

Securitization in European Mortgage Markets

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1. Introduction

Real estate represents approximately half of all the tangible capital assets in the developed countries of the world. Real estate also tends to be the most durable asset in these economies, so that the cost of acquiring real estate assets generally far exceeds the annual rental cost of using real estate. Consequently, in most developed countries, the mortgage market--meaning the market for financing real estate assets--is among the largest components of the capital markets, its size being on the same order of magnitude as the markets for government debt and traded equity securities.

Due to this importance, mortgage market efficiency is likely to be a key factor in overall financial market efficiency. In particular, a poorly functioning mortgage market is likely to "pollute" other financial markets with its inefficiency. For example, governments are likely to try to "support" inefficient mortgage markets with subsidies and regulations, which then act as implicit taxes and constraints for the rest of the capital markets. On the other hand, an efficient mortgage market will act as a positive externality for the other capital markets, creating pressure for higher efficiency in these markets.

Mortgage markets can be separated into two major parts, the residential mortgage markets that finance housing assets, and the non-residential mortgage markets that finance all other real estate assets. Residential mortgage markets take on particular importance because housing is the dominant asset, and commonly the only significant asset, of households. Household members, of course, are also voters. Consequently, governments face special pressure to ensure well functioning residential mortgage markets.

In this paper, we evaluate the implications of a newly developing form of mortgage finance--securitization--for mortgage market structure and performance. Broadly defined, securitization refers to the aggregation of individual mortgages into a security format, thus allowing mortgage assets to be sold more efficiently to capital market investors. In less than 20 years, mortgage securitization has become the dominant factor in the United States

residential mortgage markets, in the process creating a fundamental restructuring of these markets. Furthermore, during the last 5 years, non-residential mortgage securitization has created a comparable restructuring in the American non-residential mortgage markets.

Prior to the securitization revolution, American mortgage markets had operated as isolated, subsidized, and often inefficient components of the capital markets. The dramatic effects of mortgage securitization were achieved because securitization tightly integrated real estate finance with the overall capital markets. The benefits of securitization for the American mortgage markets have included lower mortgage interest rates, less sensitivity to credit rationing, less need for subsidization, and the elimination of regional variations in mortgage interest rates.

In contrast to the U.S. experience, mortgage market securitization has failed to play a dominant role in any European market, and it remains a negligible factor in most countries. This is surprising given that the benefits of lower mortgage interest rates, less credit rationing, and less subsidization all would seem as important in Europe as they were in the United States. In addition, the potential of mortgage securitization to equalize mortgage interest rates across European countries seems particularly important, given the likelihood of forthcoming capital market and monetary unification among these countries. Indeed, continuation of regionally isolated European mortgage markets will create a major obstacle to capital market and monetary unification.

Our primary goal in this paper is to identify the factors that have slowed the introduction of mortgage securitization in Europe, and to draw relevant policy conclusions. We approach this topic in two basic ways. First, we apply a general framework for analyzing the conditions that create a need for securitization and the benefits that are derived from it. Second, we compare and contrast the case studies of 3 specific countries: France, Sweden and the United States. We begin with the overall framework.

2. THE FUNDAMENTAL FEATURES OF MORTGAGE MARKETS

A mortgage market is a particular type of loan market, specialized to loans collateralized by real estate (structures and land). The special features of mortgage markets are derived directly from the problems that arise when using real estate to collateralize a loan. In the following, we focus on the key features of residential real estate collateral (by which we primarily mean 1-4 family homes). The special features of non-residential mortgages are discussed later.

2.A Special Features of Real Estate Collateral

1. Real estate is very durable, creating an asset value that generally exceeds the annual rental value by a factor of 10 or more. Furthermore, residential real estate asset values are likely to exceed the owner's net worth by a large margin and annual carrying costs are likely to represent a significant proportion of the owner's annual income.
2. Real estate valuation is not precise, since each property and location is unique, and transactions in "comparable" properties may only occur sporadically.¹
3. Evidence of real estate ownership depends on public records that vary from country to country and that may be difficult or costly to access, especially for non-specialists.
4. When a loan default does occur, eviction and foreclosure procedures must be followed before a lender can obtain control of the property. The process is invariably time consuming and costly. Furthermore, the details of the process vary from country to country, raising the costs even further for outsiders.

