored; Gorton and Pennacchi test for the presence of any of the above. They also consider whether there has been a reduction or elimination of information asymmetries between seller and buyer; if this was the case the buyer would be able to observe the effective level of monitoring done by the seller, so the moral hazard problem would disappear. The data comes for the Call Report and the sample consists of 872 individual commercial and industrial loan sold by one money centre bank between January 1987 and September 1988.

To test for the presence of contractual features that would make loan sales incentive-compatible, they regress the spread over LIBOR paid by each of the loans after they have been sold. The explanatory variables include the seller's probability of failure[118], the fraction of the loan which has been sold, and the spread over LIBOR paid by the borrower. They hypothesised that the spread of the loan sold should be positively related to the spread paid by the borrower, negatively related to any implicit guarantee given by the selling bank, and positively related to the fraction of the loan retained by the seller. They found that the spread paid by the borrower has a significantly positive influence on the spread paid by on the loan sale. No relationship was found between the seller's probability of failure and the loan sale spread suggesting there are no implicit guarantees. The fraction of the loan sold has a negative relationship with the loan spread. This result is contradictory causing the authors to re-formulate their original hypothesis: banks sell larger fractions of their highest quality loans because they need less monitoring and retain a higher proportion of poor quality loans.

[118] This probability is estimated from the level and volatility of the banks' stock. They model bank's equity as a Black-Scholes call option. Using this result they can obtain a time series of the bank's market value of assets-to-liability ratio, which can then be employed to compute the probability at the time the loan is sold that the bank will remain solvent when the loan matures.

They also employ a tobit model to test the same hypothesis which produces similar results: weak evidence of selling banks retaining a fraction of the loans, and no evidence of implicit guarantees. Their results failed to support their hypothesis concerning the presence of implicit contractual features which would reduce the level of information asymmetry between loan sellers and buyers (moral hazard).

James (1988) tests the validity of the implications rendered by the "underinvestment hypothesis" by comparing the predictions of the model with those of the "moral hazard hypothesis" formulated by Benveniste and Berger (1987). The moral hazard hypothesis states that banks securitise loans as a way to increase leverage without being subject to regulations (off-balance sheet finance), specifically to exploit the moral hazard related to fixed deposit insurance. Riskier banks would obtain the greatest benefit from securitisation and low risk assets would be securitised.

Therefore the moral hazard hypothesis predicts that securitisation increases the risk of the bank, and hence the risk of the deposits. However, if the "underinvestment hypothesis" proposed by James (1988) is true, then depositors and the bank as a whole would be better off, because securitisation allows a bank to invest in positive net present value projects which would not have been undertaken otherwise. The relationship between securitisation and bank risk would be either zero or negative.

The sample includes 58 banks from 1984 to 1986, which had stack prices data on the Compustat Quarterly Bank File. James first proxies banks' risk by the interest rate on domestic Certificates of Deposit[119] larger than $100000 and analyses the relationship between the securitisation variables (loan sales and standard letters of credit), and the interest cost of the CD's. He first regressed the rate on CD's on a set of variables: average maturity of CD's; general level of interest rates; bank's leverage; credit risk of the bank's portfolio; and bank's interest rate. This regression proves that the CD's reflect the default risks of banks.

To estimate the relationship between a bank's risk and its securitisation activities the previous regression is re-run including volume of loan sales and standard letters of credit as explanatory variables. If the underinvestment hypothesis is correct,

securitisation will not increase banks' default risk. James does not find any statistically significant relationship between the rate paid on CD's and the volume of loan sales and standby letters of credit. These facts support the underinvestment theory. However, as the author points out, loans sales included in the Report of Income and Condition are specifically without recourse so it is not clear whether they would increase the riskiness of deposits[120] according to the moral hazard hypothesis.

Berger and Udell (1993) analyse the relationship between different securitisation activities (loan sales, loan commitments, and standby letters of credit) and risk and liquidity in banking. Their objective is to test the validity of their "monitoring technology hypothesis" which postulates that a bank's liquidity and risk is not affected by securitisation because improvements in monitoring technology. There is no overall effect on a bank's risk because banks can also used the new monitoring technology to improve monitoring and screening. Thus high quality borrowers have access to capital markets, while previous unbankable borrowers can now access intermediated debt. They compare this hypothesis with James' (1988) underinvestment hypothesis. They consider that the underinvestment hypothesis would be proven if in a regression that has asset risk as the dependent variable the coefficient loan sales is statistically significant and positive, because of the incentive to sell the best assets.

They used the data from the quarterly Report of Conditions and Income. The securitisation variables are weighted by the volume of total assets to consider how these activities affect the traditional use of balance-sheet finance. The descriptive statistics for the sample show that loan sales is an important activity, with mean of a 5% of total assets, peaking at 9% at the end of 1988. Data on loan purchasers show that around 5% of the loans sold goes to non-financial institutions. Hence, loans sales could be used as a way to rebalance the portfolios amongst financial institutions with different loan origination opportunities, or as a means of increasing liquidity in the form of traded debt. Most of the loan buyers have large size as measured by total assets.

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[119] He assumes that large denomination CD's carry a default risk premium.

[120] If the relationship between banks' risk and loan sales without recourse is not clear, then it is difficult to establish whether the findings of the test support the underinvestment hypothesis only, or also the moral hazard hypothesis.

To analyse the relationship between loan securitisation and risk or liquidity, the authors run different regressions of various measures of bank risk and bank liquidity on loan sales and other off-balance sheet activities (standard letter of credit and loan commitments):

- A bank's risk is measured by its risk of failure; its return on assets; its level of non-performing loans; its level of net charge-off; its risk-weighted on-balance sheet assets; and its sum of squares of portfolio shares which measure the degree of portfolio diversification.
- A bank's liquidity is measured by its loan-to-assets ratio (with and without off-balance sheet activities); its ratio of uninsured funds-to-assets; its ratio of consumer and industrial loans-to-total assets.

To capture the effect of securitisation on a bank's risk, securitisation activities are lagged one quarter with respect to the proxies for liquidity and risk. The authors could not find any statistically significant relationship between loan sales and risk.

Berger and Udell explain this as supportive of their "monitoring technology hypothesis". The loan portfolio that remains in the securitising bank's balance sheet is not different in risk and liquidity to the loan portfolio of a bank which does not securitise loans. In other words, as predicted by their theory, banks continue to specialise in lending to information problematic borrowers. Technology improvements allow some of the traditional bank customers to be financed in the capital markets and old unbankable customers to gain access to bank finance, so the overall effect is that nothing changes in the bank risk or liquidity.

They also examine the relationship between liquidity of banks' liabilities and loan sales. They find a significant positive relationship between loan sales and the proportion of uninsured depositors, which are a more expensive way of rising funds than insured depositors. They argue that this is supportive of Pennachi's argument that banks with higher costs of funding would be expected to sell more loans.

Jagtiani, Saunders and Udell (1995) investigate the effects of capital requirements on the banks' adoption of off-balance sheet financial innovations. They model

different types of off-balance sheet activities, loan securitisation being one of them. Their sample contains information from 86 large banks.

Each of these activities is treated as an innovation, the diffusion of which among the banking industry follows an specific pattern. Once the diffusion pattern has been modelled, they can analyse the specific effect that capital requirements have on the growth of that particular off-balance sheet innovation. Two pieces of regulation related to capital requirements are considered in relation to the US financial market: the increase in capital requirements in 1985, which did not take into account off-balance sheet activities[121]; and the introduction of risk-based capital requirements in 1988, with partial effect in 1990 and full enforcement in 1992[122]. Unlike the early ratios the risk-based capital requirements translate off-balance sheet activities into credit risk equivalents and weight different activities for the first time.

The authors expected the change in capital requirements in 1985 to increase off-balance sheet activities and the 1988 risk-based capital regulations to reduce them.

A logistic diffusion model for the adoption of off-balance sheet activities is employed[123].

The adoption of an specific innovation grows at a accelerating rate until 50% of banks adopt the innovation. After that, growth is at a decelerating rate. This pattern of behaviour is justified using imitative and bandwagon effects.

The logistic curve equation is transformed so it can be estimated using OLS. Dummy variables are inserted for four different capital regimes: before the capital

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[121] The 1985 regulation imposed an uniform capital requirement for multinationals, regional and small banks. This increased the requirement for multinationals and regional banks, and decreased it for small banks.

[122] The 1985 regulation required banks a tier one capital (equity capital and long term funds) assets ratio of 6%.

[123] The number of firms m, which have adopted the innovation in period t is equal to:
$m_{t+1} - m_t = \beta (n - m_t) m_t / n$
where, $\beta > 0$ is the speed of adoption and n = total number of firms in the industry
For small periods of time *(t to t+1)* the solution to this equation is given by a logistic curve, which predicts P_t, the proportion of firms which have adopted the innovation:
$P_t = m_t / n = [1 + exp(-\alpha - \beta)]^{-1}$
Where $t = -(\alpha / \beta)$

requirements of 1985, quarter 2; the 1985, quarter 3 capital requirements; the effect of the announcement of risk based capital regulation between 1988, quarter 3 and 1990, quarter 3[124]; and the partial implementation of risk-based capital from the fourth of 1990 and the third quarter of 1992.

Two sets of regressions are run; the first one is for each individual bank for each individual off-balance sheet activity, and it estimates the speed of adoption of the innovation and the effect of the different capital regimes. For loan securitisation the speed of adoption is non-significant. With respect to capital requirements the dummy for the 1985-1988 regime is weakly (10% level) significant suggesting that banks were slightly encouraged to securitise loans by the tightening of capital requirements. The dummies for the 1988-1990 (announcement of risk-based capital) and 1990-1991 (partial effect of risk-based capital) are insignificant. The authors conclude the change to risk-based capital requirements did not affect the expansion of loan securitisation.

The second equation regressed the estimated speed of adoption coefficients on a set of bank characteristics (total assets; percentage of foreign deposits over total deposits; non-performing loans; net income; equity capital; and risk-adjusted assets weighted by the volume of total assets) to assess the differences of adoption patterns across products and banks. In the case of loan sales the authors found that none of these variables were significant. The authors show that securitisation does not appear to be related to size, capital ratio or creditworthiness of banks; they suggest that overall economic activity and technological learning factors may be more important in the expansion of securitisation.

Lockwood, Rutherford and Herrera (1996) study changes in shareholders' wealth of firms which securitise assets.

They test the following hypotheses:

- first, securitisation has a positive shareholder's wealth effects because it expands borrowing capacity, and the cash raised can be invested in positive net present value projects, or to pay debt and reduce interest expenses;

[124] Banks may have started accommodating their capital ratio to the required one.

- second, the shareholder's wealth effects are financial firm specific; to test this hypothesis their sample is divided in four groups: banks and thrifts, finance companies, automobile companies, and other industrial companies;
- third, wealth effects should be negative for banks because the moral hazard associated with fixed rate deposit encourages banks to securitise their best assets;
- fourth, if securitisation is used as a way to restore capital to its required regulatory level, banks with low financial slack[125] will experience a more negative wealth effect because the market would view securitisation by these banks less favourably;
- fifth, the wealth effects differ according to the asset that is being securitised; to test this hypothesis four assets categories are considered: auto loans, credit card receivables, trade receivables and lease receivables;
- sixth, securitisation will decrease a firm's market and interest rate risk when used to reduce leverage, and it will increase these risks if it reduces loan quality and long term earnings.

The sample has 294 public offerings of securitised assets between 1985 and 1992, obtained from the Assets Sales Report. The Asset Sales Report is published weekly by the American Banker. It covers worldwide asset securitisation. Mortgage sales are not included.

Wealth effects are examined by using standard event methodology. The mean excess return for each public offering is calculated for each event period, which covers days -10 until day +10. The results for the entire sample show that shareholders experienced an statistically significant wealth loss on the day before the announcement and a an statistically significant wealth gain on the day of the announcement[126]. These results are found to be financial firm specific: over the two day period, finance companies experienced a larger wealth gain of 2.79%, while banks suffer a loss of 0.64% and the other industries in the sample did not experience

[125] Financial slack is measured by capital surplus plus retained earnings and it proxies the strength of the banks' capital ratios. Low financial slack would imply an eroded capital base.

[126] They report results for day -1 and 0 (day before the announcement and day of the announcement) because some of the offerings were made before the stock market closed although they did not appear in the newspapers until the following day.

any wealth effect at all. No link could be established between the type of assets securitised and the wealth effects.

The banks' wealth loss was found to be larger for those with low financial slack, while banks with high financial slack experienced a wealth gain of 0.825%. Thus securitisation signals bad news for banks which are already under capital pressure. The possible explanation are twofold, either securitisation cost is higher for these banks because credit enhancements are more expensive; or weaker banks have an incentive to securitise their best assets, leading to a deterioration of the remaining portfolio.

To measure the effect of securitisation on firm's market and interest risk, the authors run the following regression for the period between days -111 to -11 and +11 to +120 of the securitisation announcement:

$$R_{it} = a_i + b_{1i}R_{mt} + b_{2i}I_t + b_{3i}R_{mt}\,D_t + b_{4i}I_t\,D_t + u_t \qquad (5.1)$$

Where,

R_{it} is the daily stock return of the securitising firm.

R_{mt} is the market return, which proxies for market risk.

I_t is the daily residuals from a regression of the treasury bill on the market return, and it proxies for interest rate risk.

D_t is a dummy variable which accounts for the after event period, with value zero from days -111 to -11 and value one from days +11 to +120.

The change in market risk for the post-event period is measured by b_3, and the change in interest rate risk for the post-event period is measure by b_4.

Banks with low financial slack were found to experience an increase in market and interest rate risk after the securitisation announcement. The other financial firms, included strong banks (i.e. banks with high financial slack), experienced a reduction in market and interest rate risk after securitisation.

The results suggest the market perceives asset securitisation as a value enhancing strategy when done by strong banks and financial companies, the latter not subject to the same regulatory requirements as banks. The use of securitisation by banks under capital pressure is treated as bad news by the market, interpreting securitisation as a last resort which signals that the bank is experiencing difficulties, or considering a too expensive funding source for high risk banks.

5.3 THE RELATIONSHIP BETWEEN THE THEORETICAL AND EMPIRICAL LITERATURE

This section uses a table to summarise this chapter's findings and compares them to the theoretical models reviewed in Chapter 4. Table 5.2 provides the reader with a quick reference to all the models reviewed in Chapter 4 and the extent to which this chapter's empirical literature supports the theoretical models.

Table 5.2 Theoretical and Empirical Literature on Securitisation: A Summary

MODEL	PREDICTION	EMPIRICAL TESTS
Pavel (1986), Cumming (1987) "cost analysis": banks use securitisation because high costs of traditional intermediation makes it a cheaper alternative.	Securitisation of high quality assets. Correctly priced regulatory taxes would decrease the incentives to securitise because they would reduce intermediation costs.	Not Applicable
Greenbaum and Thakor (1987): securitisation with partial recourse is a better mechanism to signal information about loan quality.	Securitisation of high quality assets. Complete deposit insurance, subsidies to the banking industry and low capital requirements reduce the benefits from securitisation.	Not Applicable
Benveniste and Berger (1987), Hess and Smith (1988): securitisation with recourse improves risk allocation with respect to the use of deposit funding.	Riskier banks would use securitisation more often, and they would securitise high quality assets. Securitisation of the best quality assets reduces the cost of securitisation.	Lockwood, Rutherford and Herrera (1996): riskier banks experience an increase in market and interest rate risk after the securitisation announcement. This could indicate that the market expects their portfolio to deteriorate
Pavel and Phillis (1987) Pennacchi (1988), Flannery (1989), Jaffee and Rosen (1990), Passmore (1992) and Twinn (1994): banks use securitisation to lower funding costs by avoiding regulatory taxes and by transferring assets'risk to third parties.	Higher regulatory requirements increase the incentives to securitise.	Pavel and Phillis (1989): banks with low capital and high premium per $ of deposit insurance sell more assets. Berger and Udell (1993) tests support Pennacchi's argument that banks with high funding cost (due to more uninsured depositors) securitise more often.
James (1988) and Flannery (1994): securitisation is used to attenuate the Underinvestment problem for banks.	Riskier banks and banks where capital requirements are binding will use securitisation more often. Best quality assets will be securitised.	Pavel (1988) and James (1988) found weak support of the underinvestment hypothesis.
Donahoo and Shaffer (1991): the decision to securitise is based on profitability considerations. Changes in capital requirements might affect the optimal volume of securitisation only once securitisation has been chosen for profitability reasons.	Risk-based capital requirements increase the incentive to securitise.	Not Applicable
Berger and Udell (1993): improvements in monitoring technology permit traditional bank borrowers to move to direct investors debt through securitisation.	Securitisation has no effect on bank's risk and liquidity.	Berger and Udell (1993) found no relationship between loan sales and risk. Hassan (1993) could not find a relationship between securitisation and various measures of banks' risk.
Carlstrom and Samolyk (1995): segmented markets and localised information creates incentives for local capital constrained banks to originate loans and sell them to unconstrained banks from other markets.	Not Applicable	Not Applicable
Boot and Thakor (1993) and Riddiough (1997): in a noisy rational expectations setting (adverse selection), a financial intermediary can increase revenue by pooling assets and issuing different type of securities against the pool cash flow.	Not Applicable	Not Applicable

The comparison between the predictions of the theoretical models and the results from the different empirical tests sheds little light on the economic incentives for securitisation. Part of the problem is the absence of explicit econometric test for some of the theoretical models.

Nonetheless, where there is an opportunity for comparison, the results are contradictory. Although it seems established that riskier banks use securitisation more often (James (1988) and Pavel (1988)), there is no evidence that securitisation has any effect on banks' risk (Berger and Udell (1993 and Hassan (1993)). Hence it cannot be established whether riskier banks use securitisation to increase or decrease their portfolio risk, and why they would do it at all.

The link between securitisation and capital requirements is supported by Pavel and Phillis (1987), weakly so by Berger and Udell (1993), but rejected by Jagtiani, Saunders and Udell (1995). However the regulatory regime is sometimes not clearly established or understood. And in some cases there is almost no time to observe the effect of the changes in regulation on banks' behaviour, so the lack of support for the hypothesis could be misleading. For example, Jagtiani, Saunders and Udell (1995) do not correctly specify the effects of capital regulations on securitisation; risk-based regulation should have encouraged loan sales because it increased the capital ratio from previous 6% to 8%, effectively putting pressure on all the banks. One feature of asset-backed lending is that the loans are sold without recourse (or with very little recourse), so they are completely removed from the balance sheet and no capital has to be held against them. So it should not matter that risk-based regulation includes off-balance sheet activities because if the loans are sold without recourse (as it happens for the Call Report data) they are not computed in the bank's balance sheet or off balance-sheet assets.

The underinvestment hypothesis is not rejected by the tests conducted by both James (1988) and Pavel (1988). However there is controversy as to the direction between securitisation and the banks' ex-post risk: James (1988) argues that banks' risk would not change after securitisation whereas Berger and Udell (1993) postulate an increase in banks' risk because of the incentives to securitise the best assets.

The effects of securitisation on banks' risk depend on what banks do with the cash raised through securitisation. Banks can invest on projects riskier than the securitised assets, originate assets with lower risk, or use the funds to reduce debt or distribute cash to shareholders. There is no empirical evidence on banks' ex-post behaviour needed to validate some of the hypotheses outlined in Chapter 4.

Some studies use a non-existing relationship or an indirect relationship to test the validity of their hypotheses. For example Berger and Udell (1993) consider that the lack of relationship between loan sales and securitisation proves their monitoring technology hypothesis. James predicts that if the relationship between a bank's risk and loan sales is zero, the underivestment hypothesis is proved. In both cases a non-existing relationship is used to support two very different theories, which is intellectually unsound.

There was no evidence to support other aspects of securitisation such as which type of assets are securitised, risk management and diversification issues, if securitisation is effectively cheaper than intermediation and whether issuers increase revenue by pooling assets.

5.4 CONCLUSIONS

This chapter has examined the empirical literature on banks' securitisation incentives. The lack of clarity of the results is the most important conclusion to be drawn. This can be attributed to a few problems common to most of the tests.

1. All of the studies are based on some theoretical version of the financing or the comparative advantage hypotheses, so it was important to try to identify which of these models best explain why banks securitise assets, and then look at which banks would use securitisation. However, most of the empirical studies attempt to test why securitisation occurs by looking at one or two possible aspects of the financing or the comparative advantage hypotheses, like underinvestment or capital requirements, ignoring the major arguments.

2. Most models do not clearly state what is going to be tested. As was mentioned in Chapter 4 the theoretical and empirical investigations on securitisation activities by banks need to independently consider two questions, why banks securitise and which banks securitise. The first question would be used to choose between the financing and the comparative advantage hypotheses, while the second question would examine the particular features of the chosen hypotheses to determine which type of banks engage in securitisation.
3. There is no explicit attempt to answer the question of which banks engage in securitisation, although some studies include the question as part of a broader empirical test.
4. The absence of predictions or an analysis of securitising banks ex-post behaviour means the reasons why and which banks engage in securitisation are not carefully determined. The theoretical and empirical modelling on which banks use securitisation has to account for ex-ante and ex-post bank characteristics so that incentives and consequences of securitisation can be properly isolated and tested.
5. The causality in the relationships is not clearly defined. For example, some theories predict that riskier banks with poorly diversified portfolios would use securitisation more often, other theories explain changes in risk, liquidity and diversification as the effect of asset securitisation. Unless the direction of the causality is properly established it is very difficult to test any of the theoretical models, because there is great confusion about which result would be supportive of a given theory.

There is no empirical evidence on the effects of the institutional framework on securitisation incentives: the differences between the expansion of securitisation in the US and Europe could be attributed to the different institutional arrangements and markets, especially to the government guarantees to mortgage securitisation.

As was mentioned in the introduction to this chapter, the data are another problem. The specific exclusion of residential mortgages and consumer instalment loans may cause an underestimation of both the volume of securitisation by each bank, and the number of banks actually engaging in securitisation. Another problem with the empirical work is perhaps the excessive aggregation of data, which may produce spurious results. Some studies employ all the commercial banks in the Report for

their econometric tests, other employ sub-samples like banking holding companies or large banks. The studies which pool together all the banks that file reports each year, for example Pavel and Phillis (1987) and Berger and Udell (1993), need to control for factors such as the legal limitations in geographical and functional diversification relevant to each individual bank, which might affect their results.

The key criticisms raised in these conclusions are addressed in the empirical work in the next two chapters of this thesis. This thesis attempts to take a more systematic approach to securitisation activities by banks by addressing in consecutive order the questions why banks securitise, and which banks securitise. In Chapter 6 the why question is addressed by testing the validity of the financing and the comparative advantage hypotheses. Once the comparative advantage hypothesis is rejected, Chapter 7 addresses the which hypothesis. The data used are from UK depository institutions, which is useful in that there is no government subsidisation, unlike the US. Also given the objectives of the tests in the Chapters 6 and 7 very little is lost by the absence of US data, because the tests focus on the fundamental questions, largely ignored in the US tests.

CHAPTER 6: THE ECONOMIC INCENTIVES TO SECURITISATION BY DEPOSITORY INSTITUTIONS

6.1 INTRODUCTION

Chapter 4 reviewed the theoretical literature on banks' incentives to securitise assets. The theories point to two specific characteristics of these transactions as the most likely reasons why banks engage in securitisation. The first is that securitisation separates loan origination from loan funding, thereby permitting banks to specialise on the originating function, for which they have a comparative advantage. The second is the greater flexibility of securitisation finance because banks may find it easier to communicate information about a loan portfolio than about the whole bank's balance, and with securitisation the banks can issue claims with different degrees of recourse to the bank's capital.

The objective of this chapter is to explore the economic incentives behind the securitisation decision. The chapter examines two competing hypotheses, the "comparative advantage hypothesis" and the "financing hypothesis". Having addressed the question of why banks engage in securitisation it is necessary to analyse "which banks securitise". This question, which is explored in Chapter 7, examines securitising banks' quality, and ex-ante and ex-post characteristics.

The empirical literature surveyed in Chapter 5 investigates theoretical arguments for securitisation by comparing the characteristics of banks that engage in securitisation with those that do not use securitisation. However, the need to independently consider the two questions, "why banks securitise" and "which banks securitise", is not always taken into account, a problem which this and the next chapter of this thesis hopes to rectify.

A UK data set is used, thereby avoiding some of the problems arising from US data, such as leaving out of the empirical tests the securitisation of mortgage and personal loans. Hence, these chapters make two contributions to the literature by attempting to address the "why" and "which" questions in the context of a UK database. Econometric tests are used to verify the validity of the hypotheses. The results support the financing hypothesis that is, the use of securitisation by British depository institutions is due to financing needs rather than to a loss of their comparative advantage in performing the intermediary role.

The chapter is organised as follows: section 2 introduces the hypotheses and provides a brief summary of the relevant literature, section 3 presents data and methodology, in section 4 the empirical results are analysed and section 5 concludes.

6.2 OUTLINE OF HYPOTHESES

A seen in Chapter 3 securitisation among non-financial firms is usually seen as a mechanism to raise funds, which uses the firm receivables to obtain the finance. However, financial firms, especially depository institutions, can also use securitisation to unbundle the intermediation functions and specialise on those for which they have a comparative advantage.

This chapter proposes two alternative hypotheses and tests them using British asset securitisation data. The first hypothesis, the "financing hypothesis" considers the advantages of securitisation as a funding source. The second hypothesis, the "comparative advantage hypothesis" links banks' use of securitisation to a decline of their advantage in providing some the traditional functions related to lending.

6.2.1 The "Financing Hypothesis"

Modigliani and Miller (1958) established that, in a world with perfect capital markets, a firm's capital structure is irrelevant, and the overall value of a firm does not depend on the array of securities used to finance it. However in the presence of market imperfections a firm's capital structure (i.e. the choice of finance) becomes

relevant and managers can maximize a firm's value by choosing a specific capital structure to exploit those imperfections.

Depository institutions may use securitisation as a funding mechanism because it helps to reduce asymmetric information and it permits the prioritisation of claims against the institution assets, therefore improving the risk allocation between the depository institution and investors. Some of the theories advanced in Chapter 4 emphasised some aspects of the use of securitisation as a funding source:

James (1988) and Flannery (1994) notice the role of securitisation in mitigating the underinvestment problem of financial intermediaries that are not allowed to issue collateralised debt.

Benveniste and Berger (1989) argue that the use of securitisation as a funding mechanism enables banks to optimise risk sharing and hence to reduce funding costs, by allocating the securitised assets to the risk-averse investors. Riskier banks would obtain the greatest benefits from securitisation because the funding disadvantage resulting from combining risky and safe assets in the same portfolio is more acute for these banks. Hess and Smith (1988) also argue that mortgage securitisation improves the allocation of interest rate risk within the mortgage business. The marginal investor in the capital market sets the interest rate on the securitised mortgage. Mortgage borrowers benefit from lower costs and less credit rationing.

Greenbaum and Thakor (1987) prove that securitisation with partial recourse is a better mechanism to signal information about loan quality, and therefore it lowers funding costs.

Boot and Thakor (1993) and Riddiough (1997) show that a financial intermediary wishing to raise funds in the presence of asymmetric information, can increase revenue by pooling assets and issuing different types of securities against the pool cash flow.

If there is asymmetric information about the firm's value and investment opportunities there are additional costs to raising funds: the cost of selling

undervalued securities because communicating information about the firm is more expensive, and the larger monitoring costs incurred by investors. There are three main reasons why information asymmetry arises: first, information about a firm could be scarce, for example the firm may be small or it may not have a long history. Second, the information available to the market may be unfavourable. And third, the firm may be "opaque" (difficult to appraise) because its assets do not trade frequently or its portfolio composition can be easily altered.

Depository institutions are an example of "opaque" firms. They specialise in gathering private information about customers that cannot be readily conveyed to financial markets, and they have unusually dynamic portfolios on both sides of the balance sheet. Flannery (1994) notes that outsiders cannot easily establish the institution's portfolio risk. The managers of depository institutions have exceptionally large opportunities to alter the composition of their portfolios and new investment opportunities constantly arise. Only a few of the depository institutions' assets and liabilities are traded in secondary markets, which makes it hard to calculate the value of their equity.

Assume that a depository institution needs to raise external funds to finance an investment opportunity, and that for some exogenous reason[127] it is not possible to raise new debt in the form of partially insured deposits. If reducing the information asymmetries about a pool of the institution's loans is easier than conveying information about the whole balance sheet then the depository institution would benefit from using securitisation finance.

If the market undervalues the institution as a whole, raising non-securitised external funds[128] to fund a pool of loans for which there is little information asymmetry will be more expensive than raising funds by securitising those loans. The institution would have to pay "adverse selection costs" in the form of more expensive finance because the market believes the firm and its assets to be of lower quality than they

[127] Deposits may have become relatively expensive because of competition in the household savings market; or deposit supply is insufficient to fund the financial intermediary investment opportunities; or there is a time lag between marketing the deposit products and actually getting them.
[128] By external funds it is meant debt, equity or permanent interest bearing shares (in the case of building societies)

really are. If by securitising the loans the depository institution reduces the degree of information asymmetry about that pool of loans then it would reduce the adverse selection costs.

Asset-securitisation can effectively reduce information-related costs, particularly for riskier (unfavourable information) or more opaque institutions. First, when a firm securitises assets, it pools and isolates them in a special purpose vehicle so that the risk of the securities backed from those assets depends only on the pool's risk[129], and not on the risk of the securitising institution. The securitised assets are protected from the insolvency of the issuer. With diversification within the pool, the pool risk is lower than the risk of investing in a single asset. In addition, the problem of asset substitution within the pool is very small or zero: the pool of assets is more permanent than the portfolio of a financial intermediary[130]. Using credit enhancement mechanisms further reduces the risk of the securities, so the resulting securities can obtain the highest possible rating (almost risk-free debt). Asymmetric information relating to the assets is lower than asymmetric information for the whole depository institution: securitisation reveals information about the assets than would not be known to the market in other circumstances[131].

Second, the participation of credit rating agencies in the securitisation transactions reduces the need of investors to produce information about the pool. The investor takes a passive role and does not need to monitor the activities of an "opaque" depository institution. Moreover, the fact that the assets in the pool collateralise the securities also reduces the need to monitor by investors.

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[129] If the firm issues debt instead of securitising assets, the bond-holder acquires a claim on the financial intermediary's entire portfolio of assets. In non-recourse securitisation, the investor in asset-backed securities acquires a claim solely on the assets' pool.

[130] Asset substitution in UK's special purpose vehicles is limited to including new assets in the pool when existing ones mature. This right is bounded in time, usually during the first two years. But because of investors' dislike, most of the securitisation transactions do not contemplate the possibility of asset substitution.

[131] It seems reasonable to assume that producing information about, for example, a pool of mortgage loans is less expensive than producing information about the whole portfolio of a depository institution.
For example UK mortgage-backed securities issuing prospectuses contain very detailed information about the bank's lending criteria. The size of loans, the types of mortgage loans and loan-to-value ratio for each type, the borrowers' income requirements and proof of income, the maturity and geographical distribution of the loans, and details of the mortgage indemnity and property insurance are included in the prospectuses. The prospectuses also have information about the liquidity facilities and mechanism of credit enhancement.

Another benefit of securitisation funding is that it gives priority to specific claims against the bank assets. Assuming that depository institutions are risk neutral (and investors risk averse)[132], a depository institution that is riskier than its investment opportunities would find securitisation finance attractive because it isolates the assets to be funded so finance can be raised at a cheaper rate. This is because securitisation does not create a new liability on the institutions' balance sheet, the asset-backed securities are a liability of the issuing institution, the SPV.

As it has been shown above, securitisation finance might have advantages over other funding sources because it reduces some of the costs associated with raising external funds. However, given the nature of securitisation transactions (in particular the need to credit enhance the securities) and the moral hazard problem of banking regulation[133], depository institutions might have an incentive to securitise their best assets. This creates a problem to be considered under the Modiliagni and Miller perspective, and that is what happens to the subsequent financing of the securitising institution? A bank which has securitised its best assets has increased its risk profile and therefore raising external finance in the future would be more costly. Securitisation becomes a zero-sum game if the savings from securitisation finance are offset by the higher costs of subsequent funding.

Whether securitisation finance is a zero-sum game or not is an open question. Even if it is assumed that the bank has securitised its best assets it does not necessarily follow that the bank has become riskier since it will depend on what the manager does with the funds raised through securitisation. A manager investing in assets with a lower risk will not increase the risk profile of the bank; and therefore the cost of subsequent finance will remain unchanged. Indeed the gains (in the form of savings) from securitisation finance could be so large as to more than compensate for the higher cost of subsequent finance.

Some of the empirical tests reviewed in Chapter 5 examine changes in the risk profile of the securitising bank after securitisation has taken place: Pavel (1988) did

[132] Banks risk neutrality can be due to the presence of deposit insurance. Also less-capitalised banks can be assumed to be riskier than better-capitalised banks.

not find any significant change in the risk profile of securitising banks; James (1989) reported the absence of any relationship between a bank's past securitisation activities and its funding costs.

