The Measurement and Management of Mortgage Credit Risk in the United States:

Implications for Emerging Mortgage Markets

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Implications for Emerging Mortgage Markets

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Foreword

The housing finance system of the United States is a marvel in its size, scope, and efficiency. One key feature of the U.S. housing finance system is its integration into the broader financial markets, providing Americans with access to cheap sources of capital. As a result, Americans enjoy high-quality housing and high homeownership rates. Thus, housing finance is of central importance to two critical sectors of the national economy: one obvious—the housing industry—and the other less obvious—the larger financial system of the United States.

Americans use the housing finance system daily and seem to take it for granted, whether taking out a first-time mortgage or refinancing their mortgages, and assume that the necessary mortgage capital will always be available on reasonably convenient terms. Few realize the complex underpinnings that are necessary to measure and manage credit risk, which is the most important factor in the sustained viability of any mortgage market, nor do they understand the key role of the government in unleashing the powerful forces of the private sector that consistently delivers the capital borrowers need to take advantage of homeownership.

The requisites needed for this fundamental function of a viable mortgage market—to manage credit risk—is a question asked by many delegations from other governments that visit HUD each year for briefings on American experience in housing policies and programs. For this reason, the Office of Policy Development and Research, through its Office of International Affairs, has long been interested in a study that would identify and explain the mechanisms for the effective management of credit risk.

Hence, this study, ***"The Measurement and Management of Mortgage Credit Risk in the United States: Implications for Emerging Mortgage Markets,"*** was commissioned, primarily for an international audience. It describes the legal, regulatory, and institutional factors that make possible the effective identification, measurement, management, and mitigation of mortgage credit risk, with special emphasis on the role of government. The concepts of transparency in government actions and a functioning legal system that fully recognizes and respects personal property rights are highlighted as critical for the development of market mechanisms that can effectively measure and manage credit risk. Implications for emerging mortgage markets are offered throughout this detailed study of credit risk management in the United States. As this paper shows, the ability to properly assess, price, and mitigate credit risk is critical for emerging markets to achieve success in developing their mortgage markets.

I think that all those working on ways to improve housing opportunities, whether here or abroad, will find this study both enlightening and useful.

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Section 1. Introduction

The objective of this paper is to provide a systematic review of the methods the U.S. mortgage industry uses to assess and manage default risk and to shed light on practices that emerging mortgage markets may need to develop to provide citizens effective financial support for residential purchases. As emerging markets attempt to develop their domestic housing finance markets, being able to properly assess, price, and mitigate credit risk is likely the most important success factor. Nothing stops lending programs—government or private—more quickly than out-of-control losses.

To place mortgage credit risk into context, this section provides a brief overview of residential mortgages in the United States. The purpose of this section is to familiarize the reader with the primary features of the mortgage, discuss the requisites for a functioning mortgage market, provide an overview of how mortgages terminate (with emphasis on default), and define the legal context that enables the enforcement of the mortgage contract.

What Is a Mortgage?

At the most basic level, a mortgage is a debt contract (a loan) between a borrower and a lender that is secured by a claim on real property (the collateral). The debt contract is specified through a "promissory note" that states that the borrower promises to repay the amount borrowed from the lender plus interest within a specified time. The mortgage is then created as a separate legal document that pledges real property as security in case the borrower fails to repay the debt. As a result, a mortgage stipulates that the lender has the right to take the property from the borrower (through foreclosure) if the borrower fails to abide by the terms on the promissory note. A mortgage loan is composed of these two separate legal documents and collectively they are typically referred to as the "mortgage," the combination of the promissory note and the actual mortgage. In the United States, the minimum requirements for a valid mortgage are that the contract identifies the borrower and the lender, clearly states the terms of the loan (the interest rate charged, the maturity date of the loan, and the required payments or how they are to be computed), the amount being borrowed, a full description of the property securing the loan (usually through a valid description in the legal title), and borrower and lender signatures in writing. To ensure enforceability, most mortgages are recorded in a local government office and disclosed to the public.

The unique feature that separates a *mortgage* from a *personal loan* is the use of collateral to limit lender losses in the event of a default. It is important to recognize that the ability to use real property as security for a debt contract arises from a well-defined and transparent legal system that fully recognizes and respects personal property rights. Without a functioning legal system that secures the lender's right to take the real property, a mortgage contract would be no different from a personal loan.

Requisites for Mortgage Markets

Table 1 presents the basic requisites for functioning mortgage markets. Without these requisites, residential finance can be at best a local phenomenon among relatives or within groups with common ties.

Table 1. Requisites for Mortgage Markets

Requisite	Required Elements
Residences as private property	Clear titles Enforceable foreclosures
Functioning banking system	Banks experienced in making loans Clear financial disclosure Effective government oversight A lender of last resort and/or deposit insurance
Supportive political system	Stable society Transparency of government actions Free press

First, if residences are not privately owned, then mortgages become no more than uncollateralized personal loans. If the land is not privately owned, such as in China, a mortgage market is limited by the uncertainty over the renewal of the land leases. Titles to the residences have to be clear and enforceable, with disputes adjudicated and enforced. Lenders have to be able to foreclose, evict the owners, take possession of the property, and, most likely, resell the property if borrowers do not fulfill their mortgage contracts.

It is important to stress that laws establishing clear property rights are not necessary to have a functioning secondary market, where loans can be bought and sold after origination. Secondary markets are now well established for a wide variety of consumer and corporate debt contracts, including personal loans, credit cards, and auto loans. The secondary market allows capital to flow more efficiently from sources of credit (lenders/investors) to demanders of credit (borrowers).The loans originated in a system without clear property rights, however, are personal loans with higher probabilities of default and higher expected losses in the event of default. To compensate investors for these higher default costs, interest rates on personal loans can be high.[1]

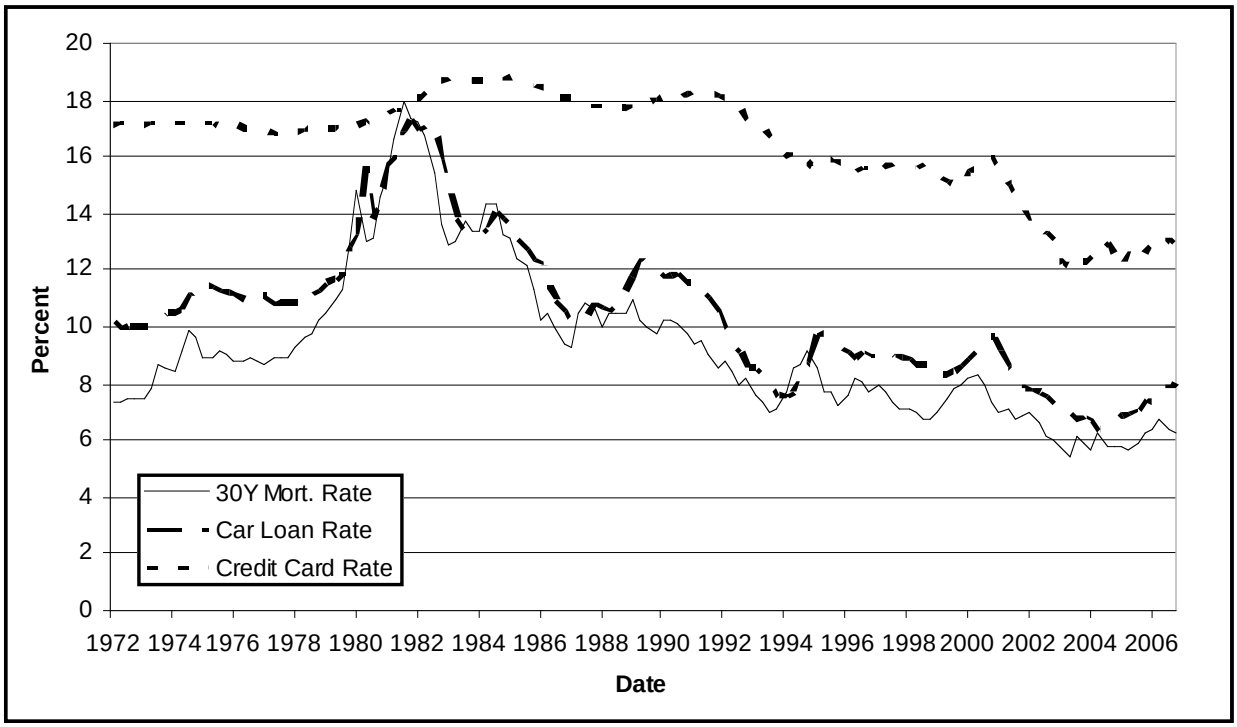
Figure 1 shows mortgage interest rates, collateralized (that is, backed by assets) consumer credit (automotive) rates, and uncollateralized credit card rates (that is, personal loans without collateral to attach if the borrower does not pay) in the United States from 1972 to 2006. Note that the car loan rates mirror the movements in residential mortgage rates but are higher by about 2 percentage points because of the difference in collateral—automobiles tend to depreciate in

[1] Another consequence of the lack of clear property rights is that the risks and expected losses associated with default may be so high that credit is unavailable (that is, rationed, or lent in amounts too small to adequately finance housing).

value whereas houses generally tend to appreciate—and the government support afforded to residential financing (see Section 6), which is not available to car financing.

Even more dramatic is the contrast to the uncollateralized credit card rates. From the early 1990s, credit card rates have been about 7 percentage points higher than mortgage rates, primarily because of the lack of collateral. (Before then, these rates were insensitive to market interest rates.)

Figure 1. 30-Year Mortgage Rate vs. Credit Card Rate and Car Loan Rate



A true "mortgage" market is possible only in a society with clear laws establishing private property rights and with an effective and transparent court system that enforces these rights. After private property rights are effectively established, a functioning mortgage market and a helpful secondary market can develop. The primary benefits of having a functioning mortgage market, versus simply a personal loan market, are twofold. First, as shown in Figure 1, mortgages have lower interest costs than other secured personal loans and *significantly* lower costs than unsecured personal loans. The lower interest costs result from the ability of the lender to use foreclosure to limit losses in the event of borrower default. Second, when property rights are fully respected and enforced by the legal system, lenders (and ultimately secondary market investors) have the confidence to extend greater amounts of credit to potential borrowers in the form of higher loan-to-value (LTV) ratios (the size of the mortgage loan divided by the value of the property). The size of a personal loan would likely not be large enough to make home purchases affordable for most potential homebuyers. Thus, an effective system of private property rights expands homeownership opportunities by lowering the monthly interest costs associated with housing finance and reducing the initial downpayment required for home purchases.

Another vital component of a mortgage market, especially an emerging mortgage market, is a functioning banking system. A well functioning banking system is one in which credit-granting functions are operative, expertise is available to underwrite borrowers and the collateral, and institutions raise and provide funds. Effective government oversight of the banks and clear and transparent financial disclosure are needed, or else the bank or banks will not function well enough to provide efficient lending services. The banking system needs to be stable enough to withstand "runs" when depositors believe they need to withdraw their funds any time they fear a danger of being unable to get their money back. A government-supported lender of last resort and deposit insurance are mechanisms that can assure depositors that they need not panic. A government-supported lender of last resort or government-provided insurance to depositors requires that the government regulate the actions of banks to ensure that lenders do not take advantage of the government support by undertaking high-risk lending activities. To be an effective regulator, the government must create institutions that are transparent in their financial transactions and adhere to international banking system standards (Basel I and Basel II).[2] Transparency has been cited as an important attribute of effective regulation.[3] Transparency not only provides depositors with assurances that their savings will be protected, but it also provides secondary market investors with assurances that lenders are engaged in disciplined underwriting. Without such discipline, the secondary market investors cannot effectively price default risk and, as a result, the secondary market will not flourish. A secondary market is not necessary for a viable mortgage market (and is not included in Table 1 as a requisite), but it makes it more efficient.

For government support of the banking system to be effective, the government needs to be stable and exhibit actions that are transparent to its citizens. The latter may be achieved with an Auditors General function that is respected, independent of the executive branch, and greatly facilitated by the existence of a free press. A free press, with tools such as the Freedom of Information Act that enable it to receive government documents, can ferret out unethical actions of government and promote transparency. In fact, a government that honors a free press is a hallmark of a government that is dedicated to transparency. In addition, a free press facilitates an efficient mortgage market (as it does for all consumer markets) by uncovering and/or publicizing unethical or illegal practices by mortgage lenders. Finally, a stable society promotes homeownership by enabling safe and stable neighborhoods, where property is respected and its valuation maintained.

How Do Mortgages Terminate?

Mortgages will end (or terminate) through one of three avenues: (1) carrying to term, (2) prepayment, or (3) default. First, the mortgage will end after the borrower makes the final required payment, thus carrying the loan to term. Because most mortgages in the United States are fully amortizing—meaning that the scheduled payment includes both interest as well as

[2] Basel I and Basel II refer to the banking laws and regulations proposed by the Basel Committee on Banking Supervision. The Basel Committee was created in 1974 by the central bank Governors of the Group of the G-10 countries (Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, Sweden, Switzerland, the United Kingdom, and the United States) and Luxembourg to recommend supervisory standards and guidelines as well as statements of best practices in banking supervision.

[3] See Arnone et al. (2007).

sufficient principal repayment—the last scheduled payment will fully retire the debt and the mortgage will be discharged. Given the long maturities of mortgages in the United States (primarily 15 to 30 years), however, it is actually relatively rare for borrowers to carry a mortgage to maturity.

Second, in contrast to carrying the loan to maturity, most mortgages in the United States terminate through borrower prepayment. Prepayment is the process by which borrowers pay off the mortgage before maturity in one lump-sum payment or make larger-than-scheduled payments, which causes the unpaid principal balance to decline at an accelerated rate, shortening the maturity. Prepayments can occur for a variety of reasons. One example of prepayment is "curtailment," which occurs when a borrower makes extra principal payments with the scheduled mortgage payments.

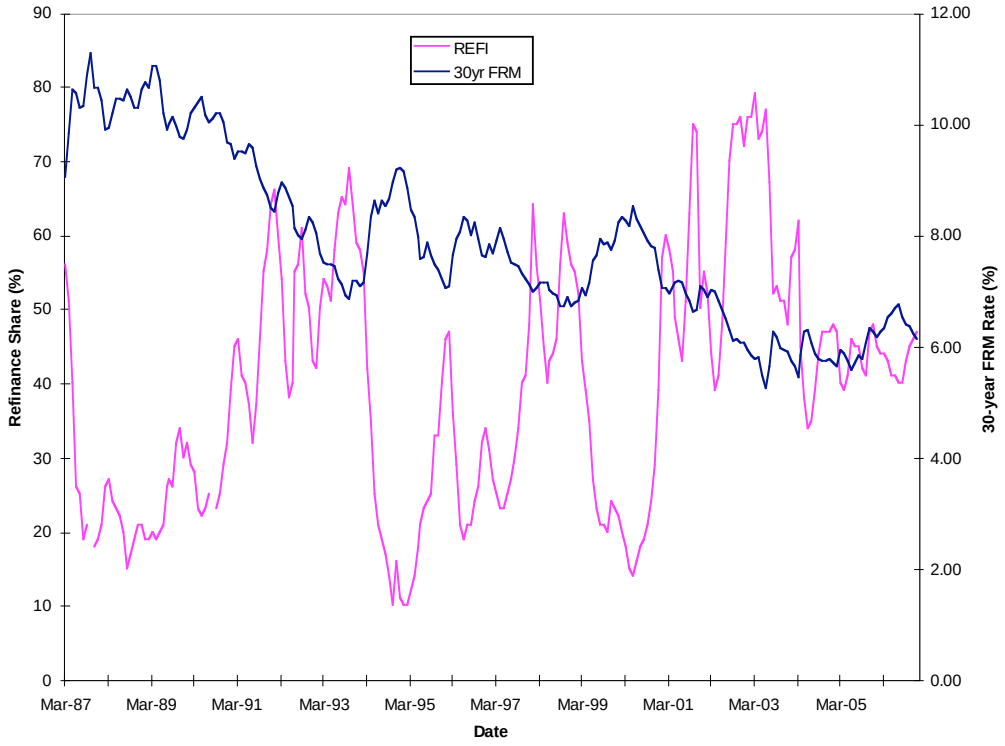
As a result of the high rate of household mobility in the United States, prepayment may also occur when a borrower sells the property collateralizing the loan. Many mortgages contain clauses that explicitly require that the borrower pay back the loan if the underlying property is sold. These clauses are known as "due-on-sale" clauses. If the mortgage does not contain a due-on-sale clause, then the new owner may assume the existing mortgage (that is, take over the payments), usually subject to the lender's approval.