¹Hedonic pricing (see Meese and Wallace [1994] and repeat sales (see Case and Shiller [1992]) are methodologies that systemize real estate valuation, although their accuracy will be greater at the level of aggregate indexes than of individual properties.

5. In some countries, the lender's recourse on residential mortgages is limited to the property itself; that is, the lender cannot access the owner's other assets.

These factors can be summarized by two basic features of real estate finance. First, real estate lending has a high level of credit risk. Second the credit risk level depends critically on local conditions, including the identity of the specific borrower and property. These features, in turn, determine the structure of mortgage markets, to which we now turn.

2.B Mortgage Market Activities

Mortgage markets can be separated into four vertically related activities: mortgage origination, mortgage holding, mortgage transfers, and related mortgage services. We briefly discuss these in turn.

Mortgage origination is the process through which mortgage debt is created, comparable to the underwriting function for other capital market securities.² It requires an evaluation of the property's collateral value and the borrower's credit worthiness, and the determination of the mortgage contract terms (including the type of mortgage, loan size, interest rate, etc.).

It is a specialized and relatively costly process.

The mortgage origination process has been the object of substantial technological advance in recent years, reflecting the application of computer automation and database information retrieval. The technology also allows for the standardization of mortgage origination, at least for properties that fit the common mold, since the process can be reduced to a replicable computer program acting on database information.

Mortgage holding refers to the activity of the investor who owns or holds the mortgage debt. Mortgages are commonly held by commercial banks, savings banks, specialized mortgage banks, insurance companies, pension funds,

² Strictly speaking, real estate loans generally consist of two documents: the note or bond which documents the terms of loan repayment; and the mortgage which provides the collateral. We will follow common usage, however, in using the term "mortgage" to refer to the complete set of loan documents.

and individual investors. The demand for mortgage debt by the various potential holders depends on general portfolio considerations (interest return, risk and risk-bearing capability, asset and liability duration matching, tax status, etc.) as well as special incentives that may be created by government subsidies.

The mortgage origination and mortgage holding functions may be integrated into a single institution or they may be carried out by separate institutions. Cost considerations should determine the adopted structure. For example, the recent technological advances in mortgage origination and mortgage transfer have significantly increased the incentive for separating the mortgage origination and mortgage holding functions.

Mortgage Transfer. Mortgage transfer refers to the process through which mortgage ownership is transferred, primarily from the originator to a holder.

In principle, this is no different than an ordinary security buy and sell transaction. In practice, however, the relatively high risk, high information costs, and small size of each individual mortgage forces a more complicated process. For example, even if the buyer could duplicate the property and credit evaluation carried out by the originator, the high costs of doing so would preclude most transactions.

Mortgage transfer costs may be reduced by the potential for large originators to establish a reputation based on a continuing stream of transactions with specific buyers. These relationships remain delicate, however, partly because the buyer obtains market power vis. a vis. the originators, and partly because when unexpected losses do occur, it is necessary to ascertain whether it arose from moral hazard, macroeconomic conditions, or just bad luck.

The technological advances that allow automation and standardization of the mortgage origination process are another source for reduced mortgage transfer costs. When the origination process is objective and replicable in principle by the buyer, the buyer's concern with moral hazard and adverse selection may be substantially reduced.

Related Mortgage Services Three additional activities or services that may be required for a well functioning mortgage market are mortgage default insurance, mortgage servicing, and credit ratings. These activities become particularly relevant when mortgages are transferred from one owner to another.

Mortgage insurance protects the mortgage owner against the risk of default by the borrower. In some cases, it is provided by the government as a form of subsidy to special classes of borrowers. In other cases, it is sold by private insurance firms, often in the same format as other casualty insurance, with deductible limits and coinsurance features. Its primary use is to protect the mortgage buyer against the moral hazard of being sold poor quality mortgages.