It is out of the scope of this thesis is to investigate what happens to the subsequent finance of the securitising banks after securitisation has taken place. However Chapter 7 does consider the wealth effects of securitisation announcements.

6.2.2 The "Comparative Advantage Hypothesis"

Securitisation can be interpreted as an alternative to intermediation rather than as a funding source. The key question is why some assets or markets are securitised rather than intermediated. The main argument proposed in the literature is that banks, which still have an advantage in originating loans, might have lost their advantage in funding and warehousing some types of loans. Some of the studies reviewed in Chapter 4 emphasised the dis-intermediation aspects of asset securitisation.

Pavel (1986) and Cumming (1987) suggest that banks use securitisation because of the very high costs of traditional intermediation. Cumming notes that the increase in the costs of financial intermediation is due to the imposition of capital requirements, higher risks of intermediating, and a more competitive environment.

Pavel and Phillis (1987), Pennacchi (1988), Flannery (1989), Jaffee and Rosen (1990), Passmore (1992) and Twinn (1994) argue that the banks funding disadvantage is a consequence of the extra costs paid by banks in the form of forgone interest rate from holding required reserves, deposit insurance premiums, and the imposition of minimum capital requirements higher than what a bank would hold in the absence of regulation. Securitisation is used to lower intermediation costs by avoiding those regulatory costs and by transferring assets risk to third parties.

Berger and Udell (1993) contend that improvements in monitoring technology permit traditional bank borrowers to move to direct investors' debt through securitisation.

[133] See Section 3.3 for a discussion of moral hazard induced by banking regulation

The disintermediation created by securitisation occurs because banks have lost the information advantage that they had with respect to those borrowers.

A depository institution securitising a pool of assets is unbundling the functions related to intermediating those assets. The depository institution chooses to maintain some of the "qualitative asset transformation" functions and to transfer the remainder to other economic agents. The most important ones being transferred is the finance and warehousing of the assets, which involves providing the capital and assuming all the risks (credit, interest, prepayment, etc.) attached to providing the finance. An efficient manager will only act in this way when funding the assets on-balance is no longer optimal: the all-in[134] funding cost is higher than the assets return. Thus, depository institutions securitise loans for which they have no comparative advantage in funding.

The depository institution could sell the assets instead of securitising them, or it could simply withdraw from that particular segment of the market, if investing in that segment is no longer profitable. However, if it still has the originating advantage, and wants to keep servicing the assets to exploit the customer base, it will prefer securitisation. Securitisation accomplishes the benefits of intermediation without tying up capital or assuming risks. The advantage in originating and servicing loans could rest in the extensive branch network of depository institutions, which reduces the costs of producing information about local customers, and facilitates servicing activities. Customers' relationships may be valuable because of the potential to cross-sell products, and also because there may be growth opportunities associated with the assets that the intermediary may want to exploit in the future. Securitisation is not like "gains trading", i.e. selling assets that have market value higher than book value, because they have "hidden assets" associated with them, so the seller can cash in that hidden value. The difference is that with securitisation the asset seller seizes that hidden value, and sells the funding because some other institution, in this case the capital markets, can provide it more efficiently[135].

[134] The all-in funding cost also includes risk hedging costs and regulatory requirements.
[135] In securitisation transactions the loans are usually transferred to the SPV at their balance-sheet value. When selling a loan, the buyer may pay a premium over the book value of the loan, because of the intangible hidden assets (customer relationships, present value of future growth opportunities) acquired with the loan. In securitisation the seller retains the hidden assets.

As mentioned above, transferring the assets finance through securitisation has two aspects: the provision of funds and the assumption of the risks by another economic agent. There are several explanations that seem plausible to account for the loss of depository institutions' comparative advantage in performing those functions:

i. Traditional funding sources are more costly because there is more competition. The depository institutions have lost the easy access to funds, which sustain their comparative advantage in the intermediary function, and particularly since the beginning of the 1990's compete with other intermediaries and the market for savings.
ii. Regulatory taxes with respect to certain assets or liabilities reduce the profits of undertaking them. It has been argued that the fixed minimum capital requirements and the broad risk categories imposed on the Basle Agreement put banks at a disadvantage when competing with non-bank financial intermediaries and capital markets[136]. Risk-based capital requirements may have modified the type of loans that can be profitably financed by depository institutions. If "regulatory taxes" are very high it is possible that a non-regulated financial intermediary[137] (like a centralised mortgage lender) can originate, service, warehouse and fund loans cheaper than depository institutions
iii. Risks in certain markets or assets, and hedging costs related to those risks, have become too large.

The interest margin, the difference between the rate received from loans and the rate paid on deposits, should cover for the risk adjusted-costs of intermediation. A falling margin may be a direct effect of high competition and lower profitability in certain markets; and the higher risk-adjusted regulatory and/or market capital requirements for depository institutions make intermediation more expensive. Therefore, a depository institution will be willing to securitise assets when falling spreads, and/or higher risk adjusted capital costs do not guarantee coverage of the costs of intermediation: the risk-adjusted return on the loans is lower than the banks cost of

[136] Jackson et al. (1999) contains an excellent review of the literature that analyses this issue.
[137] A non-regulated intermediary is a non-bank (under Bank of England supervision) or a non-building society (under the Building Society Commission). Non-depository financial intermediaries are not authorised to take deposits from the public, but they can lend money. They forego a funding source, deposits but do not have to meet regulatory requirements.

capital. The depository institution has lost its comparative advantage in funding certain types of loans. Securitisation would not be related to the balance-sheet of issuer, but to its comparative advantage in intermediating certain assets: if other types of institutions or the market can provide the funding more efficiently, it will be in the interest of the depository institution to securitise those assets.

6.2.3 Summary of the hypotheses

Financing Hypothesis: According to the financing hypothesis, the use of securitisation would be related to the depository institution's funding needs. Depository institutions would use securitisation when the alternative funding sources are not available or too expensive. If the financing hypothesis is correct securitisation should not bring about any fundamental change in the structure of the financial services, because securitisation is just an additional funding source.

Comparative Advantage Hypothesis: If the comparative advantage hypothesis is correct, the decision to securitise assets is taken irrespective of the firm's funding position. The use of securitisation is related to a decline in the depository institution role as an intermediary. The functions of depository institutions are unbundled, and new financial intermediaries and/or the capital markets assume the functions they can deliver more efficiently. Securitisation will be part of a general process of disintermediation[138].

6.3 DATA AND METHODOLOGY

To examine the validity of the two hypotheses proposed in the previous section the financial ratios of a sample of British banks and building societies are analysed. The sample contains a total of 11 banks and 13 building societies. The institutions included in the sample were chosen because there was data available, and because they are representative of the sector: rather than just choosing the largest institutions

[138] For example, the US mortgage market is becoming increasingly disintermediated. The government subsidies to securitisation probably caused firms to lose their advantage in funding and warehousing mortgage loans. Some of the depository institutions involved in these functions could be changing from portfolio lenders to mortgage originators.

it was considered better to include a sample with institutions of all sizes. Also the sample includes all the UK depository institutions which had engaged in securitisation between 1990 and 1997[139]. As seen in Chapter 2, building societies are allowed to use securitisation, although it has not been as popular as amongst banks. The Building Societies Commission was concerned with the problems that could arise by securitising assets that gave borrowers membership rights. So far the membership issue has not been a problem because the societies have securitised mortgages originated through associated companies or bought from other lenders[140]. Table 6.1 lists the depository institutions included in the tests and the year they engaged in securitisation.

[139] The only depository institution left out is The Savings Bank, which securitised a pool of assets in 1989. Data was not available for that year.

[140] For example Bradford and Bingley securitised part of the mortgages it acquired from Lloyds TSB when it purchased the Lloyds mortgage subsidiary, Mortgage Express.

Table 6.1 Sample of Depository Institutions

Banks			Building Societies		
Bank	Years	Securitisation	Building Societies	Years	Securitisation
Abbey National Plc	1990-1997	1998	Alliance & Leicester PLC	1990-1996	
Bank of Scotland	1993-1997	1996, 1998	Birmingham Midshires Building Society	1989-1996	1996
Barclays plc	1990-1997	1993, 1994	Bradford & Bingley Building Society	1990-1997	1998
HFC Bank plc	1992-1997	1994, 1995, 1996, 1997	Bristol & West plc	1989-1996	1994, 1995
Lloyds Bank plc	1991-1997		Britannia Building Society	1990-1996	1996
Midland Bank plc	1996-1997		Chelsea Building Society	1991-1997	
National Westminster Bank Plc	1990-1997	1992, 1993, 1995, 1996, 1997	Cheltenham & Gloucester PLC	1989-1996	
Royal Bank of Scotland plc (The)	1993-1997		Leeds Permanent Building Society	1989-1994	1994
Standard Chartered Plc	1991-1997	1992, 1993, 1994	Nationwide Building Society	1990-1997	
United Bank of Kuwait plc (The)	1992-1997	1995, 1996, 1997	Northern Rock Building Society	1989-1996	
Yorkshire Bank Plc	1993-1997		Portman Building Society	1990-1995	
			Woolwich Building Society	1991-1996	
			Yorkshire Building Society	1991-1997	

Financial ratios from these institutions were provided by *IBCA*[141]. Data on securitisation activities was obtained from Extel (The Financial Times information services), the Bank of England and Reuters.

The objective of the econometric study is to analyse *ex-ante* the reasons why a depository institution securitises assets. A logit model is used to predict the probability that a bank or building society would securitise assets. A logit model is a binary choice model in which a depository institution either "securitises or does not", and the alternative chosen depends on the institution's characteristics.

$$\Pr ob(Y=1) = \frac{e^{\mathbf{b'X}}}{1+e^{\mathbf{b'X}}} \tag{6.1}$$

"Y" is the binary (0/1) dependent variable (non-securitisation/securitisation). **X** is a matrix containing a set of factors that, according to the hypotheses proposed, influence the decision to securitise.

In each econometric model, and for each depository institution, the probability of securitising assets depends on variables that proxy the two hypotheses, and these variables are lagged with respect to the issuance of asset-backed securities[142]. Thus each depository institution considers its position at the end of the accounting year, and in view of that position, decides whether to securitise assets or not in the following accounting year. Accounting year "t" spans from 1 April, year "t" until 31 March, year "t-1":

$$\Pr ob(\text{sec}\,uritisation)_t = f(accounting)_{t-1} \tag{6.2}$$

Table 6.2 provides a description of all the variables used in the logit regressions:

[141] IBCA (now Fitch-IBCA) is international credit rating agency. It collects balance-sheet data and financial ratios from financial intermediaries across the world, and makes these data comparable.

Table 6.2 IBCA Explanatory Variables

AQ1	Loan Loss Reserves / Gross Loans
K1	Equity / Tot Assets
K3	Equity / Customer & Short-Term Funding
NIM	Net Interest Margin
NIR	Net Interest Revenue / Average Assets
OOI	Other Operating Income / Average Assets
NIEX	Non Interest Expenses / Average Assets
PRET	Pre-Tax Operating Income / Average Assets
ROA	Return On Average Assets
ROE	Return On Average Equity
REP	Recurring Earning Power
L3	Liquid Assets / Customer & Short-Term Funding

Where,

Average Assets or Average Equity for "year t" is calculated by taking the arithmetic mean of the value at the end of "year t-1" and "year t".

Net Loans: Gross Loans minus Loan Loss Reserve.

Net Interest Revenue: the interest received minus the interest paid by the depository institution.

Net Interest Margin: the Net Interest Revenue divided by Average Earning Assets.

Other Operating Income: Fee and Commission Income plus Dealing Income.

Non-Interest Expenses: includes Overheads (Personnel and Other Non-Interest Expenses) plus Loan Loss Provisions.

Pre-tax Operating Income: the Profit Before Taxes Minus Income from Associates and Exceptional Items.

ROA and ROE: are calculated by dividing Net Income (Pre-Tax Profit Minus Taxes) by Average Assets and Average Equity respectively.

Recurring Earning Power: is the ratio of (Profit Before Taxes plus Loan Loss Provision minus Income from Associates and minus Exceptional Income) to Average Assets.

[142] Also capturing the effects of securitisation on the explanatory variables must be avoided. For instance, after securitisation, ROA increases (other things equal) because assets have been moved off the balance sheet. The same happens to the capital ratio.

According to the "financing hypothesis" a depository institution willing to raise funds and to avoid the adverse selection costs of raising external finance would use securitisation more often. The adverse selection costs of raising funds increase when the firm raising funds has low quality assets and poor performance because in both cases the market information about the institution is unfavourable. If the institution is highly leveraged securitisation might provide a better funding source because the institution can prioritise the claims against its assets. The depository institutions would prefer securitisation finance when it provides access to capital markets in better terms than the terms achievable by the institution's unsecured debt. Therefore low quality depository institutions would engage in securitisation finance more often than higher quality ones. The following proxy variables are used to test the validity of this hypothesis:

- Leverage and gearing: Leverage is measured by ratios K1 (equity/total assets) and K3 (equity/customer and short term funding). A high leverage or gearing ratio is expected to increase the probability of securitisation. Stanton (1998), Berger and Udell (1993), Pavel and Phillis (1987) use similar ratios to proxy for leverage.
- Operating Performance: the institutions' performance is measured by ROA (return on assets); ROE (return on equity); PRET (pre-tax operating income/assets) and the institutions' recurring earning power, REP. Poor performance should increase the probability of using securitisation as a funding source because the market perceives the institution as risky. Berger and Udell (1993) employ similar variables to explain the relationship between loan sales and banks' risk.
- Asset Quality: the quality of the depository institution's portfolio is measured by ratios AQ1 (loan loss reserve/gross loans). The lower the quality of the loan portfolio, the riskier the firm, the more expensive the use of external finance and therefore the higher the probability of using securitisation. Pavel and Phillis (1987) use similar ratios to proxy for asset quality.
- Liquidity measures: Liquidity is measured by ratio L3 (liquid assets/customer and short-term funding). The liquidity of a depository institution determines its ability to meet its immediate funding needs, and also to be able to manage unexpected funding requirements. Firms prefer to use internal cash to finance

projects. A depository institution with enough liquid assets will have fewer incentives to securitise than one with less internal cash. Stanton (1998) proxies liquidity by the ratio of securities to total assets.

According to the "comparative advantage hypothesis" a depository institution that has lost its comparative advantage in intermediating certain assets or markets will securitise them. The following proxies are used to test this hypothesis:

- Net Interest Margin and Net Interest Revenue (Net Interest Margin/Average Assets) represent the difference between the yield on assets and the interest cost of liabilities. These ratios measure the profits derived from traditional intermediation, the institution's endowment income, which is the income earned from non-interest bearing deposits and the intermediation margin (Heffernan 1996). The higher these ratios the more profitable to hold the assets on balance sheet, and consequently the lower the probability of securitisation. Also if these ratios are low the institution might be moving away from traditional activities to fee income and off-balance-sheet activities which do not support regulatory taxes.
- Comparative advantage in originating loans: different ratios are employed to measure the institution's comparative advantage in performing the intermediation function. The first one is NIEX (Non Interest Expenses/Average Assets). The lower this ratio the higher the institution's comparative advantage in originating and servicing loans and the higher the likelihood of disintermediation type securitisation. A depository institution that has an advantage in originating loans can exploit it by securitisation, because securitisation enables the bank to leverage the origination function. Recall Pavel and Phillis (1987) use a similar proxy for comparative advantage and find that this ratio has a large negative impact on the likelihood of selling loans. OOI ((Fee and Commissions + Dealing Income)/Assets) which measures the non-intermediation income, is also used: the higher this ratio the greater the likelihood of securitisation because the higher the income the institution derives from non-traditional activities.

6.4 ANALYSIS OF EMPIRICAL RESULTS

Different logit equations were estimated to test the hypotheses. The hypotheses are tested independently, this allows to choose which one of them better explains securitisation by UK depository institutions. The first set of results presented in Table 6.3 includes both types of depository institutions in the sample, banks and building societies.

Table 6.3 Logit Regressions on Why Depository Institutions Use Securitisation?

	(1)	(2)	(3)	(4)	(5)	(6)
constant	3.30**	-1.38	3.51**	-2.25**	-3.27**	-3.21**
NIM				-0.61*	-0.58	-0.58
NIEX				0.8**	0.62*	0.63*
OOI				-0.047		-0.38
K1		-0.49			0.19	0.18
AQ1	0.29**	0.29**	0.28**		0.20*	0.21*
ROA	-0.62	-0.79	-0.65			
K3	0.16**	0.33**	0.16**			
REP	-0.14					
L3	0.25		0.28			
N	162	162	162	162	162	162
Max. Log Likelihood	-61.71	-61.21	-61.78	-64.46	-62.57	-62.57
Goodneess of Fit	84.50%	85.18%	85.80%	83.95%	83.30%	83.30%
Pseudo R-sq	13.51%	14.21%	13.41%	9.65%	12.30%	12.30%

The sample includes 11 commercial banks and 13 building societies between years 1989-1997 (see Table 6.1).
** (*) indicates that the statistic is different from zero at the 95% (90%) level of confidence.
The Goodness of Fit measures the percentage of observations of the independent variable correctly predicted by the fitted equation.
The Pseudo R-square compares the maximised log-likelihood value provided by the model with the maximised log-likelihood value of a logit regression in which the only explanatory value is the constant term[143].

The first three regressions [(1) to (3)] test the financing hypothesis; the last three regressions [(4) to (6)] test the comparative advantage hypothesis. In the first three regressions, the variable that proxies for asset quality is always significant and has the correct sign. As predicted by the financing hypothesis low quality institutions

[143] Pseudo R-Square= 1- $[(LL_0)/ (LL_M)]$, where LL_0 is the maximised log-likelihood value of a regression in which the only explanatory variable is the constant term, and LL_M is the model's maximised log-likelihood value.

(with high AQ1) engage in securitisation more often. The variables that proxies for leverage are either non-significant (K1), or are wrong-signed (K3). The proxies for the institution's performance, return on assets (ROA) and recurring earning power (REP) are not significant, nor is liquidity (L3).

In regressions (4) to (6), which test the comparative advantage hypothesis, the net interest margin is significant in one case (regression 4) and it always has the right sign. The level of non-interest expenses, which proxies for the comparative advantage in originating loans, is always significant but without the expected negative sign. Recall this hypothesis would predict that institutions with low level of non-interest expenses have a comparative advantage in originating loans, and that advantage could be exploited by using securitisation. The other proxy for the institution's comparative advantage (OOI) is significant but it does not have the expected positive sign.

Measures of goodness of fit reported for each test allow a comparison between the two hypotheses. Three different measures are reported: Maximised log-likelihood, Goodness of Fit and the Pseudo R-squared. The measures are significantly better for the regressions that fit the financing hypothesis.

A non-nested test based on the Akaike Information Criterion is also employed to identify the optimal model. Two regression models are said to be non-nested if the regressors of one model cannot be expressed as an exact linear combination of the regressors of the other model. The Akaike Information Criterion to choose between non-nested models (M1 and M_2) is as follows:

$$AIC\ (M_1{:}M_2)=LL_1-LL_2-(k_1-k_2) \qquad (6.3)$$

Where,
LL is the maximised log-likelihood value and k is the number of regressors.

M_1 will be chosen over M_2 if AIC $(M_1{:}M_2)>0$. Otherwise M_2 will be chosen[144].

[144] (Pesaran M.H. and Pesaran B. (1997): *Working with Microfit 4.0: Interactive Econometric Analysis*, (page 354) Oxford University Press)

A comparison of the best regression (the one with the largest maximised log-likelihood value) for each hypothesis is done:
AIC (regression 2:regression 6) = 2.36, therefore the financing hypothesis is preferred[145].

The results from the Akaike Information Criterion and the comparisons between the different measures of goodness of fit point to the financing hypothesis to be the better of the two models. However some of the variables that proxy for the financing hypothesis have the wrong sign or are not statistically significant. A closer examination of the results from the logit regressions shows that the equations always fail to predict the securitisation transactions done by building societies. This could suggest that there are important structural differences in the depository institutions that the logit models cannot capture.

Table 6.4 reports difference in means and between banks' financial ratios and building societies' financial ratios.

Table 6.4 Firm Characteristics for 11 Commercial Banks and 13 Building Societies.

		Banks	Building Societies	Difference in means	
		Mean	Mean	P-value two sided t-test	
AQ1	Loan Loss Res / Gross Loans	3.15	0.77	0.00	**
K1	Equity / Tot Assets	5.33	4.90	0.09	*
K3	Equity / Cust & ST Funding	7.42	5.43	0.00	**
NIM	Net Interest Margin	3.61	2.06	0.00	**
NIR	Net Int Rev / Avg Assets	3.25	2.01	0.00	**
OOI	Oth Op Inc / Avg Assets	1.37	0.61	0.00	**
NIEX	Non Int Exp / Avg Assets	3.91	1.66	0.00	**
PRET	Pre-Tax Op Inc / Avg Assets	0.72	0.96	0.07	*
ROA	Return On Avg Assets (ROAA)	0.85	0.64	0.02	**
ROE	Return On Avg Equity (ROAE)	16.17	13.22	0.03	**
REP	Recurring Earning Power	1.55	1.32	0.07	*
L3	Liquid Assets / Cust & ST Funding	21.72	19.38	0.04	**

The data cover the years 1989 to1997 (see Table 6.1).
** (*) indicates that the statistic is different from zero at the 95% (90%) level.
P-value gives the probability of the difference in means being equal to zero.

[145] According to equation (6.3), AIC (regression 2 : regression 6) = -61.21+62.57-5+6 = 2.36

The difference in means between the two types of institutions is statistically significant for all the financial ratios. It is possible that because a larger proportion of banks engage in securitisation relative than building societies, the econometric models are picking up differences between the two samples rather than the incentives to engage in securitisation which should be reflected in the differences between securitising and non-securitising institutions. For example the banks' asset quality ratio (AQ1) is worse (higher) than the building societies'. Building societies have higher leverage as measured by K1 and K3, and their performance as measured by ROA, ROE and REP is lower than that of banks. Only the ratio of pre-tax operating income-to-average assets is better for building societies. The balance sheet of building societies is more liquid as measured by L3. Also banks operate with higher interest margins, but they have a higher level of non-interest expenses.

To avoid the problem of pooling banks and building societies, and to gain more information on the relative superiority of the two hypotheses, the regressions which test the comparative advantage hypothesis were run for a reduced sample that includes only banks[146]. Table 6.5 reports the results of the best[147] of those regressions.

[146] The next chapter investigates in detail the role of securitisation as a funding source for banks; hence regressions which test the financing hypothesis are not reported here since they are extensively covered in next chapter.

Table 6.5 Logit Regressions on Why Depository Institutions Use Securitisation? Comparative Advantage Hypothesis

	(1)	(2)
constant	-0.77	-2.64
NIM	-0.48	-0.55
NIEX	0.59	0.46
OOI	-0.1	
K1		0.29
AQ1		0.98
ROA		
K3		
REP		
L3		
N	67	67
Max. Log Likelihood	-39.28	-38.16
Goodneess of Fit	68.65%	68.65%
Pseudo R-sq	3.81%	6.56%

The sample includes 11 commercial banks between years 1989-1997 (see Table 6.1).
** (*) indicates that the statistic is different from zero at the 95% (90%) level.

Regression (1) and (2) test the validity of the comparative advantage hypothesis. In both cases none of the variables is statistically significant, and the measures of goodness of fit are very low. Therefore the comparative advantage hypothesis can be rejected for UK depository institutions.

6.5 CONCLUSIONS

This chapter has investigated the empirical validity of two general hypotheses aimed at explaining why British depository institutions engage in securitisation. The hypotheses analysed here are treated as contrasting hypotheses, so they are tested independently with the objective to determine which one of them explains better why UK depository institutions engage in securitisation.

[147] The results from the regressions with the worst goodness of fit measures are not reported.

The vast majority of the theoretical and empirical research on securitisation has been done in the US. One of the arguments advanced by the literature to explain the use of securitisation is the comparative advantage hypothesis: a depository institution engages in securitisation because it has lost its comparative advantage in loan intermediation. The involvement of the US government in mortgage securitisation is a very important factor when examining securitisation across countries. It can be argued that depository institutions participating in the US mortgage market have lost their comparative advantage in funding and warehousing mortgages, especially when the funding and warehousing of mortgages is securitised with the aid of federal agencies which substitute the risk of the mortgages for their own risk. A similar type of government subsidies is not found in non-mortgage US securitisation or in securitisation outside the US. That opens the door for an alternative reason to explain why depository institutions engage in securitisation, and that is that securitisation could be used as an efficient source of finance.

The econometric analysis reported in this chapter finds no evidence to support a relationship between the growth of securitisation in the UK financial sector and a decline in the intermediary function of banks and building societies. This means that a general process of disintermediation like the one observed in the US mortgage market is not likely to happen in the UK.

The use of securitisation appears to be better explained by the quality of the financial institution. The econometric results suggest that poorly performing risky institutions or institutions with high information asymmetries are more likely to engage in securitisation. For these institutions raising external finance would be relatively costly; and according to the "financing hypothesis", the use of securitisation finance by these institutions could have resulted in substantial savings.

The analysis of depository institutions' involvement in securitisation cannot be completed without considering which banks engage in securitisation. Once the financing hypothesis is accepted as the most plausible explanation to account for banks securitisation activities, it is necessary to investigate which type of banks would find this type of finance more attractive, and why. Also what are the

consequences for the securitising bank's shareholders? These issues are addressed in next chapter, Chapter 7.

CHAPTER 7: THE ROLE OF SECURITISATION IN THE CAPITAL STRUCTURE OF BANKS

7.1 INTRODUCTION

Chapter 6 showed that UK banks use securitisation as a funding source. Once the reason for securitisation has been established it is necessary to address a second question, "which banks securitise". In this case the issue under examination is securitising banks' quality, and ex-ante and ex-post characteristics. This chapter attempts to answer this question.

To do so, the role of securitisation in the capital structure of banks is investigated. Three aspects related to the issue of any security are analysed: first, the ex-ante characteristics of the banks choosing this funding source; second, the market reaction to the security issues announcement; and third, the ex-post characteristics of the issuing banks. The results indicate that banks with worse capital ratios, low quality assets and poor performance are more likely to use securitisation. It is also found that agency costs of managerial discretion play a role in explaining an identified negative market reaction to the securitisation issue and the subsequent bank investment behaviour.

As will be seen in the next section, the benefits of securitisation have made the asset-backed market an increasingly important funding source. The use of securitisation finance by banks is also related to banking regulation. Banks have to observe minimum capital ratios, potentially causing capital constrained banks to pass up profitable investment opportunities. A bank required by regulators to boost its risk weighted capital-to-assets ratio can increase the numerator, by issuing equity and within certain limitations subordinated debt; or it can reduce the denominator by

selling or securitising assets[148]. In this sense securitisation could be considered as a substitute for equity issue. On the other hand, asset-backed securities are very similar to secured debt, since specific assets are pledged to repay investors. Finally, funds raised through securitisation have similarities with internal cash because they do not limit management's course of actions in the way external funds would do.

The chapter is organised as follows: the following section introduces the security issue decision and the distortions surrounding it; section 3 presents the hypotheses to be tested; section 4 analyses banks' ex-ante characteristics; section 5 uses event study methodology to analyse the market reaction to the securitisation announcement; section 6 examines the bank's ex-post characteristics, and section 7 concludes. The main contribution of this chapter to the literature is that for the first time securitisation finance is examined in the context of the capital structure of banks.

7.2 THE SECURITY ISSUE CHOICE AND INVESTMENT DISTORTIONS

Modigliani and Miller (1958) established that in a world with perfect capital markets, firms' capital structure is irrelevant and financing does not matter: when presented with new investment opportunities, firms always invest in positive-NPV projects and reject negative-NPV projects. The choice of financing for the project has no influence on the investment decision.

In the real world however, capital markets are not perfect and firms face different types of transaction costs and information frictions: firms might not be able to raise funds at a fair price and/or managers might seek their own goals[149] rather than those of shareholders. As a result of these financial imperfections firms suffer from two types of distorted investment incentives: overinvestment, that is, undertaking negative-NPV projects, and underinvestment, that is, passing-up positive-NPV projects. These distortions reduce the value of the firm and therefore, shareholder

[148] Provided that the securitisation is non-recourse.
[149] For instance managers may want to maximize size at the cost of shareholders' wealth; or they may be more risk averse than shareholders.

wealth. The choice of financing matters because the decision to invest on a particular project depends not only on the project characteristics but also on the way the project is financed.

Traditionally the finance literature focused on analysing the funding-investment decision with regard to equity and debt. Assets sales and securitisation finance have been rarely considered. Only a few theories stand out as explanations for why firms choose to finance in a specific way, and which investment distortions, if any, are important. The six major theoretical contributions in this area are outlined in the remainder of this section.

1. Pecking Order Theory: Myers and Majluf (1984) suggest that adverse selection due to information asymmetries between managers and investors causes equity prices to drop at the announcement of a new equity issue. The market believes that bad firms dominate the population of equity issuing firms so they discount the value of all issuing firms. A firm may pass up a valuable investment opportunity (and therefore underinvest) rather than issuing undervalued stock. They argue that firms follow a "pecking order" when choosing finance. A firm with a valuable investment opportunity will prefer to use internal funds, and if it has to use external funds it will issue the safest or most senior security because it will be the less susceptible to information asymmetries[150]. Firms that can finance with low risk debt do so; otherwise they issue equity only when they have good investment opportunities or when the issue is not very informative.

Therefore managers will only issue equity when they have exhausted the firm's capacity to sell low risk debt. Also they will time equity issues for times at which information asymmetry is low[151] to avoid issuing uderpriced equity. If the manager has good information about the firm's prospects, it will issue the security with lowest risk, the one with lowest sensitivity to the manager's private information and it will use the proceeds to invest in positive NPV projects (Myers 1984).

[150] Jung, Kim and Stulz (1996) notice that the pecking order hypothesis rests on the assumption of information asymmetry. With asymmetric information (which makes equity issues more expensive), if the firm has good investment opportunities, shareholders and managers incentives should be aligned, and the firm would follow the pecking order hypothesis when raising finance.
[151] The outsiders' valuation of the firm and the managers' valuation to the firm are close.

2. Agency Costs: If managers act in their own interest rather than in the interest of shareholders there would be "agency costs" of managerial discretion: equity issues will only be valuable for firms with good investment opportunities. If firms do not have good investment opportunities, the liquidity raised by the equity issue can be used by managers to pursue their own objectives. Managers investing in negative-NPV projects prefer to issue equity because debt reduces the resources under management control[152]. Debt helps to reduce these agency costs because the managers' actions will be monitored by debtholders, and managers will have less liquidity to undertake their own projects since the firm's cash-flow would have to be used to repay the debt. The use of external funding will also expose managers to the discipline of capital markets, so their objectives will be more in line with those of the shareholders (Stulz, 1980).

3. Timing Considerations: There may also be "timing" considerations affecting financing decisions. Ritter (1991) indicates that firms go public near the peak of industry-specific "fads" and that they time issues to reduce their cost of capital. Loughran and Ritter (1995) argue that firms time their equity issues to coincide with periods in which their shares are overvalued: managers acting on behalf of shareholders take advantage of private information about the firm to issue equity when it is overvalued by the market. Subsequent stock underperformance of issuing firms reflects the market realising that the firm was overvalued and adjusting its price accordingly.

4. Bank Regulation Effects: Bank capital regulation may also cause regulated banks to underinvest. Prudential regulation establishes minimum capital ratios and allows supervisory authorities to put pressure on bank managers to satisfy their standards. Capital adequacy depends on loan quality and possible future losses from bad loans, hence the authorities need to be convinced that loan loss and capital accounts can cover expected losses. If the examination process results in an increase of a bank's

[152] A negative NPV project would leave the manager with very little liquidity after debtholders are repaid.

"bad loans" the authorities will require the bank to increase its capital ratio[153], or reduce its operations. Being directed to reduce asset growth is a form of underinvestment because the bank may be forced to pass-up valuable investment opportunities (Slovin, Sushka and Polonchek, 1991). Williams-Stanton (1998) found that banks' underinvestment caused by capital regulation is more common during periods or in markets in which investment opportunities have been of lower than average quality because loan losses would have eroded the capital base of banks and more banks would have being recommended to reduce their operations.

In the UK, the Financial Services Authority (FSA) has established similar supervisory requirements:

> "The FSA carries out 'prudential' supervision of banks which includes determining whether they are financially sound]...[If there is a threat to depositors, the FSA has powers to take away a bank's authorisation, or to restrict its scope by requiring it to operate in a certain way or to limit its operations." (FSA, 1998a).
>
> "The FSA's continuing supervision of the banks it has authorised is conducted through the collection of information from statistical returns, through the reporting accountants' reports referred to above, by visits to banks and through regular formal interviews. The starting point is a systematic analysis of the risk profile of each bank, which then determines the supervisory strategy for the period ahead. Supervisors have to be satisfied that the downside is properly covered and the risks of the bank's failure reduced" (FSA, 1998b).

Flannery (1987) argues that bank regulators force banks with low capital ratios to write down bad loans, but they do not permit to reflect the increase in value of good loans: good loans are carried at book value. That reduces the amount of capital available to the bank. The only way for the bank to realise the appreciation in value of the good loans is to sell them. Banks with low capital ratios and high net charge-off (i.e. low quality assets), which could reduce further the capital base, should be more likely to sell loans.