The most prevalent reason for which prepayment occurs is financial incentive: when market interest rates fall below the contract interest rate on the mortgage, a borrower is inclined to refinance the existing mortgage.[4] This type of prepayment is often referred to as a financially motivated prepayment. To illustrate the importance of changes in market interest rates on prepayment, Figure 2 shows the percentage of mortgage origination volume that is for refinance purposes along with the 30-year, fixed-rate mortgage rate over time. The inverse correlation is evident: when the mortgage rate falls, prepayments increase. Note that the refinance rate slows down when the rate stays historically low, as since 2002 in Figure 1, because many of the mortgagors who are financially motivated to prepay have previously done so and do not need to do so again unless rates were to decrease further.

Finally, prepayment may also occur with cash-out refinances, those in which borrowers replace an existing mortgage with a new loan with a larger balance, effectively relinquishing some of the accumulated equity for a cash payment. (Emerging markets that have low population mobility rates may find the demand for cash-outs to be greater than the demand for home purchases.)

[4] In the United States, many residential mortgages do not have prepayment penalties and those that do typically have windows during which the penalty does not apply (such as near an interest rate adjustment date). In countries that have significant prepayment penalties, such as Canada, prepayments are not as popular as they are in the United States.

Figure 2. U.S. Mortgage Refinance Activity and 30-Year Fixed-Rate Mortgage Interest Rates



FRM = fixed-rate mortgage.
Sources: Freddie Mac Housing and Mortgage Data (http://www.freddiemac.com/news/finance/data.html); the Federal Reserve Bank of St. Louis (http://research.stlouisfed.org/fred2/)

The third and final avenue for terminating a mortgage is by default, the focus of this paper. Technically, default is the failure by the borrower to abide by the contract provisions contained in the mortgage. The most common trigger of default is failure to make the required mortgage payments. Later in this section, we will discuss default and the legal mechanisms used in the United States for remedying default. For now, we note that default can result in a court-ordered sale of the underlying collateral property with the proceeds being used to repay all or part of the outstanding loan amount. Most often the sale proceeds are insufficient to repay the loan amount plus the costs to acquire and sell the collateral property; as a result, the lender suffers a loss. Note that most defaults occur when the house value is less than the outstanding mortgage balance.

In this paper, because our focus is on understanding, measuring, and managing credit (default) risk and because default is avoided by prepayment of the mortgage, we will also discuss prepayment risk as it influences default risk. In fact, the interaction of default and prepayment makes measuring mortgage credit risk more difficult than measuring credit risk for other corporate and consumer debts.

The Legal Framework for Default

Because the mortgage is secured by the underlying house or real property, default implies that borrowers have exercised their option to “put” the house back to the lender in exchange for

release of the debt contract.[5] Although this simplified view of default makes it tractable to build economic models of the mortgage contract, it does not fully recognize the complexity of the default process and the potential ramifications of this process on credit losses, which we explain in some detail in this paper.

At the basic level, default is defined as the failure to comply with any of the mortgage contract terms; thus, default can occur for a variety of reasons. For example, the lender can declare a mortgage in default for failure to pay the property taxes or insurance premiums on the underlying collateral. In some cases, the lender can declare the borrower in default for failing to properly maintain the collateral, although this action is rarely taken in the United States (because of the difficulty of enforcement)[6].In most cases, however, default occurs when borrowers fail to make the scheduled mortgage payments. This definition is the classic definition of default and the one we assume in this paper.

Technically, borrowers are in default if they miss a regularly scheduled payment. The lender then has the right to accelerate the note and demand full repayment of the debt. In practice, however, lenders do not declare borrowers in default after missing a payment. Rather, lenders move borrowers through a delinquency period representing the number of missed payments: 30 days (one payment), 60 days (two payments), and 90 days (three payments) delinquent. During this period, the lender often attempts to contact the borrower to convince him or her to resume the scheduled payments, repay any missed payments, and pay any associated interest and penalties.

At the 90-day delinquency point, corresponding to three missed payments, the borrower has established a sufficient pattern of nonpayment enabling the lender to declare the note in default and accelerate the maturity. If the borrower fails to repay the debt, the lender begins the legal process of foreclosing on the collateral property. In Section 5, we describe alternative tactics.

The actual legal process and time required to foreclose will depend on the borrower's state of residence, because each state has specific laws and regulations covering the foreclosure process. In states with borrower-friendly laws, the foreclosure process may require a significant amount of time and expenditure of resources on the part of the lender. The primary costs to the investor for longer foreclosure periods are the potential for further erosion in house value in a down market, the cost of carrying a nonpaying asset, and potential deterioration of the property by a noncaring owner in default. In states with lender-friendly laws, the foreclosure process may be relatively swift. If the borrower ultimately fails to repay the debt, however, then, on the request of the lender, the respective state court or authorized agent will order the collateral property sold to satisfy the debt obligation. Usually, the lender bids the outstanding loan amount at the foreclosure sale to protect the lien position. If the lender is the high bidder, then the property title is transferred to the lender and it is recorded on the lender's books as "real estate owned." In simplistic terms, the lender's credit loss equals the difference between the outstanding loan

[5] The term "put" is financial jargon referring to the "put option." It is effective only if the lender does not pursue recourse against the borrower on deficiencies after a foreclosure sale, which is typically the case.

[6] For "reverse mortgages," in which the lender makes payments to the borrower (usually an elderly homeowner who can thereby convert some or even most of his or her home equity into monthly cash payments), not keeping up with housing-related expenses may very well lead to foreclosure.

amount plus any accrued interest and the costs of the foreclosure/acquisition/sale process and the price received from the eventual sale of the property. Occasionally, as in a rising housing market, a lender makes a profit on the sale.

Objectives for This Paper

The mortgage is a complex contract. The purpose of this paper is to provide a general overview of the credit risks inherent in mortgage contracts and to discuss the mechanisms and institutional factors that have developed in the United States to effectively measure, manage, and mitigate these risks. Sections 2 and 3 review the contemporary understanding of mortgage risk and how it is measured. Section 4 discusses the role of underwriting—the process of controlling risk before the loan is originated. Section 5 reviews the methods used to mitigate losses after the loan has been originated and goes delinquent. Throughout these sections, potential implications are suggested for emerging mortgage markets. Section 6 discusses the role of government in the U.S. mortgage market and implications for that role in emerging markets. Section 7 discusses potential ways that data limitations may be overcome in emerging markets. Section 8 summarizes the inferences drawn throughout this paper. Finally, a list of references and additional readings of research on the topic of mortgage credit risk is provided as a guide for more detailed reading.

Section 2. Understanding Mortgage Credit Risk

Conceptually, a mortgage contract can be viewed as an annuity contract. That is, the lender pays money to the borrower in exchange for a series of future payments. This simple annuity contract, however, is complicated by the possibilities of default or prepayment before the maturity date. Because the decision to prepay or default on a mortgage is made by the borrower, the prepayment or default is usually referred to as an "option." A call (put) option gives the owner of the option the right to buy (sell) a particular asset at a prespecified price at or before a certain date. In the case of mortgages, the borrower's right to prepay is equivalent to a call option. That is, at any time before the maturity of the mortgage, the borrower has the right to buy back the outstanding mortgage contract (the asset) from the lender by paying the then-unpaid principal balance (at the prespecified price of par).

On the other hand, the borrower's right to default is equivalent to a "put" option. That is, at any time before the maturity of the mortgage, the borrower has the right to sell the collateral property (the asset) to the lender at the price equal to the then-unpaid principal balance (at the prespecified price of par). As a result, in reality, when making a mortgage loan, the lender essentially purchases a bond (an annuity) and sells the borrower both a call option and a put option. The actual performance of the bond, and hence its market price, is determined jointly by expectations regarding the borrower's future exercise of the two embedded options as well as by the borrower's realized actions.

The measurement and management of mortgage investments in the United States are largely developed under this option-based framework. In principle, borrowers generally decide whether and when to exercise these options to minimize the amount of money needed to repay the mortgage, which in turn maximizes their wealth. In the real world, however, many other financial and nonfinancial reasons can lead to exercising these options, or not to exercise them even when it is financially desirable to do so. By properly analyzing the tendency to exercise these two options, a lender will be able to understand the relative risks among different mortgage contracts, borrowers, and collateral properties. This analysis is complicated and, therefore, subject to a substantial margin of error.

What Is a Default?

No universally accepted definition explains *mortgage default*. The recently published New Basel Accord capital framework, generally known as Basel II, enables national banking supervisors to issue guidance on how to define *default* in their own jurisdictions.[7] In general, mortgage default refers to the failure of the borrower to honor the terms of the loan agreement. This explanation may seem a bit ambiguous because a default may mean skipping a single payment, at one extreme, to the completion of foreclosing on and acquiring the collateral property, at the other extreme. Many U.S. lenders view a borrower's missing three or more consecutive scheduled (monthly) payments as being "in default."

[7] Basel Committee on Banking Supervision (2006).

This delayed recognition of default occurs because the legal process of foreclosure requires that the lender establish a pattern of nonpayment by the borrower before a court will permit the lender to accelerate the mortgage note or will issue a foreclosure order that the collateral be sold to pay off the debt contract. Also, the delayed default recognition avoids classifying a loan as being in default for borrowers who encounter an incidental interruption in their regular payment routine; for example, because of a delay in the mail system. In fact, most U.S. lenders allow a grace period (typically 15 days) during which no late payment penalty is imposed. These cushions enable the lender to more clearly determine if a particular borrower is likely to resume the scheduled payments. Because the interest of the missed payments and the penalties keep accumulating over time, it becomes less likely that the borrower could afford the large payment needed after missing three payments to become current again. In addition, it is common practice in the U.S. secondary mortgage market for the issuer of a mortgage-backed security (MBS) to purchase back a mortgage from the pool that missed three payments; the issuer does so to provide more flexibility for workouts, which are discussed in Section 5.

Banks and researchers, however, believe that if a mortgage is in "default," a loss is likely. A relatively large percentage of mortgages that are more than 3 months delinquent do, in fact, reinstate or are "worked out" to be on a current-paying status (see Section 5). Most importantly, the terminology of Basel II says that, upon default, a "loss given default" occurs, implying that default is defined as the extreme, where the property is taken over by the lender/investor and a loss likely ensues. Before default in this sense, there are simply various states of delinquency, including the foreclosure period. We adopt this definition of default in this paper, which implies that the delinquency period is completed and the lender acquires the property from the former borrower.

Why Mortgages Default

Mortgage defaults are usually driven by either the "willingness-to-pay" problem or the "ability-to-pay" problem. The former refers to the situation in which the borrower finds that it is preferable to let the lender take over the collateral property rather than continue making mortgage payments. The latter refers to the situation in which the borrower is unable or unwilling to amass the required amount of money to make the scheduled payments.

Willingness-to-pay Problem

As described in the previous paragraphs, default is an option that allows borrowers to sell the collateral house to the lender at the amount equal to the unpaid principal balance of the mortgage. With this option, rational borrowers will default only if they are unable to sell the collateral property on the market for more than what is still owed to the lender. Default, however, does not happen immediately when the house value drops below the mortgage balance. Many costs to borrowers are associated with a default, among them the bad credit record that will impinge their ability to borrow in the future and the cost and bother of moving. Nevertheless, the decline in collateral value has been shown to be the top driver of mortgage default losses.

Ability-to-pay Problem

Mortgage contracts require that borrowers make monthly payments according to a specified rule. Borrowers normally use their household income to pay for everything they purchase as well as for the required mortgage and other debt payments. Under normal conditions, household income is expected to increase over time, making the mortgage payment more affordable as time goes on. Interruption of household income may occur because of job loss or as a result of other expenses increasing; for example, when a change in family condition, such as a birth or a divorce, occurs, a change in family needs, such as increases in education or medical expenses, occurs. Any temporary or long-term reduction in disposable household income could put the borrower in the difficult position of being unable to afford the previously committed mortgage payments and could cause delayed or missed payments. As a result, the level and stability of the borrower's income and expenses are among the most important factors that drive mortgage defaults.

The ability-to-pay problem can also arise without the reduction of disposable family income. Some mortgage types, such as graduated payment mortgages, have an embedded payment increase over time. Although the rising payment was originally designed to match the expected increase in the borrower's income over time, it is not always guaranteed that the borrower's income will increase at the same speed as payments increase. In the case of adjustable-rate mortgages (ARMs), the monthly payment will change with a market index rate; for example, the 1-year Treasury rate or the London Interbank Offered Rate (LIBOR). During a rising interest rate environment, the mortgage payment can increase beyond what the borrower can afford. This situation is particularly significant in the cases of ARMs with initial teaser rates, which are special discounted rates for an initial period of the mortgage contract. As a result, any mortgage contract with the potential of payment shock in the future can cause the ability-to-pay problem independent of the borrower's income and expense stability. Mortgages in most emerging markets tend to be ARMs or rollover mortgages[8]. The payment shock can be a serious problem in those contracts. As a result, the trend and uncertainty of future interest rates are other important drivers of defaults with ARMs or rollover mortgages.

Combined Effect

In real life, mortgage default does not occur because of a single event. In most cases, both ability-to-pay and willingness-to-pay problems are required to trigger a default.[9] Because of high moving costs, the high cost of bad credit, the sentimental value of the home, and the possibility of facing a deficiency judgment,[10] borrowers rarely default when they can still afford the payments. Meanwhile, as long as the house collateral value is still above the mortgage balance, the borrower has the option to sell the house and use the proceeds to repay the mortgage. The probability of this occurring, however, is lower as the borrower provides a larger amount of

[8] Also known as balloon mortgages, in which the mortgage is due periodically and then another mortgage is issued at the then-current market interest rate.
[9] See Yang, Buist, and Megbolugbe (1998) and Peter Elmer (1999).
[10] Deficiency judgments allow the lender to go after the borrower's personal property and future income for recovering losses associated with a mortgage default.

initial downpayment. Should the borrower default, the extra costs incurred with a foreclosure can easily exhaust any remaining equity value the borrower may still have in the house.

Forces Driving Default

The discussion regarding why mortgages default can be summarized by categorizing driving forces of default into three factors: (1) the uncertainty of collateral value, (2) the uncertainty of future interest rates, and (3) the uncertainty of the borrower's disposable income and the accompanying effect on the willingness and ability to pay. To accurately estimate mortgage credit risk, one should consider the future trend and volatility of the house value, of the household income and interest rates, and of the interrelationship among them. For example, a job market recession such as the "dot com" industry meltdown in the early 2000s was offset in terms of mortgage defaults by the strong housing market during the same period. As a result, most mortgage credit risk measurement models are built on factors related to these three fundamental driving forces.