Mortgage servicing refers to the activity of collecting the monthly payments from the borrowers and transmitting the funds to the mortgage holder. Also, the mortgage servicer confirms that the borrower maintains property insurance, pays the property taxes, and remains current on the mortgage payments. In the case of a mortgage default, the servicer is responsible for carrying out the foreclosure process.

Rating services evaluate and publicly rate (AAA, AA, etc) mortgage securities, in much the manner they rate corporate and municipal securities. Rated mortgage securities allow investors to obtain a measure of the credit risk without the costs of a detailed credit evaluation.

2.C Existing Mortgage Market Institutions³

Mortgage markets are operated by a wide variety of institutions in the United States and Europe. We summarize here the two primary formats, depository institutions and mortgage banks, focusing on their advantages and disadvantages.

³The discussion in this section is based in part on Michael J. Lea, "The Applicability of Secondary Mortgage Markets to Developing Countries," Housing Finance International, March 1994.

Depository Institutions

Depository institutions, including commercial banks, savings banks, and building and loan societies, are the principal mortgage market institutions in many countries. Commonly, they are active both in mortgage origination and mortgage holding, thus eliminating the costs of mortgage transfer.

A major advantage of banking institutions is their access to low-cost deposit funds, which may include the benefit of subsidized deposit insurance.

Their existing branch networks may also be useful for carrying out mortgage origination activity. However, many banks actually carry out their mortgage originations through separate subsidiaries and the recent technological advances in mortgage origination have further reduced this possible advantage of banking institutions. In the United States, for example, the market share of banking institutions in mortgage origination has been falling quite rapidly.

The major disadvantage of banking institutions concerns duration matching between their assets and liabilities, and as a related matter, their capital requirements. Specifically, bank deposits tend to have quite short durations, while fixed-rate mortgages have very long durations, creating a large interest rate risk. These risks can be reduced or eliminated through interest rate hedges or by issuing adjustable rate mortgages, but each of these strategies introduces costs of its own. Furthermore, banking institutions must adhere to capital requirements, which act as implicit taxes.

A second possible disadvantage of depository intermediaries is that they may not achieve the desired level of geographic diversification. Especially in the United States, where the majority of banks are small and locally based, most of the mortgage loans from an individual bank come only from its own market area. On the other hand, banks also automatically achieve a significant degree of sectoral diversification, given that they make loans to a wide variety of business and consumer customers.

Mortgage Bankers and Mortgage Banks

The primary alternative to the depository structure is a secondary market system. With this system, the mortgages are originated by specialized institutions, sometimes called mortgage bankers (which can include depository intermediaries acting in this role). The mortgage banker then transfers the originated mortgages to the final investor. There are many variations here, depending on how the transfer occurs and on the identity of the final holder.

In many European countries, the final holder is a mortgage bank, which issues its own debt and uses the funds to purchase mortgages from the originators. In another version, the mortgage bank issues debt and then lends funds to the mortgage originator, which keeps the mortgages on its own balance sheet. In either version, the mortgage bank is often affiliated with the government, or at least it is a link through which the government subsidizes mortgage interest rates.

The United States has comparable secondary market facilities. For one thing, there are two government sponsored agencies--Federal National Mortgage Association (FNMA, or Fannie Mae) and Federal Home Loan Mortgage Corporation (FHLMC or Freddie Mac)--which, among other activities, purchase mortgages directly from originators. For another thing, the Federal Home Loan Banks (another government agency) lends funds to mortgage originators.

Comparison of Depository Institutions and Mortgage Banks

The distinctive feature of the mortgage bank system is that the funds to finance the mortgages are raised directly in the capital markets, rather than through bank deposits. This suggests that the two systems could be readily compared in terms of the least-cost method for raising the funds. However, this oversimplifies the comparison, since in most cases the mortgage banks are government related agencies, which allows them to issue debt based in part on the government's credit rating, while also raising the cost of borrowing for the country's Treasury. The upshot is that in practice it is not an easy

matter to compare the "all in" costs (including costs imposed on the government) of the depository institution and mortgage bank formats.⁴

2.D Special Features of Nonresidential Mortgage Markets

Nonresidential mortgage markets share the general features just presented for residential mortgages, but differ in three important aspects:

1. Nonresidential real estate properties tend to be substantially larger than residential properties, creating the need for correspondingly larger real estate loans.
2. Nonresidential mortgages tend to be substantially more risky than residential mortgages, because the business demand for space can be more volatile than the household demand.
3. To meet the special needs of either the borrower or lender, nonresidential mortgages often include a variety of special features such as an equity interest for the lender, extra payments to the lender when the property's rental income exceeds certain benchmarks, etc.