[153] By raising external equity, or by improving profitability enough so as to generate more internal equity.

5. Agency Costs of Debt: High leverage[154] further distorts the shareholders investment incentives[155] because of the agency cost of debt. Assuming that management acts on behalf of shareholders, the decision to undertake a new investment depends on whether investing in the project creates value and transfers wealth from shareholders to debtholders. The decision to invest is determined by the characteristics of the project and by the way it is funded (Myers, 1977). The value of the equity of a leveraged firm is equal to the value of the firm's assets minus the market value of its debt. Merton (1973) establishes that the value of the debt falls as the firm risk increases. Shareholder's limited liability means they are willing to accept negative-NPV projects if they sufficiently increase the risk of the firm, and therefore reduce the market value of the firms' debt; whereas they would reject positive-NPV investments which do not add enough to the firms' risk. Underinvestment is more acute when the probability of failure is high and is less severe for firms that have relatively good investment opportunities.

Risk-based capital regulation prevents banks from compensating decreases in assets risk with increases in financial leverage because it establishes a negative relationship between the amount of leverage permissible and the level of risk of the individual loans in the bank's portfolio. In order to increase leverage the insured bank has to reduce assets risk.

Another agency cost of debt is the asset substitution problem described by Jensen and Meckling (1976). This can be considered as a form of overinvestment since shareholders substitute high risk projects for low risk ones in order to expropriate wealth from debtholders.

6. Moral Hazard of Deposit Insurance: Finally, moral hazard associated with partial deposit insurance will induce some banks to undertake excessive risks and to overinvest. As mentioned above shareholders in any firm have an *incentive to* expropriate wealth from debtholders. Debtholders use different measures to avoid this such as monitoring or restrictive bond covenants. Yet, bank depositors

[154] Leverage is defined as the ratio of debt-to-equity.
[155] As mentioned above shareholders should undertake all positive NPV projects and reject all negative NPV projects.

(debtholders) have very few incentives to monitor shareholders because of the protection given by deposit insurance.

To summarise, banks face the same investment distortions as any other firm. However these investment distortions could be more pronounced for banks, and the correct set of incentives more difficult to restore.

7.3 OUTLINE OF THE HYPOTHESES

The remainder of this chapter investigates what role asset securitisation plays in the capital structure of banks; and whether financing by securitisation contributes to restore shareholders' and managers' correct investment incentives. The hypotheses presented in this section refer to the investment distortions outlined in the previous section and how they are affected by using securitisation finance:

Before outlining the hypotheses some characteristics of securitisation finance are briefly summarised below[156]:

- Securitisation goes one step further than pure loan sales because it implies a transformation of the assets: the assets are pooled and repackaged into a new security format.

- Funds raised through securitisation are exposed to fewer information asymmetries than funds raised by selling whole loans or by using debt and equity. Either it may be easier to convey investors information about a specific pool of assets than about the whole bank, or by securitising assets the need to inform investors is reduced[157].

- Securitised assets are isolated and the investor's return is a function of the cash flow and risk of the assets. Securitisation is similar to secure debt because

[156] Different aspects of securitisation have been extensively covered in Chapters 2 and 3.
[157] This effect could be achieved by using credit enhancement and rating the securities. Firms could also credit enhance and rate their debt, but it might be cheaper to do that for a specific pool of assets.

specific assets are earmarked to repay investors, and new debtholders cannot expropriate wealth from shareholders or old debtholders.

- Finance raised by securitisation has common features with the use of internal funds. As with internal funds there is little monitoring by outsiders. In securitisation investors do not monitor the bank because the assets have been removed from the banks' balance sheet. The bank usually continues to service the assets, which pays fee income, but because investors in asset backed securities do not have recourse to the bank they do not monitor the bank so closely as in the case of normal debt or equity. Managers are not restricted by debt covenants and repaying the investors in asset-backed securities does not deplete the firm free cash flow.

7.3.1 Hypotheses

1. Securitisation could help to alleviate the underinvestment incentives that arise when a bank has risky debt outstanding. The underinvestment problem occurs because shareholders will pass up profitable investment opportunities (i.e. underinvest) if existing depositors and other debtors receive a disproportionate share of the benefits from undertaking the new investment opportunity. Undertaking the investment opportunity would have implied a wealth transfer from shareholders to debtholders[158], hence shareholders underinvestment incentive.

The underinvestment problem is more acute if the bank is likely to default since in that case the benefits for existing depositors would be larger. By investing in positive NPV projects, depositors benefit from either a reduction in the probability of default, or an increase in the cash flow in the event of default.

Securitisation reduces wealth transfers between shareholders and existing depositors. Recall the underinvestment theories reviewed in Chapter 5. James (1988) argues that by securitising assets the bank can sell new investors claims to loans that otherwise would accrue to existing depositors, therefore reducing wealth transfers between

shareholders and existing depositors. The use of loan sales will be more frequent in banks with binding capital requirements and higher levels of risk (higher probability of default on existing deposits). Flannery (1994) maintains securitisation will correct underinvestment incentives only when banks securitise newly originated assets.

Hypothesis 1: Underinvestment induced by leverage. If avoiding underinvestment distortions is the main reason for securitisation finance, a cross-section of securitising banks should, ex-ante, have the characteristics symptomatic of the underinvestment problem; high leverage, low profitability and low investment. Shareholders losses from underinvestment are larger if the bank has good investment opportunities[159]. The larger the losses from underinvestment the more likely the bank will adopt securitisation finance, so it is expected that the cross-section of securitising banks will have valuable investment opportunities. The market reaction to the issue should be positive because it is expected that the banks use the proceeds to undertake valuable investment opportunities[160]: securitisation allows a bank to invest in positive NPV projects which would not have been undertaken otherwise. Ex-post, the securitising banks will show an increase in investment. If banks will invest the proceeds in positive NPV projects, the quality of the bank portfolio should improve.

2. Securitisation can be viewed as a substitute to issuing equity to meet capital requirements. The choice between issuing equity or securitising assets depends on the managers' private information and market reaction to the issue announcement. According to the "timing" model a manager that believes the stock to be overvalued will issue equity, because even if the market reaction is negative it takes time to fully incorporate to the stock price the information conveyed by the announcement.

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[158] The interest rate paid to the debtholders would not be adjusted to reflect the lower risk of the bank as a consequence of this new profitable investment opportunity, hence the wealth transfer.

[159] The underinvestment losses are the losses from not undertaking the profitable investment opportunity, therefore the better the opportunity the greater the loss.

[160] Here it could be argued that if the bank has an incentive to securitise its best assets, and the market anticipates such incentive, then the market reaction would depend on the quality of the assets originated with the funds raised. However, assuming the bank uses securitisation to avoid underinvestment distortions (like with secured debt), then it is going to invest the proceeds in positive-NPV projects.

However, banks might be forced to improve capital ratios, by issuing equity or reducing operations at the request of supervisory authorities. Different studies have shown that the valuation effects of equity issues by banks in need of improving their capital ratios (involuntary equity issues) are not as negative as for banks with adequate capital ratios or firms in other industries (Cornett, Mehran and Tehranian, 1997). The explanation for this is that managers are not trying to take advantage of private information and to issue equity at the top of the market, rather they are forced by the regulatory authorities to boost their capital ratio.

A bank can also improve its capital ratio by securitising assets, i.e. by reducing the denominator of the capital ratio. Securitisation can also generate accounting gains from the sale if the book value of the asset is lower than the sale price. These gains increase the value of equity. If the use of securitisation is related to the need to improve capital ratio the market reaction should be similar to that of involuntary equity issues. The market sees securitisation as a substitute for an equity issue, and as a signal that the bank is in trouble[161]; but since the manager prefers to securitise rather than issue equity, that is also a signal that the stock is not overpriced. Otherwise, according to the timing model the bank should issue equity.

Hypothesis 2: Underinvestment induced by capital regulation. If banks securitise assets to improve their capital ratios, the cross-section of securitising banks should, ex ante, include the capital constrained ones, with low quality assets and poor investment opportunities because those would have further contributed to erode the capital base and prompted the intervention by the authorities. The market reaction to the securitisation announcement would be negative, although not as negative as the reaction to an equity issue announcement. Ex-post, banks should improve their capital ratios and increase investment.

3. According to the "pecking order" hypothesis, with information asymmetry, a manager maximising shareholder's wealth has an incentive to issue securities at a price higher than their real value. The market anticipates this behaviour and adjusts its valuation of the firm to the information conveyed by the security issue. The

[161] Regulators may have to intervene and the bank may be forced to stop lending if minimum capital requirements are no met.

adjustment will be higher the higher the sensitivity of the security values to the real value of the firm. Therefore, managers raising external finance to undertake valuable investment opportunities prefer to issue the security with the lowest information sensitivity.

Hypothesis 3: Pecking order. If avoiding information asymmetry costs is the main reason to use securitisation finance, a cross-section of securitising banks should, ex-ante, have high leverage[162], greater information frictions and good investment opportunities. The cheaper funds and increased liquidity associated with securitisation will be good for shareholders. Therefore a positive market reaction to the securitisation announcement would be expected. Ex-post the firm should increase investment.

4. If managers pursue their own objectives rather those of shareholders, securitisation is bad news for shareholders. Funds raised through securitisation give managers greater freedom to maximise the manager rather than shareholders wealth.

Hypothesis 4: Agency Costs Hypothesis. If banks with high agency costs of managerial discretion and poor investment opportunities use securitisation finance, the manager is likely to use the proceeds to invest in projects which do not increase shareholders' wealth but instead increase the manager's own utility[163]. The market reaction to securitisation would be negative. The subsequent performance of the bank would be expected to be low because the manager has incentives to overinvest and has fewer restrictions in doing so[164].

A summary of the hypotheses appears in table 7.1. In the next sections their empirical validity is jointly tested:

[162] Which might have exhausted their capacity to issue low risk-debt.
[163] For example the manager might want to maximize the banks' size.
[164] Funds for securitisation are like free-cash flow.

Table 7.1 Outline of Hypotheses on Which Banks Securitise?

Theory	Ex-ante Characteristics	Market Reaction	Ex-post Characteristics
Underinvestment induced by leverage	Good investment opportunities; high leverage; poor performance and low investment	Positive	Increased investment; better performance; and improved asset quality ratios
Underinvestment induced by capital regulation	Capital constrained; poor asset quality; low investment	Negative	Increased investment; improved capital ratios
Pecking order	High leverage; high information asymmetry; good investment opportunities	Positive	Increased investment; improved asset quality ratios
Agency Costs	High agency costs; poor investment opportunities	Negative	Poor performance

7.4 SAMPLE CONSTRUCTION AND DATA

To examine the validity of the hypotheses proposed in the previous section the accounting ratios and stock performance of eleven British and one Irish[165] retail banks for the years 1990 to 1997 are analysed. Building societies were not included in the sample because they are not allowed to raise equity finance, so some of the hypotheses outlined above cannot be applied to them. Also recall from Chapter 6 that there are some structural difference between banks and building societies which may influence the results from the tests. Table 7.2 provides a list of the banks included in the sample. As in the previous chapter the banks were chosen because of data availability and because they are representative of the market.

[165] The Bank of Ireland is included because they are very active in the UK mortgage market and have regularly used securitisation.

Table 7.2 List of Banks Used in the Econometric Analysis

Logit Regressions			Abnormal Returns	
Bank	Years	Asset-backed securities issue year	Bank	Asset-backed securities issue year
Abbey National Plc	1990-1997	1998	TSB	1988
Bank of Scotland	1990-1997	1996, 1998	NatWest	1992, 1993 (2), 1995, 1996 (2), 1997
Bank of Ireland	1994-1997	1994, 1997	Bank of Ireland	1988, 1994, 1997
Barclays plc	1990-1997	1993-1994	Barclays plc	1993-1994 (2)
HFC Bank plc	1996-1997	1997	Standard Chartered Plc	1990, 1992, 1993 (2), 1994
Lloyds Bank plc	1990-1996		Abbey National Plc	1998
Midland Bank plc	1996-1997		Bank of Scotland	1996, 1998
NatWest	1990-1997	1992, 1993, 1995, 1996, 1997	First National Bank	1992, 1993 (2), 1994 (2)
Royal Bank of Scotland plc	1990,1993-1997			
Standard Chartered Plc	1990-1997	1992, 1993, 1994		
United Bank of Kuwait plc	1993-1997	1995, 1996, 1997		
Yorkshire Bank Plc	1990-1997			

Accounting data were obtained from IBCA[166]. Data on securitisation activities was obtained from Extel (The Financial Times information services), The Bank of England and Reuters.

A list of the accounting data and financial ratios used in the econometric analysis is reported in Table 7.3.

Table 7.3 List of IBCA Accounting Data and Financial Ratios

AQ1	Loan Loss Reserve / Gross Loans
AQ2	Loan Loss Provision / Net Int Rev
AQ3	Net Charge off / Average Gross Loans
AQ4	Net Charge off / Net Inc Bef Ln Lss Prov
K1	Equity / Tot Assets
K2	Equity / Net Loans
K3	Equity / Customer & Short Term Funding
K4	Equity / Liabilities
K5	Capital Funds / Tot Assets
K6	Capital Funds / Net Loans
K7	Capital Funds / Customer & Short Term Funding
K8	Capital Funds / Liabilities
K9	Subordinated Debt / Capital Funds
OP1	Net Interest Margin
OP2	Net Interest Revenue / Average Assets
OP3	Non Interest Expenses /AverageAssets
OP4	Pre-Tax Operating Income / AverageAssets
OP5	Non Op Items & Taxes / Average Assets
ROA	Return On Average Assets
ROE	Return On Average Equity
DIV	Dividend Pay-Out
OP7	Income Net Of Distribution / Average Equity
OP8	Recurring Earning Power
OL1	Net Loans / Tot Assets
L2	Net Loans / Customer & Short Term Funding
L3	Net Loans / Total Deposits & Borrowing
L4	Liquid Assets / Customer & Short Term Funding
L5	Liquid Assets / Total Deposits & Borrowing
SIZE	Log assets
OFFTA	Off Balance Sheet Items/Total Assets
NETA	Non-Earning Assets/Total Assets
EATA	Earning Assets/Total Assets
GRNL	Percentage Growth in Net Loans
INVOPP	(Market Value Equity+Total Assets-Book Value Equity)/Total Assets

[166] Due to restrictions in the availability of data two of the banks used to analyze market reaction could not be included in the regressions which examine cross-sectional characteristics. First National Bank was bought by Abbey National in 1995 and it was dropped from the IBCA dataset; data for The Saving Bank (TSB) is included in the IBCA files but it had many gaps on important variables and had to be excluded.

Where,

Gross Loans: is Loans plus Loan Loss Provisions.

Capital Funds: is Equity plus Hybrid Capital and Subordinated Debt.

Recurring Earning Power: is the ratio of (Profit Before Taxes plus Loan Loss Provision minus Income from Associates and minus Exceptional Income) to Average Assets.

Net Loans: is Gross Loans minus Loan Loss Reserves.

Most of these variables have already been used in the literature. The following variables are employed to test the hypotheses outlined above:

1. Percentage Growth in Net Loans (GRNL): Net Loans equals Gross Loans minus Loan Loss Reserve. Growth in bank lending has been used in a number of studies to measure bank's investment incentives[167]: For example, Stanton (1998) found that growth in loans was positively related to investment opportunities, liquidity and capital ratios, and negatively related to asset quality.

2. The Q-ratio, defined as:

(Market Value of Equity + Total Assets – Book Value of Equity)/(Total Assets)

is used as measure of investment opportunities. A Q-ratio higher than 1 indicates future growth, whereas a Q-ratio lower than 1 indicates future decline[168]. However the Q-ratio is considered a controversial measure, especially for banks (Heffernan 1996).

3. Bank risk. Two different types of variables are employed to account for bank risk. The first type relates to asset quality: ratios AQ1 to AQ4 measure in different ways the level of non-performing loans and net charge-off with respect to the bank portfolio. The second type measures operating performance: these are ROA, ROE and ratios OP1 to OP5 and OP7 to OP8. Berger and Udell (1993) use similar variables to explain the relationship between loan sales and banks' risk.

4. Bank liquidity. Liquidity ratios L1 to L5 have been used in previous analysis of bank liquidity. Berger and Udell (1993) measure liquidity by loan-to-asset ratio, and the ratio of consumer and industrial loans to total assets. Stanton (1998) proxies

[167] This would account for underinvestment and overinvestment incentives.

[168] Some of the banks included in the sample are not listed, so Q-ratios cannot be calculated. Therefore the Q-ratio is used to examine the market reaction to securitisation announcements, and to compare bank characteristics for a reduced sample.

liquidity by the ratio of securities to total assets. Liquidity has also been used in the capital structure literature as a proxy for the degree of asymmetric information: a firm that issues equity when it has slack (as measured by cash and liquid assets divided by total assets) is thought to be doing so because of low information frictions[169] (Jung, Kim and Stulz, 1996)[170].

5. Leverage. Ratios K1 to K9 measure bank's leverage. Stanton (1998), Berger and Udell (1993), Pavel and Phillis (1987) employ similar ratios to proxy for leverage.

6. To measure the degree of regulatory induced capital constraints a dummy variable, that takes the value of one if the equity-to-assets ratio is less than 4%, is employed. Ideally, the BIS risk-weighted capital-to-assets ratio would be used but only a few of the banks in the sample report the ratio. The cut-off point of 4% for the equity-to-assets ratio is standard in the literature to proxy for the likelihood of regulatory pressure on the bank to improve its capital ratio (Stanton 1998).

6. Management efficiency. The ratio of earning assets to total assets is used as a proxy for management efficiency (Angbazo 1997).

7. Size. To control for firm size, the natural logarithm of the bank's total assets is used.

7.5 BANK EX-ANTE CHARACTERISTICS AND THE PROBABILITY TO USE SECURITISATION FINANCE

7.5.1 Methodology

The objective of this sub-section is to identify which banks use securitisation finance, by examining the bank *ex-ante* characteristics and the probability of engaging in securitisation. This is done by using a logit model[171]. In this case the choice, "to securitise or not to securitise", depends on the financial situation of the bank, and the explanatory variables are used to jointly test the validity of the hypotheses proposed in Section 7.3.

[169] According to the pecking order hypothesis if there is high information asymmetry between manager and outside investors the firm should not issue equity because of the costs of adverse selection, so it is assumed that high liquidity proxies for low information asymmetries.

[170] However this relationship between liquidity and information asymmetry is highly debatable since it is based in an indirect relationship yet to be proven.

[171] See Chapter 6, section 4 for an explanation of the logit methodology

As in Chapter 6 it is assumed that each bank considers its position at the end of the accounting year, and in view of that the bank decides whether to securitise assets or not in the following accounting year. Therefore, the financial characteristics of the securitising bank before the issue of asset-backed securities determine the likelihood of using securitisation: the securitisation activities are lagged with respect to proxies for liquidity, leverage, investment opportunities and incentives, efficiency and risk.

$$\Pr ob(\text{sec}uritisation)_t = f(accounting)_{t-1}, \tag{7.1}$$

Where t and t-1 are adjacent accounting years.

7.5.2 Analysis of the Empirical Results

Table 7.4 reports mean and median values for various firm characteristics and financial ratios of securitising and non-securitising banks.

Table 7.4 Ex-Ante Firm Characteristics for 18 Securitising Bank-Years and 56 Non-Securitising Bank-Years.

		Issuing banks		Non-issuing banks		Difference in means	
		Mean	Median	Mean	Median	P-value two sided t-test	P-value one sided t-test
SIZE	Log Assets	4.53	4.60	4.55	4.67	0.92	0.46
OFFTA	Off Balance Sheet Items/Total Assets	0.27	0.17	0.23	0.20	0.53	0.27
EATA	Earning Assets/Total Assets	0.92	0.92	0.92	0.92	0.81	0.40
AQ1	Loan Loss Res / Gross Loans	3.79	2.87	3.02	2.45	0.29	0.14
AQ2	Loan Loss Prov / Net Int Rev	25.77	20.87	19.89	17.08	0.23	0.11
AQ3	NCO / Average Gross Loans	1.20	1.09	0.99	0.81	0.31	0.16
AQ4	NCO / Net Inc Bef Ln Lss Prov	53.38	54.47	39.48	35.35	0.058*	0.029**
K1	Equity / Tot Assets	5.09	4.34	5.14	4.60	0.93	0.46
K2	Equity / Net Loans	9.53	7.67	8.50	7.95	0.36	0.18
K3	Equity / Cust & ST Funding	7.05	5.34	6.56	5.91	0.73	0.36
K4	Equity / Liabilities	5.62	4.74	5.60	5.07	0.98	0.49
K5	Cap Funds / Tot Assets	8.50	8.10	7.87	7.71	0.30	0.15
K6	Cap Funds / Net Loans	15.84	14.32	13.12	11.87	0.090*	0.045**
K7	Cap Funds / Cust & ST Funding	11.52	9.31	9.99	9.42	0.40	0.20
K8	Cap Funds / Liabilities	9.36	8.81	8.58	8.35	0.30	0.15
K9	Subord Debt / Cap Funds	23.73	23.73	21.68	22.18	0.29	0.15
OP1	Net Interest Margin	2.95	2.82	3.45	2.77	0.23	0.12
OP2	Net Int Rev / Avg Assets	2.66	2.59	3.12	2.57	0.22	0.11
OP3	Non Int Exp / Avg Assets	3.53	3.17	3.56	3.31	0.96	0.48
OP4	Pre-Tax Op Inc / Avg Assets	0.53	0.61	0.79	0.87	0.23	0.11
OP5	Non Op Items & Taxes / Avg Ast	0.10	-0.04	0.16	-0.04	0.80	0.40
ROA	Return On Avg Assets	0.63	0.61	0.95	0.86	0.043**	0.021**
ROE	Return On Avg Equity	11.84	9.78	18.18	19.17	0.007**	0.003**
DIV	Dividend Pay-Out	73.00	45.71	60.00	47.37	0.56	0.28
OP7	Inc Net Of Dist / Avg Equity	5.49	4.31	8.14	9.35	0.20	0.097*
OP8	Recurring Earning Power	1.28	1.40	1.46	1.26	0.33	0.16
L1	Net Loans / Tot Assets	56.19	56.16	61.75	60.08	0.077*	0.038**
L2	Net Loans / Cust & ST Funding	74.58	70.58	77.37	74.12	0.74	0.37
L3	Net Loans / Tot Dep & Bor	68.55	67.80	74.04	71.64	0.18	0.091*
L4	Liquid Assets / Cust & ST Funding	24.87	22.88	21.07	20.92	0.17	0.085*
L5	Liquid Assets / Tot Dep & Bor	24.23	22.72	20.48	20.59	0.20	0.097*
GRNL	Percentage Growth in Net Loans	5.28%	4.78%	9.65%	0.09	0.082*	0.041**
	INVOPP	1.0103	1.0136	1.0277	1.0292	0.071*	0.035**

INVOPP are only available for 16 securitising bank-years and 39 non-securitising bank-years
All accounting data for the securitising banks are for the year before the issue.
*significant at the 90% confidence level, ** significant at the 95% confidence level.
P-values gives the probability of the difference in means being equal to zero.

There is no difference in size between both samples. Similar management efficiency is indicated by the ratios of earning assets-to-total assets, which are roughly the same for both samples.

Risk, as measured by asset quality and operating performance, is higher for banks using securitisation finance. All asset quality ratios are higher[172] in the securitising sample and AQ4 (Net Charge-Off/Net Income before Loan Loss Provision)[173] is significantly higher. This ratio is interesting because if issuing banks had made riskier loans with the expectation that they would yield a higher return it would be recognised in this ratio; however it seems that riskier investments have not paid off. Issuing banks do not perform as well as non-issuing banks: ROA and ROE are significantly lower for securitising banks, as it is OP7 (Income Net of Distribution/Average Equity). Banks using securitisation finance have also significantly worse investment opportunities, as measured by the Q-ratio, than non-securitising banks.

Banks in the issuing sample have better liquidity ratios and they seem to be better capitalised: K6 (capital funds/net loans) is significantly higher for securitising banks; and as for the other ratios, only K1 (equity/assets) is smaller but the difference between samples is not statistically significant[174]. However growth in net loans is significantly lower for the securitising sample suggesting that securitising banks underinvest compared with the non-securitising banks.

To explore in more detail the role of securitisation finance in bank's capital structure different logit regressions of equation (7.1) are run. Since some of the independent variables are highly correlated[175], to avoid multicollinearity, different combinations of the explanatory variables found significantly different in Table 7.4[176] are tried. Table 7.5 summarises the results from such regressions.

[172] In this case the higher the ratio the lower the asset quality.
[173] NCO/Net income before loan loss provision.
[174] Although median values for capital ratios are lower in the securitising sample.
[175] See Table 7.A.1 in the appendix 7.A for a partial correlation table.
[176] Percentage Growth in Net loans is not included in the regression because this variable has a smaller number of observations; deleting those observations for the whole sample would mean deleting some of the "securitising bank years".

Table 7.5 Logit Regressions on the Probability of Using Securitisation

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	constant	-7.94	-1.295	-1.329	-2.373*	-6.08	7.627	-2.21	-3.36**
Capital	EQDM	1.960**	1.443*	1.455*	1.501*	1.599*	1.635*		2.190**
Leverage	K1							0.376	
Asset Quality	AQ4	0.014			0.013	0.013	0.012	0.015	1.924*
Oper. Perf.	ROA							-1.604**	
	ROE	-0.252	-0.091**	-0.093**	-0.076*	-0.092*	-0.085**		
	OP7	0.228							
	OP8					0.385			
Liquidity	L4	0.076**		0.063*	0.066*	0.074**			1.928**
	L5		0.057*						
Man. Efficien.	EATA	6.598		-0.111		3.484			
	SIZE						-0.792	-0.06	
	N	74	74	74	74	74	74	74	74
	Max. Log Likelihood	-31.86	-34.19	-33.93	-33.29	-32.83	-34.20	-36.33	-35.41
	Pesaran-Timmermann	-15.48**	-17.50**	-16.62**	-17.50**	-16.23**	-20.15**	-24.44**	-20.59**
	Goodneess of Fit	81.08%	81.08%	79.73%	81.08%	82.43%	81.08%	78.37%	78.37%
	Pseudo R-sq	22.50%	16.72%	17.35%	18.92%	20.03%	16.69%	11.50%	13.73%

The sample includes 12 commercial banks between 1990-1997 (see Table 7.2).
** (*) indicates that the statistic is different from zero at the 95% (90%) level.
The Pesaran-Timmerman statistic is a non-parametric test for predictive performance. It is based the proportion of times that the direction of change of the dependent variable is correctly predicted by the independent variables. Under the null hypothesis that the independent variable has no prediction power it is distributed as a standard normal.

Capital constraints, measured by EQDM, a dummy variable that takes the value of 1 if the equity-to-assets ratio is lower than 4% is consistently significant across the regressions; however leverage measured by K1 is not-significant[177]. This may suggest that the relationship between capital adequacy and securitisation finance is non-linear: low capital increases the probability of using securitisation up to a certain point and then it stops being a determinant. Stanton (1998) found a similar relationship between loan sales and a low capital dummy.

The performance measures, ROA and ROE, have highly significant negative coefficients suggesting that poor performing banks are more likely to use securitisation finance. Minton, Opler and Stanton (1997) obtained a similar relationship between profitability measures and securitisation incentives. The

coefficient for asset quality has the right sign in all the regressions, and it is significant in equation (8) when performance measures are excluded.

Less liquid banks would be expected to use securitisation to raise liquidity. There are two reasons for that: banks that hold large amounts of illiquid assets would benefit more from securitisation because loans that were untraded before securitisation are traded in liquid secondary markets after securitisation takes place; and if liquidity proxies for the degree of information frictions (Jung, Kim and Stulz, 1996) it would also be expected that the less banks liquid (or banks with more information asymmetry) use more securitisation finance. However the variables that proxy for liquidity are significant in each regression but they have the wrong sign.

To summarise, the results from comparing firm characteristics and from the logit regressions suggest securitising banks tend to be less profitable, with poorer investment opportunities and worse capital ratios than other banks.

Issuing banks grow at a lower rate and have relatively low quality: low quality loans combined with tight capital ratios (as measured by the equity dummy) might be suggestive of a high incidence of the underinvestment problem caused by capital regulation amongst securitising banks. These banks could use securitisation finance instead of equity issues to improve their capital ratios. The effect of securitisation on shareholders wealth would be slightly negative because securitisation signals that the bank needs to improve capital ratios. However, the manager chooses to securitise assets rather than issuing equity suggesting that the bank is not overvalued by the market.

The results could also be analysed in the light of the pecking order hypothesis: Minton, Opler and Stanton (1997) argue that information asymmetry may be an issue in firms wanting to raise external capital if those firms have significant credit risk and are not performing well. Securitising banks (which as seen from above have lower quality assets and inferior performance) could have more information frictions, making external finance more expensive to raise, thereby contributing to lower growth For these firms, securitisation would be in the interest of shareholders

[177] Other regressions including other measures of leverage were run: none of them was significant.

because it would allow them to obtain cheaper finance and pursue positive-NPV investments that they could not otherwise afford. In the absence of securitisation, raising funds from unsecured debt or equity would be expensive because of respectively the high leverage and information asymmetries.

James (1988) also found evidence, consistent with the one reported here, supporting the underinvestment hypothesis: banks securitise assets when other financing sources are too expensive or unavailable and bank riskiness does not deteriorate as a consequence of securitisation[178].

No significant relationship between size and securitisation finance was found. Minton, Opler and Stanton (1997) argued that if there are economies of scale[179] associated with securitisation transactions, larger firms would securitise more. On the other hand the "pecking order" hypothesis would suggest smaller firms for which information asymmetries are more common would benefit more from securitisation.

The positive relationship between liquidity and securitisation is difficult to interpret in the light of the above theories. If high liquidity proxies for low information asymmetry, the pecking order theory would not be proved. However, it could be argued that excess liquidity reduces debt capacity because of the high agency costs of liquidity, so these excessively liquid banks have higher costs of debt finance and therefore have more incentives to securitise.

The presence of agency costs of managerial discretion could not be established either. Management efficiency, as measured by the ratio of earning-to-total assets is similar in both samples. However, securitising banks have worse investment opportunities, as measured by the Q-ratio, than non-securitising banks. In this case, raising funds by securitising assets when the expected future growth of the bank is low might not be in the interest of shareholders but in the manager's own interest.

[178] Suggesting that funds raised by securitisation are used to invest in positive NPV projects.
[179] Because of the high fixed costs associated with setting up the legal and financial structure of the transaction.

Stanton (1998) found results similar to the ones reported in this section: banks with low capital ratios, relatively low quality assets and low liquidity ratios engage in securitisation more often.

7.6 VALUATION EFFECTS OF THE SECURITISATION ANNOUNCEMENT

7.6.1 Methodology

In the previous section it was established that, prior to issuing asset-backed securities, securitising banks have tighter capital ratios, inferior performance, less valuable investment opportunities and the quality of their assets is lower. The aim of this section is to investigate the valuation effects of securitisation, i.e. how the market reacts to the securitisation announcement.

Standard event study methodology is employed. The sample consists of securitisation announcements by British commercial banks. The date of the announcement was obtained from Extel and Reuters News Service. To eliminate events with too much noise the issues for which the date of the announcement was not clear were not included in the sample[180]. The final sample includes 27 securitisation announcements by 8 commercial banks between the years 1988 and 1998. The size of the issues ranges for £66 million to almost £600 million. The assets backing the issues are first and second class residential mortgages[181], personal loans, auto loans and business loans.

Daily returns for the 8 banks were obtained from Datastream. The FTA All share index was used as a proxy for the market. Considering day t=0 as the announcement day, and days t=-10 to t=10 as the event period, daily abnormal returns are computed for each security (A_{it}) during the event period:

[180] These are issues for which there is a conflict between the announcement dates as reported in Extel and Reuters. The cases for which there is information about the issue in the financial press (usually in the Financial Times or Euromoney) previously to the reported announcement date, or issues for which there is not an announcement prior to the date of the issue have also been excluded.