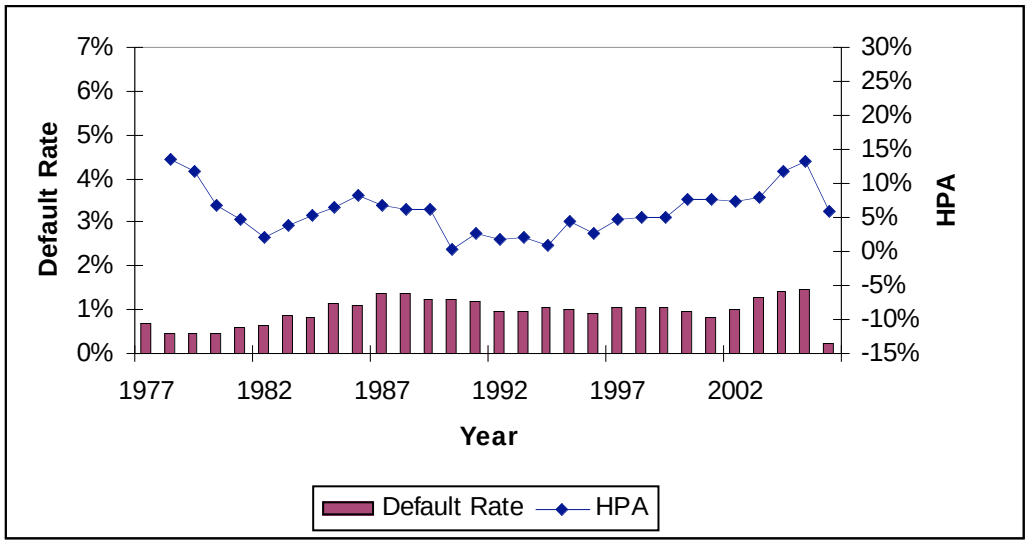
The Uncertainty of Collateral Value

House values in most areas of the United States tend to increase over time. Figure 3 shows the growth rate of the Office of Federal Housing Enterprise Oversight (OFHEO) house price index, called the house price appreciation (HPA) rate[11], for the entire United States from 1977 to 2006. Also shown is the default rate (the bars) of mortgages insured by the Federal Housing Administration (FHA). As this graph illustrates, little correlation exists between the HPA and default rates at the national level. The reason is that, in the United States, housing recessions have been local rather than national events, with the possible exception of the Great Depression of the 1930s (for which there is little data). The local nature of housing recessions is demonstrated in Figures 4 and 5, which show the HPA and default rates for two metropolitan areas—Houston, Texas, and Nassau, New York. In Figure 4, Houston default rates increased dramatically as HPA turned negative in the early 1980s and fell to low levels as subsequent HPA became positive. In Figure 5, HPA was low in Nassau in the late 1970s to early 1980s, and default rates were relatively high. As HPA increased in the early 1980s, default rates dropped dramatically. Then as HPA slowed, starting in the late 1980s, the default rate increased and then finally fell as HPA increased.

Two tendencies emerged from these empirical investigations: (1) HPA statistics are averages inferred for a given area and subareas experience lower HPA, which may lead to defaults, and (2) a lag exists between changes in HPA and default rates because of a lag in the realization by homeowners that their home price has fallen and also because of the sometimes lengthy delinquency process that precedes default (see Section 5).

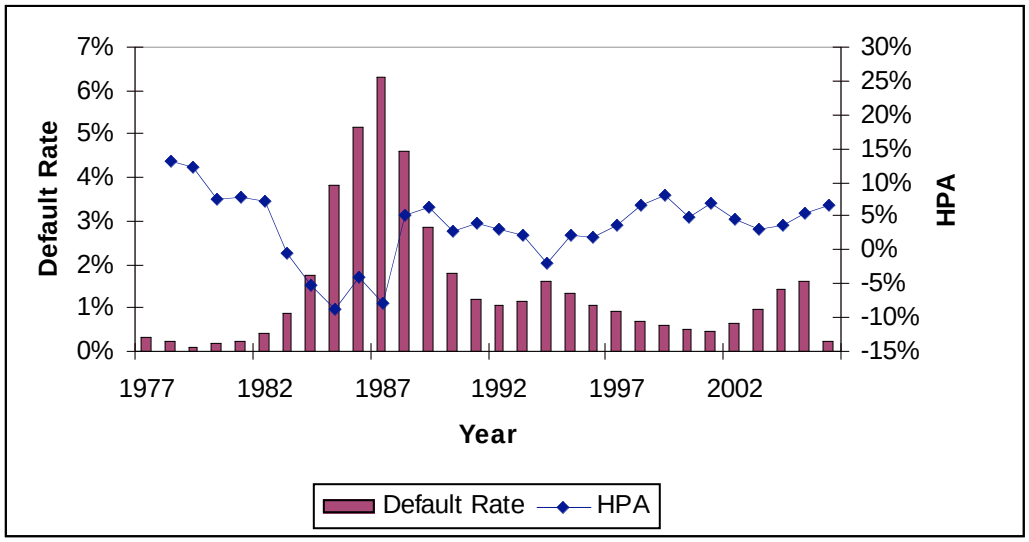
[11] House price appreciation is published by OFHEO, the Office of Federal Housing Enterprise Oversight, which regulates the two government-sponsored enterprises, Fannie Mae and Freddie Mac, the primary players in the U.S. secondary mortgage market.

Figure 3. National HPA and FHA Mortgage Default Rate



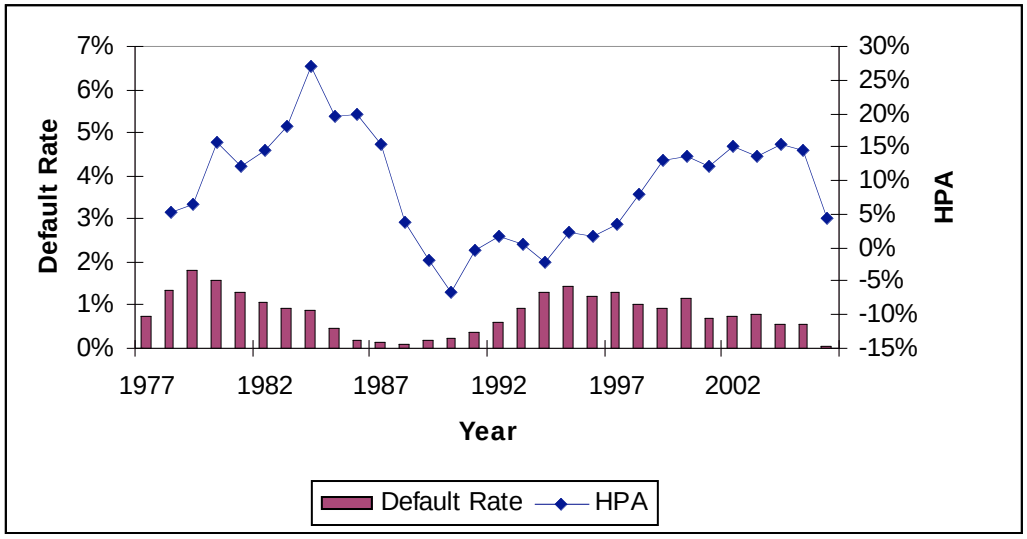
FHA = Federal Housing Administration. HPA = house price appreciation. OFHEO = Office of Federal Housing Enterprise Oversight.
Note: Average conditional claim rate of FHA-insured loans by metropolitan statistical area and the entire United States.
Source: 2006 Q4 OFHEO house price indices: http://www.ofheo.gov/HPI.asp

Figure 4. HPA and FHA Mortgage Default Rate for Houston, Texas



FHA = Federal Housing Administration. HPA = house price appreciation. OFHEO = Office of Federal Housing Enterprise Oversight.
Note: Average conditional claim rate of FHA-insured loans by metropolitan statistical area and the entire United States.
Source: 2006 Q4 OFHEO house price indices: http://www.ofheo.gov/HPI.asp

Figure 5. HPA and FHA Mortgage Default Rate for Nassau, New York



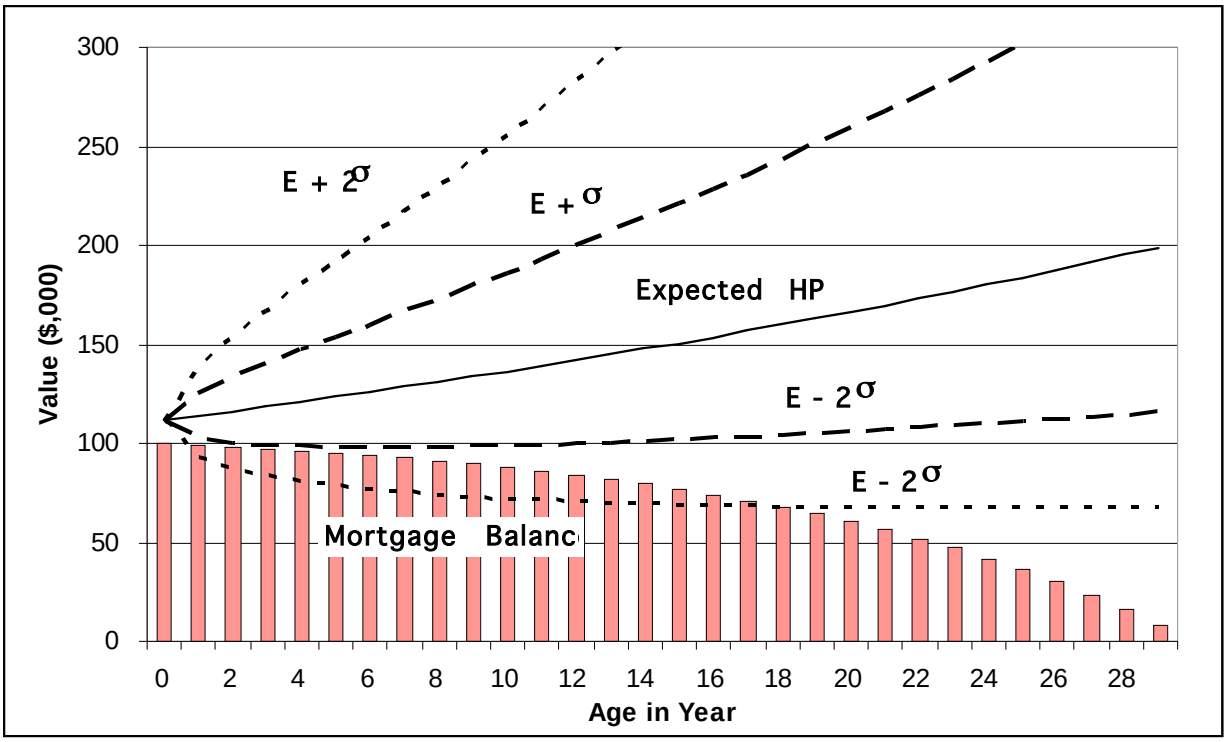
FHA = Federal Housing Administration. HPA = house price appreciation. OFHEO = Office of Federal Housing Enterprise Oversight.
Note: Average conditional claim rate of FHA-insured loans by MSA and the entire United States.
Source: 2006 Q4 OFHEO house price indices: http://www.ofheo.gov/HPI.asp

To emphasize the first point, it is important to realize that default is observed on individual houses, but the HPA for a given area is computed based on the average among all houses that are sold during a particular time period. Even if the local housing market is stable, as shown by a flat or even a slightly positive HPA in Figures 3 through 5, certain neighborhoods may be suffering from physical or economic deterioration. The default option is an option on the particular house underlying a mortgage. It is the value of that specific house that matters. When considering the house price impact, one must focus on the volatility of appreciation rates of individual houses.[12]

Figure 6 shows a stylistic view of the possible future value of a particular house. The willingness-to-pay problem comes into play when the house value drops below the mortgage balance. In general, one would expect the house price to grow over time; for example, is depicted by the rising solid line labeled the "Expected HP." The envelope that expands the further out in time around the expected house price represents the possible variance of the house prices. The two dashed lines represent the one standard deviation around the expected price. The two dotted lines represent the two standard deviations around the expected price. The mortgage balance line represents the outstanding balance of the mortgage, which decreases over time following an amortization schedule. The portion of the envelope of potential house prices that are below this mortgage balance line represent the situations that the house price is below the loan balance, implying the borrower has negative equity in the house. Under such conditions, an incentive exists for the borrower to default on the mortgage.

[12] See Cho, Lin, and Yang (2007) for a discussion of the measurement of the volatility of individual houses.

Figure 6. Default Risk and House Price Uncertainty



HP = house price.

Qualitatively, the possibility of default is higher when the expected growth rate of the collateral house price is lower and when the volatility of the future growth rate is higher, as could be shown by widening the one- and two-standard deviation envelope. This figure also implies that default risk rises quickly during the beginning years, which is depicted by the rapid expansion of the possible house price paths in the figure coincident with the mortgage balance that decreases only slightly at first. It then gradually decreases over time, in an accelerating manner. In the later years of the mortgage life, as house prices are generally expected to rise and the mortgage balance is reduced by amortization, default risk becomes trivial. Note that without amortization, the line depicting the mortgage balance would be flat instead of decreasing, and the likelihood of the house price being below the mortgage balance would be increased. On the other hand, a 15-year amortization schedule produces a much lower mortgage balance line than does a 30-year amortization schedule, and the likelihood of negative equity is thereby reduced considerably. Also note that the difference between the house price and the mortgage balance at time zero represents the downpayment paid by the borrower. When the downpayment is low, the risk of negative equity is higher. For example, without a downpayment, the mortgage balance curve would shift up and start at the same level as the house price curves. This shift in downpayment will increase the area that the house price envelope falls below the mortgage balance curve, indicating a higher likelihood of negative equity and default.

The Uncertainty of Future Interest Rates

The payment shock of ARMs is driven by the trend and volatility of market interest rates.[13] Interest rate uncertainty has been researched extensively by academics and practitioners. Based on this research, several theories and models have been developed and are widely applied by institutional investors. In the United States, the future trend and volatility of interest rates are reflected by market values of the various products sold in the market whose value depends on interest rates. Similar products and the information that may be gleaned from their market prices, however, may not be readily available in most emerging markets. In addition, because the dominant mortgage contracts in those areas are ARM products, it will be particularly difficult to accurately capture this risk driver.

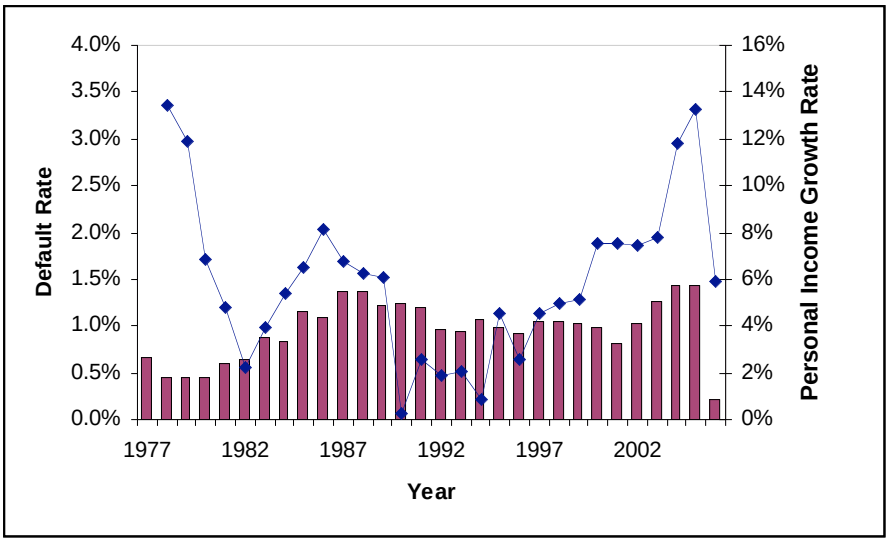
The Uncertainty of the Borrower's Disposable Income

Unlike the ability to estimate house price growth rate and interest rate, it is very difficult to estimate the volatility of household income. Typically, household incomes increase gradually. Income interruption, however, can happen to a small percentage of households. And when interruption happens, it is usually in dramatic magnitudes. Figure 7 shows the U.S. national personal income growth rate between 1977 and 2006, along with the national mortgage default rate. Similar to the national HPA rate, little correlation exists between the two. Figures 8 and 9 show the personal income growth rate for Texas and New York. These figures show little correlation between changes in income and default at the local level. Empirical evidence indicates that household income uncertainty is largely an idiosyncratic risk rather than a systematic risk. As a result, household income uncertainty is usually not incorporated in default risk models, whereas house price and interest rate uncertainty typically are included.[14]

[13] The most popular indices used in U.S. adjustable-rate mortgages are the 1-year Treasury rate, the 11th district cost of fund index, and the London Interbank Offered Rate.