Mortgage financing for nonresidential properties reflects these special features. Commercial banks, pension funds, and life insurance companies all originate and hold nonresidential mortgages, based on their expertise in evaluating nonresidential properties and negotiating the special features of the mortgage contracts. Alternatively, those firms with direct access to the capital markets can issue corporate bonds with a credit enhancement using real estate property as collateral.

⁴ For a fuller discussion of these issues, see Diamond and Lea, "Housing Finance in Developed Countries: An International Comparison of Efficiency," Journal of Housing Research, 3,1,1992 and "The Decline of Special Circuits in Developed Country Housing Finance," Housing Policy Debate, 3,3,1992.

3. A FRAMEWORK FOR ANALYZING SECURITIZATION

Mortgage securitization represents a newly developed method for structuring a mortgage market. In this system, a pool manager securitizes a pool of mortgages and then sells the securities to capital market investors. The pool manager is an institution that specializes in creating mortgage securities, often referred as the mortgage conduit⁵ The following describes the process in more detail, focusing first on the case of residential mortgages.

3.A Description of Residential Passthrough Mortgage Securities

The mortgage pool is created simply by combining a large number of individual mortgages. Each investor in the mortgage security receives a prorated share of the net cash flow arising from the mortgage pool. The cash flow consists of all categories of borrower payments: interest, amortization of principal, and prepayment of principal. The securities are described as "passthrough" because all payments made by the borrower pass through to the investor. The cash flow received by the investor, however, is net of a fee charged by the mortgage conduit for (1) servicing the mortgages, (2) bearing or insuring the credit risk, and (3) changes in interest rate levels from the date of mortgage origination to the date of security issuance. In the United States, these fees range upward from 25 basis points annually.

For example, a mortgage security, based on a mortgage pool with an average coupon rate of 8.5% and with a 25 basis point servicing fee, a 50 basis point credit fee, and a 25 basis point interest rate gain, would pay the security investors an effective coupon rate of 7.50%. This effective coupon rate is applied to the outstanding principal balance of the mortgages in the pool. As the principal balances are paid down by the borrowers, the effective coupon rate applies only to the remaining principal. When the mortgage pool principal balance reaches zero, the mortgage security is considered redeemed.

⁵The mortgage conduit can be an independent firm that purchases the mortgages from originators, or the conduit and the originator may be the same firm.

A special problem arises when the mortgage borrowers are late in making their payments, or when the borrowers default on all payments. Although in principal the risk of late payment or default could also be passed through to the investors, in practice most mortgage securities are designed to make this a highly unlikely event. We next consider the common measures taken to eliminate default risk.

3.B Measures to Eliminate Default Risk on Residential Mortgage Securities

Investors in mortgage securities face a moral hazard, namely that the conduit firm creating the security would place high risk mortgages in the pool. To protect against this possibility, most residential mortgage securities provide investors with nearly complete protection against losses created by default. This has been achieved in a variety of ways.

Government Insured Mortgages

One solution is for the mortgage pool to contain only mortgages fully guaranteed by the government. In this case, if the borrower fails to make the required payments, the government steps in and makes the payments to the investors.⁶ This is the method used on the first U.S. mortgage securities, the GNMA (Government National Mortgage Association) securities, which were based on mortgage pools consisting only of mortgages already fully guaranteed by the U.S. government.

Government Insurance of the Mortgage Conduit

An alternative solution is for the mortgage conduit institution to guarantee investors against any risk of late payment or default. To make this guarantee fully credible, the government, in turn, may guarantee the obligations of the mortgage conduit. This is the method used on all mortgage passthrough securities issued by the FNMA and FHLMC mortgage conduits in the

⁶The investors, of course, could still face delays in receiving the payments. This is not a fundamental problem, since the investors will accrue interest on the outstanding mortgage balance until the delay or default is corrected. In practice, on many mortgage securities, the servicing agent is required to make the payments on a timely basis, for which it is later reimbursed by the government.