[181] A first/second class mortgage is the first/second mortgage on the property. The second class mortgage ranks below the first class mortgage in case of default.

$$A_{it} = R_{it} - \bar{R}_{it} \tag{7.2}$$

Where R_{it} is the arithmetic return

and

$$\bar{R}_{it} = a_i + b_i R_{mt} \tag{7.3}$$

where R_{mt} is the market return

The parameters for the above equation were obtained from a least squares regression estimated between days –110 and –11:

$$\bar{R}_{it} = \alpha_i + \beta_i R_{mt} + e_{it}, \forall t = (-110,-11) \tag{7.4}$$

To test the null hypothesis than the mean portfolio abnormal return (AR_{pt}) across all the announcements equals zero the following t-statistic is used (Campbell, Lo, and Mckinlay, 1997):

$$t-stat = \frac{\overline{AR}_{pt}}{std(\overline{AR}_{pt})} \tag{7.5}$$

$$\text{Where } \overline{AR}_{pt} = \sum_{t=1}^{n} \frac{AR_{pt}}{n} \tag{7.6}$$

$$\text{and}^{182}\, std(\overline{AR}_{pt}) = \sqrt{\sum_{t=-110}^{t=-11} \frac{(AR_{pt})^2}{98}} \tag{7.7}$$

To test the null hypothesis that the mean cumulative portfolio abnormal return (CAR_p) for any event subperiod (t_1,t_2) equals zero, the following t-statistic is used:

$$t-stat = \frac{\overline{CAR}_p}{std(\overline{CAR}_p)} \tag{7.8}$$

$$\text{where } \overline{CAR}_p(t_1,t_2) = \sum_{t=t1}^{t2} \overline{AR}_{pt} \tag{7.9}$$

$$\text{and } std(\overline{CAR}_p(t_1,t_2)) = \sqrt{T(std(AR_{pt}))^2 + 2(T-1)\text{cov}(AR_{pt}, AR_{pt-1})} \tag{7.10}$$

where $T = t_2 - t_1 + 1$

[182] The standard deviation is estimated from an average of abnormal returns to take into account the serial correlation among abnormal returns

Assuming that the AR_{pt} are stationary normal processes the t-statistics described above follow a Student-t distribution with n-2 (98) degrees of freedom.

However, the size of the sample (27 securitisation announcements) greatly reduces the power of these tests so a non-parametric, test the Wilcoxon median test[183], is also used to test the null hypothesis that the median portfolio abnormal return (or the median cumulative portfolio abnormal return) is equal to zero.

7.6.2 Analysis of the Empirical Results

Table 7.6 reports the results on the valuation effects of securitisation. Day t=0 is the day of the securitisation announcement as shown in Extel or Reuters News Services. Mean and median portfolio abnormal returns are reported for days t=-1 and t=0. Mean and median portfolio cumulative abnormal returns are reported for the two days subperiod (-1,0).

[183]The T-statistic associated with this test is obtained by finding the absolute value of the difference between each abnormal return and the hypothesized median value (in this case 0). These differences are ranked from smallest to largest. The ranks for all positive values are added, and the same for all negative values: the smallest of these sums is the Wilcoxon T-statistic.

Table 7.6 Abnormal Returns for Securitisation Announcements.

Panel A Interval	n=27 Abnormal Return	t-statistic	% Positive		
	mean			median	(Wilcoxon T-stat)
Day (-1)	0.2160%	1.4711	59.25%	0.0200%	145
Day (0)	-0.2870%	-1.9513*	37.37%	-0.0610%	120**
Days (-1,0)	-0.0705%	-0.2759	48.14%	-0.0009%	185
Panel B Interval	n=22 Abnormal Return	t-statistic	% Positive		
	mean			median	(Wilcoxon T-stat)
Day (-1)	0.1884%	1.8234*	59.09%	0.0250%	103
Day (0)	-0.1224%	-1.1253	36.36%	-0.0557%	85**
Days (-1,0)	0.0760%	0.4091	45.45%	-0.0323%	123

** (*) indicates that the statistic is different from zero at the 95% (90%) level.
Panel A shows results for the total sample.
Panel B shows results from a reduced sample that excludes securitisation announcement by First National Bank

Results for the total sample (Panel A) show that shareholders of securitising banks experience a wealth loss of -0.287% (t-statistic significant at the 90% level of confidence) at the day of the announcement. The findings using non-parametric tests are similar: the median abnormal return at the day of the announcement is negative (Wilcoxon T-statistic different form zero at the 95% level of confidence).

Therefore the market relates banks' securitisation announcements to unfavourable information about the bank.

To gain further insight into the wealth effects of asset securitisation, the cross-sectional variation of abnormal returns around the securitisation announcement is examined. Table 7.7 reports the correlation between abnormal returns and the following financial ratios: ROE, ROA, the set of investment opportunities and two

measures of capital adequacy[184]. The financial ratios and accounting data are the last ones reported before the securitisation announcement. They typically belong to the accounting year prior to the issue. The market value of equity is measured the month before the announcement.

Table 7.7 Correlation Coefficients Between Abnormal Returns and Firm Characteristics I.

	AR(0)	CAR(-1,0)
ROA	33.84%*	20.29%
ROE	15.81%	28.44%
INVOPP	31.42%	28.79%
BIS-ratio	8.99%	27.09%
Cap-ratio	-43.11%**	-27.75%

** (*) indicates that the statistic is different from zero at the 95% (90%) confidence level, based on a test of significance for the correlation coefficient [185].

Where,

ROA: is the Return on Average Assets,

ROE: is the Return on Average Equity,

INVOPP: is the Q-ratio

BIS-ratio: is the Basle Risk-Weighted Capital Ratio, and

Cap-ratio: is the ratio of Total Equity to Total Assets.

There is a positive relationship between banks' performance as measured by ROA or ROE and abnormal and cumulative abnormal returns. The correlation coefficient is significant for the ROA and the abnormal return the day of the announcement. The

[184] For all banks except First National Bank it was possible to use the BIS risk-adjusted capital ratio. The other capital ratio is equal to Equity Capital/Assets.

[185] Under the null hypothesis that the correlation is zero, the following statistic "r" is distributed as a t-Student with n-2 degrees of freedom: $r=\frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$

same positive relationship is observed for the Q-ratio, the proxy for investment opportunities, and the market reaction, although this correlation coefficient is only marginally significant (p-value equals 0.11).

The evidence regarding capital adequacy is puzzling: abnormal returns around securitisation announcements are positively (although the correlation coefficients are not significant) related to risk-adjusted capital ratios, but negatively and significantly related to non-risk adjusted capital ratios. The correlation coefficients calculated above for BIS-ratio exclude one bank in the sample, First National Bank. This bank could be considered an outlier: it has very high equity-to-assets ratios but it has negative ROA and ROE for all the event periods. The wealth effects of securitisation are re-estimated excluding the 5 events belonging to this bank. Panel B of table 7.6 shows a negative (although non-significant) abnormal return the day of the announcement and a significant (at 90% level of confidence) wealth gain the previous day. The non-parametric test of the median, which is more suited in this case,[186] indicates a wealth loss on the announcement date similar in size to the one reported for the whole sample.

Again, the correlation coefficients are re-calculated (Table 7.8) to better understand the differential wealth effects across banks.

[186] The sample size is only 22 now.

Table 7.8 Correlation Coefficients Between Abnormal Returns and Firm Characteristics II.

	AR(0)	CAR(-1,0)
ROA	5.26%	19.66%
ROE	-7.25%	7.28%
INVOPP	-1.0%	10.24%
BIS-ratio	8.99%	27.09%
Cap-ratio	10.55%	15.84%

** (*) indicates that the statistic is different from zero at the 95% (90%) confidence level, based on a test of significance for the correlation coefficient.

Where,

ROA: is the Return on Average Assets,
ROE: is the Return on Average Equity,
INVOPP: is the Q-ratio
BIS-ratio: is the Basle Risk-Weighted Capital Ratio, and
Cap-ratio: is the ratio of Total Equity to Total Assets.

In this case the size of the abnormal return is positively related to both capital ratios, suggesting securitisation is bad news for banks with low capital ratios. However the correlation coefficients are not significant. This could be due to the reduced power of the test since sample size is only 22. Securitisation may be seen by the market as a signal that the bank is under pressure to improve its capital ratio, that it will not be able to do it by retaining earnings (hence the positive relationship between abnormal returns and performance measures) and that subordinated debt might be unavailable[187] or too expensive. The moral hazard associated with deposit insurance induces banks to securitise their best assets, which is also seen as bad news by

[187] Subordinated debt can be computed as Tier2 capital for regulatory purposes. It has to be kept within certain limits which are usually discussed in a case by case basis with the Financial Services Authority.

investors. However, since the bank chooses to securitise rather than issuing equity, the news is not as bad as those associated with an equity issue, in the same fashion as with the involuntary equity issues described above.

If high agency costs of managerial discretion are assumed, securitisation finance is not in the interest of shareholders either. Also the market reaction to the announcement would be expected to be negatively related to the leverage of the bank, and positively related to its operating performance and set of investment opportunities; securitisation would just add extra liquidity, with no monitoring by outsiders, in the hands of inefficient managers. Besides, securitisation by well-capitalised banks is less expected by the market, so the reaction will be stronger. The case of First National Bank could be an example of this problem: this was a bank without capital problems, but with poor performance and in all but one of the event periods it had a Q-ratio lower to 1. The use of securitisation by this type of banks increases the agency costs of managerial discretion and leads to control activities by outsiders. In this case the result was a buy-out by Abbey National.

The results from the event studies performed in this section have to be taken with caution considering the small size of the sample. However, they are consistent with the very few other empirical results in the literature: Lockwood, Rutherford and Herrera (1996) found that banks suffer a loss of 0.64% in the two days (-1,0) around the securitisation announcement. The wealth loss for banks is larger for those with "low financial slack"[188], while other banks experienced a wealth gain of 0.825%. Slovin, Sushka and Polonchek (1991) report a –1.07% two-days cumulative abnormal return for banks announcements of sale-and-leaseback operations.

7.7 BANK EX-POST CHARACTERISTICS

The objective of this section is to examine the ex-post characteristics of banks that securitise assets, and to compare them with the non-securitising banks.

[188] The authors measure financial slack as capital surplus plus retained earnings in the quarter preceding the announcement.

Table 7.9 compares firm characteristics for non-issuing and issuing banks in the year of the issue.

Table 7.9 Firm Characteristics for 17 Securitising Bank-Years and 56 Non-Securitising Bank-Years.

		Issuing banks		Non-issuing banks		Difference in means	
		Mean	Median	Mean	Median	P-value two sided t-test	P-value one sided t-test
SIZE	Log Assets	4.43	4.50	4.59	4.70	0.43	0.21
OFFTA	Off Balance Sheet Items/Total Assets	0.35	0.35	0.20	0.17	0.060*	0.030**
EATA	Earning Assets/Total Assets	0.91	0.91	0.93	0.94	0.11	0.055*
AQ1	Loan Loss Res / Gross Loans	4.02	2.60	2.93	2.45	0.12	0.060*
AQ2	Loan Loss Prov / Net Int Rev	22.86	17.75	20.79	18.00	0.58	0.29
AQ3	NCO / Average Gross Loans	1.31	1.21	0.95	0.78	0.076*	0.038**
AQ4	NCO / Net Inc Bef Ln Lss Prov	55.32	52.74	38.56	34.59	0.030**	0.015**
K1	Equity / Tot Assets	5.57	4.44	4.98	4.59	0.28	0.14
K2	Equity / Net Loans	10.40	8.83	8.18	7.70	0.041**	0.020**
K3	Equity / Cust & ST Funding	8.44	5.67	6.07	5.68	0.16	0.080*
K4	Equity / Liabilities	6.19	4.79	5.40	4.97	0.24	0.12
K5	Cap Funds / Tot Assets	9.06	8.27	7.66	7.69	0.034**	0.017**
K6	Cap Funds / Net Loans	16.99	15.65	12.67	11.68	0.004**	0.002**
K7	Cap Funds / Cust & ST Funding	13.30	10.73	9.35	9.30	0.066**	0.033**
K8	Cap Funds / Liabilities	10.04	9.01	8.33	8.33	0.035**	0.017**
K9	Subord Debt / Cap Funds	22.72	21.23	21.99	22.86	0.70	0.35
OP1	Net Interest Margin	3.38	2.78	3.31	2.78	0.90	0.45
OP2	Net Int Rev / Avg Assets	3.02	2.55	3.01	2.59	0.97	0.48
OP3	Non Int Exp / Avg Assets	3.92	3.50	3.43	3.27	0.33	0.17
OP4	Pre-Tax Op Inc / Avg Assets	0.55	0.58	0.79	0.84	0.29	0.15
OP5	Non Op Items & Taxes / Avg Ast	0.27	-0.04	0.10	-0.05	0.53	0.27
ROA	Return On Avg Assets	0.82	0.77	0.89	0.81	0.68	0.34
ROE	Return On Avg Equity	13.82	11.11	17.61	18.75	0.079*	0.039**
DIV	Dividend Pay-Out	66.92	53.03	61.87	47.18	0.68	0.34
OP7	Inc Net Of Dist / Avg Equity	7.04	5.22	7.66	9.32	0.75	0.37
OP8	Recurring Earning Power	1.28	1.35	1.46	1.26	0.34	0.17
L1	Net Loans / Tot Assets	54.91	52.71	62.29	59.91	0.016**	0.008**
L2	Net Loans / Cust & ST Funding	79.04	67.08	75.88	73.91	0.75	0.37
L3	Net Loans / Tot Dep & Bor	69.58	66.86	73.78	71.46	0.34	0.17
L4	Liquid Assets / Cust & ST Funding	27.20	24.80	20.20	20.28	0.004**	0.002**
L5	Liquid Assets / Tot Dep & Bor	26.35	24.69	19.68	19.51	0.012**	0.006**
GRNL	Percentage Growth in Net Loans	3.93%	0.90%	10.02%	8.19%	0.062*	0.031**
	INVOPP	1.0184	1.0243	1.0244	1.0266	0.53	0.27

INVOPP are only available for 16 securitising bank-years and 39 non-securitising bank-years
All accounting data for the securitising banks are for the year of the issue.
*significant at the 90% confidence level, ** significant at the 95% confidence level.
P-values gives the probability of the difference in means being equal to zero

To fully appreciate their meaning, these results are compared to the differences in firm characteristics between issuing and non-issuing firms prior to securitisation. After securitisation takes place the issuing banks experienced an improvement in all their capital ratios, which are now significantly higher than those of non-issuing firms. The liquidity ratios are much better for the securitising banks. And

performance ratios have also improved: both samples have similar ROA and the difference in ROE, although still present, is smaller.

The asset quality in securitising banks is still worse than in the non-securitising sample. It may be possible that banks have chosen to securitise good quality assets because it is cheaper to provide credit enhancement. The ratio of off-balance sheet assets to total assets is significantly larger for securitising banks which suggests that these banks could be providing themselves the credit enhancement[189]. Securitisation of good assets may also be related to the moral hazard associated with deposit insurance mentioned above: Pavel (1988) found that banks do sell low risk-high quality loans to improve their capital ratios. Growth in net loans is still significantly smaller than for the non-securitising sample, suggesting that underinvestment continues to be present, but investment opportunities are not significantly different between the two samples after securitisation.

In table 7.10 the percentage changes in firm characteristics for issuing firms from the accounting year before securitisation to the accounting year in which securitisation takes place, and to the accounting year following the securitisation[190] are computed. Given the very small sample sizes (16 and 13) median percentage changes are examined. The Wilcoxon T-statistic is employed to test for statistical significance.

[189] For instance by providing an standby letter of credit

[190] The reason for using one and two years periods is that some changes may not be easy to implement in a single year.

Table 7.10 Percentage Change in Firm Characteristics for the One and Two Years Period Overlapping the Securitisation Decision.

		Issue Year -Year before the issue n=16		Year after issue -Year before the issue n=13	
		Mean	Median	Mean	Median
SIZE	Log Assets	0.65%	0.41% **	1.14%	1.27% **
OFFTA	Off Balance Sheet Items/Total Assets	34.40%	-1.36%	35.09%	-3.33%
EATA	Earning Assets/Total Assets	-0.65%	-0.33%	-0.66%	-0.63%
AQ1	Loan Loss Res / Gross Loans	-2.74%	-5.43%	-17.66%	-15.10% **
AQ2	Loan Loss Prov / Net Int Rev	0.54%	-9.32%	-17.50%	-41.55%
AQ3	NCO / Average Gross Loans	14.14%	-18.62% **	13.00%	-34.23%
AQ4	NCO / Net Inc Bef Ln Lss Prov	8.20%	-18.13%	3.20%	-23.01%
K1	Equity / Tot Assets	2.05%	2.51%	8.89%	5.73% **
K2	Equity / Net Loans	5.38%	2.63%	17.22%	15.83% **
K3	Equity / Cust & ST Funding	3.95%	4.51%	13.24%	10.02% **
K4	Equity / Liabilities	2.17%	2.76%	8.91%	6.22% **
K5	Cap Funds / Tot Assets	0.98%	-0.16%	0.03%	1.59%
K6	Cap Funds / Net Loans	4.13%	3.24%	7.75%	4.47% **
K7	Cap Funds / Cust & ST Funding	2.95%	0.25%	4.20%	2.98% **
K8	Cap Funds / Liabilities	1.12%	-0.15%	0.07%	1.64%
K9	Subord Debt / Cap Funds	-0.84%	-4.78% *	-15.72%	-15.45% **
OP1	Net Interest Margin	0.15%	-2.26%	0.82%	1.75%
OP2	Net Int Rev / Avg Assets	-0.48%	-2.37%	-0.21%	1.00%
OP3	Non Int Exp / Avg Assets	-2.54%	-4.16%	-9.08%	-18.86%
OP4	Pre-Tax Op Inc / Avg Assets	54.37%	-1.06%	31.99%	34.48%
OP5	Non Op Items & Taxes / Avg Ast	-35.93%	-60.71%	-92.17%	-79.17% *
ROA	Return On Avg Assets	36.59%	24.16%	68.38%	58.75%
ROE	Return On Avg Equity	36.22%	12.60%	66.78%	27.29%
DIV	Dividend Pay-Out	-10.53%	-1.04%	-27.38%	-4.18%
OP7	Inc Net Of Dist / Avg Equity	23.46%	-4.98%	83.80%	17.62%
OP8	Recurring Earning Power	5.18%	-0.30%	3.85%	8.14%
L1	Net Loans / Tot Assets	-2.98%	-4.65%	-6.91%	-10.85% **
L2	Net Loans / Cust & ST Funding	-1.14%	-3.84%	-3.02%	-5.67%
L3	Net Loans / Tot Dep & Bor	-1.16%	-4.17%	-4.00%	-6.45% *
L4	Liquid Assets / Cust & ST Funding	23.39%	8.98% *	42.00%	12.71% *
L5	Liquid Assets / Tot Dep & Bor	23.17%	8.25% *	40.44%	10.65% *
GRNL	Percentage Growth in Net Loans	3.93%	0.90%	6.35%	1.31%

* * (*) indicates that the median is different from zero at the 95% (90%) level (Wilcoxon test).

In the one-year period overlapping securitisation, banks experience an improvement in asset quality as measured by AQ3 (NCO/Average Gross Loans), and they increase in size (defined as logarithm of total assets). The issuing banks build up their levels of liquidity as shown by the improvements of ratios L4 (Net Loans-to-Total Assets) and L5 (Liquid Assets-to-Total Deposits and Borrowing). A very interesting result is that the ratio of subordinated debt to capital funds drops: banks might use some of the proceeds from securitisation to repay part of their outstanding subordinated debt, suggesting the bank wants to reduce the incidence of underinvestment induced by high leverage [191]. Managers might want to free-up debt capacity also, and withdraw an expensive source of finance. Nevertheless, if agency costs of managerial discretion are high, managers might want to lower debt levels to reduce monitoring by outsiders.

Growth in net loans is not significantly different from zero so these banks may still underinvest.

The changes noticed in the two-year period overlapping securitisation confirmed the above results. There were further improvements in asset quality and liquidity, growth, and improvements in all capital ratios, except subordinated debt-to-capital funds, which falls. The significant increase in size is not accompanied by a significant growth in net loans, and there is a decrease in the ratio of earning-to-total assets, although not significant, which could be suggestive of managerial inefficiency.

7.8 CONCLUSIONS

This chapter has investigated the empirical validity of different theories applied to the use of securitisation finance by banks. The objective was to establish which types of banks were more likely to engage in securitisation finance. To do so the different advantages of securitisation finance were summarised, and four hypotheses were proposed and jointly tested.

According to Myers and Majluf "pecking order hypothesis" securitisation can be used as a mechanism to issue low-risk debt-type securities. Highly leveraged, poor performing risky banks, and banks with considerable information asymmetries should be amongst the most frequent issuers. The benefit of securitisation is that it allows a low quality bank to issue high quality securities, thereby reducing the costs of finance.

Asset-backed securities have pay-off features similar to secured debt and securitisation could be used by high-leveraged banks to avoid underinvestment incentives.

Another advantage of securitisation is that it allows banks to improve their capital ratios and avoid the underinvestment incentive caused by regulation. Yet moral hazard arising from deposit insurance may induce banks to securitise their best asses.

This chapter examined the ex-ante and ex-post characteristics of the securitising banks as well as the market reaction to securitisation announcements. Table 7.11 summarizes the evidence found through the econometric tests performed in this chapter and their relationship with the hypotheses.

[191] Subordinated debt increases the incidence of the underinvestment problem, especially for weaker banks (Stanton, 1998).

Table 7.11 How the Hypotheses Stand Up to Econometric Testing

Evidence		*Underinvestment induced by leverage*	*Underinvestment induced by capital regulation*	*Pecking order*	*Agency costs*
Ex-Ante	Low investment	X	X		
	Low quality assets	X	X	X	
	Inferior performance	X	X	X	
	Capital constrained		X		
	Poor investment opp.				X
	Liquidity				X
Market Reaction	Negative		X		X
Ex-Post	Improved asset quality	X		X	
	Liquidity				X
	Reduced leverage				X
	Low investment				X
	Increased size				X

"X" indicates that the row's evidence confirms the hypothesis in the column.

The empirical work done in this chapter shows that "ex-ante" the banks which engage in securitisation finance have worse capital ratios, perform poorly, underinvest and have low quality assets. This evidence support three of the hypotheses proposed at the beginning of the chapter. Recall table 7.1: as suggested by the "underinvestment induced by leverage" hypothesis, securitising banks perform poorly, underinvest and have low quality assets. When the underinvestment is induced by regulation ("underinvestment induced by regulation hypothesis") the securitising banks would be also capital constrained. Third, the "pecking order hypothesis" predicts that securitising banks would exhibit inferior performance and have low quality assets.

Contrary to what is predicted by the "underinvestment induced by leverage" and the "pecking order" hypotheses, the market reacts negatively to securitisation announcements. Analysis of a bank's behaviour after securitisation showed mixed results. Banks use part of the proceeds to reduce leverage, but there is no confirmation that underinvestment distortions have been corrected.

The fourth hypothesis predicts that allowing for the presence of agency costs of managerial discretion will better explain the market reaction to securitisation announcements and the banks' behaviour afterward. The securitising banks have less

valuable investment opportunities than the non-securitising banks, and yet they choose to finance by issuing the security with lowest level of outside monitoring.

The fact that, after securitisation, banks still have loan growth rates lower than those of non-securitising banks is difficult to explain in the light of the "pecking order", "underinvestment" or "capital regulation" hypotheses. But it fits the "agency cost" hypothesis. It is also consistent with why the market associates securitisation announcements with bad news, especially for poor performing banks with high capital ratios and poor investment opportunities. Securitisation is a funding source subjected to very low monitoring, meaning the funds raised may be used to maximize the managers' utility function, which could conflict with the objective of maximizing profits. For example, using the finance raised to repay subordinated debt will be in the interest of managers, because they will have a greater cash flow and less outside monitoring to pursue their own objectives.

This chapter's findings are comparable to the very scarce literature on the capital structure of banks that examines loan sales or securitisation. Together with the results of Chapter 6, they also shed some light on banks incentives to engage in securitisation.

To summarise the findings of this and the previous chapter: in the absence of regulatory subsidies to securitisation like the ones seen in the US[192], British banks use securitisation as a source of finance, and there is no evidence pointing to a decline in bank's intermediation function[193].

The characteristics of securitisation transactions, which isolates the assets from the issuer, means banks with low capital ratios, low quality assets and poor performance are more likely to use securitisation.

However the managers of securitising banks might be acting in their own interest when raising finance by selling assets if the future prospects of the bank are poor. In

[192] See Chapter 2 for details.
[193] See Chapter 6.

that case the market reacts negatively because the funds raised via securitisation might not be used in the interest of shareholders.

APPENDIX 7.A

Table 7.A.1 Partial Correlation Coefficients

	AQ1	AQ2	AQ3	AQ4	K1	K2	K3	K4	K5	K6	K7	K8	K9	OP1	OP2	OP3	OP4	OP5	ROA	ROE	DIV	OP7	OP8	OL1	L2	L3	L4	L5
AQ1	1.00																											
AQ2	0.34	1.00																										
AQ3	0.34	0.45	1.00																									
AQ4	0.40	0.43	0.78	1.00																								
K1	-0.10	-0.06	0.22	-0.16	1.00																							
K2	0.06	-0.27	-0.01	-0.12	0.72	1.00																						
K3	-0.09	-0.02	0.27	-0.11	0.85	0.53	1.00																					
K4	-0.08	-0.05	0.23	-0.15	1.00	0.73	0.86	1.00																				
K5	0.29	0.10	0.35	0.10	0.84	0.71	0.73	0.86	1.00																			
K6	0.34	-0.15	0.07	0.08	0.51	0.91	0.36	0.53	0.72	1.00																		
K7	0.09	0.06	0.34	0.02	0.78	0.53	0.96	0.81	0.81	0.47	1.00																	
K8	0.28	0.10	0.35	0.09	0.85	0.71	0.75	0.87	1.00	0.72	0.83	1.00																
K9	-0.04	0.11	0.11	0.04	0.28	0.37	0.16	0.29	0.43	0.44	0.23	0.43	1.00															
OP1	0.07	0.20	0.62	0.12	0.62	0.06	0.61	0.62	0.52	-0.07	0.58	0.52	0.04	1.00														
OP2	0.05	0.21	0.61	0.10	0.64	0.06	0.62	0.64	0.53	-0.07	0.58	0.53	0.06	1.00	1.00													
OP3	0.28	0.47	0.72	0.35	0.46	0.00	0.56	0.47	0.48	-0.03	0.58	0.48	0.04	0.88	0.86	1.00												
OP4	-0.32	-0.51	0.00	-0.16	0.10	0.06	-0.07	0.08	-0.03	-0.04	-0.13	-0.04	-0.01	0.19	0.19	-0.17	1.00											
OP5	0.25	0.35	0.17	0.02	0.31	0.09	0.50	0.33	0.34	0.08	0.52	0.35	0.06	0.29	0.29	0.51	-0.82	1.00										
ROA	-0.19	-0.37	0.27	-0.25	0.64	0.23	0.64	0.64	0.46	0.05	0.56	0.46	0.06	0.77	0.77	0.48	0.51	0.07	1.00									
ROE	-0.15	-0.57	0.09	-0.28	0.19	-0.05	0.21	0.19	0.07	-0.14	0.16	0.07	-0.06	0.47	0.46	0.19	0.61	-0.15	0.84	1.00								
DIV	0.02	0.30	0.23	0.24	0.06	0.06	-0.05	0.06	0.13	0.10	-0.02	0.12	0.19	0.08	0.08	0.16	-0.15	0.05	-0.20	-0.30	1.00							
OP7	-0.08	-0.56	-0.24	-0.28	0.03	-0.03	0.14	0.03	-0.02	-0.07	0.13	-0.02	-0.28	0.05	0.03	-0.08	0.29	-0.06	0.43	0.60	-0.60	1.00						
OP8	-0.16	-0.02	0.41	0.03	0.32	-0.01	0.17	0.31	0.21	-0.11	0.11	0.20	0.08	0.63	0.63	0.34	0.81	-0.52	0.63	0.53	0.03	0.04	1.00					
OL1	-0.18	0.35	0.23	-0.06	0.25	-0.44	0.21	0.24	0.12	-0.56	0.14	0.12	-0.03	0.61	0.64	0.46	0.07	0.18	0.40	0.23	0.04	-0.02	0.43	1.00				
L2	-0.17	0.19	0.32	-0.08	0.56	-0.05	0.80	0.57	0.43	-0.19	0.76	0.45	0.01	0.72	0.73	0.65	-0.07	0.49	0.62	0.28	-0.08	0.15	0.28	0.66	1.00			
L3	-0.14	0.32	0.34	-0.02	0.37	-0.35	0.45	0.37	0.26	-0.46	0.41	0.27	-0.06	0.75	0.77	0.64	0.06	0.29	0.55	0.32	-0.03	0.07	0.46	0.93	0.85	1.00		
L4	0.12	-0.41	-0.15	0.03	0.01	0.56	-0.09	0.02	0.16	0.65	-0.01	0.16	0.12	-0.35	-0.37	-0.34	0.15	-0.25	-0.11	-0.01	0.05	0.05	-0.16	-0.74	-0.53	-0.68	1.00	
L5	0.15	-0.38	-0.15	0.05	-0.03	0.53	-0.17	-0.03	0.13	0.64	-0.09	0.13	0.11	-0.38	-0.40	-0.36	0.16	-0.29	-0.16	-0.03	0.07	0.01	-0.15	-0.73	-0.60	-0.70	0.99	1.00

CHAPTER 8: THE EFFECT OF SECURITISATION ON PRICING BEHAVIOUR IN THE UK MORTGAGE MARKET

8.1 INTRODUCTION

Chapter 2 summarised the institutional characteristics of securitisation in the US and European countries. One of the most remarkable aspects of US securitisation is the involvement of the government, especially in mortgage securitisation. The US Federal Agencies subsidise the use of securitisation by substituting the credit risk of mortgages with that of the US government. This form of credit enhancement is cheaper and preferred by the market investors to private arrangements. It also makes mortgage securitisation very attractive to the lenders. The "swap programme" of Fannie Mae and Freddie Mac permits lenders, in exchange for a fee, to replace their mortgage portfolio with mortgage-backed securities, issued and guaranteed by the Federal Agencies. Besides the reduction in risk[194], a portfolio of "agency's" mortgage-backed securities carries a lower risk-weighted capital requirement than a mortgage portfolio.

The advocates of securitisation use the results of US empirical research to show that securitisation has improved the competition in the mortgage market, through specialisation, and it has contributed to the integration of the mortgage market and other capital markets. As a result, mortgage spreads with respect to money market rates have decreased. Researchers argue that it was the deregulation and financial innovation of the late 1970's what transformed the US mortgage market. Securitisation, the most important innovation, altered the financial intermediation process and redistributed the risks associated with housing finance: the development of a secondary market where mortgages were traded before being securitised

[194] The default risk of the mortgages is exchanged by the default risk of the Federal Agencies that guarantee the securities. The mortgage-backed securities have lower liquidity risks than the original mortgages, and prepayment and interest rate risks are lowered by the use of senior/subordinated structures.

encouraged specialisation in the mortgage industry. In particular, the originating and servicing functions could be separated from funding: certain institutions, like thrifts, specialised in originating and servicing, while investors in capital markets were able to invest in the securitised mortgages. Finally since investors financed the securitised mortgages, securitisation could have improved the link between mortgage rates and money market rates.

It is impossible to separate the securitisation effects on competition from the government subsidies to securitisation. The improvements in competition and integration with capital markets seen in the US mortgage market are consequence of both, securitisation and the government subsidies.

In the UK, mortgage securitisation, without government subsidies, was introduced in the late 1980's when the first centralised mortgage lenders were established. The market share of centralised lenders has fluctuated considerably, reaching its peak at 15% in 1989 (Diamond and Lea 1992). The 1980's also corresponded with the introduction of a number of regulations intended to make the banking system more open and competitive. In more recent years, some UK banks and building societies have used securitisation to fund pools of mortgages and other assets. Still, the widespread use of securitisation in the US mortgage market is not comparable to any other country: the tendency to use securitisation has been steadily rising since the late 70's, in 1981 securitisation was used to fund 15% of total US residential mortgage origination, almost 40% by 1990, and 93% in 1993 (Kolari, Fraser and Anari 1998).

The objective of this chapter is to analyse the relationship between mortgage rates offered by different UK lenders and money market rates, and to test a variety of hypotheses on the way different types of lenders respond to changes in capital market rates.

This chapter contributes to the literature on competitive behaviour on the UK mortgage market by comparing the prices of mortgages offered by the two types of lenders encountered on the market: depository institutions and centralised lenders[195].

[195] Heffernan (1993) and (1997) has analysed the competitive behaviour of banks and building societies.

The results obtained here show that centralised lenders rates adjust slightly faster to changes in capital market rates; the difference in mark up over the capital market rates is lower for centralised lenders but it is not statistically significant. It is also shown that the centralised lenders market share fluctuates with the level of capital market rates suggesting that these lenders price mortgages close to their marginal cost of funds. This study also permits a very limited comparison of the effects of securitisation in the UK with the effects of securitisation in the US market.

The next section provides a short summary of the UK mortgage market during the past decade. Section 3 describes the data. Section 4 formally presents the hypotheses to be tested. Section 5 reports the econometric results. Section 6 analyses the results and Section 7 concludes.

8.2 EVOLUTION OF THE UK MORTGAGE MARKET

To understand the development of securitisation in the UK, one must consider first the evolution of the mortgage market and the deregulation of the financial sector in the 1980s.