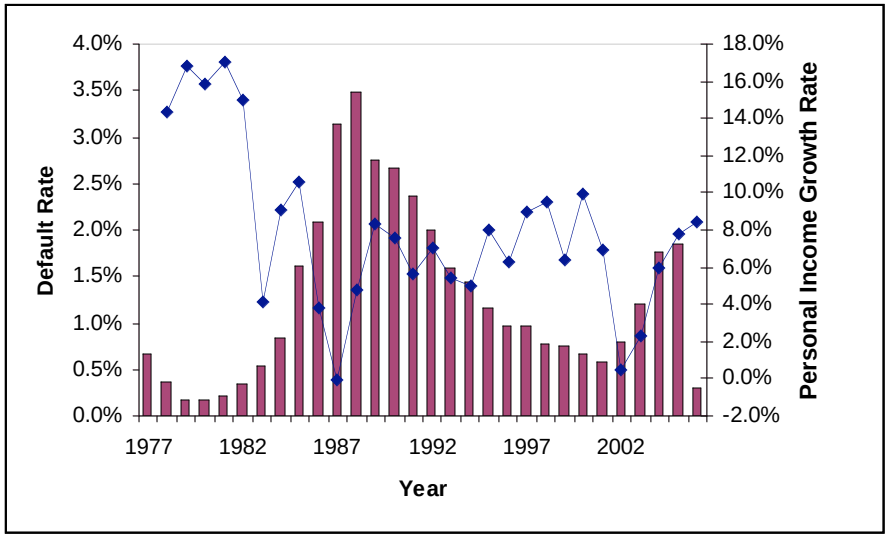
[14] Most estimates of mortgage default do not include (even the local) unemployment rate, because the unemployment rate has not proven statistically powerful in explaining defaults.

Figure 7. U.S. National Personal Income Growth Rate and FHA Mortgage Default Rate



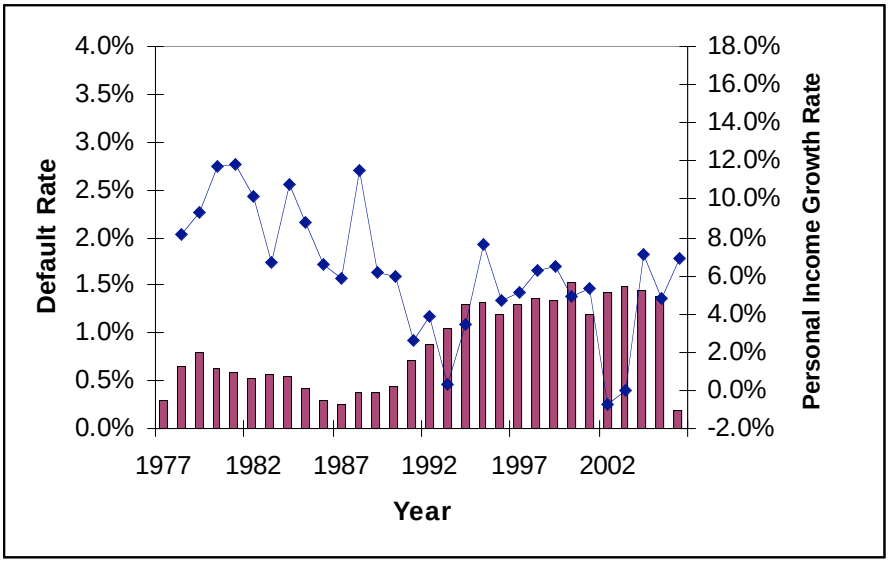
FHA = Federal Housing Administration.
Note: Average conditional claim rate of FHA-insured loans by state and the entire United States.
Source: Personal income is from Bureau of Economic Accounts:
http://www.bea.gov/regional/sqpi/default.cfm?sqtable=SQ1

Figure 8. Personal Income Growth Rate and FHA Mortgage Default Rate for Texas



FHA = Federal Housing Administration.
Note: Average conditional claim rate of FHA-insured loans by state and the entire United States.
Source: Personal income is from Bureau of Economic Accounts:
http://www.bea.gov/regional/sqpi/default.cfm?sqtable=SQ1

Figure 9. Personal Income Growth Rate and FHA Mortgage Default Rate for New York State



FHA = Federal Housing Administration.
Note: Average conditional claim rate of FHA-insured loans by state and the entire United States.
Source: Personal income is from Bureau of Economic Accounts:
http://www.bea.gov/regional/sqpi/default.cfm?sqtable=SQ1

Section 3. Measuring Mortgage Credit Risk

In Section 2, we discussed qualitatively why borrowers default and the important forces driving the event. Now we turn to the issue of quantifying credit risk. To profit from making mortgage loans and avoid excessive risks, lenders need to be able to quantify the relative size of the credit risk. The measurement of credit risk is an important factor in pricing mortgage contracts and determining the fair interest rate to be charged.

Measuring credit risk involves the product of two key measures. Following the Basel II terminology, we refer to these measures as the Probability of Default (PD) and the Loss Given Default (LGD). The PD is a measure of the possibility of default occurring and the LGD is a measure of the percentage of loss due to default, conditional on a default occurring.

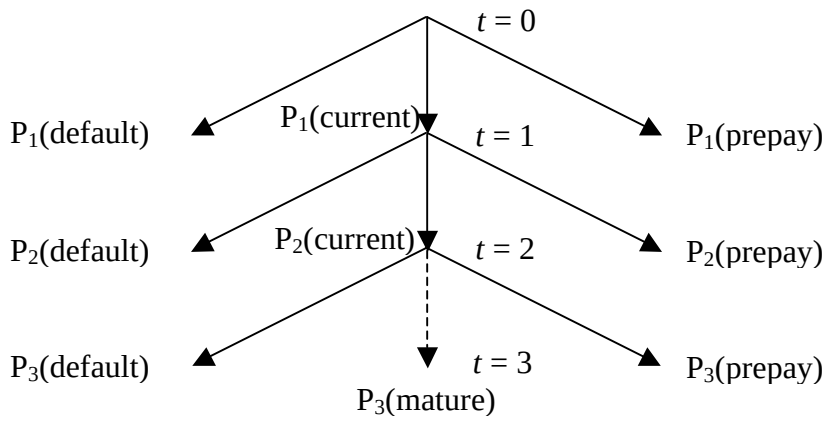
Probability of Default

The Probability of Default is a simple measure for typical corporate or consumer debt. It quantifies the probability that the borrower does not return the entire principal amount and the promised interest according to the contract. Because of the complications of the long term to maturity and the additional possibility of early prepayment for mortgages, the estimation of PD is more complicated than with other types of debt instruments.

As described earlier, a mortgage can terminate through one of three avenues: carried to term, prepayment, or default. Because a mortgage can terminate only once, a prepayment in the early years eliminates the possibility of default in the future. Thus, the measurement of mortgage default risk usually also incorporates the analysis of prepayments. For a 30-year mortgage with monthly payments, the lender needs to consider as many as 360 repetitions of the uncertain outcomes depending on whether the borrower chooses to prepay, default, or keep the mortgage current by paying the scheduled payment.[15] Figure 10 shows the event structure, assuming a mortgage with only three periods to maturity.

[15] The framework can be extended to include the different stages of delinquencies and foreclosure.

Figure 10. Uncertain Future Events for a Three-period Mortgage



As shown in Figure 10, at time $t = 1$, three possible outcomes could be realized with respective probabilities P_1(default), P_1(prepay), and P_1(current).[16] If either default or prepayment happens, the mortgage terminates. There is no need for further analysis. Otherwise, the mortgage will remain current. Then it will enter the second period and the same three outcomes are possible, with probabilities that may be different in magnitude from the respective probabilities of the first period. The probabilities during the second period are relevant, of course, only if the mortgage was not terminated during the first period. Thus, P_2(default), P_2(prepay), and P_2(current) are measured conditional on the loan not defaulting or prepaying in the first period. Thus, they are considered *conditional* probabilities (which are more complicated than simple probabilities).

Note that during the first time period, prepayment, default, and current are the only three possible outcomes. The sum of the three probabilities is always 100 percent. Thus, if one can estimate two of the three probabilities, the third probability is automatically determined. Researchers usually focus on the probabilities of default and prepayment, with the probability of being current then inferred from those two probabilities.

If the mortgage does not default or prepay at $t = 2$, then it will experience another uncertain outcome at $t = 3$. At $t = 3$, although theoretically there are three possible outcomes as shown in the figure, the results of prepaying and maturing are identical (because this hypothetical mortgage is paid off in the third period if it does not default then and can be viewed as the same result as prepayment.) Therefore, the measurement of mortgage credit risk involves estimating the six probabilities in the outer columns in the figure: P_1(default), P_1(prepay), P_2(default), P_2(prepay), P_3(default) and P_3(prepay).

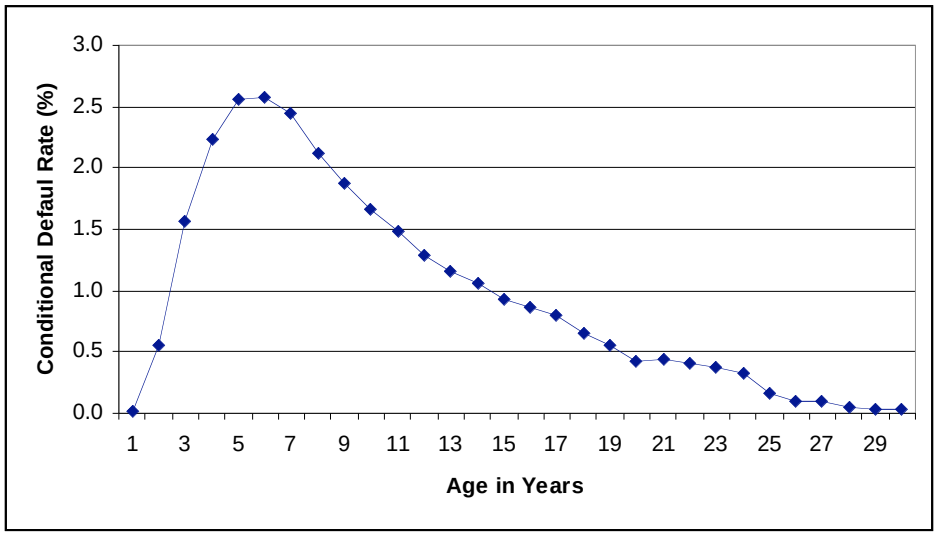
A 30-year mortgage with monthly payments requires the estimation of up to 720 conditional probabilities: 360 default probabilities and 360 prepayment probabilities. Because of the time value of money, the PD during the early years is more important to the lender's risk. Also, PDs during the later years of the mortgage life are less likely to be relevant (that is, large in magnitude) because the mortgage must have remained current (and not previously prepaid or

[16] We ignore here the complications of partial prepayments and intermittent periods of delinquency.

defaulted) for all the previous months to be eligible to default later on. The probability for the conditional probabilities at t to be relevant is P_1(current) × P_2(current) × · · · × P_{t-1}(current), a small number when t is large. (Also, later in the mortgage's life the outstanding balance is more likely to be lower relative to the house price as discussed in the previous section, making default even less relevant.) The most comprehensive credit risk measurement is to lay out all the possible events similar to those of Figure 10 and to use estimation techniques appropriate to this layout.

In general, the conditional PD increases in the early years of the mortgage, reaches a peak in about 4 to 8 years after origination, then gradually diminishes. Figure 11 plots the time profile of the conditional default rates of U.S. mortgages insured by the Federal Housing Administration (FHA). The conditional default rates are computed from the 2006 Actuarial Review of FHA Mutual Mortgage Insurance Fund ALL mortgages conditional claim rates, averaged among loans originated between 1977 and 2005. A similar hump-shaped PD profile is also found in other loan types in the United States (including conventional [that is, nongovernment] and adjustable-rate mortgages [ARMs]), in other developed markets (such as Canada, Taiwan, and South Korea), and in most emerging markets (such as Thailand).

Figure 11. Historical Conditional Default Rate of FHA-Insured Mortgages by Age



FHA = Federal Housing Administration.
Source: 2006 Actuarial Review of FHA Mutual Mortgage Insurance Fund: http://www.hud.gov/offices/hsg/comp/rpts/actr/2006actr.cfm.

Alternative PD Measures

Because of the complicated structure required to estimate the comprehensive PD measure, alternative methods are typically applied to represent the PD of a mortgage, depending on the business application. For example, the lender views the probability that a mortgage will ever default before the maturity date as being critical; this probability can be estimated by summing the probabilities of default calculated at each point in time. This lifetime PD is usually used in differentiating a "good" mortgage from a "bad" one.

Because early default will have the most significant impact on the lender's profitability, the cumulative default probability during the first 1 or 2 years may receive greater attention from investors. This outcome is particularly true in the U.S. market, where mortgages are often sold into the secondary mortgage market. To avoid the problem of fraud or mistakes in the underwriting process, a recourse clause is usually included in the mortgage sale contract. The recourse clause gives the buyer of the mortgage the right to sell the mortgage back to the original lender at par value should the mortgage default shortly after origination (or even later if defective underwriting or fraud can be identified).

Loss Given Default

The second dimension related to credit loss is the Loss Given Default. Usually, when a mortgage defaults, the lender uses the proceeds from the sale of the property to recover all or part of the loss associated with the default. The LGD is usually calculated as the amount recovered from the sale of the property net of all expenses as a percentage of the unpaid principal balance at the time default happens. Although the sales price and the unpaid balance of the mortgage at default are relatively easy to determine, numerous associated expenses must also be considered. The ability to accurately estimate these expenses is the main challenge in the LGD measure.[17]

Default-related expenses can be related to (1) disposition of the property, (2) foreclosure, (3) unearned interest, and (4) efforts to mitigate losses. The first category includes the expenses associated with the disposition of the collateral property, including professional fees such as real estate broker's commissions, title transfer recording fees, the cost of maintaining and repairing the property, insurance and property taxes while held as REO ("real estate owned" property that a lender has taken back as a result of foreclosure), and any marketing-related costs.

The second category includes expenses incurred during the foreclosure process. The amount of these expenses depends on the foreclosure law. In the U.S. legal system the time and procedure vary among the states. In the "judicial" states, foreclosure can be enforced only with a court order. To foreclose a property, the lender needs to file in court and go through a lengthy process to obtain its right to foreclose. This process can take up to several years, depending on the state. Because the borrower already defaulted on the mortgage, it is unlikely that he/she will pay the property tax and insurance or take good care of the property, adding to the total cost of the default. The lag between the first delinquency and the completion of the foreclosure process is a primary determinant of the size of the LGD. In "nonjudicial" states, where lenders do not have to go through the court system to foreclose, lenders are able to foreclose properties quickly, which reduces the size of LGD. The additional legal and administrative fees in judicial states increase the size of foreclosure-related costs.