United States. FNMA and FHLMC are government sponsored agencies, and as such, market investors perceive that the guarantee obligations of FNMA and FHLMC are backed by the U.S. government.

Private Insurance of Mortgages and Mortgage Pools

Another system is for private insurance firms to provide insurance against default on the individual mortgages or on the entire mortgage pool. Of course, this still leaves investors with the risk that the insurance firm itself might fail. As a result, most mortgage securities based on private mortgage insurance obtain a quality rating by a specialist firm, such as Standard and Poors. Even though most privately insured mortgage securities receive a credit rating of AAA, they still provide investors a slightly higher yield than the yield on mortgage securities backed by government guarantees.

Credit Enhancement through Over-Collateralization

It is also possible to protect mortgage security investors against default risk without the use of insurance, private or government. The most common device is to create a mortgage pool with a principal value that is larger than the principal value of the mortgage securities. The excess value in the mortgage pool provides protection should some mortgages in the pool default. Furthermore, as defaults do occur, the mortgage conduit is generally required to replace the defaulted mortgages with additional performing mortgages.⁷

3.C The Economic Incentives of Mortgage Conduits

Institutions act as mortgage conduits in response to the profits that can be achieved by purchasing individual mortgages at one price and selling the mortgages in a security form at a higher price. The form of the profit function can be easily developed if we make two sets of simplifying assumptions (we refer to the individual mortgages as "the mortgages" and to

⁷This raises the question whether the mortgage conduit will have the replacement mortgages or the resources to purchase them. In practice, those mortgage conduits carrying out over collateralization are associated with large and diversified financial institutions, making the replacement guarantee credible.

the mortgage security as "the security"):

1) The mortgages all have the same coupon rate, maturity, and credit risk.

As a result, the mortgages all have the same market price, quoted as a percentage of their principal value, which we denote as P^m (the price at which mortgages are supplied to the conduit).

The security has the same coupon rate as the mortgages. The market price of the security, quoted as a percentage of its principal value, which we denote as P^d (the price at which investors demand securities from the conduit).

These assumptions represent a convenient normalization, because they allow us to compute the conduit's net operating revenue directly as a function of the price spread $P^d - P^m$. Alternatively, we could assume that the mortgages and security have different coupons, but the computation of net operating income would then be more complicated, depending on both the coupon rates and the market prices.

2) The average operating costs of the conduit, including fees paid for servicing and credit risk, are denoted as $C(X)$, where X is the total principal value of the security, (equal to the principal value of the mortgages).

With these assumptions, the profit function of a mortgage conduit takes a simple form:

$$(1) \quad \mathcal{D} = [P^d(X) - P^m(X)] - C(X) X, \text{ where}$$

- $P^d(X)$ is the price that security investors are willing to pay to obtain the amount X of mortgage securities.
- $P^m(X)$ is the price that borrowers must receive to issue the amount X of new mortgage debt.
- $C(X)$ is the average operating cost at the scale X .

The business decision of a mortgage conduit is illustrated in Figure 1. The principal quantity of mortgages, equal to the principal quantity of the

security, is shown on the horizontal axis. The prices for the mortgages and security are shown on the vertical axis. The curve marked $P^d(X)$ is the negatively sloped inverse security demand curve. The curve marked $P^m(X)$ is the positively sloped inverse mortgage supply curve. Finally, the inverse security supply curve, $P^s(X)$, is determined by vertically summing the mortgage supply curve and the conduit cost curve; that is, $P^s(X) = P^m(X) + C(X)$.

Equilibrium in the Mortgage Security Market

The nature of the equilibrium established in the market for mortgage securities will depend on the competitive conditions in this market. If the market operates in a perfectly competitive fashion, then equilibrium is determined by applying the zero profit condition to equation (1):

$$(2) \quad P^d(X) = P^s(X) = P^m(X) + C(x).$$

This is illustrated in Figure 1 at the quantity X^* and the security price P^* , implying a mortgage price $P' = P^* - C(x)$.