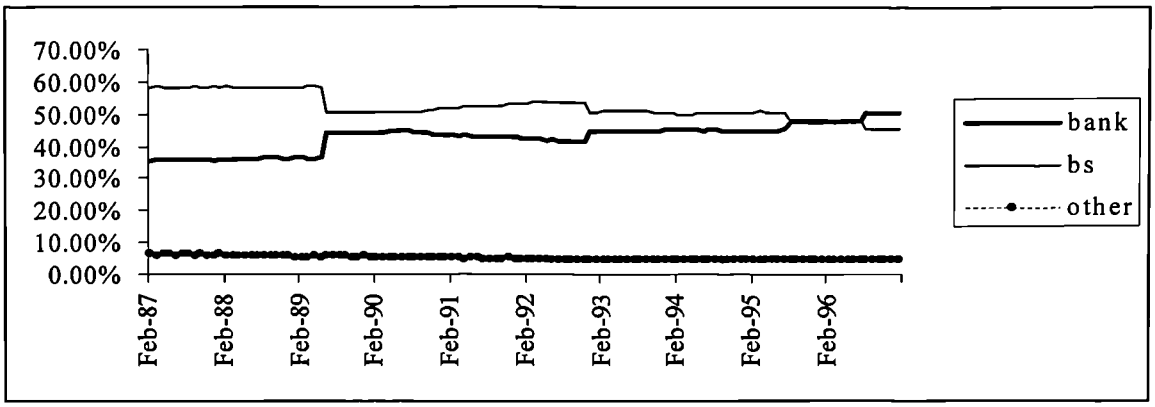
Until the beginning of the 80's, the building societies dominated the residential mortgage market. In 1980, the building societies accounted for 81.4% of market share, local authorities for 7.3% of the market and banks had a share of 5.5%[196]. This was consequence of the segmentation of UK financial markets: a system of credit controls (the "corset") on the banking sector, among other factors, restricted formally and informally the range of authorised activities, and the expansion of banks' balance-sheet[197]. Banks were not prohibited from offering mortgages; the corset aimed at reducing the availability of credit in general by taxing high interest rate deposits, so banks could not use them to fund loans. However, there was almost no direct competition between clearing banks and building societies.

[196] Standard & Poor's Creditweek International, 1996.

[197] Banks were officially advised to concentrate their activities on the business sector; and the Bank of England imposed high reserve requirements to limit credit growth.

Clearing banks did business in the retail and corporate sector, and managed the payment mechanisms, while building societies dealt exclusively with the personal sector and concentrated on mortgages and personal savings. Banks introduced current accounts which paid interest from the mid-1980's, in addition personal loans and a wider range of deposit accounts. Building societies only started offering chequing and current accounts by the mid-1980's. The public perceived building societies as the only mortgage lenders[198]. The building societies' dominance of the savings retail market was enhanced by a tax advantage: building societies paid interest net of tax, calculated on the interest earned by the average depositor, hence benefiting depositors with large savings (Diamond and Lea 1992). Figure 7.1 plots the market shares of different institutions in the retail savings market. The drop in the building societies share at the end of 1989 reflects the conversion of Abbey National to a bank in July 1989.

Figure 8.1 Market Share of UK Retail Savings Market



Source: Bank of England DataGraph: "Building societies' 'retail' deposits include all shares held, or sums deposited, by individuals. Also included are shares and deposits placed with societies in accordance with the terms of contractual savings schemes operated by banks and friendly societies acting as intermediaries for individuals and, where a building society has so elected, shares and deposits of under £50,000 from corporate bodies. Retail issues of subscribed capital e.g. Permanent Interest Bearing Shares are excluded. Banks' 'retail' deposits are defined as deposits which arise from a customer's acceptance of an advertised rate (including nil) for a particular product; typically 'retail' deposits are taken in the banks' branch networks"

When the "corset" was lifted banks moved into the mortgage market[199], attracted by good margins, relatively low risk (given the security provided by the collateral and a

[198] Standards and Poor's Creditweek International 1996

[199] In 1982, banks originated 40% of new mortgages; their share of the mortgage market dropped to 15% in 1984. At the beginning of the 1990's it was near 30%, until 1993 when it rose to 40% (see

booming property market), and good diversification opportunities from a poorly performing corporate sector.

Pryke and Whitehead (1991) describe intermediation between borrower and lender in the pre-reforms mortgage market as very simple. Building societies funded mortgages in the retail market[200]; housing finance risk was contained within the housing sector because low competition for retail funding protected savings and mortgage rates from macroeconomic fluctuations; the main source of risk in the mortgage business came from the performance of the housing sector. Building societies' mismatch risk[201] was small because only variable rate mortgages were available. The building societies acted as an informal cartel. The Building Societies Association recommended both share and mortgage rates, and sought to stabilise both rates over time. In 1983, the cartel was effectively broken when Abbey National refused to conform to the Association's rate setting (Heffernan 1996).

Mortgage rates did not necessarily follow changes in money market rates. For example, interest rates were not set at market-clearing level: when capital market interest rates moved upwards, building societies deposit rates normally lagged behind; as a consequence they might, for a time, have less competitive saving rates than other intermediaries. However, the building societies kept their customers by using credit rationing, queuing systems, and the imposition of a minimum time or a minimum balance within the society before being eligible for a mortgage.

A shortage of funds was a serious problem in the mid 1980s when a wave of public sector privatisation enticed the public to hold stock and invest in funds. The drop in savings and the fierce competition for deposits increased the costs of retail funding, eventually driving the mortgage rate above LIBOR rate (Diamond and Lea, 1992). Rates across building societies became less uniform after the breakdown of the cartel and the Building Societies Act (1986), which among other measures, allowed them

figure 7.2 below). The progressive increase in market share since 1989 is also explained by the conversion of some building societies into banks (Standard & Poor's Creditweek International, 1996).

[200] The typical funding instrument was a passbook share account, although since the beginning of the 80's other instruments like deposits with different term or minimum amount were introduced.

[201] Mismatch risk arises because building societies fund long-term mortgages with short-term deposits.

to use wholesale (up to a maximum of 20%, increased to 40% in 1989, and to 50% in 1997) funding for the first time.

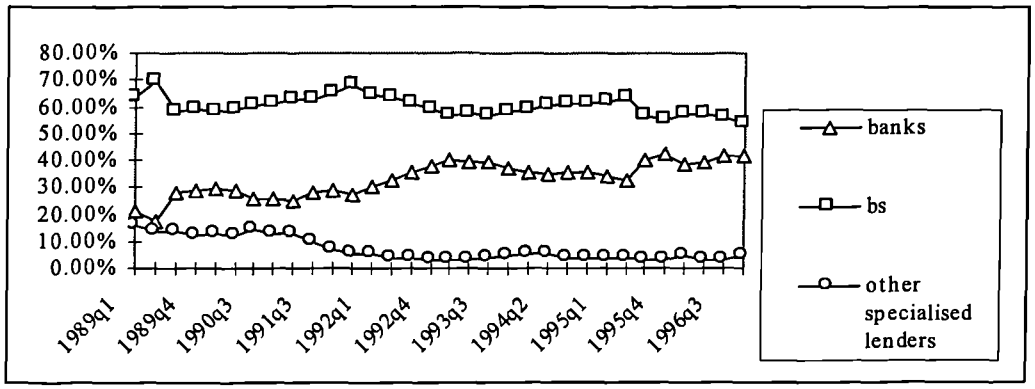
By the mid-1980's the mortgage market had become more efficient and open; and the strength of the relationship between mortgage rates and market interest rates in the economy increased.

The rapid growth of the mortgage market[202] attracted a whole new set of lenders including foreign banks, insurance companies and especially the so-called "centralised lenders". The main characteristic of centralised lenders is that, in the absence of bank status and therefore a branch network funded the mortgages in the wholesale market through securitisation (Coles 1992). In 1985 and 1986, three centralised lenders were established: National Home Loans Corporation, which issued the first UK mortgage-backed securities in March 1987, Household Mortgage Corporation and The Mortgage Corporation (Morrisey 1992). Centralised mortgage lenders bought and originated mortgages through agreements with insurance companies or real estate agents. By 1988 their market share was 13% (Diamond and Lea 1992), and 15% in 1989, a market share almost as high as that of the commercial banks at that time[203]. The growth in market share of centralised lenders also was due to the rapid growth the demand for mortgage loans, product innovation, and the competitiveness of wholesale funding (McCrone and Stephens, 1995). They also serviced mortgage portfolios of other institutions, and provided brokerage activities in mortgage sales. Centralised lenders became significant participants in the mortgage market until the end of 1991 (see Figure 8.2).

[202] The ratio of mortgage debt to GDP increased from 41% in 1982 to 67% in 1990. Diamond and Lea (1992) identify the increase in home ownership as the main reason for the expansion of the mortgage market. This was consequence of various factors: strong growth of the economy; sale of public property by the Government; the decline of the private rental property sector; and greater competition and liberalisation in the mortgage market which allowed previously "unbankable" borrowers to obtain mortgage loans.

[203] The increases in banks' market share (and parallel drops in building societies market share) in 1989, 1995 and 1996 reflect the conversion of Abbey National to plc status, the acquisition of Cheltenham and Gloucester by The Lloyds Bank Group and the acquisition of National and Provincial by Abbey National, respectively. Other conversions or acquisitions that took place in the last two years have had similar effect on the market shares and relative importance of both types of institutions. The conversion of Halifax, the Woolwich, Alliance & Leicester and Northern Rock shifted respectively 30%, 10%, 8% and 4% of building societies assets to the banking sector.

Figure 8.2 Lenders Share of Gross Lending Secured on Dwellings



Source: Bank of England Monetary and Financial Statistics

Centralised lenders contributed to the segmentation and specialisation of activities related to mortgage lending. Their limited asset base and thin capitalisation encouraged the creation of a UK secondary mortgage market (Pryke and Whitehead 1992). Myerberg (1996) argues that the imbalance between supply and demand in the mortgage market and the absence of regulation created an opportunity to use securitisation funding. Furthermore, there was a strong demand for high quality sterling floating rate securities. Mortgage-backed securities are usually structured as eurobond floating rate notes. Before securitisation the main issuers of eurobond floating rate notes were building societies, but they were constrained in the amount they could borrow wholesale, so supply was limited. Securitisation was welcomed by investors in the eurobond floating rate market because it increased the supply of securities.

The arrival of centralised lenders introduced important changes to the mortgage market structure: they separated the origination, servicing, and funding functions; they operated without branches, thereby reducing barriers and costs to entry in the market (McCrone and Stephens, 1995). By securitising their mortgage portfolios they expanded the supply of funds to the UK mortgage market, and improved the link between mortgage and other money market rates (Pryke and Whitehead, 1992).

8.3 REVIEW OF RELATED EMPIRICAL EVIDENCE

The analysis of the effects of securitisation on the US mortgage market has considered two issues; first whether the increased in firm entry brought by securitisation narrowed the spread between mortgage rates and money market rates; and second if securitisation improved the integration of the mortgage and capital markets.

Black, Garbade and Silver (1981) examine the marketability and liquidity of GNMAs and their effects on the underlying mortgages. Recall from Chapter 2 that GNMAs are mortgage-backed securities guaranteed by Ginnie Mae; the issuer is the institution that buys and pools the mortgages. Ginnie Mae only issues a guarantee if the mortgages have been guaranteed or insured by the Federal Housing Administration, the Veterans Administration and the Farmers Home Administration. The authors results show that the improvements in the marketability of GNMA's have reduced the cost of FHA (Federal Housing Administration) mortgages.

Hendershott and Shilling (1989) investigate the effect of securitisation on the market for "conventional" mortgages. A "conventional" mortgage is a mortgage which meets the criteria of loan-to-value ratio, size, and so on set annually by the US Government. Fannie Mae and Freddie Mac buy "conventional" mortgages from lenders to securitise them. Hendershott and Shilling show the expansion of securitisation has reduced the mortgage rate on "conventional" and on non-conventional mortgages which just exceed the criteria.

Ryding (1990) demonstrates that mortgage securitisation has reduced the spread between mortgage and other money market interest rates. Furthermore financial innovation in housing finance, of which securitisation is an example, has made residential property demand less exposed to monetary tightening policies than in the past. Ryding simulates the effects of an increase of one percentage point of the federal funds rate: without securitisation the response of housing demand to the tightening is found to be much larger.

Kolari, Fraser and Anari (1998) prove that a 10% increase in the level of mortgage securitisation as a proportion of total mortgage originations cut the mortgage spread by as much as 20 basis points. The mortgage spread is calculated as the difference between average mortgage rates and a constant maturity Treasury yield.

Hendershott (1990) and Hendershott and Van Order (1989) show that mortgage securitisation has resulted in a better integration between mortgage and capital markets, which in turn has softened housing cycles.

Gabriel (1987) argues that securitisation improves the integration between mortgage and capital markets. Integration increases the availability of funding but makes conventional fixed rate mortgage rates more vulnerable to fluctuations in the cost of capital[204]. Securitisation has also helped to alleviate the effects of capital shortages and financing constraints on the housing sector. Roth (1988) reports a closer adjustment of mortgage rates to changes in money market rates and an increase in the volatility of mortgage rates since the use of securitisation.

Cantor and Demsetz (1993) prove that securitisation in three different lending categories, residential mortgages, consumer credit, and business loans has helped to smooth the effects of the 1990 recessionary period: over the two years after the recession. Off-balance sheet credit grew by almost 30% in the mortgage market, by almost 70% in the consumer sector and by 15% in the business sector, while traditional lending fell. Thrifts, mortgage companies and finance companies were more active than commercial banks in securitising their portfolios during the recession.

Sellon and Van Nahmen (1988) argue that the development of the Ginnie Mae pass-through programme has improved the geographical efficiency of housing finance, increasing the liquidity of the mortgage market.

Follain and Zorn (1990) postulate that the increase in mortgage securitisation is the most important factor affecting the unbundling of residential mortgage finance. The

[204] Gabriel argues that during the 1970's only 20% of the change in 10-year Treasury was mirrored in the mortgage market within a week compared to 80% in 1986-1987.

success of the secondary mortgage market has confirmed that separating the activities related to the provision of mortgage credit can lower the cost of financial intermediation. The impact of securitisation can be perceived in all the intermediation functions: as securitisation develops, origination, increasingly standardised, has become easier, which has encouraged lenders to expand origination and separate it from financing. The unbundling of the servicing function has brought in new mortgage investors who were not interested in mortgage servicing. Finally, the unbundling of mortgage holding through the secondary mortgage market implies that investors other than traditional lenders could hold mortgages and mortgage-backed securities. It also encouraged traditional mortgage holders, like thrifts, to engage in securitisation since the federal guarantee which backs mortgage-backed securities reduces the default risk[205] of investing in the mortgage market. The authors affirm that unbundling through securitisation will cover all but the "mortgages-too-difficult-to-securitise", which are those with higher information asymmetry.

8.4 OUTLINE OF HYPOTHESES

This section proposes a simple model of mortgage rates. The model makes the following assumptions:

1. Building societies can be treated as profit maximisers. The literature that analyses industries in which both types of firms, mutual and stock-owned, coexist has traditionally focused on whether managers' in both types of firms have the same incentives. Managers of stock-owned firms are assumed to maximise profits or shareholder's wealth. However the presence of agency costs of ownership structure might distort the manager's incentives in mutual firms. Agency theory states that the degree of diffusion of ownership is very important because of its effects on the incentives and efficiency of the firm. A mutual firm can be considered as the most diffuse form of ownership structure, therefore agency problems might be larger for mutually owned financial institutions than for stock financial institutions[206]. In a mutual, the depositors-shareholders and the borrowers are the "de jure" owners, but

[205] See above the "swap programmes" of Fannie Mae and Freddie Mac

[206] Although agency costs of diffuse ownership are also present in banks whose stock is widely held. This is a problem common to all firms where ownership is dispersed, mutual or otherwise.

the managers and the government (through deposit insurance) are the "de facto" owners[207]. This gives rise to two problems, the managers of mutual institutions expend more and the mutual institutions operate at less efficient levels than their stock counterparts.

However, the activities of UK banks and building societies have converged since the beginning of the 1980's, especially since the Building Societies Act of 1986 which allows building societies to offer full retail banking services (Heffernan 1996). Gilmore argues (1998) that their different purposes and legislation rather than differences in manager's objectives cause the distinctions between building societies and stock-owned banks. The wave of conversions and take-overs amongst large building societies in the recent past responds to legal constraints rather than to a perception by managers that a stock-owned organisation would be more efficient[208]. Still most UK building societies operate with loan margins lower than banks: 2.2% in 1994 against 4% for banks[209]. Gilmore argues that this is because building societies return the profit to the owners through the interest rate offered in their products because their owners are also their customers.

2. The mortgage market is assumed to be less than perfectly competitive. Empirical studies conclusively showed that retail banking markets are imperfectly competitive[210]. The objective of this chapter is to examine the extent to which mortgage rates deviate from perfect competition, and whether the responsiveness of mortgage rates to money market rates is different among the different type of lenders, that is whether some lenders behave in a more competitive manner than others.

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[207] This happens because from a practical point of view their ownership rights and powers are very limited (Masulis 1987): Voting rights are generally given up in favour of the managers when opening the account; furthermore, depositors-shareholders have a maximum number of votes, independently of their deposit size. The ability to liquidate the firm, by redeeming the deposit decreases with the size of the outstanding deposit, so the ability to discipline the manager by partially liquidating the firm is low. Mutual owners are more like creditors of the firm since they cannot force the mutual to pay them anything more than principal and interest. Despite having a right to the mutual current earnings, these claims are not transferable and earnings can be indefinitely retained as net worth to finance growth. The lack of a take-over mechanism to correct inefficient management of mutual firms means that the managers are able to seize a large fraction of the firm's profit directly (high salaries and perquisites), or indirectly (contracting in the name of the firm in the managers' interest).

[208] The Building Societies Act of 1986 makes it easy to grow by converting to plc status than by merging with another building society, and conversion protects the building society from hostile take-overs for the five years following conversion

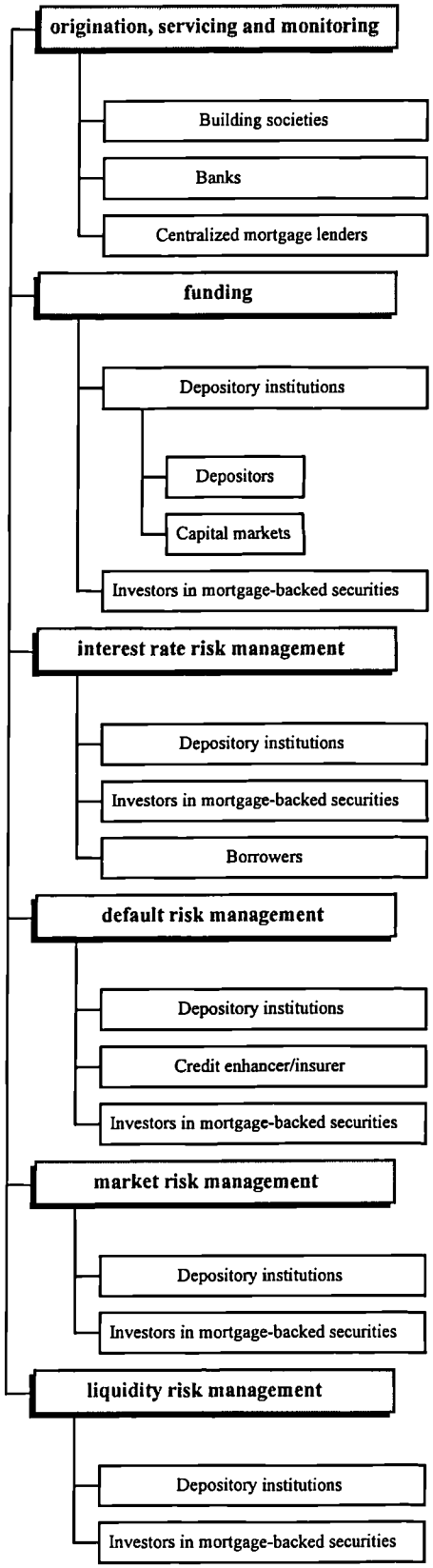
[209] Moody's Investors service: Changing Times for UK Building Societies, May 1995.

[210] See Heffernan (1993) and Heffernan (1997).

3. Mortgage lenders are classified by the set of functions associated with mortgage intermediation which they perform, and therefore by the risks they assume. In one extreme of the classification there are the centralised lending firms which "unbundle" most of the functions associated with intermediation; specifically, by not funding the mortgages, centralised lenders pass on to different agents the interest rate, default, market and liquidity risk. At the other extreme there are the depository institutions (banks and building societies) which perform all the functions associated with intermediation and therefore assume all the risks.

Figure 8.3 describes the distribution of functions amongst participants in the mortgage market. Building societies, banks and centralised lenders originate, service and monitor borrowers. However, because centralised lenders do not fund the mortgages they do not have to manage the risks associated with investing in mortgages. Instead it is the investors in mortgage-backed securities or the providers of credit and liquidity enhancement who have to manage those risks.

Figure 8.3 Allocation of Functions in the British Mortgage Market



4. Mortgage rates are assumed to be a linear function of money market rates and the risks associated with mortgage intermediation. The response of mortgage rates to changes in those variables should be predictable and quick. Mortgage rates do not depend on characteristics specific to the type of institution granting the mortgage other than the functions and risks assumed by the lender[211]. It is assumed that the mortgage market is integrated with other capital markets and therefore mortgage rates respond to general economic and market variables, but not to factors specific to the mortgage market (as it would be in a segmented market).

5. Lenders hedge the risks incurred by operating in the mortgage market, and the hedging costs are assumed to be passed to the borrowers through the mortgage rate.

6. Mortgage lenders set mortgage rates as follows:

$$M_{it} = I_t + R_{ij} * H_j \qquad (8.1)$$

where

M_{it} is the mortgage rate charged by the *i*th lender at time t,

I_t is the capital market interest rate,

R_{ij} is the *j*th risk assumed by the *i*th lender and,

H_j is the cost of hedging that risk.

6. It is assumed that the more competitive the mortgage market, the lower the cost of hedging risks and therefore the lower the spread of the mortgage rate with respect to money market rates. Also some lenders might have a competitive advantage in managing a type of risk and therefore be willing to assume it for a lower price. For simplicity of analysis it is assumed that the component of the mortgage rate which is associated to the risks assumed by the lender and the hedging costs is constant. It is reasonable to expect that each lender provides a series of intermediation and financing services which is constant over a long period. For example, centralised lenders do not finance the mortgages themselves; funding the mortgages would require a big change in the structure of these lenders, so assuming a constant mark-up

[211] All lenders, mutual building societies, and stock-owned banks and centralised lenders are assumed to have the same objective: *maximise profits.*

over the money market rate seems reasonable. Therefore $R_{ij}*H_j$ becomes a constant C_i.

It is important to point out that in this simple model of mortgage market, it is the ultimate financier of the mortgages who sets the rates. Securitised mortgages are financed in the capital market, and because of the structure of these securities, the final investor does not fully assume interest rate risk, liquidity risk and the majority of the default risk. However, an investor in a bank or building society, who indirectly invests in the institution's asset portfolio, requires from the bank or building society the managing and hedging of all the risks related to intermediation. Therefore, the borrower cost includes the provision of the hedging of those risks.

8.4.1 Hypotheses

The hypotheses to be tested are the following:

Hypothesis 1: Securitisation improves competitive behaviour in the mortgage market because it separates the functions associated with financial intermediation: First, lenders can transfer some of those functions to other agents willing to undertake those functions. And second, the separation of functions lowers the barriers to entry into the mortgage market. A more competitive mortgage market implies decreasing spreads between mortgage rates and money market rates, and in the long run it should make mortgage loans cheaper and less exposed to credit shortages.

Hypothesis 2: The development of securitisation facilitates the flow of funds into the mortgage market from a variety of sources and therefore it improves the integration of the mortgage and capital markets.

Hypothesis 3: The speed of adjustment of mortgage rates offered by lenders who use securitisation as their primary source of funds to changes in money market rates should be faster than for other lenders. When mortgages are securitised, investors in asset-backed securities are paid from the cash flows (interest and principal) generated by the mortgages. The common procedure in the UK has been to structure the

mortgage-backed securities as floating-rate notes linked to 3-month Libor[212]: every three months the rate on the securities is adjusted to reflect current 3-month Libor plus a fixed spread. This leaves the lender who securitised the assets exposed to basis risk, which arises when the interest rate from the assets (mortgages in this case) does not cover the interest rate due on the securities. One of the consequences of securitisation is that the seller keeps the customer relationship; borrowers of securitised assets are frequently unaware that securitisation took place at all. The lender will have to pass on to the borrowers any increase in the interest rate which is required to repay the investors, because otherwise the shortage of funds will have to be covered by the lender. Centralised mortgage lenders are thinly capitalised, and as said above, their main funding source is securitisation; consequently, they are unable to absorb losses from not transmitting to borrowers the rate increases necessary to repay investors. Their mortgage rates should adjust faster to changes in money market rates than rates of other lenders, who may wish to protect customer relationships by delaying the adjustment, especially when money market rates have increased.

Hypothesis 4: the difference between the money market rate and the mortgage rate should be narrower for the centralised lenders, whether the difference is rising or falling. Centralised lenders assume fewer intermediation functions and risks than depository institutions[213], therefore they have lower costs, and according to equation (8.1) their mortgage rates should exceed money market rates by a lower amount.

8.5 DESCRIPTION OF THE DATA AND METHODOLOGY

8.5.1 The Choice of Market Rate

Two proxies for the money market rate are considered: 3-month Libor and the Bank of England base rate.

[212] The London Interbank Offer Rate
[213] See Figure 8.3

The vast majority of the US literature proxies the money market rates by some long-term Government rate. This is because most of the US mortgages are fixed rate. Since the UK market is dominated by variable rate mortgages[214], especially during the 1980's, it is more appropriate to use a short-term rate like 3-month Libor.

Libor represents the marginal cost pricing (Heffernan 1993) because it is the inter-bank rate at which banks and some building societies can borrow and lend to each other. 3-month Libor is also used as the index rate for setting the interest rate of UK mortgage-backed securities. In this sense Libor is the marginal cost of funds for the lenders that fund through securitisation.

The Bank of England base rate is a macroeconomic rate, because the Bank uses changes in this rate to induce changes in retail market rates (Heffernan 1997).

Granger causality tests were performed on the two money market rates[215], Libor and the Bank of England base rate to determine which rate better helps to forecast the other one. The results of the test showed that Libor Granger-causes the Bank of England base rate but not the opposite. This suggests that the market anticipates the changes in the Bank's base rate. This result makes the use of both rates and comparison between the results obtained with both rates more interesting: more competitive mortgage rates should be better integrated with Libor.

In the light of the Granger results, the Bank of England base rate is also used. Heffernan (1997) uses an error-correction model to capture the dynamics of British retail deposit and loan rate responses to changes in the Bank of England base rate. Heffernan's objective was to analyse the speed of the money transmission mechanism. The test is conducted by employing a monthly series on four retail

[214] Fixed rate mortgages have become more common in the UK since the beginning of the 1990's; at their peak in 1993 they represented 56% of the market. However in the four following years, the variable rate mortgages became again the dominant product with market shares of 50%, 73%, 81% and 62% in 1994, 1995, 1996 and 1997, respectively. In the last year the share of fixed rate mortgages has grown once more to 56%. *Loans for house purchase and Remortgages* in Survey of Mortgage Lenders (SML) produced jointly for the Council of Mortgage Lenders (CML) and the Department of the Environment, Transport & the Regions (DETR). (http://www.cml.org.uk/)

[215] The Granger non-causality computes the log-likelihood ratio for testing the null hypothesis that the coefficients of a subset of variables in a VAR model equals zero. Since both rates (Libor and the base rate) contain a unit root, the test is performed by using a VAR model in first differences (see below

banking products offered by eight depository institutions (5 banks and 3 building societies) between 1987 and 1993[216]. In this chapter, only her repayment mortgage results are relevant, and are used as a benchmark for comparative purposes. Even so, the differences in both samples mean the comparison has to be treated with caution.

8.5.2 The Mortgage Rates

To examine and compare how different types of mortgage lenders set mortgage rates the *Moneyfacts*[217] database is used. This database contains information on monthly rates and other characteristics of mortgage products (i.e. whether fixed or variable) offered by all the UK mortgage lenders. To maximise the number of observations per lender, and to avoid using small institutions less established in the market, the econometric analysis is confined to the mortgage lenders reported in Table 8.1 below.

Section 8.5.2 for an explanation of VAR modelling). The test examines the extent to which changes in one variable are transmitted to the other variable.

[216] 1986 to 1992 for mortgages.

[217] The Moneyfacts Group publishes a series of weekly magazines with financial information. Their oldest one collects and publishes monthly mortgage and saving rates offered by the majority of lenders in the UK.

Table 8.1 Mortgage Lenders Used in the Econometric Analysis

Name	Period	N. Obsrvs.
Panel A		
Banks		
Abbey National Plc (ABBEY)	Jul/89-March/96	81
Bank of Ireland (BIRE)	Nov/88-March/96	89
Panel B		
Building Societies		
Alliance &Leicester (ALL)	Nov/88-March/96	89
Bradford &Bingley (BR)	Nov/88-March/96	89
Britannia (BRIT)	Nov/88-March/96	89
Cheltenham&Gloucester (CH)	Nov/88-March/96	89
Halifax (HALF)	Nov/88-March/96	89
National&Provincial (NAT)	Nov/88-March/96	89
Nationwide (NWIDE)	Nov/88-March/96	89
Leeds Permanent (LEEDS)	Nov/88-Feb/95	76
Woolwich (WOOL)	Nov/88-March/96	89
Panel C		
Centralised Lenders		
First Mortgage Securities (FMS)	Jul/89-March/92	33
Household Mortgage Corporation (HMC)	Nov/88-March/96	89
National Home Loans (NHL)	Nov/88-Nov/91	37
The Mortgage Corporation (TMC)	Nov/88-March/96	89

The number of retail banks in the sample is very small, this is a shortcoming of the empirical analysis. Unfortunately, the database does not contain full information on mortgage rates for the major retail banks until the beginning of the 1990's. To capture any possible differences in the setting rates behaviour among the depository institutions and centralised lenders, lenders with similar data availability where included in the sample. Since centralised lenders had their biggest market share at the end of the 1980's firms with rates going back to that time were included. Nevertheless, the exclusion of the major banks from the analysis does not mean that the sample of depository institution is not representative enough. Appendix 8.A shows aggregate total market shares by type of depository institution between 1988-1998 (Table 8.A.1). Only in the last two years, 1997 and 1998, had the banks a market share larger than building societies, and it is a consequence of some of the largest building societies converting to plc. status rather than the traditional banks increasing their market share: Table 8.A.2 shows that the seven largest players in the in 1990 were building societies (all of them included in the sample in the sample used in this study). They accounted for more than 55% of the total market share. In 1997 the seven largest lenders included six banks, 4 of which were converted

building societies and another one a banking group which had acquired a building society (see Table 8.A.3).

The *Moneyfacts* database has information on most of the mortgage products offered by each lender. With very few exceptions the only mortgage available is a variable rate mortgage, especially in the late 1980's. There are two methods of repaying a variable rate mortgages: repayment and endowment or interest only. With a repayment mortgage, each monthly payment to the lender comprises part interest, part repayment of the loan itself (capital). At maturity, and provided the borrower has kept up with the scheduled payments, the loan is paid off in full. With an interest only or endowment mortgage, the monthly payments cover just the interest on the loan. The borrower usually makes contributions to a separate investment vehicle e.g. an endowment policy, and gives the lender legal rights over the sums accumulated on that investment during the term of the mortgage. The lump sum on maturity of the policy pays off the capital of the loan, and could even yield surplus cash; conversely, it could be smaller that the amount required to pay off the capital of the loan, leaving the borrower with a debt to settle.

The lenders almost invariably quote the same basic variable rate for repayment and endowment mortgages. The difference in interest rate between repayment and endowment mortgages is very small, and is usually explained by firms advertising the change for one type of mortgages one or two days before the other one. Also, even in the cases in which there is a difference, such difference would only be relevant if the delay takes place when the month changes because the data used here is monthly. Repayment mortgages represented the smallest market share during the period in consideration, only reaching a share of at least 30% from 1994 onwards (see Table 8.A.4 in Appendix 8.A)[218]. Furthermore some of the lenders, particularly

[218] MIRAS, Mortgage Interest Relief at Source, introduced in the early 1980's allows mortgage borrowers to pay interest net of tax "relief". In repayment mortgages that amount of "relief" obtained diminishes every year because the repayment of the capital reduces the balance outstanding and therefore the amount of interest charged on the loan. In a repayment mortgages the monthly payments are constant but the amount of the payment dedicated to cover principal and interest varies during the life of the loan: at the beginning most of the payment is interest and little capital is repaid, at the end it happens the contrary. With interest only mortgages the amount of "relief" is constant because the payment of capital does not happen until maturity and therefore the mortgage payments only cover interest. In the 1980's, the tax "relief" under MIRAS was large; therefore borrowers preferred interest only mortgages. In the last years the "relief" obtained from MIRAS has been reduced (at the moment is 10% of the first £30000 of the loan) so repayment mortgages are becoming more common.

the centralised lenders, limited their offerings to endowment mortgages for part of the period. For these reasons rates on endowment mortgages were chosen to represent the mortgage rate in the study.