The third category includes the opportunity cost of unearned interest, or the "carrying cost" of the nonperforming loan. Between the borrower's last payment date and the completion of the disposition, the lender receives no interest income for the money invested in the mortgage while still paying interest on the mortgage's financing or for the funds to pay off that financing. The loss of interest is one of the most significant parts of the LGD. Because this expense is

[17] The LGD (Loss Given Default) as a percent of the unpaid principal balance is also referred as the "loss severity rate."

proportional to the default-to-disposition lag, a shorter time lag can effectively decrease the LGD. As with the administrative expenses, carrying costs are much larger in judicial states.

The last default cost category ironically results from efforts to mitigate losses. Foreclosure alternatives are widely applied to defaulted loans as ways to reduce the total LGD (see Section 5 for greater detail). In these situations, default could be avoided by renegotiation between the lender and the borrower. If default is avoided, then there is no LGD. When there is a default despite the mitigation efforts, however, the costs to carry out the mitigation methods and any loss resulting from changes in contract terms is considered a component of LGD. Yet, research comparing the costs and benefits associated with various loss mitigation programs indicates that the cost savings from mitigating one default (that is, avoiding foreclosure) can compensate for the losses associated with a large number of mitigation failures (loans that ultimately end in foreclosure).[18]

Unlike the PD, LGD is rarely used independently as a measure of credit risk by itself. It is almost always used in conjunction with the PD to measure the magnitude of the credit risk, and the product of the two is the estimate of the loss rate.

Dollar-loss-related Default Risk Measures

In financial reporting and risk management applications, it is necessary to estimate the default risk of seasoned (that is, extant) loans. For loss reserves prescribed by accounting rules, lenders are required to estimate the default losses to be realized during the next 12 months or so. Because it takes substantial time to settle a defaulted loan, the loss reserve is usually focused on the estimate of the losses on currently delinquent loans. In other words, the focus is on the LGD instead of the PD.

In the portfolio management context, lenders need to estimate the cost of default for the remaining life of its outstanding mortgages, both current and delinquent. Thus, the lender must update the estimate of the future conditional default and prepayment probabilities using current market conditions. The seasoning profile of the PD (as shown in Figure 11) also plays an important role in this type of back-end credit risk measurement.

Several measures are commonly used in the U.S. mortgage industry to estimate the back-end (that is, portfolio) credit risk. First, financial institution risk-based capital requirements help control mortgage credit risk. For example, the Office of Federal Housing Enterprise Oversight (OFHEO), the regulator of Fannie Mae and Freddie Mac, implements the congressionally mandated risk-based capital requirements based on the results from an analysis of Fannie Mae's and Freddie Mac's outstanding portfolio to prespecified stressful economic scenarios. In this context, capital risk is measured as the present value of future net income generated under the stressful scenarios from the two companies' mortgage default guarantee businesses. OFHEO mandates that Fannie Mae and Freddie Mac hold sufficient capital to offset a possible negative present value of future net income under stress.

[18] See Ambrose and Capone (1996) for an analysis of the costs and benefits associated with various loss mitigation programs. Their analysis indicates that loss mitigation programs can be cost effective (from the lender's perspective) even when the probability of successful mitigation is less than 50 percent.

Second, the U.S. Congress requires an annual actuarial review of the FHA insurance fund. The credit risk is measured by the present value of the fund under the expected economic scenario. In addition, the Office of Management and Budget, as required by the Federal Credit Reform Act of 1990, measures FHA's credit risk and financial stability through the annual budget estimate and reestimate process. To avoid the risk of insolvency with minor downside risk, Congress requires the FHA fund to maintain at least 2-percent capital under the expected economic scenario.

Third, Basel I requires banks to keep 4-percent capital for holding qualified residential mortgages in the portfolio.[19] The 4-percent, risk-based capital represents 50 percent of the capital requirement of other loans. This requirement implies that the mortgage credit risk is approximately half that of other credits, such as corporate loans or unsecured consumer loans. The new Basel II allows lenders to self-determine the minimum capital according to the credit risk level of the mortgages. The specific calculation of the minimum capital level is a complicated function of PD and LGD that also incorporates adjustments for stressed economic impacts.

Fourth, rating agencies are often asked to give ratings to pools of mortgages or mortgage-backed securities (MBSs). Although each rating agency has its own proprietary process to assign the ratings to various interests in MBSs, their objectives are similar. Different ratings are assigned depending on the rating agency's estimate of the probability that investors will suffer from loss of principal investment under different stressed economic scenarios. High-stress scenarios are applied to determine the rating of the MBS or of its various classes if it is a multiclass security.

Finally, the largest financial institutions in the United States develop their own internal risk analysis models (for their own risk management needs and for use in the Basel II risk-based-capital derivations). These models, which are built on advanced statistical methods for estimating PD and LGD, incorporate a large number of possible future economic scenarios through Monte Carlo simulations. The Monte Carlo simulations not only provide the fair value of mortgage credit risk in an uncertain world but also provide credit value-at-risk measures that enable the lender to choose the policy to effectively avoid the probability of insolvency at the desired confidence level. These models represent the most advanced analytics of mortgage pricing and risk measurement in the industry.

Analyzing New Products

The measurement of mortgage credit risk requires large amounts of data over a long time period. Such performance data may not be available in certain situations, such as when new mortgage products are introduced into the market. A method commonly applied by U.S. lenders is that of benchmarking the credit risk of the new product to an existing product with which the lender is familiar. With some twist of the model assumptions and judgments, experienced mortgage lenders and modelers are able to obtain a reasonable estimate of the credit risk of the new product. This situation would be most relevant to emerging mortgage markets, where little data

[19] Only residential mortgages that meet the GSE (government-sponsored enterprises—Fannie Mae and Freddie Mac) conventional underwriting standards (that is, those that have loan-to-value ratios less than 80 percent or have mortgage insurance) qualify for the 4-percent capital ratio treatment.

are available. Instead of benchmarking to an existing product (which does not exist), however, lenders may need to benchmark to performance of similar products in other countries. Adjustment for cultural and legal differences would be particularly important (and difficult) in those situations. Just as mortgage lending in the United States started without the benefit of sophisticated models of PD and LGD, so too will emerging mortgage markets start without them. Now that these methods are available, early application of them would enhance the understanding and management of mortgage credit risk in these markets. Participants in emerging markets would do well to collect their mortgage data systematically for this purpose. Section 7 provides further discussions of this challenge in emerging mortgage markets.

Section 4. Underwriting: Front-End Risk Evaluation

Underwriting is the lender's process of evaluating a loan's risk that results in a decision regarding whether to make the loan and, if so, under what terms. Through careful underwriting, the lender attempts to originate loans having predictable expected losses so that the mortgage interest rate and, thus, the expected return adequately compensate for the risk of loss associated with the loan. In particular, the lender attempts to satisfactorily answer the following three questions: (1) Can the borrower repay the loan? (2) Will the borrower repay the loan? (3) How adequate is the collateral in case the borrower does not repay the loan?

The first two questions focus on the borrower's creditworthiness and the third focuses on the collateral that backs the loan. These questions cover the traditional "three Cs" of lending: capacity, credit, and collateral. Table 2 describes the elements underwriters attempt to quantify and the associated requirements to do so, which mostly involves verifying information about the borrower and the property. The major verifications are shown in Table 3 and discussed below, along with difficulties that may arise in achieving adequate verifications in emerging mortgage markets. Unfortunately, misrepresentation and fraud are omnipresent when large amounts of money change hands, in both developed and emerging markets, and that is what the verifications are designed to protect against.

Table 2. Underwriting Functions

Function	Focus	Requirements
Creditworthiness assessment	Willingness to pay:	
	Past credit performance	Verifications*
	Reputation	Verifications*
	Ability to pay:	
	Current and past income	Verifications*
	Total debt payments	Verifications*
	Wealth/assets	Verifications*
		Ability to obtain deficiency judgments
Collateral assessment	Existence	Verifications*
	Valuation/condition	Verifications*
	Clear title	Ability to enforce foreclosure and sale of property

*See Table 3.

Table 3. Verifications for the Mortgage Transaction

Information Item	Primary Check	Secondary Check
Borrower is who he/she says he/she is	Government-issued identification with photo	
Borrower's credit history	Borrower's disclosure	Credit repositories
Income	Pay stubs	Call to employer
	Form W-2, income tax returns	Returns directly from the IRS
	Compare pay stubs to bank account deposits	
Assets	Borrower's balance sheet	Reasonableness
	Bank statements	Verify with bank
	Broker's statements	
Collateral existence and condition	Independent inspectors	Internal inspection
Collateral value	Independent appraisers	Accreditation by supervisory body
	Databases of price and attributes of recent sales	Model estimates of value
	Downpayment in buyer's possession before sale from bank statements	Verify with bank
	Check if buyer and seller are related	Independent closing agent
	Sales history of subject property	

Form W-2 = Wage and Tax Statement form used in the United States to report wages paid to employees and taxes withheld from them. IRS = Internal Revenue Service.
Note: Many banks and the GSEs (government-sponsored enterprises—Fannie Mae and Freddie Mac) publish exclusionary lists, precluding people and firms who have acted fraudulently from being any part of the sales and mortgage transaction. The lists include mortgage brokers, appraisers, underwriters, and closers.

Capacity: Can the Borrower Repay the Loan?

The first question to answer in underwriting is whether the borrower has the capacity to repay the loan given the anticipated loan terms: the loan amount, interest rate level and variability, and maturity. Determining the borrower's capacity to repay requires the lender to assess the borrower's proposed housing expenses, the borrower's income and its potential volatility, the borrower's existing debt, and the borrower's wealth that can be used to continue repayment of the loan should income decrease or household expenses unexpectedly increase.

In determining the borrower's capacity to repay the loan, the underwriter uses the payment-to-income ratio, which is the sum of the expected housing expenses divided by the borrower's income. The expected housing expenses consist of the proposed mortgage payment (principal

and interest), taxes associated with owning the property, and premium payments for any required homeownership insurance (all four elements are called PITI—principal, interest, taxes, insurance). Essentially, the lender is attempting to judge whether the borrower has the cash flow necessary after expenditures for critical life needs such as food, clothing, and taxes to pay periodic housing expenses. In the United States, the secondary market agencies (government-sponsored enterprises, or GSEs—Fannie Mae and Freddie Mac) have instituted guidelines that borrowers should not pay more than 28 percent of their incomes in housing expenses.

After the lender has determined that the proposed housing expenses are consistent with their income, the second step is to verify that the income exists and assess the probability of its continuing. In the United States, lenders normally verify a borrower's income by requiring the borrower to submit employer-issued pay stubs and W-2 forms—documents employers issue simultaneously to the employee and the Internal Revenue Service (IRS) showing the annual wages paid. For a self-employed borrower, his/her tax return serves as a substitute for the employer-issued documents. With these documents, the underwriter verifies that the borrower is employed and earning the income stated in his/her mortgage application. Checking the past year's wages (with the W-2 forms) provides the lender with an indication of the stability of the borrower's income. The lender also reviews the borrower's bank statements to confirm the consistency between bank deposits and stated income. (Measurement difficulties arise here because of situations such as part-time jobs, nonreported income such as tips, or payments in kind rather than in cash.)

The third step in determining the borrower's capacity is to ensure that the borrower can service the proposed new loan in addition to all existing debts. Thus, the lender computes the borrower's total debt-to-income ratio, which includes the payments for the proposed housing payments plus those for all other existing debts. Borrowers disclose other debts in the mortgage application, and credit repositories usually contain records of most of their debts. Again, the GSEs in the United States have set guidelines that the borrower's total debt-to-income ratio should not exceed 36 percent.

The final step in determining capacity to repay is the borrower's wealth. If personal deficiency judgments are allowed in case the borrower defaults,[20] the higher the net wealth the safer the loan. Also, underwriters use wealth data in a qualitative way to assess the overall risk, especially for variable-rate mortgages or rollover (or balloon) mortgages.[21] These types of mortgages can cause sharp increases in mortgage payments, or "payment shock," causing defaults if incomes have not kept pace.

As discussed in the following sections, however, borrower asset verifications have normally focused primarily on the amount needed for the downpayment (plus other closing costs) by checking borrower-supplied bank statements.

[20] The nonjudicial foreclosure states in the United States generally do not allow deficiency judgments, in which other assets and future income of the defaulted borrower are attached to pay for the lender's net loss upon default.
[21] Mortgages that are periodically renewed and the interest rate reset to current market levels. They are more popular in Europe than in the United States.

Verifications of Capacity

As mentioned previously, verification of income is usually accomplished by submitting computer-generated pay stubs and W-2 forms. Because these documents can be fabricated into authentic-looking documents by unscrupulous brokers, lenders often call employers[22] to confirm their accuracy, or to at least ensure that the applicant is employed and has the type of job he/she claims to have. Yet, even this level of verification is not foolproof because the "employer" may be a sham operation or a blood relative of the applicant. For the self-employed, tax returns are often obtained directly from the IRS.[23] Lenders sometimes verify bank balances, mostly for quality control. By applying multiple underwriting verification checks, lenders can reduce the frequency of mortgage-origination fraud.

The implication for emerging markets is that the difficulty in verifying income and wealth can make it difficult to assess the ability of the borrower to pay and may impede the development of an efficient mortgage market. A bank in a developing market, however, may be able to use deposit information of its own customers to make inferences about their income and wealth based on the amount of a borrower's periodic deposits and account balances. The bank may also be able to glean insights about a borrower's creditworthiness based on the extent of overdrafts on the applicant's depository accounts and the regularity of payments to creditors. This information gives the largest banks a competitive edge over other potential lenders when it is difficult to verify income.

The denominator of the total payment-to-income ratio is the sum of all periodic debt payments. Nonmortgage debts and their monthly debt burdens come from the applicant's disclosure and are verified by credit repository data. If such repositories are not available in emerging markets, a large, dominant bank would have the advantage by having information on any credit the bank has extended the applicant and possibly on the pattern of the applicant's payments to creditors.

Credit: Will the Borrower Repay the Loan?

The second underwriting question seeks to uncover the borrower's willingness to repay the debt. To many lenders, this question is the most critical because without the *willingness* to repay a debt, the *ability* to repay is of little consequence.[24]

Before the advent of today's readily accessible and fairly complete credit files since the 1960s, banks observed the borrower's character (or willingness to repay) through a series of smaller transactions over a period of time. For example, a potential borrower would open a checking or savings account with a lender, thereby establishing a relationship with that lender. By observing that the borrower consistently avoided overdrafts on the account and by observing the pattern of deposits versus withdrawals, the lender could infer whether the borrower was financially conscientious with his/her funds. In addition, the borrower could create a lending record with the

[22] This action requires the permission of the applicant.
[23] Again, this action requires the permission of the applicant.
[24] Previously, this "C" represented "character," but this term has been supplanted by "credit" with the widespread application of automated underwriting. Previously, face-to-face evaluation of the borrower included a judgment of the borrower's character, not just an evaluation of the dry facts that are in credit files and other documents.

bank by obtaining (and repaying) a series of smaller loans before seeking a mortgage. Furthermore, the lender could verify that the borrower consistently repaid prior debts by checking payment patterns from other creditors, or at least from the borrower's current landlord or utility company. A segment of the U.S. population has thin credit files or no credit files, because these people may have recently immigrated or do not use credit. For these potential borrowers, observing alternative types of creditworthiness is still applicable.