In a forthcoming paper, Hermalin and Jaffee [1995] discuss the competitive conditions in the markets for residential mortgage securitization in the United States. They find that highly competitive conditions exist in the supply of mortgages to the conduits and in the demand for mortgage securities by investors.

The remaining question is whether the mortgage conduits themselves exercise market power. Here the issue is more complicated because the market for mortgage securities is currently segmented into two parts: "conforming" mortgages (which basically consist of all mortgages not exceeding a principal balance of \$203,000 and "nonconforming" (or "jumbo" mortgages). First consider the conforming mortgage market. The two government-related firms, FNMA and FHLMC, are legally restricted to securitizing only conforming mortgages, but within this market they have a major competitive advantage because there are implicit government guarantees on the mortgage securities they issue. Both Goodman and Passmore [1992] and Hermalin and Jaffee [1995] find that the two firms do exercise their market power, perhaps by acting as

tacitly colluding duopolists. If the mortgage conduit firms have such market power, then the equilibrium illustrated in Figure 1 will be determined by the marginal revenue and marginal cost curves, instead of the average revenue and average cost curves. Of course, this would result in a lower quantity of securitization, a higher price P^d for investors, and a lower price P^m for mortgage borrowers.

Next consider the non-conforming mortgage market. Hermalin and Jaffee find much more competitive conditions in this market (from which FNMA and FHLMC are currently legally excluded). Furthermore, this market exhibits substantial entry and exit, consistent with a competitive market. For example, for the years between 1989 and 1993, 8 different firms were among the top 4 firms in this segment of the industry, and many of the largest financial service firms in the United States were participating. Finally, Hermalin and Jaffee consider the likely state of competition for mortgage securitization were FNMA and FHLMC privatized, meaning they would give up their access to government guarantees but would be free to enter all segments of the mortgage securitization markets. They conclude that the mortgage securitization markets would likely operate competitively under these conditions, although these results are necessarily more speculative.⁸

The Welfare Benefits of Mortgage Securitization

The welfare benefits of mortgage securitization are easily illustrated in Figure 1, assuming that the securitization market operates in the competitive fashion shown there. Both mortgage borrowers and security investors benefit from securitization.

For mortgage borrowers, the effect of mortgage securitization is to raise the price at which they can issue mortgage obligations from P_1 when securitization is zero, to P' when securitization is at the competitive level X^* . The welfare benefit can then be measured by the shaded area under the

⁸A critical factor concerns the minimum efficient size for mortgage conduits. FNMA and FHLMC are currently much larger than any of the other mortgage conduits, but it is hard to know whether this is the result of operating efficiencies or of the government guarantees.

mortgage borrower supply curve. The amount of welfare benefit, therefore, depends on the elasticity of the supply curve. Given a high sensitivity of mortgage borrowers to mortgage interest rates, the welfare benefits could be significant. In the United States, the reduction in mortgage interest rates (comparable to higher mortgage prices in Figure 1) has been estimated to be in the range of 35 to 50 basis points, a very significant saving in view of the large amount of mortgages outstanding.

For security investors, the effect of mortgage securitization is to lower the price at which they can purchase mortgage securities from P_3 when securitization is zero, to P^* when securitization is at the competitive level X^* . The welfare benefit can then be measured by the shaded area under the security demand curve, depending on the elasticity of the demand curve. The demand curves for capital market instruments are generally highly elastic, given the rich supply of close substitutes. Hermalin and Jaffee concur with this conclusion, implying that the welfare benefits for mortgage investors may be relatively small.

3.D Advantages of Mortgage Securitization

Mortgage securitization can be compared with the alternative mortgage structures we discussed earlier, namely depository institutions and mortgage banks. To simplify these comparisons, we assume that the investor demand curve for mortgage securities is horizontal, allowing us to focus solely on the benefits obtained by mortgage borrowers as determined by the level of the mortgage interest rate. Whether or not mortgage securitization offers advantages over the alternative mortgage market structures can then be determined from a very simple test: would the institutions currently holding mortgages under the current system find it advantageous to sell some or all of their mortgages through securitization? If the answer is yes, then the amount of mortgage lending would surely expand, thus lowering the mortgage interest rates paid by borrowers.