There is information on two rates: the rate charged to existing customers, and the rate charged to new customers. The rate charged to existing customers has the advantage of reflecting how changes in capital market rates are passed onto the existing borrowers.

8.5.2 Methodology: Cointegration and Error-Correction Models

Error-correction models (ECMs) allow the identification of long-run relationships between economic variables. The time-path of cointegrated variables is affected by the fact that they must always return to their long-run equilibrium. If the variables considered are interest rates, the ECM can be used to measure the extent and speed at which one interest rate adjusts to changes in other rates. It is postulated that there is a long-run linear relationship between mortgage interest rates and capital market interest rates. If the gap between those rates gets too "large" relative to the long-run equilibrium, then the mortgage rate has to change to close the gap. The short-run dynamics between the variables is therefore influenced by deviations from the long-run relationship, since the system has to converge to the long-run equilibrium.

A more formal exposition is as follows. If two economic series (y_t and x_t) are integrated of order 1 [I(1)], there might be a linear combination between them which is stable around some fixed value (Greene, 1993), i.e., the linear combination might be stationary, [I(0)]:

$$\varepsilon_t = y_t - \beta x_t \qquad (8.2)$$

where

ε is the error

ß is a vector of parameters.

If the error term is stationary, the series is said to be cointegrated and the vector [1, -ß] is the *cointegrating* vector. Cointegration implies that although the individual time series can contain stochastic trends (i.e. they are non-stationary), there is some long-run equilibrium, represented by the cointegrated vector, which ties them together (Hamilton, 1994). The variables cannot move independently from each other. The relationship between them is stable (i.e. stationary).

The hypothesis to be tested here is that in a competitive mortgage market there is a long-run equilibrium relationship between capital market and mortgage rates. If the mortgage rates deviate from such equilibrium, economic forces will restore it to the long-term level. Equation (8.1) represents the long-term equilibrium between mortgage and market rates.

Restating equation (8.2) in terms of interest rates results in the following expression:

$$e_{it} = M_{it} - B*Ir_t - C_i \qquad (8.3)$$

where

e_{it} is the "error" in the mortgage rate offered by the *i*th lender at time t

M_{it} is the mortgage rate charged by the *i*th lender at time t,

Ir_t is the capital market interest rate,

C_I is a constant and,

B is a coefficient.

If mortgage rates are cointegrated with capital market rates, e_{it} will be a stationary process.

Testing for cointegration requires that the time series involved are I[1] processes. To test for nonstationarity in the data the Augmented Dickey-Fuller (ADF)[219] test is employed. The null hypothesis of the ADF test is that the series contains a "unit root", i.e., that the series is nonstationary. ADF tests were conducted on all 18 of the lenders' mortgages rates and Libor and the Bank of England base rate. The null hypothesis of nonstationarity could not be rejected at the 95% level for any of the series.

The next step is to test for the presence of cointegration relationships amongst the variables. The Johansen maximum likelihood procedure is employed. This method is based on modeling the nonstationary time series using a vector autoregressive approach (VAR). Johansen's procedure permits the estimation of dynamic relationships between endogenous variables without imposing a priori restrictions (Harris 1995). For example, in an OLS framework one of the variables must be chosen as the regressand, and thus its coefficient is normalized to one, which might affect the estimation of the cointegrating relationships. The Johansen method treats all the variables as endogenous.

Vector z_t is defined as a (Nx1) vector of n endogenous variables; it is possible to model z_t as a VAR:

$$z_t = A_1 z_{t-1} + ... + A_p z_{t-p} + \alpha + T + u_t \quad (8.4)$$

where,

A_i is a (NxN) matrix of parameters,

α is a vector of constants,

u_t is a vector of Gaussian errors, and

T=1..t is a time trend.

Each variable is therefore regressed on past lagged values of itself, lagged values of the other variables, and if required, a constant and a time trend. All regressions have the same explanatory variables. For each mortgage lender, the vector z_t=(M_t, I_t), is defined and modelled as a VAR.

This equation can be transformed into a vector error-correction which separates long-run from short-run effects.

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + ... + \Gamma_{p-1} \Delta z_{t-p} + \Pi z_{t-p+1} + \alpha + T + u_t \quad (8.5)$$

where,

Γ_1, .. Γ_{p-1}, and Π are matrices of unknown parameters.

---

[219] Dickey and Fuller (1979)

The Johansen method focuses in the matrix Π. Equation (7.5) is estimated subject to the restriction that Π has reduced rank, i.e. r<N. The rank "r" of Π will be the number of cointegrating relationships among the variables in z_t. The rank of the matrix is equal to the number of its non-zero characteristic roots (eigenvalues), which is equal to the number of non-zero of columns of v, the speed of adjustment. If this restriction is not met, then there is no cointegrating relationship.

If Π has reduced rank then there is a representation of Π such that

$$\Pi = \alpha\beta' \tag{8.6}$$

Π is the "long-run" "levels" solution where α, which is called the adjustment matrix, represents the speed of adjustment of the variables with respect to a shock in the system; and β, which is called the cointegrating matrix, is a matrix of long-run coefficients representing the cointegrating relationships and ensuring that the system returns to the long-run equilibrium.

Prior to estimating the number of cointegrating relationships and cointegrating vectors, the order of VAR for each equation must be determined. The lag length represents the length of adjustment to deviations from the log-run equilibrium. Choosing the appropriate order is done by using a model selection criterion: the Akaike Information Criterion, the Schwarz Bayesian Criterion or by log-likelihood tests. The results from the three criteria are usually consistent: if there are inconsistencies the lowest order VAR is chosen to avoid possible over-parameterization. In all but two cases the order of the VAR selected was 1: this indicates that disturbances to the system work their way through it very fast.

Once the order of the VAR is known the number of cointegrating relationships in each VAR is estimated. This is equal to "r", the rank of the matrix of coefficients of the "levels" variables (Π) in equation (5).

To determine the number of cointegrating relationships in each VAR, the Johansen method performs two types of tests: the "maximum eigenvalue statistic" and the "trace statistic". The "maximum eigenvalue statistic" tests the null hypothesis of

H_0: Rank (Π) = r

Against the alternative

H_a: Rank (Π) = r+1

Whereas the "trace statistic" uses the alternative

H_a: Rank (Π) > r+1

Table 8.2 presents the results of such estimations for the selected order VAR. The results are reported with an intercept in the VAR, but not a time trend, because it was found not to be statistically significant in earlier regressions. With respect to Libor, the existence of one cointegrating relationship could not be rejected in all cases but one, First Mortgage Securities. For the base rate, there was no cointegrating relationship in two cases, First Mortgage Securities and Alliance and Leicester.

Table 8.2 Cointegration Tests Results

PANEL A						PANEL B					
Johansen Cointegration test, restricted intercepts and no trends in VAR						Johansen Cointegration test, restricted intercepts and no trends in VAR					
r = number of cointegrating vectors						r = number of cointegrating vectors					
Bank of England Base Rate						Three Month Libor					
Null	*Alternative*	*Statistic*	*95% Critical Value*	*90% Critical Value*		*Null*	*Alternative*	*Statistic*	*95% Critical Value*	*90% Critical Value*	
TMC		1988M12 to 1996M8				TMC		1988M12 to 1996M8			
order of VAR=1						order of VAR=1					
r=0	r=1	24.0927	15.8700	13.8100	**	r=0	r=1	51.6624	15.8700	13.8100	**
r=0	r>=1	26.5248	20.1800	17.8800	**	r=0	r>=1	53.9803	20.1800	17.8800	**
r<=1	r=2	2.4320	9.1600	7.5300		r<=1	r=2	2.3179	9.1600	7.5300	
HMC		1989M11 to 1996M8				HMC		1989M11 to 1996M8			
Order of VAR=2						Order of VAR=1					
r=0	r=1	16.0476	15.8700	13.8100	**	r=0	r=1	67.9650	15.8700	13.8100	**
r=0	r>=1	19.0632	20.1800	17.8800	*	r=0	r>=1	70.5127	20.1800	17.8800	**
r<=1	r=2	3.0155	9.1600	7.5300		r<=1	r=2	2.5478	9.1600	7.5300	
NHL		1988M12 to 1991M11				NHL		1988M12 to 1991M11			
Order of VAR=1						Order of VAR=1					
r=0	r=1	26.1335	15.8700	13.8100	**	r=0	r=1	28.8597	15.8700	13.8100	
r=0	r>=1	26.5221	20.1800	17.8800	**	r=0	r>=1	23.9540	20.1800	17.8800	*
r<=1	r=2	0.3895	9.1600	7.5300		r<=1	r=2	1.6743	9.1600	7.5300	
FMS		1989M8 to 1992M8				FMS		1989M8 to 1992M8			
Order of VAR=1						Order of VAR=1					
r=0	r=1	14.3831	15.8700	13.8100		r=0	r=1	11.3527	15.8700	13.8100	
r=0	r>=1	16.0500	20.1800	17.8800		r=0	r>=1	13.1362	20.1800	17.8800	
r<=1	r=2	1.6669	9.1600	7.5300		r<=1	r=2	1.7835	9.1600	7.5300	
BIRELAND		1989M11 to 1996M8				BIRELAND		1989M11 to 1996M8			
Order of VAR=1						Order of VAR=1					
r=0	r=1	32.5250	15.8700	13.8100	**	r=0	r=1	42.9240	15.8700	13.8100	**
r=0	r>=1	34.4001	20.1800	17.8800	**	r=0	r>=1	44.7299	20.1800	17.8800	**
r<=1	r=2	1.8752	9.1600	7.5300		r<=1	r=2	1.8058	9.1600	7.5300	
ABBEY		1988M12 to 1996M8				ABBEY		1988M12 to 1996M8			
order of VAR=1						order of VAR=1					
r=0	r=1	27.1136	15.8700	13.8100	**	r=0	r=1	39.3982	15.8700	13.8100	**
r=0	r>=1	28.9965	20.1800	17.8800	**	r=0	r>=1	41.9472	20.1800	17.8800	**
r<=1	r=2	1.8829	9.1600	7.5300		r<=1	r=2	2.5490	9.1600	7.5300	
HALIFAX		1988M12 to 1996M8				HALIFAX		1988M12 to 1996M8			
order of VAR=1						order of VAR=1					
r=0	r=1	23.1076	15.8700	13.8100	**	r=0	r=1	53.0622	15.8700	13.8100	**
r=0	r>=1	24.8705	20.1800	17.8800	**	r=0	r>=1	55.5006	20.1800	17.8800	**
r<=1	r=2	1.7630	9.1600	7.5300		r<=1	r=2	2.4384	9.1600	7.5300	

Table 8.2 (cont'd) Cointegration Tests Results

PANEL A						PANEL B					
Johansen Cointegration test, restricted intercepts and no trends in VAR						Johansen Cointegration test, restricted intercepts and no trends in VAR					
r = number of cointegrating vectors						r = number of cointegrating vectors					
Bank of England Base Rate						Three Month Libor					
Null	*Alternative*	*Statistic*	*95% Critical Value*	*90% Critical Value*		*Null*	*Alternative*	*Statistic*	*95% Critical Value*	*90% Critical Value*	
ALL.&LEIC 1988M12 to 1996M3						ALL.&LEIC 1988M12 to 1996M3					
order of VAR=2						order of VAR=1					
r=0	r=1	12.5417	15.8700	13.8100		r=0	r=1	42.7038	15.8700	13.8100	**
r=0	r>=1	15.2027	20.1800	17.8800		r=0	r>=1	45.1019	20.1800	17.8800	**
r<=1	r=2	2.6610	9.1600	7.5300		r<=1	r=2	2.3981	9.1600	7.5300	
BR.&BINGL 1988M12 to 1996M3						BR.&BINGL 1988M12 to 1996M3					
order of VAR=1						order of VAR=1					
r=0	r=1	34.1385	15.8700	13.8100	**	r=0	r=1	40.9856	15.8700	13.8100	**
r=0	r>=1	36.3230	20.1800	17.8800	**	r=0	r>=1	42.7760	20.1800	17.8800	**
r<=1	r=2	2.1850	9.1600	7.5300		r<=1	r=2	1.7902	9.1600	7.5300	
CH.&GLOUC 1988M12 to 1996M3						CH.&GLOUC 1988M12 to 1996M3					
order of VAR=1						order of VAR=1					
r=0	r=1	28.5489	15.8700	13.8100	**	r=0	r=1	40.6330	15.8700	13.8100	**
r=0	r>=1	30.3174	20.1800	17.8800	**	r=0	r>=1	42.6508	20.1800	17.8800	**
r<=1	r=2	1.7685	9.1600	7.5300		r<=1	r=2	2.0179	9.1600	7.5300	
LEEDS 1988M12 to 1995M2						LEEDS 1988M12 to 1995M2					
order of VAR=1						order of VAR=1					
r=0	r=1	21.8350	15.8700	13.8100	**	r=0	r=1	43.1897	15.8700	13.8100	**
r=0	r>=1	23.8317	20.1800	17.8800	**	r=0	r>=1	44.8006	20.1800	17.8800	**
r<=1	r=2	1.9966	9.1600	7.5300		r<=1	r=2	1.6109	9.1600	7.5300	
WOOL 1988M12 to 1996M3						WOOL 1988M12 to 1996M3					
order of VAR=1						order of VAR=1					
r=0	r=1	16.5250	15.8700	13.8100	**	r=0	r=1	50.4157	15.8700	13.8100	**
r=0	r>=1	18.4605	20.1800	17.8800	*	r=0	r>=1	52.3852	20.1800	17.8800	**
r<=1	r=2	2.3212	9.1600	7.5300		r<=1	r=2	1.9705	9.1600	7.5300	
NAT.&PROV 1989M11 to 1996M3						NAT.&PROV 1989M11 to 1996M3					
order of VAR=1						order of VAR=1					
r=0	r=1	39.9750	15.8700	13.8100	**	r=0	r=1	45.1702	15.8700	13.8100	**
r=0	r>=1	41.8211	20.1800	17.8800	**	r=0	r>=1	47.0741	20.1800	17.8800	**
r<=1	r=2	1.8461	9.1600	7.5300		r<=1	r=2	1.9039	9.1600	7.5300	
BRITANNIA 1989M11 to 1996M3						BRITANNIA 1989M11 to 1996M3					
Order of VAR=1						Order of VAR=1					
r=0	r=1	41.2891	15.8700	13.8100	**	r=0	r=1	41.6674	15.8700	13.8100	**
r=0	r>=1	43.1014	20.1800	17.8800	**	r=0	r>=1	43.4588	20.1800	17.8800	**
r<=1	r=2	1.8122	9.1600	7.5300		r<=1	r=2	1.7914	9.1600	7.5300	
NWIDE 1989M11 to 1996M3						NWIDE 1989M11 to 1996M3					
Order of VAR=1						Order of VAR=1					
r=0	r=1	16.3312	15.8700	13.8100	**	r=0	r=1	43.7214	15.8700	13.8100	**
r=0	r>=1	19.0983	20.1800	17.8800	*	r=0	r>=1	45.6130	20.1800	17.8800	**
r<=1	r=2	2.7671	9.1600	7.5300		r<=1	r=2	1.8916	9.1600	7.5300	

The cointegrating vector is estimated using maximum likelihood. The Johansen method does not impose normalization of one of the coefficients when estimating the number of cointegrating relationships. However to make economic sense of the cointegrating parameters one variable must be assigned a coefficient of unity. Normalization is done by dividing all coefficients by the one chosen to be normalized. Following equation (8.3) a value of unity is assigned to the mortgage rate coefficient[220].

Table 8.3 reports the cointegrating vectors for all mortgage rates. These cointegrating vectors represent the long-run relationship between mortgage rates and capital market rates. There was no cointegrating relationship between First Mortgage Securities and the two money market rates, or between Alliance and Leicester and Bank of England base rate[221], hence no cointegrating vector is reported.

Table 8.3 Long Run Relationship Between Mortgage Rates and Capital Market Rates

Normalised cointegrating coefficents indicating the long-run relationship implied by cointegrating vector	PANEL A		PANEL B	
	Intercept	**Base rate**	**Intercept**	**Libor**
TMC	3.82 (0.23)**	0.783 (0.022)**	3.685 (0.21)**	0.783 (0.02)**
HMC	2.879(0.19)**	0.86 (0.1)**	2.7191 (0.16)**	0.8611 (0.01)**
NHL	1.26 (1.02)	0.97(0.07)**	2.49 (1.51)	0.874 (0.11)**
B.IRELAND	3.051 (0.228)**	0.817 (0.02)**	2.929 (0.27)**	0.815 (0.02)**
ABBEY	3.139 (0.24)**	0.795 (0.02)**	2.986 (0.29)**	0.795 (0.02)**
HALIFAX	3.09(0.24)**	0.79(0.02)**	2.97 (0.21)**	0.79 (0.02)**
ALL.&LEIC.			2.94 (0.28)**	0.79 (0.02)**
BR.&BINGL.	3.27 (0.19)**	0.78 (0.01)**	3.13 (0.25)**	0.788 (0.02)**
CH.&GLOUC	3.0 (0.22)**	0.80 (0.02)**	2.85 (0.27)**	0.80 (0.02)**
LEEDS	3.466 (0.23)**	0.76 (0.02)**	3.306 (0.25)**	0.768 (0.02)**
WOOL	3.290 (0.25)**	0.77 (0.02)**	3.165 (0.20)**	0.772 (0.01)**
NAT.&PROV	3.103 (0.19)**	0.801 (0.01)**	2.92 (0.26)**	0.80 (0.02)**
BRITANNIA	3.23 (0.21) **	0.78 (0.02)**	3.078 (0.3)**	0.78 (0.03)**
NWIDE	3.09 (0.31)**	0.79 (0.03)**	2.97 (0.25)**	0.79 (0.02)**

Values in brackets are standard errors

** indicates that the coefficient is different form 0 at the 99% level of confidence

[220] In equation 8.3: $e_{it} = M_{it} - B*Ir_t - C_i$, so the coefficient for the mortgage rate, M_{it}, is already unity.

[221] See table 8.2

Table 8.4 reports the t-statistics for the hypothesis of unity coefficients on the money market rate. Only two centralized lenders, the Household Mortgage Corporation and National Home Loans, do not reject the hypothesis of unity coefficients.

Table 8.4 T-Statistics for the Hypothesis of Unity Coefficients on the Money Market Rate.

t-statistics Hypothesis: coefficent for the money rate equals unity	base rate	libor
TMC	-9.86	-10.85
HMC	**-0.74**	-13.89
NHL	**-0.43**	**-1.15**
B.IRELAND	-9.15	-9.25
ABBEY	-10.25	-10.25
HALIFAX	-10.50	-10.50
ALL.&LEIC.		-10.50
BR.&BINGL.	-22.00	-10.60
CH.&GLOUC	-10.00	-10.00
LEEDS	-12.00	-11.60
WOOL	-11.50	-22.80
NAT.&PROV	-19.50	-10.00
BRITANNIA	-11.00	-7.33
NWIDE	-7.00	-7.00

Bold indicates that the hypothesis cannot be rejected at the 99% level of confidence.

Finally Table 8.5 reports the error correction form of the cointegrating relationships in the VAR model. The error correction form shows the short-run dynamics of the system. The dependent variable is the monthly change in mortgage rates. The coefficient for ecm(-1) shows the extent of adjustment to the long-run equilibrium which is achieved in one month.

Table 8.5 Short-Run Relationship Between Mortgage Rates and Capital Market Rates

Error Correction Form of the Relations in the Cointegrating VAR Model

PANEL A	Bank of England Base Rate						
Regressor	**DTMC**	**DHMC**	**DNHL**	**DBIRE**	**DABBEY**	**DHALF**	**DALL**
ecm(-1)	-0.383**	-0.418 **	-0.52**	-0.439**	-0.401**	-0.33**	
dbofengl(-1)		0.422 **					
dhmc(-1)		-0.042					
R-Bar Sq	20.13%	49.30%	51.40%	29.90%	24.40%	18.40%	
F-sts for S.Corr	1.73*	1.25	0.55	1.01	1.26	2.08*	
PANEL B	Libor						
Regressor	**DTMC**	**DHMC**	**DNHL**	**DBIRE**	**DABBEY**	**DHALF**	**DALL**
ecm(-1)	-0.36**	-0.488**	-0.336**	-0.343**	-0.315**	-0.319**	-0.266**
R-Bar Sq	41.70%	53.20%	44.16%	35.50%	33.20%	42.20%	34.90%
F-sts for S.Corr	1.32	1.097	1.29	0.967	1.211	1.38	0.033

** indicates that the coefficient is different form 0 at the 99% level of confidence

* indicates the presence of serial correlationin the residuals

The coefficients and standard errors are White's heteroskedasticity adjusted

Table 8.5 (cont'd) Short-Run Relationship Between Mortgage Rates and Capital Market Rates

Error Correction Form of the Relations in the Cointegrating VAR Model

PANEL A	Bank of England Base Rate						
Regressor	**DBR**	**DCH**	**DLEEDS**	**DWOOL**	**DNAT**	**DBRIT**	**DNWIDE**
ecm(-1)	-0.449**	-0.438**	-0.41**	-0.32**	-0.41**	-0.41**	-0.25**
dbofengl(-1)							
dhmc(-1)							
R-Bar Sq	29.30%	25.90%	21.34%	10.08%	34.70%	35.11%	10.90%
F-sts for S.Corr	1.36	0.95	1.53	1.56	1.79*	1.04	1.73*
PANEL B	Libor						
Regressor	**DBR**	**DCH**	**DLEEDS**	**DWOOL**	**DNAT**	**DBRIT**	**DNWIDE**
ecm(-1)	-0.333**	-0.337**	-0.349**	-0.36**	-0.28**	-0.28**	-0.29**
R-Bar Sq	34.40%	33.90%	40.90%	40.60%	36.50%	33.30%	36.02%
F-sts for S.Corr	0.69	0.916	1.04	1.69*	0.725	0.461	1.31

** indicates that the coefficient is different form 0 at the 99% level of confidence

* indicates the presence of serial correlationin the residuals

The coefficients and standard errors are White's heteroskedasticity adjusted

8.5.2 Market Share and Wholesale Funding

A popular belief in the financial press is that centralised mortgage lenders had a funding advantage over other lenders at times in which the Libor rates were falling relative to deposit funding rates. By the same argument these lenders lost market share when the relationship is reversed because of their reliance on wholesale funding. This behaviour would be consistent with Hypothesis 4 which predicts that the difference between centralised lenders mortgage rate and capital market rates is narrower than the same difference for depository institutions. If wholesale rates are falling the centralised lenders may be able to offer lower mortgage rates and therefore gain market share.

To test the above proposition Table 8.6 below shows the correlation coefficients between different lenders' market share and the average monthly money market rates (Libor and base rate) between the years 1987 and 1992. The market share, in percentage, is proxied by the each lenders' monthly share of gross lending secured on dwellings, obtained from the Bank of England Monetary and Financial Statistics.

Table 8.6 Correlation Between Market Share and Money Market Rates

	Base Rate	Libor
Banks	-1.2%	1.8%
BS	11.5%	12.3%
CL	-21.9%	-31.3%

Period: 36 monthly observations between April 1993 and March 1996.

Where,
BS are building societies, and
CL are the centralised lenders

The results show that the market share of centralised lenders is inversely related to both market rates. A test of significance is performed for the correlation coefficient (see footnote 180). The null hypothesis that the correlation coefficient is equal to

zero is rejected in all cases except for the correlation coefficient between Libor an centralised lenders market share.

8.6 ANALYSIS OF RESULTS

Tables 8.3, 8.4 and 8.5 report the results from the estimation of the error correction models for mortgage rates. Table 8.3 shows the long-run relationship between the rates. In a competitive market the coefficient for the money market rate would be expected to be close to unity, indicating that changes in the lenders' marginal costs of funds are immediately passed to the borrowers. However, as it is reported in table 8.5, only two of the centralised lenders cannot reject the hypothesis of unity coefficients. The other lenders have coefficients smaller than unity, which on its own, would indicate that these lenders behave in more than perfectly competitive way. Also the more competitive the market, the lower the intercept term. All the intercept terms are close to 3, except for National Home Loans. A coefficient of less than unity coupled with a large positive intercept indicates firms are engaging in interest rate smoothing and remarking up rates above the money market rate, that is the lenders absorb some of the change in interest rates rather than passing them to the borrowers (Heffernan 1995).

Table 8.5 reports the percentage of error corrected by each lender every month. Five of the regressions show the presence of serial correlation in the residuals. The F-test for serial correlation indicates the presence of serial correlation in the residuals of the regressions for The Mortgage Corporation, Halifax, National and Provincial, Nationwide and the base rate, and the Woolwich and Libor. The Johansen method requires Gaussian residuals, i.e. homoskedasticity and non-serial correlation in the residuals. To correct for serial correlation different order VAR's were tried. Unfortunately in all the cases increasing the order of the VAR failed to show a cointegrating relationship between the rates.

All the coefficients for the ecm(-1) variable in Table 8.5 have the correct sign and are highly significant. The percentage of error corrected within a month is higher in the case of the base rate, but the equations that use Libor have greater explanatory power

in most of the cases[222] as indicated by the higher adjusted R-squared. It was established earlier that Libor Granger-causes the Bank of England base rate, suggesting that the market anticipates the Bank's decisions. This would explain the disparity in results; mortgage rates adjusts faster to changes in the base rate, but because Libor anticipates those changes, it has a higher explanatory power.

Table 8.7 summarises the results presented above and compares the average coefficient for the different types of lenders. When lenders are split between centralised lenders and depository institutions the results are slightly different, suggesting as hypothesised earlier that the two types of lenders differ in the way they set their mortgage rates. The mark-up above the money market rates is lower for centralised lenders and the centralised lenders long-term money market rate coefficients are higher indicating a closer relation, which indicates less smoothing by centralised lenders. The error corrected each month by centralised lenders is larger. A non-parametric test, the Mann Whitney test (also called the Wilcoxon rank-sum test) was performed to test for the statistical significance of the difference between the coefficients. The null hypothesis is that, under the assumption that the two populations have the same form and dispersion, the medians of the two populations are equal.

The tests fail to reject the null hypothesis in all cases (at 95% and 90% level of confidence) except for the short-run relationship coefficients in panel B, that is the speed of adjustment to changes in Libor.

[222] Only for the Britannia building society and for National Home Loans, the explanatory power of the

Table 8.7: Summary of the Error-Correction Models

Long-run relationship	PANEL A	base rate	PANEL B	Libor
	intercept	market rate coef.	intercept	market rate coef.
all	3.02	0.81	3.01	0.80
depository institutions	3.14	0.79	3.02	0.79
centralised lenders	2.65	0.87	2.96	0.84

Short-run relationship	PANEL A	PANEL B
	base rate	Libor
all	0.40	0.33
depository institutions	0.39	0.32
centralised lenders	0.44	0.39

As argued in hypothesis 3, centralised lenders adjust faster to changes in capital market rates. The difference in speed is quite large with respect to Libor changes: 39% of the error closed within a month as compared to 32% for depository lenders, and it is significant at the 90% level of confidence. This would support the theory that centralised lenders have to hedge against basis risk by transmitting borrowers of securitised mortgages the changes in Libor.

Hypothesis 4 suggested that since centralised lenders pass to other agents some of the functions and risks associated with intermediation, centralised lenders' mortgage rates should be lower. The difference above market rates is lower for centralised lenders (see average intercept coefficients in Table 8.7), but it is not statistically significant. The failure to reject the null hypothesis of equal populations could be attributed to one of the centralised lenders, The Mortgage Corporation, which has intercept values more similar to those of the depository institutions than to those of the other centralised lenders.

The results presented in Table 8.6 above are supportive of Hypothesis 4 that is, the difference over the market rate of centralised lenders mortgage rates is narrower than the difference of depository institutions mortgage rates. Therefore, when Libor

base rate regression is higher than that of Libor.

decreases, centralised lenders rates become very competitive and consequently their market share increases.

Comparing the results presented here for the base rate with Heffernan's (1997) results is useful to analyse the validity of hypothesis 1 and 2. Heffernan analyses the dynamics of repayment mortgage rate responses to changes in the Bank of England base rate, and concludes that her findings show behaviour consistent with imperfect competition[223]. The objective of the comparison is to assess if the mortgage market was more competitive then (1986-1993) or now (1988-1996). However it has to be stressed that the Heffernan sample was different (Heffernan uses repayment mortgages and this chapter uses endowment mortgages, and Heffernan uses three building societies and five retail banks) and so her objectives, which means that the comparison has to be treated with extreme caution and it is only done for illustrative purposes.

Hypothesis 1 suggests that securitisation should result in higher competition for the mortgage market in the form of lower spreads over capital market rates. Table 8.7 shows an average spread of 3.02 ("all" intercept coefficients in Table 8.7) over the base rate which is higher than Heffernan's (2.48). It is also difficult to establish whether mortgage rates are lower with respect to capital market rates now or then: Heffernan reports lower spreads but a average base rate coefficient of 0.978, which is higher than the coefficient of 0.81 ("all" base rate coefficient in Table 8.7) obtained here.

In a competitive market the coefficient for the money market rate would be expected to be close to unity: the average value of 0.81 reported here is lower than Heffernan's (0.978), which would suggest more than perfect competition now. However, as mentioned above, this coefficient lower than unity coupled with a large spread (intercept coefficient) indicates interest rate smoothing. And the interest rate smoothing would be more pronounced in this sample than in Heffernan's sample.

[223] See Section 8.5.1 for details.

The validity of hypothesis 2 requires the average speed of adjustment to be faster now that in earlier years. The average speed of adjustment was found to be 40%, which is just slightly lower than Heffernan's (42%).

8.7 CONCLUSION

This chapter has examined the way the two different lenders found in the British mortgage market (depository institutions and centralised lenders) set the mortgage rates. The lenders were classified according to the degree of intermediation services they offer. Depository institutions, i.e. banks and building societies, offer full intermediation services and therefore have to manage the risks associated with providing mortgage finance. The arrival of centralised lenders brought a small degree of specialisation to the UK mortgage market. They use securitisation to finance mortgage loans; consequently they pass on to third parties some of the intermediation functions and the risks associated to holding mortgages on the balance sheet. According to this classification, an error correction model was used to examine the extent to which different lenders deviate form perfect competition.

It was stated in the introduction of the chapter that the amount of securitisation in the UK mortgage market is still relatively small, and that drawing general conclusions comparable to the US research would be too ambitious. Still, when lenders are classified by the intermediation services they provide, there is limited evidence indicating that they set mortgage rates in a different way.

The chapter proposed four hypotheses to test the competitive behaviour of different lenders and the integration of mortgage and capital market rates. These hypotheses, outlined in pages 209-210 can be summarised as follows: By Hypothesis 1, securitisation should increase the overall level of competition in the mortgage market; Hypothesis 2 postulated that securitisation facilitates the flow of funds into the mortgage market and therefore the integration of mortgage and capital markets; Hypotheses 3 suggested that centralised lenders behave in a more competitive way than depository institutions and offer mortgage rates closer to the capital market rates; finally Hypothesis 4 indicated that since centralised lenders assume fewer

intermediation functions and risks than depository institutions, they have lower costs, so their rates should be lower than other lender's rates. The implications of the hypotheses were as follows:

- Hypothesis 1: the average spread of mortgage rates over market rates will narrow over time
- Hypothesis 2: mortgage rates should be better integrated with capital market rates.
- Hypothesis 3: centralized lenders adjust their mortgage rates to changes in capital market rates faster than other lenders.
- Hypothesis 4: the spread of mortgage rates over capital market rates should be smaller for centralized lenders than depository institutions.

The econometric test could only find weak evidence supporting Hypotheses 3 and 4. When this chapter's results are compared to Heffernan's (1997) empirical study of the UK retail banking there is very little or no improvement at all in competition in the mortgage market, therefore rejecting Hypotheses 1 and 2. Only centralized lenders seemed to behave in a slightly more competitive fashion, as shown by their faster speed of adjustment to changes in Libor. This faster speed of adjustment is weakly significant, lending some support to Hypothesis 3. Centralized lenders appear to engage in less interest rate smoothing, and their behaviour is atypical of other lenders. The empirical work also finds a significant negative correlation between centralized lenders market share and Libor rate, which is consistent with the predictions of Hypothesis 4.

Several reasons could be brought forward to explain these results: First, the early 1990's coincided with high interest rates: when mortgages are variable rate, high interest rates increase the probability of default. With variable rate loans interest rate risk is transformed into default risk: if the lender increases the mortgage rate to reflect changes in money market rates, the borrowers may be unable to afford the new monthly payments and default on the loan. Perhaps, the lenders, aware of this, and of the potential losses associated with default, opted to delay or reduce the transmission of interest rate changes. This problem would be particularly poignant in the case of the centralised lenders which had allegedly originated lower quality loans. Centralised lenders suffered more than other lenders during the property market

crisis of the early 1990's. Their percentage of bad loans was higher than average: perhaps in the rush to gain market share they granted loans to more risky borrowers than other lenders. As a consequence, National Home Loans almost went bankrupt, and Abbey National bought The Mortgage Corporation at the end of 1996.