Today, lenders in the United States use the services of credit reporting agencies, called credit repositories,[25] to efficiently gauge the payment history of borrowers. The credit repositories maintain centralized databases containing credit and payment history for millions of individuals. For a fee, the repositories provide access to these databases to lenders, enabling them to effectively see the payment pattern and credit accounts opened by the applicant.

In addition, the repositories provide lenders with a proprietary credit score[26] that summarizes the borrower's relationship with current and previous creditors. This score, which substitutes for the qualitative process a human underwriter would use to evaluate the content of the credit files, usually focuses on just the number and severity of delinquencies, judgments against the borrower, and bankruptcies. The purpose of the credit score is to quantify the probability that a borrower will default on a future debt. A borrower with a high credit score is statistically a very low credit risk with a low probability of future default. Although the algorithms used to compute credit scores are proprietary, in general, they reflect a number of factors, including the history of late payments and judgments, the number of credit lines currently open, the amount of credit currently available to the borrower, and whether the borrower has defaulted or declared bankruptcy in the past 7 years. For example, holding all else equal, as the number of delinquencies increase, the borrower's credit score decreases.

Verifications of Credit and Alternative Approaches

The credit repositories in the United States expend great effort to ensure the completeness and accuracy of the credit data; for example, ensuring the credit file is attributed to the correct person. Citizens have the right to examine their own credit files and to challenge incorrect information through a procedure that results in creditors correcting any erroneous information. Errors, however, can still remain. Also, some "credit doctors" may illegally attempt to make a credit file look better than it is. As a result, difficulties arise in using the data. In emerging markets with inadequate credit repositories, verifying an applicant's credit performance may be very difficult. Again, large banks have an advantage because they can observe relatively easily and accurately the credit and deposit performance of many potential mortgage applicants who are currently the banks' customers on the deposit and loan sides.

Relying on alternative credit-like information also may be useful if debt payment data are not available. Here, payment histories for rent and utilities might be verifiable and thus form the basis of the underwriting. In the United States, however, with so much consumer credit available, borrowers who have little or no credit information in the repositories tend to have higher default risk; so, checking these nonstandard payment patterns may be of only marginal help in

[25] The three major credit repositories in the United States are Equifax, Experian, and TransUnion.
[26] The most popular is the "FICO" score (developed by Fair Isaac & Co scale).

underwriting. In countries in which applicants do not have the extensive use of credit, however, these patterns should be more predictive of future mortgage payment performance.

Also, in the United States, cancelled checks or money orders provide fairly reliable forms of evidence regarding rent and utility payments; however, these instruments may not be used extensively in a more cash-oriented economy. Furthermore, asking the landlord whether renters are making timely payments may not be reliable because the landlord would benefit if a tenant with an uneven rent payment record moved out and became someone else's problem. Therefore, the truth may not be forthcoming.

Collateral: How Adequate Is the Collateral in Case the Borrower Does Not Repay the Loan?

The final question the lender needs to answer during the underwriting process is whether the quality of the collateral offered is adequate to secure the loan. By taking over the collateral when a borrower defaults, the lender can be at least partially compensated for default losses. For the collateral to be meaningful, the lender needs to verify that it (1) exists, (2) has a specific market value, and (3) can and will be fully owned by the borrower. The lender can verify the first two factors by conducting an appraisal and the last one by researching legal records. Before making loans, lenders use their own internal appraisers or appraisal models, or a third party, to determine the estimated value of the collateral.

The standard default risk indicator for collateral is the loan-to-value ratio (LTV), which is the loan amount divided by the value of the underlying property. Generally, the higher the LTV ratio, the greater is the risk of default. The complement of the LTV ratio is the amount of equity that the borrower has placed at risk. For example, if the loan-to-value ratio is 100 percent, then the borrower has no equity in the property. As discussed in Section 2 (where default is described as a put option), the optimal default condition can occur if the property value falls below the mortgage balance. As a result, the LTV ratio effectively determines the amount of first-loss protection offered to the lender. For example, if the LTV is 80 percent, then the lender knows that property values would have to fall 20 percent before the willingness-to-pay problem would become relevant.

Verifying Collateral

A major concern for lenders, after they have verified the existence and condition of the property, is that the value is not inflated beyond what the price would be for an arms-length transaction (that is, a transaction in which the borrower is independent of the seller and they both are fairly informed). This concern is managed by estimating an appraised value of the property. Typically, the process of appraisal is based on an analysis of how the subject property compares in its attributes to other relevant properties that have been sold and on the use of the sales prices of those sold properties to infer what the sales price of the subject property would be in a fair market transaction.

Lenders depend on appraisal reports as the main evidence to verify the stated sales price of the property. To be conservative, the GSEs' guidelines require the use of the lower of the appraised

value and the stated sales price in computing the LTV ratio. Appraisers, who are required to be licensed in the state to perform appraisals, generally inspect the house, apply three approaches to derive separate estimates, and then provide one market value based on their best judgment.

If no third party is involved with the house sale, the price agreed on is likely to be the fair market value, as long as the buyer and seller are independent and equally informed about the market. When a lender is involved in the transaction, however, the incentive is to inflate the price. For example, the seller could "throw in" a new luxury car as part of the transaction. The borrower could pay a fair price for the house/car bundle, but with the total price being represented as the price for the house alone. After the transaction, only the house is collateral for the mortgage. Thus, the actual LTV is much higher, making it a riskier mortgage than thought beforehand. The problem when the property price is inflated is that the maximum allowable loan amount will be calculated from the inflated price. If the loan defaults, the property will not sell for what was thought to be the initial price, even if market prices have held steady.

Another example of how such situations occur involves the collusion of the seller and the borrower. For example, the borrower might agree to pay an inflated price while the seller arranges to supply the difference between the fair market value and the inflated value to the buyer before or at the settlement to fulfill the lender's downpayment requirement. Verifying that the downpayment funds are in the bank account of the buyer at least a month before the property settlement discourages a payment by the seller to the buyer beforehand. An independent and reliable appraisal report can often detect these inflated stated sales prices. The closing agent (the person who conducts the buyer-seller meeting to conclude the transaction, is supposed to check for signs—and stop the transaction if true—that the buyer and seller are related in some way; if they are, more trust between them makes under-the-table transactions feasible.

Appraisers are also supposed to check whether the sales price of the house has increased during the last few transactions, indicating that it had been "flipped," or fraudulently inflated in value in the recent past. Flipping may have occurred among conspirators in a previous transaction to give the appearance that the last sales price was a legitimate market value, and the house may have then put on the market again immediately.

It is also possible that some appraisers may intentionally inflate the appraised value, being complicit in a fraud scheme, the worst of which is when the house does not exist.[27] The groups that supervise and authorize credentials for appraisers have established review procedures, have disbarred some of their members for unethical practices, and are monitoring the activities of appraisers more diligently today than they did before the 1990s. A similar antifraud mechanism has been the creation of exclusionary lists by lenders and the GSEs that preclude mostly felons from any part of the transaction. In addition to exclusionary lists, lenders have developed databases of names of people who are "parties to the mortgage transaction" and tracked the ensuing loan performance, attributing that performance to each of the people identified as participants. Those associated with consistently poor loan performance are especially identified and may be put on their exclusionary lists. New loan originations that involve any of these

[27]When the house does not exist, the mortgage is called an "air loan," which is very embarrassing and costly for lenders when they try to foreclose, the ultimate result in all these cases.

identified parties send red flags to lenders, precipitating further investigation before making the loan.

In the United States, sales prices and house attributes are sufficiently available so that statistical models have been developed and used since the 1990s to estimate house value. Many automated valuation systems are now readily available to provide fair market value estimation for the subject property. These models may apply one or more appraisal approaches and/or house price indices to assess the property value. Some systems even generate a range of the possible value or produce a confidence indicator for the accuracy of the system-estimated value. These models appear reliable and are widely used as components of the automated underwriting systems (AUSs), sometimes making manual appraisals unnecessary. Inspections of the property, however, are still usually carried out.

Other Underwriting Issues

In addition to considering capacity, credit, and collateral, proper underwriting also considers several other factors describing the loan. In general, loans are either originated to purchase a property (purchase-money mortgages) or refinance an existing mortgage. Most lenders consider purchase-money mortgages as being riskier than refinance mortgages because the borrower does not have tenure in the property, does not have a sentimental attachment to it, and has not demonstrated a history of making housing payments on the new house. Mortgages are also classified as “owner-occupied” or “rental” to denote the status of the owner/borrower. Generally, mortgages on rental properties are riskier because of the lack of sentimental bonding to the property and the possibility that the property may become vacant in the future. Without the rental income, the borrower’s ability to pay can be seriously damaged. Because the borrower of a rental property loan does not need to move out of the property, the cost to exercise the default option is lower, which leads to a higher probability of the willingness-to-pay problem.

Lenders also classify mortgages based on whether the property is a first or second home, where the second home is generally treated as a higher risk than a primary residence.

Finally, lenders classify mortgages based on the seniority of the lien; that is, first lien versus second lien. A mortgage having the first lien position has lower risk than a second lien mortgage because the first-lien holder will be repaid first in the event of any default. Within each of the above classifications, lenders set basic underwriting standards that govern the amount of risk they are willing to accept for a given interest rate.

A number of lending programs do not require verification of various underwriting factors, such as income or assets. These programs are called “reduced-documentation” loans. The purpose of these programs is to facilitate more efficient and faster underwriting, but the risk of the loans tends to be higher, mainly because of potential fraud. These loans are especially useful for a self-employed borrower, whose income tends to be less stable and the income available for housing payments is difficult to estimate. Competition among lenders who are not the ultimate holder of the mortgage is the main driving force for these types of underwriting practices. Recognizing the risks, the ultimate investors usually require recourse arrangements on these loans that allow

investors to sell the loans back to the originator should defaults occur during the first 1 or 2 years.

As mentioned in Section 2, mortgage default requires the realization of both the ability-to-pay and the willingness-to pay problems. Recently, as the U.S. mortgage market became extremely competitive, lenders started relaxing underwriting requirements to gain higher business volume. These "marginal" loans relax either the capacity and credit requirement or the collateral requirement. A reflection of the underwriting process is the so-called "subprime market," in which loans are made to less creditworthy (less-than-prime) borrowers and almost always carry higher interest rates and lower LTVs. As a result, lenders of these loans rely on the value of the underlying property and not on the creditworthiness of the borrower. At the other extreme, high-LTV loans rely less on the property to serve as a backstop. Borrowers with less-than-perfect credit, however, have to pay a higher interest rate or obtain government insurance/guarantee, such as through the FHA program. These two extremes reflect the practice of relying on only "one way out" instead of the usual two—the borrower and the property. In addition, high LTV loans with marginally creditworthy borrowers (as with a segment of FHA loans) relax both standards. As Yang, Buist, Megbolugbe (1998) demonstrate, simultaneously relaxing the requirements of both the borrower and the property can cause the default risk to be uncontrollable.

Automated Underwriting Systems

Since the mid-1990s, automated underwriting systems have been the dominant form of underwriting in the United States. They were developed to replace the judgmental approach that varied from one underwriter to another. Initial attempts at AUSs focused on automating the thought process of good underwriters. Good underwriters, however, did not have the benefit of statistical analyses that could inform them of the subsequent performance results of their decisions, so this approach was based more on "lore" than results. Underwriters need to assess tradeoffs among all the many factors that are examined to assess the overall creditworthiness of applicants. Statistical modeling can quantify the link between underwriting factors and subsequent loan performance *and* account for interactions among the factors. For example, AUSs can determine how large a downpayment needs to be to qualify applicants for a specific loan to offset a not-so-clean credit history; for example, as reflected in their FICO scores, which have been included in most AUSs. Without statistical models, underwriters were unable to make this kind of tradeoff accurately and consistently across underwriters.

Another benefit of AUSs is the speed of making the underwriting decision and the ability to define a population of applicants who are of such high-credit quality that fewer documents are needed to qualify them, speeding up the origination process.

AUSs, using verified information supplied by the borrower, pull credit histories directly from the credit repositories. The statistical models, called "scorecards," are quantified based on data sets of past borrower information that are used to "explain" observed loan performance, including at least severe delinquencies if not defaults. Usually, then, at least 3 or 4 years of performance need to be observed to estimate the scorecards, and the scorecards are periodically updated as new performance data become available as time passes. Most scorecard researchers continually

search for techniques to improve the “explanatory power” of their models, to better help the respective lenders/investors choose the loans they purchase or ensure more accuracy than their competitors. The use of AUSs is considered a competitive advantage, and those using weak or no AUS are subject to “adverse selection,” paying too much for poorer quality loans. In emerging markets, it is very important to keep automated records of past loan/borrower attributes, along with subsequent performance, so that a more scientific approach can be developed to underwrite future mortgages.

Section 5. Loss Mitigation: Back-End Risk Mitigation

The most effective strategy for avoiding loss is by employing appropriate and thorough upfront underwriting. The purpose of underwriting is to classify loans into categories that have distinctive and predictable expected loss rates, from the very best ("super prime," for example, the best of the prime loans) to the high-risk loans ("subprime"). In all categories, however, defaults are possible. When defaults do occur, a number of strategies and tactics are used in the United States to mitigate the extent of the losses associated with default. In addition, a number of strategies shift the losses to specialized investors or insurers.

This section describes various loss mitigation methods used by mortgage servicers, the agents that deal with the borrower through the life and "death" of the mortgage. Servicers may be part of a vertically integrated firm that originates and invests in the mortgage, such as at many commercial banks, or they can be independent firms.[28] Regardless of the organizational arrangement, servicers are agents of the investors and operate to maximize the investors' best interests.

The mortgage default process covers many phases, starting with delinquency. The term *delinquency* covers all the periods of nontimely payment. A mortgage may have multiple periods of delinquency throughout its life, and the actions of servicers are aimed at encouraging borrowers to reinstate their timely payments and make up for past delinquencies.[29]

As discussed in Section 3, the major cost components of default losses are as follows:

1. Sales price plus selling costs less the mortgage balance (usually negative upon default).
2. Transactions costs for conducting the foreclosure and house acquisition and disposition process, which include legal costs and payments to the many agents who carry out these tasks.
3. Holding or carrying costs; that is, the costs to finance the nonperforming asset and property insurance.

The longer the period from the first delinquency to the final sale of the property, the more costly each cost component becomes, especially in a period of declining house prices. Loss rates are exacerbated when house prices in the area are falling because the Loss Given Default is increased, but total losses are exacerbated as well, because during these housing price slumps the default rate also increases, for a compounded increase in losses. In addition, the disuse and often

[28] In the United States, a relatively small number of servicers dominate the market, taking advantage of economies of size in servicing.

[29] Servicers may have conflicting interests. For example, servicers earn late fees on mortgage delinquencies and thus have an incentive to prolong borrower delinquency. Longer delinquency periods, however, are correlated with higher overall default probabilities, which are harmful to the interests of the investor, whom servicers are supposed to serve. Properly designing servicing guidelines and compensation contracts to align the interests of the servicer and the investor mitigates this conflict and further improves the efficiency of the execution of this back-end risk mitigation.

misuse of the property by the borrower during the period of delinquency can erode the physical condition of the house and its resale value.

The carrying costs are daily charges that increase linearly with the time to disposition. Typically, after 120 days of delinquency, the financing of the assets becomes short term,[30] so the carrying charge can cause additional risk, especially during a rising interest-rate environment. Servicers attempt to walk the fine line between giving delinquent borrowers enough time to reinstate their payments yet shortening the time it takes to complete the default process, because the longer it takes, the costlier is the default. The adage "time is money" is doubly true here.

Servicer actions are focused on preforeclosure and then the foreclosure, if it is necessary. We discuss each of these actions in turn.