Depository Institutions

First consider the depository institutions who are currently holding mortgages in their portfolio. Their decision to sell these mortgages through securitization would depend on the price they realize through a security sale versus the present value of the net returns obtained when the mortgages are held in portfolio. The net return on the mortgages held in portfolio consists of the gross return on the mortgages minus the cost of funds (including operating costs), hedging costs (to balance the duration of the mortgages with the funding source), mortgage risk costs (mortgage insurance), and bank capital costs.

These elements are likely to vary from institution to institution, as well as from country to country, so it is likely that some institutions will find securitization attractive, while others will not. In fact, it is this variation across institutions that allows mortgage securitization to achieve the regional equalization in mortgage interest rates. That is, institutions in regions with high mortgage interest rates will find securitization attractive, allowing them to expand their origination activities, and thus reduce the mortgage interest rates in their regions.

Data from the United States provides one measure of the extent to which depository intermediaries find securitization attractive. It is clear from these data that a substantial number of U.S. depository intermediaries find securitization financially attractive.

Mortgage Banks

The same methodology just applied to depository institutions can be applied to a mortgage bank structure. The decision of mortgage banks to sell the mortgages through securitization would depend on the price they realize through a security sale versus the present value of the net returns obtained when the mortgages are held in portfolio and financed through bond issues, taking into account the interest risk, credit risk, and capital costs.

Again the U.S. experience is instructive about the possible outcome. The two government-related agencies, FNMA and FHLMC (hereafter F&F) are the most relevant cases. F&F currently carry out both activities: that is, they

hold mortgages in portfolio and they securitize mortgages. In earlier periods, mortgage holding was the larger activity, but mortgage securitization is now larger. This raises the further question why F&F carry out both activities. The likely answer is that the firms face diminishing marginal returns to both activities, so that profit-maximization leads to an interior solution with both activities present, rather than a corner solution with just one activity. In any case, it is apparent that the current economic fundamentals are highly favorable to a substantial amount of securitization activity.

3.D Forms of Residential Mortgage Securitization

Our discussion so far has focused on the basic form of mortgage securitization, namely passthrough securities. In recent years, however, the securitization market has expanded to incorporate a number of more complicated securitization formats.

The impetus for these innovations is that most fixed-rate mortgages in the United States have a prepayment option that allows a borrower to repay a mortgage at little or no extra cost, as well as a due on sale clause which forces the borrower to prepay the mortgage if the property is sold. Each of these creates a condition under which a mortgage may be repaid far ahead of the normal amortization schedule. For mortgage holders, this creates an interest rate risk, comparable to the risk on any callable debt instrument, which reduces the price investors are willing to pay for mortgages or mortgage securities.

Mortgage conduits, however, found they could reduce the effects of this risk, by selling mortgage securities that were separated into different prepayment classes (also called prepayment tiers or tranche). For example, a \$100 million mortgage pool might support a 3-class structure:

Class A securities (\$25 million principal, 7% coupon). The cash flow to this class consists of two parts: the 7% return on the remaining principal; and all mortgage pool repayments of principal (from normal amortization or repayment), until the remaining principal balance on Class A reaches 0 and the class is

therefore redeemed.

Class B securities (\$50 million principal, 8% coupon). Initially, the cash flow to this class consists only of the 8% return on the \$50 million principal. However, once Class A is redeemed, all further mortgage pool repayments of principal are allocated to Class B until the remaining principal balance on Class B reaches 0 and the class is therefore redeemed.

Class C securities (\$25 million principal, 9% coupon).

Initially, the cash flow to this class consists only of the 9% return on the \$25 million principal. However, once both the Class A and Class B securities have been redeemed, all further repayments of principal are allocated to Class C until the remaining principal balance on Class B reaches 0 and the class is therefore redeemed.