Second, the scope of the empirical analysis undertaken in this chapter is very small. The lack of data reduced the sample of retail banks to just two institutions, one of them is converted building society (Abbey National), and the other one (the Bank of Ireland) is not one of the major banks. The absence of other banks may have biased the results and the findings that there was little difference in pricing behaviour as between depository institutions and centralised lenders. Also, as mentioned earlier retail banks operate with higher margins than building societies 4% in 1994 against 2.2%, suggesting a difference in pricing behaviour between the two types of depository institutions.

It was mentioned in Chapter 2 and also in the introduction to this chapter that it is impossible to separate the securitisation effects on US competition from the government subsidies to securitisation. By examining US research it is difficult to conclude that securitisation without subsidies would be expected to increase competition and integration in banking markets. However, given the evidence on centralised lenders and the short history of securitisation in the UK market (which at least grants the benefit of the doubt), it might be too soon to reject completely the possibility that securitisation might increase competition in the British mortgage market.

APPENDIX 8.A

Table 8.A.1 Volume of Total Mortgage Debt Outstanding by Type of Depository Institution

	Banks	Building Societies
1988	20%	69%
1989	31%	59%
1990	29%	60%
1991	28%	61%
1992	28%	62%
1993	30%	61%
1994	31%	61%
1995	36%	57%
1996	39%	55%
1997	71%	23%
1998	70%	24%

Source: Mortgages 1998, *Mintel Marketing Intelligence.*

Table 8.A.2 Major Players in the Mortgage Market 1990

	1990 Total Market Share
Lender	
Halifax	16.30%
Nationwide	10.74%
Woolwich	7.00%
Cheltenham and Gloucester	6.88%
Alliance and Leicester	5.96%
Bradford and Bingley	4.78%
Leeds Permanent	4.16%

Source: The Mortgage Market 1992, *Mintel Marketing Intelligence.*

Table 8.A.3 Major Players in the Mortgage Market 1997

	1997 Total Market Share
Lender	
Halifax	18.50%
Abbey National	14.00%
Cheltenham and Gloucester /Lloyds/TSB	7.00%
Nationwide	6.86%
Woolwich	5.38%
Barclays Bank	3.93%
Alliance and Leicester	3.91%

Source: Mortgages 1998, *Mintel Marketing Intelligence.*

Table 8.A.4 Volume of Mortgages by Method of Repayment

Building Societies	Repayment	Interest Only
1987	18%	80%
1988	14%	83%
1989	18%	79%
1990	20%	76%
1991	18%	77%
1992	17%	72%
1993	21%	77%
1994	25%	74%

All Lenders	Repayment	Interest Only
1993	26%	73%
1994	30%	70%
1995	35%	64%
1996	37%	61%

Source: Compendium of Housing Finance Statistics 1997, *Council of Mortgage Lenders.*
From 1993 onwards "Interest Only" mortgages include "Endowment", "PEP" and "Pension" and "Interest Only", depending on the investment vehicle used by the borrower to accumulate the capital required to repay the loan.

CHAPTER 9: PRICING RISKS IN UK MORTGAGE BACKED SECURITIES

9.1 INTRODUCTION

Chapters 6 and 7 established that UK depository institutions use securitisation as a funding source. One of the key issues of any funding decision, especially when external investors provide the finance, is to understand which and how those investors price risks. This question becomes even more important in the case of asset-backed securities, since one of the benefits of securitisation is the transfer of the risks associated with the assets to the ultimate investors.

Understanding the pricing mechanisms is important for several reasons. Financial innovation literature reviewed in Chapter 4 has argued that one of the benefits of securitisation is that the resulting securities are less sensitive to information, so the market prices them "better" (the issuer gets a higher revenue). Also the prices of asset-backed securities should reflect the risks of the underlying assets but not risks related to the originator of the assets. However, the market could perceive some issuers as less risky because of lower "adverse selection" (the market thinks that the quality of their portfolio is higher)[224].

The objective of this chapter is two-fold: first to develop and test an econometric model of sterling mortgage-backed securities valuation to determine the effects of contractual features and risk on the issue price. Second, to estimate the functional relationship between the price of sterling mortgage backed securities and the risk of the underlying assets to establish which factors affect the price of the securities in the secondary market.

[224] See Chapter 2 for an explanation of the adverse selection problem.

The chapter is organised as follows: Section 2 introduces the valuation problems of floating-rate securities, Section 3 analyses the risks associated with investing in mortgage-backed securities, Section 4 provides a brief review of the UK mortgage-backed securities market, Section 5 presents an econometric analysis of the determinants of the price of mortgage-backed securities at issue, Section 6 investigates the factors that affect the prices of mortgage-backed securities in the secondary market by using kernel multivariate-density estimation, and Section 7 concludes the paper.

9.2 VALUATION OF FLOATING RATE NOTES

On of the distinct features of the UK asset-backed securities market is that the majority of the securities issued have taken the form of floating-rate notes[225]. The coupon on floating rate instruments consists of two parts: the index rate and a fixed spread above or below the index rate. Coupons are reset at specific intervals of time to reflect market interest rates through the index rate. UK asset-backed securities are usually reset every three months to reflect the current three-month Libor rate. The size of the spread depends on the credit quality of the borrower.

The following equation describes the coupon of a common floater at any point in time.

$$C_t = \text{index}_{t-1} + \text{fixed-spread} \qquad (9.1)$$

Since the coupons are reset to reflect current market rates, these securities have lower interest rate risk and less volatile prices than fixed rate securities.

Ramaswany and Sundaseran (1986) develop a framework for analysing floating rate instruments. They first consider a hypothetical default free floating security, that pays a semi-annual coupon, the payment of which and settlement date (the day the coupon rate is reset to reflect the current index rate for the next 6-months) coincide. The index rate is the yield on a newly issued 6-months default free security, and the

spread over the index is 0 because of the default-free nature. This floating rate instrument must be priced at par on the payment-settlement date because the payoff of this instrument is the same as rolling over the 6-month default free security. The same would happen when considering a risky floating rate security with a coupon formula such that, at settlement, the floater returns the yield on newly issued securities of exactly the same risk, and maturity equal to the time until next coupon. In theory, every time the coupon is reset the interest risk is eliminated, so if there have been no changes in the default risk of the securities (accounted for in the fixed spread), the price should be equal to the par value. In both cases, riskless and risky floaters, the price dynamics between coupon payment-settlement dates should be equal to those of the index instrument.

Ramaswamy and Sundaresan state that the value of a risky floater where the coupon is reset continuously[226] depends on two factors: the current interest rate, and an instrumental variable which is the market expected risk premium (π) on a newly issued short-term obligation considered by the market as a substitute to the floater (in terms of risk). Assuming that bonds are priced according to the Local Expectations Hypothesis:

$$E_t(dP) + (r(t) + mg)dt = P[r(t) + \pi(t)]dt \qquad (9.2)$$

Where,
P: is the price of the floater,
(r(t) + mg): represents the "continuously" reset coupon, and
mg: is the fixed spread set at issue.

The price of the floating rate security will depend on whether the fixed spread is higher or lower than the market required risk premium. If the market demands a premium higher than the fixed spread, the security will sell at discount and the opposite will happen if the market required premium is lower than the fixed spread.

[225] To date there are only five issues fixed rate mortgage-backed (BARINGS Review of UK Mortgage-Backed Securities Market)

In the real financial markets, floating rate instruments do not have continuously reset coupons, but much less frequent resetting formulas: for example, quarterly or semi-annual. To isolate the effects of changes in default risk on the price of the floater it is necessary to wait until the next settlement date to see if the floater is trading above or below par. Otherwise one would not be able to differentiate between movements in price due to changes in the short-term interest rates and those caused by changes in risk. An alternative approach is to use the floating rate "neutral price". This is the price at which the security will have to trade on at the next coupon date to guarantee that the investor receives a return equal to the index plus the fixed spread, over the period from settlement to the next coupon date.[227]

Floating rate notes are hybrid securities. In some repects they behave like a short-term money market security: once the coupon rate of a floating rate note is adjusted to reflect current interest rates, subsequent changes in the index rate (keeping credit risk constant) between settlement and payment date will affect the value of the floating rate note as if it was a money market instrument that matures at the next coupon payment date. However if the market required risk premium, reflected in the required spread over the index, changes, the price dynamics of the floating rate note will be like those of a fixed-rate instrument, and one would expect the price of the floating rate instrument to differ from par.

In theory, floating rate-notes prices are more stable than the prices of fixed rate instruments. The basis risk (interest rate risk) is eliminated, and unless there are changes in other risks the price should be stable. Figure 9.1 plots the "neutral price" of a selected group of building society floating rate notes.

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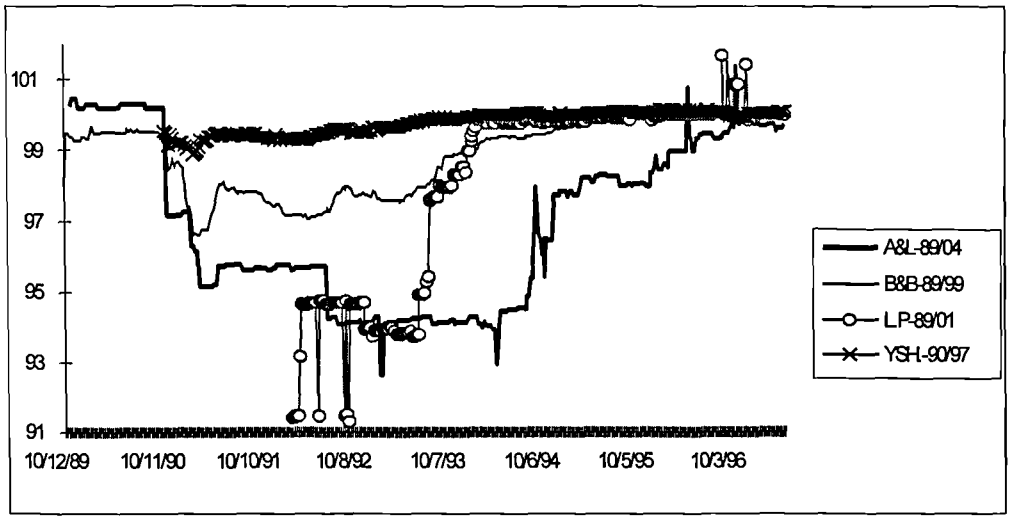
[226] By allowing for continuously resetting of the coupon, they can isolate the effects of changes in default risk on the price.

[227] Neutral Price = (P+A)+[(index+M)*(Days/360)]-coupon

where, P = current price
M = margin
Days = number of days elapsed
A = accrued interest

(R. Williams, 1986)

Figure 9.1 Neutral Price of Selected Building Societies Floating Rates Notes



Source: Datastream

Where,

A&L is Alliance and Leicester Building Society,

B&B is Bristol and West Building Society,

L.P. is Leeds Permanent Building Society, and

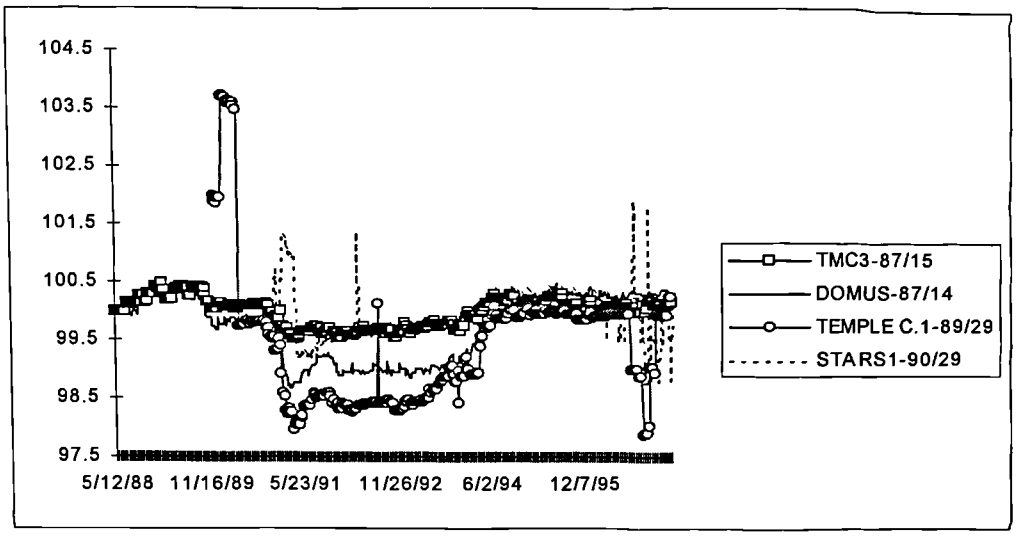
YSH is the Yorkshire Building Society

The prices exhibit high volatility (except the prices of the Yorkshire Building Society note), particularly between 1990 and the middle of 1995. This period coincides with one of the worst property crises in the UK market. Satchell and Mcube (1994) point out that the risks associated with mortgage default have increased disproportionately in the last years: building societies' repossessions went from 3,480 in 1981 to 75,540 in 1991, while the number of building societies' mortgages increased from 6,210,000 to 9,922,000. This suggests that there was a fall in the quality of mortgage lenders assets; which, in turn, could have increased the credit risk of building societies and the price of their floating rate notes. Three of the four societies in Figure 9.1 had their credit ratings reduced during this period[228]: Alliance & Leicester at the end of 1990, Bradford & Bingley in mid-1991, and Leeds Permanent at the end of 1995. The fourth one, the Yorkshire had its credit rating improved in 1993.

[228] Standard & Poor's mentions asset quality concerns as contributing to the rating actions of the beginning of the 90's, (Standard and Poor's Creditweek International, 1996).

Figure 9.2 plots the "neutral price" of four mortgage-backed securities. Mortgage-backed securities appear much less volatile than building societies floating rate notes, despite having been equally affected by the property crisis[229]. Like the building societies, most of the mortgage-backed securities were downgraded.[230]

Figure 9.2 Neutral Prices for Selected Mortgage-Backed Securities.



Source: Datastream
Note: All senior tranches

Where,

TMC: is TMC3, originated by The Mortgage Corporation (belongs to Salmon Brothers),

DOMUS 1: has been originated by the Chemical Bank,

Temple Court 1: has been originated by Legal & General Mortgage Services, and

STARS: has been originated by Citibank.

The comparison of mortgage-backed securities and building *societies floating rate* notes is interesting because building societies floating rate notes are close substitutes to mortgage-backed securities. The former represents an indirect investment on a

[229] Standard and Poor's report peak average arrears of more than 60-days, for all pools of mortgage-backed securities, of 20% in 1993.

[230] Standard and Poor's reports that the first rating action on mortgage-backed securities was taken to reflect the lowering of the ratings of third party counterparts on the transactions. However, they mention that even had these parties not been downgraded, some of the mortgage-backed securities would have been downgraded to reflect the lower credit quality of the mortgage pools. Of the securities depicted in figure 2, TMC3 has gone from a credit rating of AA to A+; DOMUS form AAA to A2; and STARS form AAA to AA-. (Standard and Poor's Creditweek International, 1995).

well-diversified portfolio of mortgages, the latter a direct investment on a specific pool of mortgages. An investor in building society floating rate notes assesses the credit risk of the issuer, which is influenced, amongst other things, by the quality of its mortgage portfolio. An investor in a pool of mortgages is offered some risk protection by different mechanisms of credit and liquidity enhancement, but is not completely immune to the risks of the underlying mortgages[231]. Although the objective of this chapter is not to compare the sensitivity of building societies floating rate notes and the sensitivity of mortgage-backed securities to the performance of the underlying mortgages, Figures 9.1 and 9.2 suggest that mortgage-backed securities are less sensitive and therefore less risky. Recall the financial innovation and security design theories review in Chapter 4: an issuer who maximises expected revenue can accomplish this by pooling assets, then partitioning the portfolio cash-flows into securities with different levels of seniority such that the senior tranches are less sensitive to information. The mortgage-backed securities depicted in Figure 9.2 are all senior tranches.

9.3 RISKS OF INVESTING IN MORTGAGE-BACKED SECURITIES

The investor in mortgage-backed securities faces the risks related to investing in the underlying mortgages. These risks include the options embedded in any mortgage contract. As a result, *a mortgage-backed security is a complex financial instrument.*

A mortgage borrower has two options: the option to default, i.e. to "put" the property back to the lender at an exercise price equal to the value of the mortgage[232]; and the option to prepay, i.e. to "call" the mortgage from the lender at an exercise price equal to the outstanding principal. These options can be exercised at any time. However, in some cases, prepayment during the first year carries a penalty of between 1 to 3 months of interest rate. Nor is the exercise of the options always for financial reasons: financial prepayment should occur when the borrower can obtain lower financing (after allowing for transaction costs in prepayment) somewhere else.

[231] The same is not true for US Agency mortgage-backed securities, that have full credit support of the US Government.

[232] As Mcube and Satchell (1994) note, viewing default as the exercise of a put option by the borrower is a good approximation of the real world, since the likelihood of being prosecuted in the UK for defaulting in your mortgage payments is minimal.

However borrowers prepay for a myriad of other non-financial reasons: sale of the property, divorce, or a new job in another location.

The UK mortgage market is dominated by variable-rate mortgages. Although the mortgage rate is adjusted to reflect current interest rates, variable rate mortgages carry prepayment risk. As seen in Chapter 8 lenders take time to adjust their mortgage rates to changes in market rates so re-financing opportunities exist in the market. Kau, Keenan, Muller and Epperson (1993) point out that in order to correctly value adjustable rate mortgages and adjustable rate mortgage-backed securities both, default and prepayment risks must be taken into account.

The risk of prepayment faced by the investor in mortgage-backed securities is the risk of the securities being called at any time due to the investors prepaying their mortgages. The issuing prospectus of sterling mortgage-backed securities clearly state this risk by pointing out that the notes are partially redeemable at any coupon payment date by the amount of prepayment in the pool since the last payment date. The disadvantage for the holder of the note is that if prepayment occurs when interest rates are falling, the holder will have to reinvest the proceeds at a lower rate, so there is reinvestment risk. Also, the life of the notes is uncertain. UK mortgage-backed securities have a stated maximum maturity of around 25-30 years, the maturity of the underlying mortgages, but the effective life is much shorter and crucially dependent upon prepayment behaviour. Issuers of mortgage-backed securities have been experiencing an average prepayment rate of around 20% in an annualised basis, compared to the average 10% rate reported by building societies in the last 10 years.[233]

The risk of default is the risk that the mortgage borrower will default on repayments. From an option perspective, the borrower "sells" the property to the lender in exchange for the mortgage instrument. If the value of the property plus the first loss

[233] This information appears in the issuing prospectus of Gracechurch Mortgage Finance 1, a mortgage-backed security deal originated by Barclays Bank in 1989, and has been checked against the redemption rates of mortgage backed-securities (Goldman Sachs European Asset Backed Database, 1996) and the reported redemption rates of building societies mortgages (Central Statistics Office). The large difference between the prepayment rates of building societies and centralised lenders is difficult to explain. Given that both types of lenders offer similar mortgages, the different prepayment rates could be attributed to having different types of borrowers.

protection provided by the credit enhancement system built into the securitisation structure does not cover all interest and principal payments due, the mortgage-backed security holders experience a loss.

The traditional approach to pricing mortgage and mortgage-backed securities has been to construct a theoretical model to value the options embedded in the mortgage: this requires modelling the dynamic behaviour of interest rates and house prices, incorporating prepayment and default options in the price of the mortgage-backed securities. Most of the theoretical and empirical work has been done in the US. Mcube and Satchell (1994) model and test UK mortgage default using option techniques, and Breedon and Joyce (1993) estimate the determinants of UK arrears and possessions. However there are no studies on UK prepayments. One reason (also pointed out by the above authors) is the lack of data. Building societies, the major mortgage lenders, and the Council of Mortgage Lenders (a body that groups all the authorised mortgage lenders) rarely disclose information. Data on default only appears semi-annually, building societies publish quarterly repayment data, but the high level of aggregation of the figures reduces their usefulness. Empirical validation of any model of prepayment and default is therefore limited.

In this chapter a different approach is taken. Since mortgage-backed securities contain options to prepay and to default, the chapter aims to test the sensitivity of the security prices to changes in the probability and the risks of those options being exercised. Moreover the presence of these risks should be able to explain the price behaviour of mortgage-backed securities since the pool of assets has been isolated from the originator through securitisation.

9.4 DESCRIPTION OF THE UK MORTGAGE-BACKED SECURITIES MARKET

Table 9.1 summarises the activity of the public[234] UK mortgage-backed securities market between 1987 and 1997. Almost £20 billions have been issued. The average

[234] The size of the UK private mortgage-backed securities market is estimated around 5%-10% of the public market.

annual volume is slightly below £2.5 billion. Centralised mortgage lenders were the most active issuers during the first half of the period; banks have become predominant issuers in the second half.

Table 9.1: UK Mortgage-Backed Securities Issuance

	TOTAL	*Centr. Lenders*	*Banks*	*Building Societies*	*Insurance Cos.*	*Other*
Panel A	*Annual volume by type of originator*					
1987	1000000	900000	100000			
1988	3001650	2266650	735000			
1989	2795820	1984320	475000		175000	161500
1990	2104000	1629000	475000			
1991	2841500	2566500	150000		125000	
1992	573900	199750	374150			
1993	1001000	359000	642000			
1994	2615730	561050	2054680			
1995	271000	271000				
1996	2924700	690900		1769600		464200
1997	62200					62200
Panel B	*Percentage volume by type of originator*					
1987		90.0%	10.0%			
1988		75.5%	24.5%			
1989		71.0%	17.0%		6.3%	5.8%
1990		77.4%	22.6%			
1991		90.3%	5.3%		4.4%	
1992		34.8%	65.2%			
1993		35.9%	64.1%			
1994		21.4%	78.6%			
1995		100.0%				
1996		23.6%		60.5%		15.9%
1997						100%
Panel C	*Annual Volume by type of originator*					
1987	9	8	1			
1988	20	16	4			
1989	12	8	2		1	1
1990	11	10	1			
1991	23	21	1		1	
1992	4	2	2			
1993	6	3	3			
1994	9	4	5			
1995	2	2				
1996	7	2		3		2
1997	1					1
Avrg.Size	184132.2	162807.4	244782.6	589866.6	150000.0	151933.3

Source: Datastream

In terms of activity the UK mortgage-backed (MBS) market had its worst years between the end of 1991 and mid-1993, and during 1995. During the early 1990's higher than average spreads over Libor discouraged the use of mortgage securitisation. The economic and housing market recession slowed the mortgage market activity, which in turn reduced performance in the securities market. Business in the UK MBS market has being increasing since 1993, despite the almost complete lack of issues in 1995. During the last few years the banks have become the main issuers, but the market has not reached the levels witnessed between 1988 and 1991, because mortgage origination is still relatively slow. The involvement of building societies has also increased, notably since the Building Societies Commission began publishing guidelines in securitisation on 1994[235].

Pools of mortgages securitised have all been very similar in characteristics: between 40% and 60% of the mortgages are backed by properties located in the South of England. Around 70% of the mortgages were newly originated or have life of less than 1 year, and in most cases the pools mainly contained interest only mortgages[236]. The loan-to-value ratios have average values of 80% to 90%.

The securities are listed in the Luxembourg or London International stock exchanges. The majority had an initial rating of AAA. As mentioned above they are all floating rate notes, and they pay quarterly coupons equal to three-month Libor plus a fixed spread set at issue. The securities are partially redeemable at every coupon payment date provided there are sufficient funds. All but one issue have fixed margins that step-up after a few years (between 4 and 10). Normally on the same date of the step-up, the issuer has the option to call the notes. This can be seen as a mechanism to guarantee a certain life of the notes. Taking into account prepayment, the amount outstanding at the step-up date will be small enough to call the issue. However the life of the notes at issue is a guessed work. The issuing prospectus provides an estimate for the "average life"[237] of the notes under different prepayment scenarios, assuming they will call the outstanding notes on the step-up date. But this is only an estimation and they clearly state that the final life can be very different. Some

[235] See Chapter 2.
[236] See Chapter 8. Interest only mortgages dominate the market, and also they were the only mortgage offered by some of the centralised lenders.
[237] The average life is the average time to receipt of the principal payments.

securities have a further call option that can be exercised before the step-up date: this is another attempt to guarantee a shorter life for the notes.

9.5 ANALYSIS OF THE PRICING OF MORTGAGE-BACKED SECURITIES IN THE PRIMARY MARKET

The first objective is to establish which factors determine the size of the fixed spread of mortgage-backed securities. This spread is the risk premium demanded by investors in the notes. It is assumed that the size of the premium (π) depends on two set of variables: a vector of contract specific variables (ϕ), and a vector of housing and mortgage market specific variables (ω) which affect the probabilities of default and prepayment, which in turn are the risks associated with investing in mortgage-backed securities:

$$\pi_{ti} = f(\phi, \omega) \tag{9.3}$$

Mcube and Satchell (1994) found negative equity to be one of the most important components of the decision to default. A borrower has negative equity when the outstanding value of the mortgage is larger that the current value of the property. Breedon and Joyce (1993) use unemployment and income as explanatory variables for the incidence of mortgage default. However, the "negative equity trap", and loss of income through unemployment or other factors, are part of the same problem: two surveys (by The Council of Mortgage Lenders) at the beginning of the 90's showed that around 40% of arrears were associated with unemployment and another 40% with loss of income. In the past when house inflation was high, a borrower unable to meet repayments would sell the house and satisfy the mortgage obligation. However at the beginning of the 90's the depressed state of the housing market prevented borrowers facing repayment difficulties from selling the properties, because they were "trapped" in negative equity (Standard and Poor's Creditweek International, 1995).

Similarly, in the US Kau, Keenan, Muller and Epperson (1993) found that high house price volatility and low house prices are associated with a high default rate. High

default is also more common when the loan-to-value ratios of the loans are high, since this will increase the probability of being trapped in negative equity.

Investors in mortgage-backed securities also need to consider the likelihood of prepayment. Optimal prepayment by borrowers is driven by the existence of better investment opportunities, i.e. lower interest rates. The analysis is not as simple as it looks because to analyse refinancing opportunities, the current level of interest rate plus the path it follows to achieve the actual level. Thus, the problem is path dependent: at any point the rate of prepayment in a pool will depend on whether there has been past refinancing opportunities. It is necessary to consider both the level of the interest rate and the term structure.

The following equation is estimated:

$$\pi_i = \beta_0 + \beta_1 + \beta_2 WEIGHT + \beta_3 ORIGIN + \beta_4 CALL + \beta_5 SIZE + \beta_6 LIFE + \beta_7 TERM + \beta_8 MORT + \beta_9 EUROY + \beta_{10} UNEMP + \beta_{11} VOL + \beta_{12} HOUSE \quad (9.4)$$

Where,

π: is the logarithm of the fixed spread plus any discount or premium in the issue price discounted over the life of the security from issue to step-up date, using the simple margin discount for floating-rate notes[238].

WEIGHT: is a dummy variable that takes the value of 1 if the security was issued between January 1, 1991 and January 1, 1993. This is to account for the effect in the spread of the announcement made by the Bank of England at the beginning of 1991 that from 1993 onwards mortgage-backed securities were to carry a risk-weighting of 100% for capital adequacy purposes[239]. 26 issues were made during this period. The coefficient on this variable is expected to be positive.

ORIGIN: a dummy variable that takes the value of 1 if the security was issued by a centralised lender. It proxies for investors' preference for a type of issuers. 67 of the issues in the sample were made by centralised lenders and 27 by banks. One would expect a positive coefficient if investors prefer banks.

[238] This is done by dividing the discount or premium by the time (in years) to step-up of the coupon.
[239] When January 1993 finally arrived the Bank of England did not apply the new weighting and residential mortgage-backed securities continue to have a weight of 50%

CALL: is a dummy variable that takes the value of 1 if the security can be called before the step-up date. 49 securities had this call option. The parameter for this variable is expected to be positive.

SIZE: is the logarithm of the size of the issue. Since large issues are more liquid, a negative coefficient is expected.

LIFE: is the logarithm of the life of the issue, measured as the time between theissue and step-up dates. This definition is the best proxy for the effective life of the notes. A stated final maturity of the mortgage-backed security is not useful measure. 'life" is also the "maturity" of the notes at the original margin. After the step-up date, the issuer has an option to exchange the original notes for similar ones with a higher spread. The parameter should be positive, since long maturities are associated with higher risk.

TERM: is the short end of the term-structure of interest rates, measured as the difference between the bid rates of the 6-month Libid[240] and the 3-month Libid at the beginning of the month of issue. The coefficient should be negative because an upward sloping curve indicates less likelihood of mortgage prepayment, and also makes investing in floating rate notes more attractive.

MORT: the mortgage rate prevailing in the market in the month of issue. The parameter is expected to be positive, since higher mortgage rates increase the probability of default.

EUROYIELD: is the Credit Suisse Sterling Eurobond index yield in the month previous to issue. This variable reflects the general state of the Eurobond market where the securities are issued. The parameter for this variable is expected to be positive.

UNEMP: is the logarithm of the rate of unemployment at the beginning of the month of issue minus the logarithm of the rate of unemployment at the beginning of the previous month. Since higher unemployment rate increases default risk, the coefficient should be positive.

VOL: the 12-month volatility of the "HALIFAX all houses price index". The parameter for this variable is expected to be positive, since high house price volatility acts as an incentive to default.

[240] London Interbank Bidding Rate

LEADING: is the logarithm of the UK longer leading[241] indicator at the beginning of the month of issue. It takes into account the future outlook of the economy. It is expected to be positive.

HOUSE: the change in the "HALIFAX all houses price index" in the month previous to issue. Increases in house prices reduces negative equity and therefore, default incentives, so he coefficient should be negative.

The data used to estimate the above equation consists on 94 senior tranches of sterling residential mortgage-backed securities, issued between April 1987 and June 1996. The information was collected from various issuing prospectuses, Datastream, and the following publications: Goldman Sachs European Backed Database (1996), BARINGS Review of UK Mortgage Backed Securities Markets (1992), ING-BARINGS Structured Finance (1996) Moody's Global ratings (1996), IFR Securities Data, Standard's and Poor's. The results of equation (9.4) estimated by Generalised Least Squares are reported in Table 9.2.

Table 9.2 GLS Regression for UK Mortgage-Backed Securities Margins at Issue

Regressor	*Coefficient*	*p-value*
Constant	-26.459	0.000 **
D-weighting	0.497	0.001 **
D-originator	-0.078	0.261
D-call	0.048	0.378
Size	-0.074	0.062 *
Life	0.327	0.000 **
Term-structure	-0.499	0.007 **
Mortgage	0.043	0.022 **
Euroyield	*1.428*	*0.136*
Unemp	3.847	0.053 *
Volatility	0.014	0.064 *
Leading	5.392	0.000 **
House	-0.503	0.828
Adjusted R-sq 76.5	94 observations	

The dependent variable is the log of (margin pus discount)
Based on Adjusted White's heteroskedasticity consistent standard errors.
**(*) indicates the coefficient is different from zero at 95% (90%) confidence level.
The p-value gives the probability of the coefficient been equal to zero.

[241] As published by the Office for National Statistics

The equation has been corrected for heteroskedasticity using the adjusted White's heteroskedasticity standard errors. All the coefficients have the expected sign, and all but four are significant at the 90% and 95% level of confidence. The regression has a high Adjusted R-Square, indicating a good fit. The dummy variable for type of originator is not significant nor is the call dummy. Surprisingly the variable for the change in house prices is not significant. One reason for that may be the high level of aggregation of this variable: it represents housing prices for the whole country, whereas the majority of the mortgages in the pools are form the South of England, which was hit much harder and for a longer period by the housing market recession.

9.6 ANALYSIS OF THE PRICING MORTGAGE-BACKED SECURITIES IN THE SECONDARY MARKET

Having estimated a model for the market premium on mortgage-backed securities at issue, the next step is to analyse the dynamics of their price in the secondary market. The emphasis is on the bond characteristics of the mortgage-backed securities, i.e. default and prepayment risks; monthly "neutral prices" of 9 different mortgage-backed securities are employed. The reason to choose these particular securities (the characteristics of which can be seen in Table 9.3) is that there are at least 100 data points for each of them. Monthly "neutral prices" were obtained from Datastream for October 1988 to January 1997.