Preforeclosure Actions

In the United States, so-called "behavioral" statistical models, such as Fannie Mae's Risk Profiler and Freddie Mac's EarlyIndicator, identify the delinquent mortgages that are most likely to go through default for each stage of delinquency. These behavioral scorecard models predict the probability of reinstatement based on various factors, such as the borrower's history of previous delinquencies and the estimate of the market value of the homeowner's equity. Servicers use these estimates to prioritize telephone calls toward those borrowers in delinquency who are the least likely to reinstate to personally encourage them to make up their payments and to conduct "triage," an action in which servicers may decide which loans would be the best for executing early loss-mitigation tactics. The telephone calls remind delinquent borrowers that someone is watching and cares whether they make the payments, which, in many cases, is sufficient to induce them to reinstate. The calls also attempt to determine the nature and severity of the financial problem, such as lost employment, marital problems, or overextended credit. Depending on the problem's severity, initiating sale of the property before starting foreclosure may be determined to be the optimal strategy. This strategy, referred to as a "preforeclosure sale," requires the homeowners' consent and is usually most effective when the homeowner has positive equity in the house. In a preforeclosure sale, borrowers are released from their mortgage obligations by giving up their houses with little damage to their credit reputations, and the lenders get paid off. Often, because the significant amount of extra expenses associated with foreclosure can be avoided, the servicer offers financial incentives to the borrowers for this action.

Other options at this preforeclosure point may involve various types of loan modifications, or workouts.[31] For example, accumulated skipped loan payments can be capitalized; that is, added to the outstanding principal balance of the mortgage, and a new payment schedule is computed under the assumption that the borrower can now keep payments current. Another commonly used modification is extending the maturity term. By extending the term over which the principal balance will be amortized, the monthly payment of the mortgage would be reduced. It is also possible to lower the contract rate, which is used especially when the current market rate is

[30] The expected remaining life of the loan becomes very short compared to an otherwise identical active mortgage.
[31] Additional restrictions may apply at this stage if the particular mortgage was sold to investors in the secondary mortgage market.

below the contract rate on the mortgage. This type of modification is equivalent to allowing the borrower to refinance into a new loan. These modifications put the modified mortgage on a current status. Modifications are used when a high likelihood exists that the borrower will continue to make his/her modified payments in a timely manner.

Actions Following the Initiation of Foreclosure

Servicers often use the issuance of a foreclosure notice as a way to induce a delinquent borrower to respond to suggested alternatives to foreclosure. A foreclosure notice gets the delinquent borrower's attention by making him/her realize that the threat of losing the property is real.

Depending on the nature and seriousness of the borrower's problems, alternatives, such as loan modifications mentioned previously, may be viable. Sometimes the servicer agrees to "forebear" (forgive the debt for) a specified period of delinquency if recovery prospects are good and if sufficient equity is in the house so that an eventual foreclosure would not entail much loss. In a few cases, some of the loan balance may be forgiven. For example, if the house value has fallen, eventual losses may be likely. Taking a loss before default and having a borrower who has an incentive to maintain the mortgage may be the least-costly alternative. Servicers tend to be leery of the moral hazard that this alternative creates, however, because a borrower might intentionally go into delinquency to obtain forgiveness. A complicating factor associated with loan forbearance is the tax treatment of debt forgiveness. Forgiven debt is classified as income and becomes a tax liability for the borrower. Thus, a borrower in financial difficulty (for example, through job loss or an unforeseen medical problem) who received debt forgiveness may end up with a large tax liability, making this option less attractive.

A "deed-in-lieu" is also a way to foreshorten the process. With this option, a borrower voluntarily signs over the deed on the property to the investor instead of proceeding through foreclosure, which avoids further damage to his/her credit reputation. Servicers often offer financial incentives to induce cooperation but also threaten deficiency judgments. Although often difficult to enforce in many situations, the threat of losing more than the collateral housing tends to encourage "volunteer" cooperation to shorten the foreclosure process and hence reduce losses. In nonjudicial foreclosure states, a servicer has to choose between foreclosing on the property and obtaining a deficiency judgment. Choosing one precludes the other.

Costs and Benefits Associated With Loss Mitigation

In research conducted at the Department of Housing and Urban Development in the early 1990s, Ambrose and Capone (1996) analyzed the costs and benefits associated with various foreclosure alternatives, including preforeclosure sale, deed-in-lieu, loan modification, and lender forbearance. The purpose of their analysis was to demonstrate that the concepts of loss mitigation, which were relatively new at the time, could be profitable. Using simulation analysis, they compared the cost saving benefits of a loss-mitigation program to the additional losses that would occur in the event that the loss-mitigation program was unsuccessful; that is, that the loan ultimately ended in default.

They simulated the costs and benefits associated with loss mitigation programs under the assumption that a high proportion of delinquent borrowers reinstate their mortgages without assistance, based on the observation that the mortgage industry reported an average cure rate of 75 percent on post-90-day delinquencies. Not surprisingly, as the rate of "self-cures" increases, the profitability of loss-mitigation programs, which expend resources and accept losses in some cases, falls. In the case with high self-cure rates, the simulations indicate that the deed-in-lieu option was no longer profitable and the preforeclosure sale option was marginally profitable. That is why the behavioral scorecards (mentioned previously) that predict default, given delinquency, are so important: servicers can ignore those borrowers who are likely to cure and focus on those more likely to default, making their actions cost effective.

Completion of Foreclosure

The foreclosure timeline varies by state, depending on the extent to which the state laws allow the delinquent owner to remain in the house. Expected default losses, then, depend on those state laws. The steps of foreclosure are generally as follows:

1. Issue a foreclosure notice, generally after 90 days of delinquency.
2. Continue to encourage the borrower to reinstate or accept alternative workouts, as previously explained.
3. Transfer title to the investor and evict the owner.
4. Prepare the house for sale and sell it.

Specialized agents are required for each step, and legal advice is important to ensure a conclusive start and finish to the process.

Segmenting Investors

The party that takes on the incidence of default losses often is not involved in any part of the above processes. Investors or insurers at risk, however, generally have the right and the interest to determine the extent and types of loss mitigation strategies and tactics. Before the Great Depression in the 1930s, banks and thrifts primarily originated mortgages and held them in their portfolios and did not lay off any of the credit risk to other parties. During the ensuing Great Depression housing crisis (fostered by nonrenewal of short-term balloon mortgages, the most common mortgage type at the time, which had little or no amortization), a number of mechanisms were created to shift the incidence of loss to various third parties, mostly specialized institutions whose expertise is to make a positive expected return by specializing in mortgage credit risk.

The first such major institution, which continues to this day, was a federal government agency, the Federal Housing Administration (FHA). For a fee, the FHA insures the loan in the event of a default. The FHA required fully amortizing mortgages and thus set the standard for the primary mortgage market. Today, it focuses on high loan-to-value (LTV) ratio loans and low- and moderate-income borrowers. The U.S. Department of Veterans Affairs similarly insures mortgages primarily for military veterans.

The government-sponsored enterprises (GSEs)—Fannie Mae and Freddie Mac—and the Federal Home Loan Banks (FHLBanks) represent a second major default-shifting mechanism. The GSEs have federal charters and lines of credit to the U.S. Treasury, if needed, in dire circumstances. With GSE status, their borrowing costs are lower than for private mortgage purchasers of similar credit quality. The GSEs purchase mortgages from primary lenders (hence they are in the "secondary" mortgage market), mostly commercial banks and mortgage banks, and thus generally take on the risk of any credit losses that accompany those purchased mortgages[32]

Private mortgage insurance (PMI) specializes in insuring credit losses, up to specified limits, especially for high LTV loans. The GSEs are required by law to use PMI to purchase mortgages with original LTV exceeding 80 percent.[33] Under the Basel II framework, banks need to allocate higher risk-based capital to these high LTV loans, thus inducing them to require high LTV borrowers to purchase PMI. The PMIs also provide loss coverage for mortgage-backed securities, often at the pool versus the individual loan level. Similar pool insurance is also provided by specialized bond insurers in the capital market.

Secondary Market Strategies

Residential mortgage-backed securities (RMBS) have residential mortgages as collateral. Collateralized mortgage obligations and real estate mortgage investment conduits are types of RMBS that have payment classes that depend mostly on prepayment patterns. A popular way to divide the credit risk in an RMBS is by a senior/subordinated structure similar to collateralized debt obligation products. Investors can invest in classes (or tranches) of the RMBS that have varying degrees of exposure to credit losses. The riskiest class takes the first incidence of credit losses up to a specified level. That is, these losses are subtracted from the outstanding balance that otherwise would be paid out to the investors in that class. To compensate for such a risk, the investors require a higher interest rate. Then, the next class absorbs subsequent losses up to a specified level, and so on. This sequential absorption of default losses by different classes provides a mechanism for protecting the last class the most from credit losses, making it a AAA-rated security. Independent rating agencies, such as Moody's and Standard & Poor's, provide guidance for investors by applying ratings to each class, from unrated up to AAA, as the loss exposure lessens. The lowest-rated classes are often retained by the RMBS issuer to create incentives for the issuer to maintain appropriate and transparent underwriting and loss mitigation standards. These types of senior/subordinate RMBS are very popular, especially in the jumbo[34] and subprime markets, where no government insurance/guarantee exists and the GSEs are either prevented by law or have expressed limited appetites to purchase these mortgages.

PMI companies often attach guarantees to RMBS (for a fee) or to selected classes of RMBS. The rating for the guaranteed classes becomes the rating assigned to the PMI company by the rating agencies.

[32] The commercial banks and mortgage banks generally service these loans.
[33] Exceptions to this requirement are loans that are under recourse to the lender or loans in which the lender takes on at least a 5-percent participation in the possible losses.
[34] Loans above the size that government-sponsored enterprises are allowed to purchase.

Finally, new securities, which have been created recently, act as mortgage insurance (generically called credit derivatives) that makes payouts depending on the credit loss performance of a specified set of mortgages; but these securities have not yet been widely used.

Section 6. The Role for Government in Emerging Mortgage Markets

In this paper thus far, we have introduced the nature of mortgage default, the factors that drive default, the measurement of default risk, and methods for mitigating risk. Most of our discussion is based on how the U.S. market operates. Their applicability in some emerging markets may be limited, however, because of the lack of supporting infrastructures and differences in economic environment and culture. In this section, we discuss some lessons that can be leveraged by emerging markets. Specifically, we discuss the roles that government can play in supporting the ability to effectively manage credit risk for newly established mortgage markets.

In the United States, it is widely believed that homeownership is a desirable goal for households. Homeownership is seen as a major component of providing a safe and nurturing environment for raising families. Homeowners have a vested interest in the condition and appearance of their properties and that of their neighborhoods. This priority toward homeownership in the United States is reflected in the various legislation and institutions created to promote it. As one component in promoting affordable homeownership, the U.S. government developed a number of programs designed to reduce mortgage borrowing costs.

Supportive Legal Framework

A free and open market is the basic structure relied on in the United States to direct economic decisions, and government efforts to support the mortgage market are based on this premise. Governments at all levels support the institution of private property and the sanctity of contracts, where anyone is eligible to purchase and claim legal title to a home and can sell it and borrow against it as collateral. Lenders can secure their liens (for example, by having first priority versus other liens, if they are entitled to it) and can acquire the property on a borrower's default. These legal infrastructures may not exist in all countries. Lenders in regions without a clear real property ownership system may be reluctant to make mortgage loans because it can be difficult to verify the borrower's right over the claimed collateral property. In some socialist countries, such as China, the government owns the land and provides term leases to its citizens, who in turn can "own" the structure and potentially borrow against it. But the periodic renewal of the land lease creates a tension for lenders because they have no guarantee that the lease can or will be renewed to the then-owner of the structure. In particular, if the lender forecloses on the property, they have no assurance that the government will renew the land lease to the lender as owner. In many countries, foreclosure is very difficult and costly, implying that lenders really do not have an enforceable claim on the property upon default. As a result, the loan is not collateralized securely.

Government actions that ensure the lender's right to foreclose on collateral properties sometimes require that the government have policies in place to provide temporary shelter to ensure that everyone has access to basic shelter. For example, various rent subsidy and public shelter programs offered by state and local governments in the United States ensure the availability of the minimum shelter for citizens. In some socialist emerging markets, a lender is required to provide alternative shelter to a borrower before foreclosing on a property.

If a supportive legal foundation is put in place, it will greatly facilitate the development of a mortgage market. As with all laws, sufficient policing of them should exist as well as adjudication channels for disputes. The establishment and enforcement of the appropriate legal infrastructure require substantial time and cost; but such infrastructure is the essential foundation of a primary mortgage market.

Credit Reputation

In the United States, credit repositories are private institutions. The primary laws under which they operate are privacy laws, which protect citizens from inappropriate use of their credit information and other proprietary information. Users of the credit information must have "permissible purpose" that relates to specific extensions of credit, which could be unsolicited. Mortgage applicants also approve employment and earnings verifications, including tax returns that the lender obtains directly from the Internal Revenue Service (as mentioned in Section 4).

In developing economies, in which the use of credit is not as pervasive as it is in developed economies, the markets are usually dominated by large banks. Those banks have a vested interest in not sharing the credit information they have on their customers, because it is a competitive advantage. In the United States, antitrust laws limit the dominance by any single lender. Because there are more independent lenders, the gains in efficiency by sharing borrower credit data through the credit repositories seem to offset the benefits to each bank of not sharing. In developing markets, however, economies of scale may be so important that they outweigh the desire to reap the benefits of competition. In those cases, the government could encourage, but not force, competition by having sufficiently low barriers to entry into banking.

The fact that the U.S. mortgage market had functioned smoothly for many years before the incorporation of borrower credit history from the credit repositories suggests that although credit history information can improve mortgage market efficiency, it is not necessary to effectively measure and mitigate credit risk. Reasonable underwriting and mitigation can be operational before such data becomes available in emerging markets.

Implicit Subsidies

In the United States, the Federal Reserve Banks are federally chartered with the specific purpose of providing a backstop for private banks. The Federal Reserve System serves as a lender of last resort and as a provider of other services, such as check clearing, aimed at ensuring the continual viability of the banking system. The federal government also provides an implicit subsidy through government-owned deposit insurance companies, especially the Federal Deposit Insurance Corporation (FDIC), which insures deposits up to $100,000 for all banks and thrifts (or savings and loan institutions). Although no explicit promise by the federal government ensures that the FDIC does not fail, it is presumed that if the FDIC were to run out of reserves, the federal government would step in as a last resort. As mentioned in Section 1, regulation and enforcement of safe and sound banking practices accompany deposit insurance to protect the banking system and the FDIC from bearing too much risk.

Thus, the U.S. banking system, although private, has implicit government support, ensuring the continual extension of credit for mortgages and all other types of loans. In addition to supporting the banking system, the United States government supports the mortgage market with an implicit guarantee of the government-sponsored enterprises (GSEs)—Fannie Mae and Freddie Mac—which have federal charters that include explicit lines of credit to the U.S. Treasury, which have never been used. The implicit government guarantee for the GSEs helps ensure a continual supply of funds to the mortgage market and thus reduces overall mortgage interest rates.

Emerging mortgage markets would be encouraged if there were government support for the major lenders, especially as the "lender of last resort," such as the role played by the Federal Reserve Banks in the United States, and as deposit insurer, such as the role played by the FDIC. This support would minimize periods in which mortgage money dries up, which have negative consequences on borrowers and property values and on the institutions providing mortgage credit.

Explicit Subsidies

In the United States, the Federal Housing Administration (FHA) is a government-owned mortgage insurance company. Also, Ginnie Mae is a government-owned secondary mortgage market entity that guarantees timely payments of pools of FHA and Department of Veterans Affairs mortgages. With the "full faith and credit" of the U.S. federal government, FHA and Ginnie Mae enable large numbers of low- and moderate-income households to purchase their homes with little or no downpayment. Their existence also ensured a continual flow of mortgage funds, as the FHA demonstrated during the Great Depression of the 1930s.