The effect of this classification is that the Class A securities will have a relatively short duration, the Class C securities will have quite a long duration, and the Class B duration will fall between them. This allows the mortgage conduit to match investor duration preferences with the most appropriate security class. The result is that a securitized mortgage pool with classes can often be sold for a higher total price than the price that would be obtained on a single-class passthrough security. In recent years, mortgage securities have been issued with as many as 100 separate classes, including classes with floating rate coupons and with complex interactions between the classes.

3.E Non-Residential Mortgage Securitization

Although the basic principles just described for residential mortgages also apply to the securitization of non-residential mortgages, there are two important differences. First, the interest rate risk on non-residential mortgages tends to be much lower, since the mortgages generally have much shorter maturities and there is either no prepayment option or there are substantial penalties for exercising the option. The upshot is that security classes based on expected duration have not been important for non-residential

securitization. On the other hand, the credit risk on non-residential mortgages is substantial. This has been the impetus for the distinctive features of non-residential mortgage securities, which we now consider.

The primary innovation has been to adopt a senior-junior class structure, in which the senior securities have first priority with respect to both interest and principal payments. The result is that the junior classes face significant risk with regard to both slow payments (if the borrower is in arrears) and to ultimate default. This allows the mortgage conduit to match investor credit risk preferences with the most appropriate security class. That is, investors with a low risk tolerance would purchase the senior securities, while investors with a high risk tolerance would purchase the junior securities. The result is that a securitized mortgage pool with risk classes can often be sold for a higher total price than the price that could be obtained on a single-class security.

For example, consider an office building with only 50% tenancy, and thus with a cash flow to support only 50% of the original mortgage payments. The securitized mortgage on this property could then be sold with a 50% senior class (based on the available cash flow) and a 50% junior class with a value based on an hoped-for improvement in the tenancy situation or on a capital value in excess of the principal value of the senior debt.

Evaluating the expected return and riskiness of the various security classes, of course, requires substantial information regarding the conditions for each property, making an informed investment decisions potentially very costly. This aspect of the problem has been solved by rating firms, such as Standard and Poors, which have developed standards for the rating of security classes and expertise in applying these standards to determine actual ratings.

On the senior securities, these ratings allow investors to make informed decisions without incurring large costs of credit risk evaluation. The risk-rating of the junior securities, in contrast, would be much less dependable, and in fact these securities are often not rated at all, forcing investors to make individual judgments.

The innovation of such risk-class securitization has been particularly

timely in terms of the world-wide real estate collapse that occurred during the late 1980s and 1990s. Using the risk-class securitization method, the holders of poorly performing commercial mortgages have been able to sell their positions at a substantially higher price than would have been available from any alternative methods.

4. MORTGAGE SECURITIZATION IN EUROPE

We summarize here the main conclusions that can be applied to questions regarding the securitization of residential mortgages in Europe.

1. Capital market investors are likely to require securities without a significant degree of credit risk, because the costs of evaluating risk mortgage securities are simply too high. The experience with mortgage securitization in the United States suggests a number of ways to achieve this end:

- Securities based on government insured mortgages.
- Securities issued by government-guaranteed conduits.
- Securities issued with high quality private credit enhancement (such as over-collateralization).
- Securities with a senior/junior debt structure, allowing the senior securities to be rate AAA.

2. Potential problems due to repayments by mortgage borrowers can be handled with a multi-class security structure providing priority claims on principal payments for specified classes.

3. The economic advantages of mortgage securitization relative to traditional mortgage systems based on depository institutions or mortgage banks depend primarily on factors concerning the cost of funds and the hedging costs for interest risks. The "revealed preference" in the United States is that both depository institutions and mortgage banks (FNMA and FHLMC) make extensive use of mortgage securitization.

4. The benefits of mortgage securitization will be shared among mortgage borrowers, capital market investors, and the mortgage conduits. Given relatively elastic demand curves by capital market investors and competitive conditions for mortgage conduits, mortgage borrowers receive the primary benefits of securitization in the form of lower mortgage interest rates.

5. Mortgage securitization also offers benefits by forcing the equalization of mortgage interest rates across regions (and potentially across countries).