Table 9.4 Characteristics of Selected UK Mortgage-Backed Securities

	NAME	issue date	size 000's	final maturity	step-up margin	step-up date	call option date/minimum amount	no-max-call	price	margin	Credit enhancement
1	TMC MORTGAGE N.1	04/01/87	200000	Sep-14			4/92-20m		100	0.250	Pool insurance
2	TMC MORTGAGE N.3	10/30/87	100000	Apr-15	0.5	Oct-97	10/92-10m		100	0.375	Pool insurance
3	TMC MORTGAGE N.2	11/30/87	100000	Nov-14	0.5	Aug-97	8/92-10m		100	0.375	Pool insurance
4	TMC MORTGAGE N.4	11/30/87	100000	May-15	0.5	Aug-97	8/92-10m		100	0.375	Pool insurance
5	DOMUS MORTGAGE FINANCE	12/04/87	100000	Dec-14	0.5	Dec-97	12/97-10m	Dec-97	100	0.350	Pool insurance
6	TMC MORTGAGE N.5	03/31/88	125000	Sep-15	0.5	Mar-98		Jun-93	100	0.350	Pool insurance
7	TMC MORTGAGE N.6	04/30/88	100000	Oct-15	0.5	Apr-98	4/93-10m		100	0.325	Pool insurance
8	TMC MORTGAGE N.7	05/31/88	100000	Nov-15	0.5	Aug-98	8/93-10m		100	0.325	Pool insurance
9	TMC MORTGAGE N.9	08/31/88	200000	Feb-19	0.5	Nov-98	11/93-20m		100	0.325	Pool insurance

	NAME	Original Rating	Actual Rating	MeanPrice	Std. Dev	Mortgage Originator
1	TMC MORTGAGE N.1	AA	AA-	99.943	0.201	The Mortgage Corporation Limited (Salomon Brothers)
2	TMC MORTGAGE N.3	AA	A+	100.018	0.246	The Mortgage Corporation Limited (Salomon Brothers)
3	TMC MORTGAGE N.2	AA	A+	100.011	0.232	The Mortgage Corporation Limited (Salomon Brothers)
4	TMC MORTGAGE N.4	AA	A+	100.005	0.258	The Mortgage Corporation Limited (Salomon Brothers)
5	DOMUS MORTGAGE FINANCE	AAA	A+	99.717	0.582	Chemical Bank & Chemical Bank Home Loans
6	TMC MORTGAGE N.5	AAA	A+	100.044	0.247	The Mortgage Corporation Limited (Salomon Brothers)
7	TMC MORTGAGE N.6	AAA	A+	99.987	0.251	The Mortgage Corporation Limited (Salomon Brothers)
8	TMC MORTGAGE N.7	AAA	A+	99.969	0.319	The Mortgage Corporation Limited (Salomon Brothers)
9	TMC MORTGAGE N.9	AAA	A+	99.922	0.417	The Mortgage Corporation Limited (Salomon Brothers)

The normal procedure in building a regression model is to assume a parametric form for the model to be estimated, and usually the choice is a linear model. However when considering the choice of the parametric form as a choice over a continuum of possible functional forms, then the likelihood of having chosen the correct form is very small. The best way to avoid model missespecification is to avoid specification of the model, and use an alternative way to extract information about the relationship between the variables from the data (Bierens 1994).

In this section a non-parametric regression estimation, specifically, kernel density regression is employed. There are two reasons for choosing non-parametric regression: firstly, the non-normality of the price time-series, since the securities exhibit bi-modal and non-symmetric density functions. Secondly, it is reasonable to assume that the relationship between prices and the proxies for default and prepayment risk is non-linear (default and prepayment can take place for non-financial reasons). Kernel density estimation can be seen as an estimation procedure that builds on the information contained in the histogram of the data. And it has the advantage of not requiring a specific parametric model to be imposed on the functional form, explicitly or implicitly (Härdle and Linton, 1994).

Campbell (1991) uses a bivariate kernel estimator to estimate the relationship between Ginnie Mae mortgage-backed securities and a Treasury bond for hedging portfolios. Multivariate kernel estimation was also used by Boudoukh, Richardson Stanton and Whitelaw (1996) to estimate which interest rate factors affect the price of GNMA default-free mortgage-backed securities. The technique seems appropriate to estimate the relationship of the prices of securities with complicated embedded options and their fundamentals. Here it is used to estimate the relationship between security prices and the factors that increase both prepayment and default risk.

Assume the following relationship between two variables (X and Y) needs to be estimated (Campbell, Lo and McKinlay, 1997, page 499):

$$Y_t = m(X_t) + e_t, \qquad (9.5)$$

Where,

m is an arbitrarily fixed unknown function, and

e_t a zero-mean identically independent distributed process.

The objective is to estimate Y_t at a specific point in time *t,* for a particular value of $X_t = x_{t0}$. If n-repeated observations of Y_t at *t*: Y_{t01}, Y_{t02} ... Y_{t0n} were obtained an estimator of *m* will be:

$$m(x_0) = (1/n)*(\Sigma y_I), \forall i \quad (9.6)$$

However if Y is a time series is it not possible to obtain repeated observations for a given value of X. Assuming that the function is sufficiently smooth, then in a small neighbourhood of x_0, $m(x_0)$ will be almost constant and can be estimated by averaging the corresponding Y_t's. Kernel density estimation regression can provide an estimator of $m(x_t)$ that takes a similar form to the former estimator:

$$m(x_t) = \Sigma W_i(x)*Y_i, \quad (9.7)$$

Where,

W_i represents the weights of each observation. The weighting is built from a probability density function called kernel.

Assuming two variables (X,Y) drawn for a bivariate normal distribution, the conditional expectation of Y given X (E [Y/X]) can be expressed as a linear regression of Y on X:

$$E[Y / X] = \frac{\int yf(x,y)dy}{\int f(x,y)dy} \quad (9.8)$$

This suggests that even if the data are non-normal or non-symmetric, or the relationship between X and Y is non-linear the same expression could be used for the expectations of Y conditioning of the realisation of X. All that is needed is to estimate the density f(x,y). A non-parametric density estimation uses the information

contained in the data to estimate the density function. A kernel function estimation for f(x), i.e. its histogram, is as follows:

$$\hat{f}_h(x) = \frac{1}{n}\sum_{i=1}^{n}\frac{1}{h}K\left(\frac{x - X_i}{h}\right) \tag{9.9}$$

where,
(K) is the kernel function. There are several types of kernel functions. The Gaussian kernel function is employed here:

$$K = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{u}{2}\right) \tag{9.10}$$

where $u = (x-X_i)/h$

The kernel density estimation for the bivariate case, f(x,y), is given by:

$$\hat{f}(x,y) = \frac{1}{n}\sum_{i=1}^{n}\frac{1}{h}K(x - X_i)\frac{1}{h}K(y - Y_i) \tag{9.11}$$

The above function can accommodate the multivariate case by allowing X to be a k-component vector of regressors.

Substituting (9.11) into (9.8) and integrating results in the Nadaraya-Watson kernel estimator:

$$\hat{m}_h(x) = \frac{\sum_{i=1}^{n} K\frac{1}{h}(x - X_i)Y_i}{\sum_{i=1}^{n} K\frac{1}{h}(x - X_i)} \tag{9.12}$$

The Nadaraya-Watson estimator provides the weighting average of the dependent variable given the independent variable(s). The weights are:

$$Wi = \frac{K\frac{1}{h}(x - X_i)}{\sum_{i=1}^{n} K\frac{1}{h}(x - X_i)} \tag{9.13}$$

One important point to note is that the Nadaraya-Watson estimator does not estimate a fixed response parameter or *beta*; rather it evaluates the dependent variable at each point in the time-series.

The bandwidth *h*, determines the degree of smoothness of the fitting. The choice of *h* is important since an excessively large h will smooth the data too much and therefore loose some of the non-linearity, whereas a very small *h* might introduce a lot of noise in the estimation. The bandwidth can be seen as the standard deviation of each probability function centred on each data point. An "objective" bandwidth based on the standard deviation of each explanatory variable is employed here:

$$h_{xi} = \sigma_{xi} * N\wedge\left(-\frac{1}{4+q}\right) \tag{9.14}$$

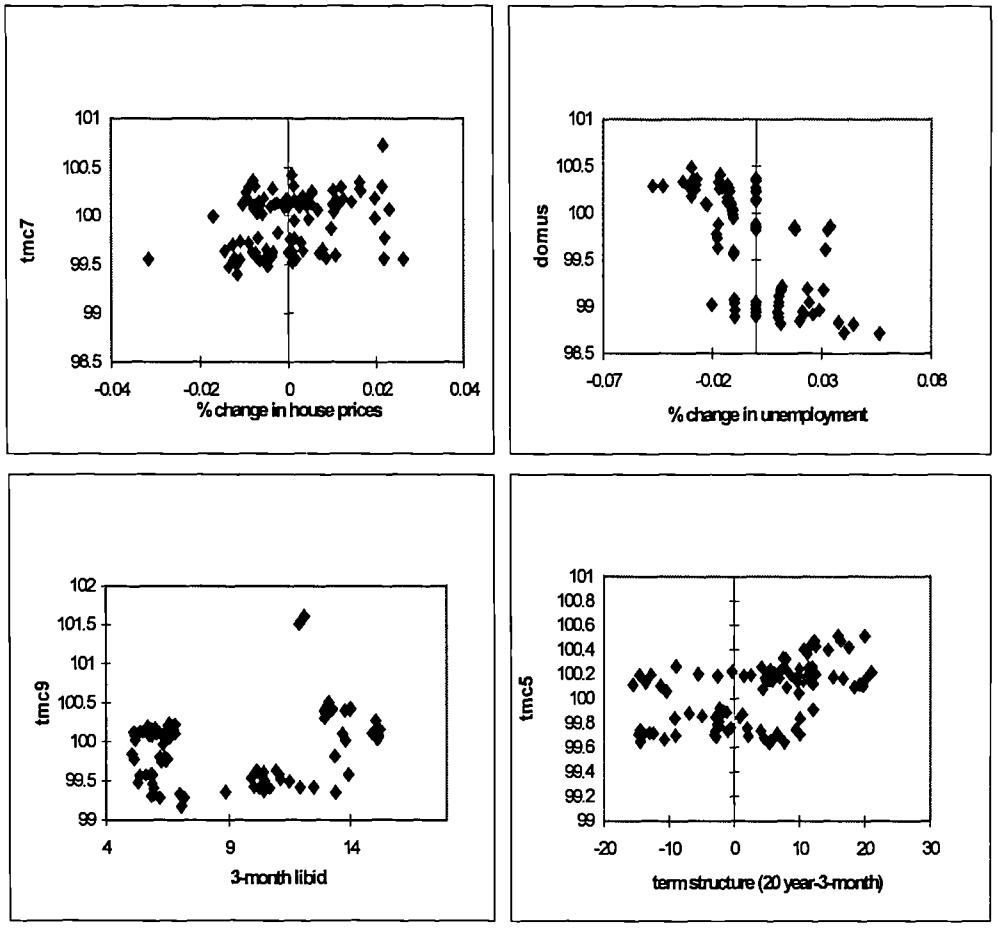
where
N is the sample size, and
q is number of regressors

Although the results with a criteria as the one referred to above are satisfactory, there is room for improvement by using a selection criterion which scales the above bandwidth to the level that minimises the mean square error of the regression. The most common such criterion is "cross-validation". It is based on the idea of choosing an scaling factor by using only a part of the sample, and "cross-validating" it on the rest of the sample by minimising the mean-square errors of the fit. Under certain circumstances this process produces an *h* that is asymptotically optimal with respect to the mean square errors. The mortgage-backed security prices used in this paper are non-stationary (Augmented Dickey-Fuller tests were performed and stationarity rejected), and therefore cross-validation must be used with care since it may fail to deliver the optimality properties: if the errors are autocorrelated, their effect takes

time to die out, causing the cross-validation criterion to interpret the "stickiness" in the errors as part of the estimation.

Figure 9.3 plots some selected scatter plots of the security prices against the explanatory variables. As seen above Mcube and Satchell (1994) and Breedon and Joyce (1993) and Kau, Keenan, Muller and Epperson, (1993) found that falling house prices and unemployment increase the incidence of default. The level of interest rates and the term structure of interest rates also affect the likelihood of default and prepayment, and therefore should influence the price of the mortgage-backed securities. All the scatters show the expected direction in the relationship between the prices and the explanatory variables, that is positive with respect to house prices, negative with respect to unemployment, and positive with 3-month Libid and the term structure.

Figure 9.3 Scatter Plots of Mortgage-Backed Securities and Proxies for Mortgage Risks



Tables 9.5, 9.6 and 9.7 present the results of the Nadaraya-Watson estimators[242]. Table 9.5 uses a two-factor model with two explanatory variables: the level of interest rate (3-month LIBID) and the unemployment rate.

Table 9.5 Descriptive Statistics for the Errors of a Two-Factor Pricing Kernel Regression

	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*	*Auto-correlations*
DOMUS	104	-0.6254	0.953	0.0097	0.3835	0.853
TMC1	104	-0.2267	0.326	0.0023	0.1196	0.707
TMC2	104	-0.2847	0.348	0.0048	0.1361	0.832
TMC3	104	-0.2843	0.363	0.0052	0.1430	0.745
TMC4	104	-0.3830	0.376	0.0062	0.1579	0.818
TMC5	104	-0.3171	0.414	0.0051	0.1478	0.760
TMC6	104	-0.3064	0.386	0.0048	0.1426	0.729
TMC7	104	-1.3666	0.496	0.0083	0.2300	0.680
TMC9	104	-1.0003	0.610	0.0045	0.2696	0.757

Where,

The regressors: three-month Libid and the % change in unemployment, and

N is the number of observations.

DOMUS and TMC_I: see details in Table 9.4

The table reports descriptive statistics for the errors in the regressions for each security: the size of the mean errors is small and their standard deviation has decreased compared to the standard deviation of the security price. However the errors for all the regression are highly auto-correlated, suggesting that there is a high amount of variation left unexplained by the regression.

Table 9.6 reports the descriptive statistics for a three-factor model that includes 3-month Libid, unemployment and the change in house prices. The results are not much better than the ones produced by the two-factor model: the mean errors are slightly larger for some securities, although the standard deviations are a bit smaller. The errors for all the regressions are still highly auto-correlated.

[242] The algorithm for Nadaraya Watson estimator was written in MATLAB using as a base existing MATLAB kernel density estimators written by C. Beardah of Nottingham University.

Table 9.6 Descriptive Statistics for the Errors of a Three-Factor Pricing Kernel Regression

	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*	*Auto-correlations*
DOMUS	104	-0.6665	0.930	0.0118	0.3705	0.823
TMC1	104	-0.2178	0.313	0.0027	0.1155	0.698
TMC2	104	-0.2631	0.320	0.0044	0.1313	0.807
TMC3	104	-0.2730	0.343	0.0046	0.1365	0.728
TMC4	104	-0.3854	0.362	0.0051	0.1533	0.806
TMC5	104	-0.3056	0.358	0.0047	0.1409	0.753
TMC6	104	-0.2894	0.340	0.0054	0.1384	0.712
TMC7	104	-1.3389	0.495	0.0089	0.2220	0.671
TMC9	104	-0.8319	0.587	0.0104	0.2502	0.718

Where:

The regressors: three-month Libid, the % change in unemployment, and % change in house prices, and

N is the number of observations.

DOMUS and TMC_I: see details in Table 9.4

Finally Panel A of Table 7 reports the descriptive statistics for a three-factor model which includes the term structure of interest rates measured as the difference between 20-year bond and the three month LIBOR, the unemployment rate and the change in house prices.

Table 9.7 Descriptive Statistics for the Errors of a Three-Factor Pricing Kernel Regression Estimation

PANEL A							*Cross-correlations*							
Security	*N*	*Minimum*	*Maxinum*	*Mean*	*Standard Deviation*	*Auto-correlation*	*Domus*	*TMC1*	*TMC2*	*TMC3*	*TMC4*	*TMC5*	*TMC6*	*TMC7*	*TMC9*
Domus	100	-0.5016	0.880	0.008904	0.3150	0.755	1.000	0.881	0.886	0.879	0.880	0.883	0.853	0.712	0.723
TMC1	100	-0.2354	0.345	0.001422	0 1122	0.660	0.881	1.000	0.851	0.861	0.859	0.909	0.860	0.719	0.602
TMC2	100	-0.2505	0.321	0.003842	0.1231	0.736	0.886	0.851	1.000	0.957	0.953	0.940	0.912	0.715	0.744
TMC3	100	-0.2544	0.395	0.002129	0.1407	0.699	0.879	0.861	0.957	1.000	0.931	0.936	0.954	0.722	0.708
TMC4	100	-0.2722	0.404	0.002781	0.1474	0.731	0.880	0.859	0.953	0.931	1.000	0.944	0.909	0.831	0.696
TMC5	100	-0.2635	0.405	0.001148	0.1373	0.697	0.883	0.909	0.940	0.936	0.944	1.000	0.909	0.798	0.731
TMC6	100	-0.2714	0.411	0.002055	0.1452	0.696	0.853	0.860	0.912	0.954	0.909	0.909	1.000	0.682	0.655
TMC7	100	-1.1261	0.417	0.005461	0.1885	0.485	0.712	0.719	0.715	0.722	0.831	0.798	0.682	1.000	0.585
TMC9	100	-1.0494	0.490	0.008242	0.2433	0.601	0.723	0.602	0.744	0.708	0.696	0.731	0.655	0.585	1.000

Regression of the kernel residuals on a dummy variable														
PANEL B					*Cross-correlations*									
Security	*Adj. R-sq*	*Dummy*	*p-value*	*Auto-corr*	*Domus*	*TMC1*	*TMC2*	*TMC3*	*TMC4*	*TMC5*	*TMC6*	*TMC7*	*TMC9*	
Domus	0.173	0.3130	0.000	0.686	1.000	0.853	0.859	0.851	0.853	0.855	0.817	0.658	0.680	
TMC1	0.267	0.1370	0.000	0.518	0.853	1.000	0.808	0.819	0.824	0.880	0.813	0.660	0.532	
TMC2	0.197	0.1300	0.000	0.652	0.859	0.808	1.000	0.946	0.943	0.924	0.888	0.658	0.705	
TMC3	0.206	0.1520	0.000	0.592	0.851	0.819	0.946	1.000	0.915	0.918	0.941	0.666	0.662	
TMC4	0.177	0.1480	0.000	0.648	0.853	0.824	0.943	0.915	1.000	0.932	0.888	0.799	0.649	
TMC5	0.221	0.1530	0.000	0.587	0.855	0.880	0.924	0.918	0.932	1.000	0.882	0.759	0.690	
TMC6	0.230	0.1650	0.000	0.571	0.817	0.813	0.888	0.941	0.888	0.882	1.000	0.616	0.597	
TMC7	0.135	0.1660	0.000	0.382	0.658	0.660	0.658	0.666	0.799	0.759	0.616	1.000	0.525	
TMC9	0.112	0.1900	0.000	0.551	0.680	0.532	0.705	0.662	0.649	0.690	0.597	0.525	1.000	

Where,

The regressors in Panel A: the term structure, the % change in unemployment, and % change in house prices,

N is the number of observations, and

Panel B regresseses the Kernel errors on a dummy variable that equals 1 for the period between 1 Jan 1991 to 1 Jan 1993.

The results are better than in the two previous regressions: the mean errors are much smaller for all the securities (for some securities they are half the size), and the same for the standard deviations. However the errors for all the regression are still auto-correlated, between 60% and 75%, except for TMC7, that has an autocorrelation of 48%. And the cross correlation table shows that there is still a common factor influencing all the securities.

To analyse the sources of common variation, the errors from the kernel regression are regressed on a dummy variable that takes the value of 1 for the months between January 1, 1991 and January 1, 1993. This is to account for the effect of the announcement made by the Bank of England at the beginning of 1991 that from 1993 onwards mortgage-backed securities were to carry a risk-weighting of 100% for capital adequacy purposes. This announcement could have depressed the prices of the securities during that period. It is expected that the parameter associated with this dummy has a positive value: the errors equal the value of the Nadaraya-Watson estimator minus the price time series. Because the kernel regression does not take into account the effect of the announcement the errors should be larger during that time.

Panel B of Table 9.7 reports the results of the error regressions. All the coefficients are significant at the 99% level and have the right sign. The size of the coefficients is similar for all the securities (around 0.15) except for DOMUS, which has a much larger coefficient. The autocorrelation of the errors of these regressions are much lower, notably for TMC 7: this suggests that after accounting for the effects of the announcement, there is less variation in the security prices left unexplained; nevertheless, as the cross-correlation table demonstrates, that unexplained variation is still due to a common factor.

One reason for the still high levels of cross correlation could be the wrong set of explanatory variables has been employed. Again a likely candidate is the "HALIFAX house price index", which is too aggregated, and fails to pick the strength of the recession in the South of England, where most of the mortgages in the pools are originated. Another reason could be that some securities are traded more often than the others and therefore respond better to the influences of the three factors on the

price: TMC7, TMC2 and TMC9 have both the lowest autocorrelation and cross-correlation of the sample. The choice of the smoothing parameter via cross-validation should also improve the fit by reducing the size of the errors and their autocorrelation.

9.7 CONCLUSION

This chapter has presented an empirical analysis of UK mortgage-backed securities pricing at issue and in the secondary market. This analysis is very important because as seen in Chapter 6 and 7, UK depository institution use securitisation as a financing mechanism. Therefore it is important to know what factors influence the pricing of these securities at issue and in the secondary market.

The results show that the risk premium on mortgage-backed securities is influenced by contractual features and market variables that increase the risks associated with investing in these types of securities. The longer the life of the securities the higher the premium demanded by the investors. Investors prefer larger sizes suggesting that these issues are more liquid. The probability of mortgage default is proxied by the mortgage rate, unemployment rate and the volatility in the housing market: all three variables have positive coefficients suggesting that the higher the risk of default on the underlying mortgages the higher the premium demanded by investors. The short end of the term structure of interest rates proxies for the probability of prepayment: the coefficient for this variable is negative indicating that as the likelihood of prepayment increases (downward sloping term structure), investors in mortgage-backed securities demand higher premium.

To estimate the functional relationship between the price of the securities in the secondary market and their fundamentals a non-parametric approach that estimates the relationship via the density of the data was employed. The reason for doing this was the non-normality of the data. It was found that the prices of UK mortgage-backed securities could be explained by three factors (term-structure, house prices and unemployment) that affect the likelihood of the options to prepay and default being exercised by the borrower. A structural break in the securities prices (also

observed in the analysis of the issue prices) was found. The break corresponds with the period of uncertainty surrounding the risk-weighting of mortgage-backed securities for capital adequacy purposes.

As mentioned in Chapter 2, one of the benefits of securitisation finance is the relationship between the risk profile of the issuer and the investor: since the assets backing the issue are isolated, the risk and return of the securities depends on the risk and return of the assets, and not on the risk and return of the issuer. The empirical analysis presented here proves this for the UK mortgage-backed securities market: the price of the securities largely reflects factors influencing the underlying assets.

CHAPTER 10: CONCLUSIONS

10.1 CONCLUSIONS

The objectives of this thesis, entitled "Essays on Asset Securitisation" were to present an overview of securitisation and to test a series of hypotheses with a view to shedding light on why and which depository institutions engage in securitisation, the effects of securitisation on the price of the underlying asset, and the price of mortgage-backed securities. In addition to reviews of institutional frameworks, and theoretical and empirical models of securitisation, the following issues have been examined:

- The economic incentives for securitisation; in particular, whether securitisation is related to a decline in banks' role as financial intermediaries, or banks engage in securitisation to raise finance,
- the role of securitisation within a bank's optimal capital structure; that is, which type of banks raise external finance by securitising assets, and the consequence of such funding decisions on shareholder wealth and the bank's investment policy,
- the effect of securitisation on the pricing of the underlying asset, and
- the pricing of asset-backed securities at issue and in the secondary market.

Chapter 2 considered the institutional and legal structure of securitisation across the US and different European countries, paying special attention to securitisation in the UK. European securitisation markets are compared to the US market. It was concluded that the broad use of securitisation in the US has no equivalent in Europe.

There are many differences between European and US securitisation, but the most crucial one is the lack of government agencies involved in securitisation in Europe. It

has been argued that the active participation (in the form of subsidies) of the US Government in mortgage securitisation contributed to its success. More important, in the US mortgage market, securitisation is probably the most efficient instrument to hedge credit risk since lenders can exchange mortgage portfolios for mortgage-backed securities backed by the full guarantee of the US government. This could explain the vast difference in the growth of securitisation in the US and Europe. Similarly, the positive effects of securitisation on competition in the US mortgage market cannot be de-coupled from the government subsidies.

An additional factor to explaining the differences in the use of securitisation among the US and Europe was US banking regulation which restricted banks' geographical and functional diversification opportunities.

Chapter 3 examined why securitisation by financial firms was different from securitisation by non-financial firms. Securitisation permits financial firms to specialise on asset origination and to transfer the funding function. Depository institutions offer deposit and loan products: they take in deposits and lend them out as loans, to be held in the institution's portfolio until maturity. Thus, in contrast with other firms which use securitisation just to raise funds, depository institutions may also engage in securitisation to diversify from their core business.

Chapter 4 evaluated the literature identifying the reasons why financial intermediaries engage in securitisation. The reasons for securitisation are divided in two broad groups:

- the theories which treat securitisation as a financing instrument, and therefore look at the benefits derived from securitisation finance to explain why firms engage in it. These theories examine, amongst other things, banks' underinvestment problem, the effect of information asymmetry on raising funds, and the ways to increase revenue by pooling assets and issuing claims against the pool,
- and the theories which see securitisation as part of disintermediation, and look at the causes which had led to banks' loss of competitive advantage in intermediation to explain why banks engage in securitisation. These theories argue that banks have lost their competitive advantage because of high

"regulatory taxes", excessive costs of risk management, and improvements in information technology.

Chapter 5 reviewed the empirical literature on banks' incentives to engage in securitisation. The comparison between the predictions of the theoretical models and the results from the empirical tests sheds little light on the economic incentives for securitisation. Part of the problem is the absence of an explicit econometric test for some of the theoretical models. Also the tests engage in partial comparisons of some aspects of the comparative advantage hypothesis and the financing hypothesis. None of the tests looks at the ex-post characteristics of the banks that engage in securitisation, so the incentives and consequences of securitisation are not properly isolated and tested.

Chapter 6 examined the question "why depository institutions securitise" for UK depository institutions. The chapter compares and tests the "comparative advantage" hypothesis against the alternative "financing" hypothesis. The results show that UK banks and building societies engage in asset securitisation as an alternative finance source, rather than as substitution for the traditional intermediary role played by these institutions in an economy.

Chapter 7 addressed the question "which banks securitise" by investigating the role of securitisation within a bank's optimal capital structure. Three issues related to any funding decision are examined: the ex-ante characteristics of the banks choosing this funding source; the market reaction to the security issue announcement; and the ex-post characteristics of the issuing banks. The results indicate that banks with low quality assets, worse capital ratios and inferior performance are more likely to use securitisation, and that agency costs of managerial discretion play a role in explaining the unfavourable market reaction to the securitisation issues and subsequent firm behaviour.

Chapter 8 examines the effect of securitisation on the prices of UK mortgages. In the US because of subsidisation of credit risk, the use of securitisation is particularly dominant in the residential mortgage market. Research on the effects of securitisation on the US mortgage market shows an increase in competition, which has narrowed

the spread between mortgage rates and capital market rates; and improved integration of the mortgage and capital markets. However, given the presence of government subsidies it is unclear whether securitisation would have the same effects in a non-subsidised market.

Employing UK data (a market with no subsidies) the rates offered by depository institutions and by centralised lenders, which raise funds by securitisation, were compared. One would expect these centralised lenders to offer more competitive mortgage rates. However, the evidence on pricing behaviour neither support nor rejected this hypothesis: centralised lenders rates adjust slightly faster to changes in capital market rates, and that there is less evidence of centralised lenders engaging in interest rate smoothing than depository institutions. Also the market share of centralised lenders is strongly related to the level of capital market rates, which does not happen for the other lenders. This suggests that these lenders price their mortgages closer to the marginal cost of funds, so when the wholesale rate is low relative to deposit rates, they gain market share.

Chapter 9 developed and tested an econometric model of sterling mortgage-backed securities valuation with a view to determining the effects of the contractual features and asset risk on the securities price. This chapter also analyses secondary market price of sterling mortgage backed securities to establish which factors affect their return. The evidence shows that the risk premium on mortgage-backed securities is influenced by contractual features and market variables which increase the risks associated with investing in these types of securities. Also the prices of UK mortgage-backed securities in the secondary market are explained by three factors (term-structure, house prices and unemployment) which increase the underlying asset risk.

10.2 LIMITATIONS OF THIS STUDY

Securitisation is a very large topic, and as evidenced by the introductory and concluding chapters it can be considered from many different perspectives. The focus of the thesis was mainly on financial firms which engage on securitisation and on the

consequences of such activities. When the role of financial firms as arrangers of securitisation transactions, rather than originators of the securitised assets, is considered, the implications of securitisation for financial firms would be different. Banks are increasingly using asset-backed commercial paper to provide finance to their customers. In this case, the customer sets up a special purpose vehicle to which it transfers receivables which are financed by the issue of asset-backed commercial paper. The bank provides the mechanism of credit enhancement for the securitisation transaction. Arguably banks preferred this form of "lending" because the capital requirement of the credit enhancement is lower than for a loan. Yet, the bank is assuming the risk of the finance because it provides the credit enhancement for the securitisation. This is a form of "capital arbitrage" which is outside the scope of this thesis because of the lack of data on such activities.

Nor does this thesis consider the consequences of the real risk retained by the UK depository institutions which engage in securitisation. As with asset-backed lending, if the securitising bank provides the mechanism of credit enhancement (usually by buying back the junior securities) it keeps the risks related to the assets, even though the amount of regulatory capital required to back that risk is reduced. There are no data available to examine this issue, because banks do not disclose if they have kept the junior tranche of the security.

The effect of securitisation on risk-reallocation in the financial system was not considered in this thesis. Securitisation removes assets and risks associated with them from a bank's balance sheet. Those risks are allocated to different agents involved in the securitisation process: insurers, credit-liquidity enhancer, and investors. Related questions are whether this reallocation is more efficient, and whether the market can efficiently supervise the risk holders.

Finally, given the relatively small size and short history of UK and European securitisation, some empirical issues can not be adequately addressed. These are the specific role of securitisation on building societies finance, an examination of the incentives for securitisation in other European countries, and a more detailed analysis of finance companies which use securitisation as their main source of funding, such as UK centralised mortgage lenders. Only increased data availability will allow these

issues to be tested, and allow more extensive testing of the hypotheses proposed in the thesis.

10.3 AVENUES FOR FUTURE RESEARCH

Section 10.2 discussed some of the limitations of this study. One of the most obvious ones is that with European securitisation still in its infancy there is not much data available. Better and more data should help to address some of the issues omitted from this thesis.

The advent of the Euro should result in the development of a large and homogeneous bond market which, in turn, may encourage more securitisation. Securitisation is still segmented by country, making economies of scale in securitisation difficult to achieve. With a single European market which limits government borrowing (compared to the past), there could be an increased in the issue of private bonds fuelled by higher demand: securitisation could therefore increase, as will the number and variety of users.

Another issue is, given a rise in securitisation, whether it will improve the integration of European credit markets, as it did for the geographically segmented US mortgage market. With securitisation, loan funding is not tied to deposit raising, nor is tied to the capacity of individual lenders to raise equity or debt capital. Securitisation gives borrowers direct access to the capital markets; therefore an expansion of securitisation could be expected to improve the flow of funds across European credit markets. If that happens, it would be possible to conduct a more extensive analysis of the effects of securitisation on the price of the underlying assets.

A final question to be explored relates to the incentives to securitise by different types of financial intermediaries. For example, different types of financial firms are subject to different forms of regulation. The issue to examine is whether or not the use of securitisation is influenced by the regulatory requirements of the financial firms.

This thesis has looked at the institutional features of securitisation, and provided a comprehensive review of the theoretical and empirical models of securitisation to date. It has used the available UK data to examine empirical questions hitherto confined to the US, where structural differences and subsidisation limit the applicability of the findings. However, as the last two sections show there are many additional issues related to securitisation to be addressed, depending on data availability and the future directions taken by securitisation.

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The results are better than in the two previous regressions: the mean errors are much smaller for all the securities (for some securities they are half the size), and the same for the standard deviations. However the errors for all the regression are still auto-correlated, between 60% and 75%, except for TMC7, that has an autocorrelation of 48%. And the cross correlation table shows that there is still a common factor influencing all the securities.

To analyse the sources of common variation, the errors from the kernel regression are regressed on a dummy variable that takes the value of 1 for the months between January 1, 1991 and January 1, 1993. This is to account for the effect of the announcement made by the Bank of England at the beginning of 1991 that from 1993 onwards mortgage-backed securities were to carry a risk-weighting of 100% for capital adequacy purposes. This announcement could have depressed the prices of the securities during that period. It is expected that the parameter associated with this dummy has a positive value: the errors equal the value of the Nadaraya-Watson estimator minus the price time series. Because the kernel regression does not take into account the effect of the announcement the errors should be larger during that time.

Panel B of Table 9.7 reports the results of the error regressions. All the coefficients are significant at the 99% level and have the right sign. The size of the coefficients is similar for all the securities (around 0.15) except for DOMUS, which has a much larger coefficient. The autocorrelation of the errors of these regressions are much lower, notably for TMC 7: this suggests that after accounting for the effects of the announcement, there is less variation in the security prices left unexplained; nevertheless, as the cross-correlation table demonstrates, that unexplained variation is still due to a common factor.

One reason for the still high levels of cross correlation could be the wrong set of explanatory variables has been employed. Again a likely candidate is the "HALIFAX house price index", which is too aggregated, and fails to pick the strength of the recession in the South of England, where most of the mortgages in the pools are originated. Another reason could be that some securities are traded more often than the others and therefore respond better to the influences of the three factors on the

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