A further subsidy to homeownership is evident in provision within the U.S. income tax system in which mortgage interest paid for housing purchases and improvements is a tax deduction; other interest payments are not. These deductions are valuable only to those households with sufficient income to pay taxes, and the deduction phases out for very high-income taxpayers.

These explicit subsidies support the mortgage market. Whether governments should consider these mechanisms for emerging mortgage markets is a complicated policy debate. The downside is the potential government funds needed to support these programs, which may be substantial if a serious housing downturn occurs.

Homebuyer Counseling

In addition to providing direct government support, as described previously, the U.S. government has also encouraged private lenders and nonprofit organizations to develop homebuyer counseling programs. These programs teach potential home purchasers how to better manage their consumption and savings to accumulate a downpayment and to build adequate credit records, so they will eventually qualify for mortgages and become homeowners. Discounts in mortgage insurance premiums or closing costs are often provided for households that previously participated in such programs. Evidence shows that participants of these programs tend to experience lower default rates.

Although the U.S. government does not directly offer these programs, it does encourage and provide incentives for private entities to conduct these services. Although these incentives may not be as effective in mitigating credit risk, they cost little and could be easily implemented in emerging markets.

Summary

Private institutions should be encouraged and supported by providing the proper legal framework, and governments should consider implicit subsidies before explicit subsidies. In the United States, private enterprise is relied on to create and maintain the process of mortgage credit-granting, and the government's role is to support that system to encourage homeownership and to step in explicitly to fill in where the private sector is perceived to be deficient.

Section 7. Overcoming Data Limitations in Emerging Mortgage Markets

Emerging mortgage markets face a serious challenge: the lack of data to support the measurement of credit risk. All modern credit risk measurement methods are built on large databases that include economic data and past mortgage performance data. For emerging economies that are just starting mortgage markets, the historical performance data can be quite limited or nonexistent. This challenge has been repeatedly raised during the development of the Basel II rules. Basel II requires at least 7 years of historical data to estimate the Probability of Default (PD) and the Loss Given Default (LGD). How developing countries will comply with this requirement is still an unresolved issue. Fortunately, the delayed implementation of Basel II provided extra time for countries to acquire the requisite performance data. On the other hand, market interest rate and house price data may not be available for countries without an active fixed-income market and an active housing resale market. The following discussion introduces several approaches toward the measurement of mortgage credit risk that offer a compromise for countries that are still developing sufficient data-collection methods.

Leverage From Developed Markets

The most straightforward approach toward measuring credit risk is to borrow the performance observed in developed mortgage markets, such as the mortgage market in the United States. It is risky, however, to directly use the U.S. PD and LGD in making mortgage decisions in emerging markets. As mentioned before, the PD and LGD can vary significantly according to the legal system and culture of the market. For example, it is well recognized that U.S. households tend to change homes frequently, with average tenure in a house between 4 and 8 years. In many emerging markets, housing is considered a permanent asset to the family. After a house is purchased, it will be passed to the next generation and almost never be resold. As a result, emerging markets may not experience the level of mobility-induced mortgage prepayment that is seen in the United States.

Borrowers in many countries, however, also tend to prepay debt as quickly as possible. Curtailments, or partial prepayments, are constantly observed, making the mortgage balance decline faster than predicted by the amortization schedule. It has been shown that mortgages with curtailments experience much lower default rates than otherwise identical loans.[35]Curtailment, however, is a relatively rare event in the United States. As a result, adjustments must be made before the U.S. PD and LGD parameters are applied to assess the credit risk of a different economy. Other important factors to consider before adapting the U.S. PD and LGD experience include differences in mortgage contract type and features, foreclosure process, type and condition of the collateral property, bank-borrower relationship, and the intangible cost of bad credit and losing one's home. The adjustments must be done carefully with mortgage lending experience, modeling skills, and a deep understanding of the social and economic environment of the market, and they should be accomplished with the collaboration of domestic and international professionals.

[35] See Lin and Yang (2005).

Leverage From Other Credit Products

It is most likely that mortgage lending is not the first credit product offered in a country. Before entering the mortgage market, banks must have experience offering corporate loans and other types of consumer financing. The performance of those alternative debt instruments also provides valuable information about the general market and the borrowers. The magnitude of the mortgage default risk can be approximated by analyzing the marginal difference between the mortgage debt and existing debts. The credit cost of other types of existing debts can also be leveraged as a benchmark for measuring mortgage credit risk in a new market.

Leverage From a Standard Product

After the market develops a reasonable measurement for a dominant mortgage product, it can serve as the benchmark for other alternative products. This approach is commonly applied even in developed mortgage markets. For example, the credit models for adjustable-rate mortgages are sometimes built with reference to the credit risk of a similar fixed-rate mortgage. Because it is always easier to assess the relative risk among different products than estimate the absolute size of the risk, using the benchmark of the "standard" product can make the credit risk measurement of other products much easier.

Return to Fundamental Driving Forces of Default

As discussed in Section 2, the main driving forces of mortgage defaults are the fluctuations of household income (capacity), interest rates (credit), and household price (collateral). For a market with little or no mortgage-lending history, it would be difficult to apply the statistical models to estimate the PD and LGD. It is possible, however, to obtain some projections about the trend and volatility of the domestic house price changes by interviewing real estate brokers, homebuyers, and sellers and by collecting historical home transaction documents. Such data collection efforts, however, can be time consuming and costly. For example, before Australia started its secondary mortgage market, they invested more than a year in building the relevant databases. After housing and interest rate data are collected, they should be adjusted to reflect the expected future national economic conditions. The default risk for a new mortgage market can then be estimated by examining scenarios that reflect simultaneously ability-to-pay and willingness-to-pay problems.

Summary

Although most credit risk measurement methods used in developed mortgage markets are based on extensive data, it is possible to estimate mortgage default risk in a newly established market. Whenever possible, lenders should attempt to leverage from the performances of similar markets or products. When no similar experiences can be leveraged, lenders can always return to the basic consumer economic theories to analyze borrower behavior. Using these alternative methods, lenders can obtain a good sense of the magnitude of mortgage credit risk even without direct past experience.

Section 8. Summary

This paper provides a systematic review of the methods used in the U.S. mortgage industry to assess and manage default risk. The goal is to shed light on the practices that emerging mortgage markets may need to develop to provide effective financial support for a strong and stable housing market. As emerging markets develop their domestic housing finance systems, the ability to properly assess, price, and mitigate credit risk is a critical component to achieving success.

In Table 1, we describe the requisites of a viable mortgage market; the primary requisite is the ability to use the house/property as collateral for the mortgage loan. Figure 1 shows this ability leads to more affordable interest rates compared to personal, noncollateralized loans and to loan amounts that permit 80 percent and higher of the property's value to be financed instead of requiring a large downpayment, a major factor regarding affordability.

The homeownership rate in the United States is almost 70 percent, and it is believed that a high ownership rate promotes a stable society and strong neighborhoods to raise children, where pride in homeownership is reflected in the nurturing environment. A stable society is also a requisite for a viable mortgage market, as are the transparency of government actions and a free press, the latter to assure that transparency and to act as a voice for homeownership interests.

This belief in homeownership is reflected in government support of a favorable environment, including the tax deductibility of mortgage interest payments; the backing for the Federal Housing Administration and Ginnie Mae, which guarantees affordable mortgages and guarantees their securitization, respectively; the implicit support of the secondary market entities—Fannie Mae, Freddie Mac, and the Federal Home Loan Banks; and the support of the U.S. banking system with the Federal Reserve Banks and the Federal Deposit Insurance Corporation, which insures bank deposits. Whether countries of emerging mortgage markets need to have all these elements is not clear, but it is clear that support of a viable banking system is a requisite for mortgage lending, as well as for other lending programs.

Figure 2 shows that mortgage refinance rates are high in the United States and are inversely related to the market mortgage rate. Repayments are important for measuring mortgage credit risk because, after the mortgage is refinanced, credit costs are zero. In emerging markets, the contractual arrangements regarding prepayment (for example, not allowing it or extracting a large fee on prepayment) will affect the measurement of credit risk.

Major factors driving default experience are the upfront underwriting criteria, the post-origination fraud losses, and the economy. The goal of mortgage underwriting is to classify applicants/properties into categories with similar, predictable rates of default and loss. The higher the expected loss (and the higher the variance in that loss), the higher the mortgage rate necessary to compensate for the additional risk, and/or the more stringent the mortgage terms may need to be, such as insisting on a higher downpayment.

After the mortgage is originated, fraud losses are usually experienced, especially in the first few years of the mortgage. When large amounts of money exchange hands, fraud and graft are real risks in both developed and emerging markets. The other primary determinant of default performance, and the most difficult to predict and hence to manage during underwriting, is the course of the economy. Figures 3, 4, and 5 demonstrate that, in the United States, national home prices rarely fall and the national default rate does not respond to the national house price appreciation (HPA) rate. Rather, local economies have more pronounced HPA movements *and* correlated default rates. It is recognized that in the United States the local economy drives mortgage defaults, but in an emerging mortgage market the national HPA may drive defaults as well.

Figure 11 shows the typical pattern of defaults over the life of an average portfolio of mortgages (that is, originated in the same time period). The (conditional) default rate increases to a maximum in about 4 to 8 years after origination and then decreases. This pattern is affected by the prevailing HPA, with a lower HPA raising the level of the default rate and extending the period of higher default rates and losses. Figure 6 provides some intuition for this pattern: the mortgage balance decreases slowly at first and then accelerates after 10 years (for a 30-year, fully amortizing mortgage), while house prices can fluctuate rapidly, but generally trend upward and, with a lagged effect on default rates, default rates peak in years 4 to 8.

The major driving forces of default are interest rates (primarily because prepayments respond to them, but also because adjustable-rate mortgages and rollover mortgages may be adversely affected by them), HPA or depreciation (as shown in Figures 5 and 6), and variations in household income and expense. Figures 7, 8, and 9 show that even at the metropolitan area, household incomes are fairly steady and are not, in aggregate, good predictors of default. Thus, variations in household incomes and expenses are usually treated as “idiosyncratic” factors, even though anecdotal evidence of the Great Depression of the 1930s suggests that they may be systemic, and in smaller emerging markets more focus on this driver of default may be needed than in the United States when trying to model and estimate default costs.

Tables 2 and 3 describe the underwriting functions and the verifications needed to prevent fraud. Creditworthiness focuses on the ability to pay—having sufficient income and assets to manage the financial burdens of homeownership—and the willingness to pay—demonstrated by previous good performance on debt obligations as a predictor of future performance. In the United States, high-quality credit repositories play a crucial role in evaluating previous credit performance, and the efficiencies of automated underwriting systems are dependent on accessing this information. These credit repositories may not be available in emerging markets, so large dominant banks may have an advantage in assessing creditworthiness by examining their internal records regarding the deposit and credit performance of mortgage applicants who are their customers.

The other major underwriting focus is on assessing the adequacy of the collateral that backs the mortgage loan. The existence of publicly available house sales transactions, including descriptions of the property attributes, facilitates the estimation of value for the proposed collateral, and even facilitates automated valuation estimates (for efficiency as well as for a fraud check). In emerging markets, these important data may not be available and, again, a large dominant bank may have an advantage by being able to build this kind of database.

The key metrics for assessing borrower creditworthiness are the payment-to-income" ratio, the total payment-to-income ratio, and the credit (FICO) score. The first is the ratio of the expected housing payments to household income and the second includes in the numerator the debt payments for all other household debts. The FICO score is a measure gleaned from the credit repository files that summarizes the likelihood of debt repayment performance. In emerging markets, difficulties may arise in verifying income and other debt burdens, so all three of these metrics may be difficult to quantify sufficiently to assist in assessing the amount of credit risk posed by a mortgage applicant.

The major metric describing collateral risk is the loan-to-value ratio. This ratio is the loan amount divided by the estimated house value. Its complement is the equity the household has invested in the property, with lower equity reflecting higher default risk.

Considerable effort is spent by mortgage servicers in the United States to mitigate losses after a mortgage becomes delinquent. They attempt to work out the delinquency with the borrower to avoid the costs involved if the loan were to go to default. These techniques include loan modifications such as extending the maturity or changing the mortgage interest rate. They also include preforeclosure sales, in which the house is sold to pay off the loan, and deeds-in-lieu, in which the deed is voluntarily turned over to the lender. The longer the delinquency period—which varies depending primarily on state foreclosure laws—the higher the Loss Given Default, which includes the daily carrying cost of the nonpaying mortgage, the potential for a lower sales price of the house in a declining market, and the physical deterioration of the house resulting from the inattention of a noncaring owner. These costs are mitigated by the various workout techniques.

In the United States, the incidence of credit losses does not necessarily reside with the original lender. Government insurance/guarantee, such as the Federal Housing Administration and Department of Veterans Affairs and implicit government guarantees of Fannie Mae, Freddie Mac, and the Federal Home Loan Banks, are mechanisms to shift the incidence. In addition, private-market, multiclass mortgage-backed securities, in particular with senior/subordinated classes, act to shift the default losses. Likewise, private mortgage insurance companies and bond insurers assume credit risk. Emerging markets, just like the market in the United States before the 1930s, may not have the infrastructure to shift credit risk and they may not have a secondary mortgage market.

Because data required to measure and assess mortgage credit risk may be scant or unavailable in emerging markets, we suggest the technique of "benchmarking" until relevant data become available. Benchmarking extrapolates expected default costs based on current lending programs (not necessarily mortgage loans) in the country or on mortgage programs in other countries. In the latter case, however, a higher degree of uncertainty accompanies making the adjustments necessary for the extrapolations. The resulting estimates of default costs are thus tenuous; they may be sufficient, however, to begin originating mortgage loans to selected borrowers with selected properties, with the view to building reliable databases that are used to refine the original estimates.

Governments of emerging markets need to determine their roles. Our analysis of mortgage credit risk suggests that governments in emerging economies that wish to promote efficient and stable housing and mortgage markets should place the highest priority on creating the appropriate legal framework that facilitates private enterprise. Private enterprise holds the greatest promise of ensuring the benefits that homeownership can bring. Capital markets that are transparent and free of government interference are adept at allocating capital efficiently based on expectations of risk. Capital market participants need transparency and stability to create contingent contracts. Without the assurance that private property rights will be respected, government programs and actions designed to promote mortgage markets are destined to fail.

After a stable and transparent legal system that respects private property rights is in place, explicit or implicit government subsidies to specific programs or policies may be necessary until the capital market participants have sufficient experience to develop and price securities that reflect the level of risk in the market. Transparency is also important in the actions of participants in the mortgage market and in the governance structure. In addition, it is important to recognize that explicit and implicit subsidies may subject the government to excessive risk: when the subsidy is needed, a budgetary crisis could threaten the stability of the government. Transparency is an essential component to ensure the efficient operation of these subsidy programs. Only with proper public disclosure and scrutiny can one be sure the benefits are allocated to the parties that need them the most.

Both explicit and implicit subsidies require the creation of rules and regulations and an enforcement apparatus to facilitate reduction of waste and fraud. Such rules and regulations are difficult to construct, however, and require serious debate to ensure they achieve the desired ends. For example, our discussion of credit risk noted that, unfortunately, fraud losses are part of any money-lending system. Fraud is difficult to control in a developed country, however, and would be even more difficult to control in developing countries. The most efficient mechanism for reducing such losses is to focus government attention on facilitating private lenders to be viable and effective mortgage lenders (for example, by effective policing and prosecution of crooks), rather than to assume that government subsidies are necessary to make the market flourish.

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