Residential Mortgage Default

BY RONEL ELUL

A dramatic expansion of mortgage credit in recent years, coupled with a rapid run-up in house prices, has focused the attention of pundits and policymakers on the risks of home mortgage lending. In this article, Ronel Elul discusses the models that economists have developed to help us understand the default risk inherent in home mortgages and how default risk and house prices are related. He also applies these models to show how falling house prices would affect mortgage default rates today and explores the impact that rising default rates would have on financial institutions and other participants in the mortgage market.

Although default rates on residential mortgages have been relatively low in recent years, policymakers and economists should still be concerned about mortgage default for several reasons. First, while the foreclosure rate in the U.S. has averaged only 1 percent over the past 20 years, there have been dramatic swings in regional default rates over this period. For example, in the early 1990s foreclosure rates in California rose fivefold, from less than 0.4 percent to nearly 2 percent. In addition, this jump in default rates coincided with a 25 percent drop in house prices in California.

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One reason to be concerned about mortgage default is the prominent role that mortgages play in our financial system. First, home mortgages represent the bulk of credit extended to consumers. According to data collected by the Federal Reserve, mortgages make up over $8 trillion of the $10 trillion in consumer debt outstanding. Second, defaults on mortgages affect not only homeowners but also the holders of the mortgages. These obviously include the original lenders, which are primarily banks and thrifts. In addition, however, mortgage-backed securities (MBS) distribute this risk throughout the entire economy; indeed, some estimates show that one-quarter of all mortgages are ultimately held by investors in MBS.[1]

In addition, the risk of default is currently of particular concern because of the rapid run-up in house prices in recent years. Although many scenarios are feasible, one possible outcome is a significant decline in many housing markets across the U.S. Both policymakers and market participants certainly need to be able to quantify the effect of falling house prices on mortgage default rates. Fortunately, economists have developed option-theoretic models that permit us to understand the default risks inherent in home mortgages and how they relate to house prices.[2] According to these models, homeowners simply compare their house value to their remaining debt when deciding whether to default. While the simplified view of the world that option-theoretic models present provides useful insights, in practice, other considerations also influence a household's decision about whether or not to default on its mortgage.

THE OPTION-THEORETIC APPROACH TO MORTGAGE DEFAULT

The Ability to Default on a

[1] Source: *Mortgage Market Statistical Annual* (2004).

[2] In addition to facing default risk, an investor in mortgages also faces prepayment risk. This is the risk that a borrower will pay a mortgage before its maturity, and the investor will have to find a new place to invest his funds. Since prepayment often occurs through refinancing the mortgage at a lower rate, it is usually disadvantageous for the lender. Not surprisingly, the primary factor that determines prepayment risk is the current level of interest rates relative to the rate when the mortgage was issued.

Mortgage Can Be Viewed as a Put Option. One way to think about the risk that a homeowner will default on his mortgage is to view default as an option available to the homeowner. In general, an option is a contract in which one party obtains the right to buy or sell some underlying asset to another party for a prespecified price, known as the "strike," or exercise, price. When the party has the right to buy the asset at a fixed price, the contract is known as a call option; if he has the right to sell the asset, it is a put option.

The most prominent example is a stock option (Figure 1). Consider the case of a put option on IBM stock with a strike price of $75. If IBM is trading at $50 per share, exercising such an option would give the holder the right to sell a share of IBM for $75, for a profit of $25. When the exercise of the option is profitable, the option is said to be *in the money*.[3] By contrast, it would not be profitable to exercise a put option with a strike price of $75 if IBM were trading at $80, since the strike price is below the current market price. In such a case the option is said to be *out of the money*. Figure 1 plots the profit an investor would earn from this put option as a function of the price of IBM stock, assuming that a rational investor would not exercise the option when it is out of the money.

In the case of a mortgage, the homeowner's ability to default can also be viewed as a put option. Should the homeowner default, he is in effect "selling" the house to the lender for the current mortgage balance. When the house value is lower than the mortgage balance (commonly termed *negative equity*), the borrower gains financially if he stops paying the mortgage, surrenders the house to the lender, and buys a similar house for less than the mortgage balance. This corresponds to "selling" the house to the lender for the mortgage balance, since the borrower essentially gains the difference between the mortgage balance and the value of the house.[4]

What We Learn from the Option-Theoretic Approach. Setting the default decision in this sort of framework is very fruitful because economists know a lot about how to value options. Indeed, the pioneering work of Fisher Black and Myron Scholes and that of Robert Merton developed a methodology that enables us to calculate a precise numerical value for very general types of options. One appeal of their approach is that it leads to a formula that depends on only a few variables, which can be measured. In the case of the mortgage default option, these variables are the current loan-to-value (LTV) ratio, the mortgage amortization schedule (that is, the monthly schedule of how the mortgage balance is paid down), the volatility of house prices, and interest rates.

Lenders can use option-pricing formulas to determine how high an interest rate they must charge in order to compensate them for the risk of default. Investors in mortgage-backed securities can also use these formulas to determine how much these securities are worth. Finally, regulators and economists interested in mortgage default can use these formulas to gauge the risk that a given drop in house prices might pose to lenders. We will perform an exercise of this type later.

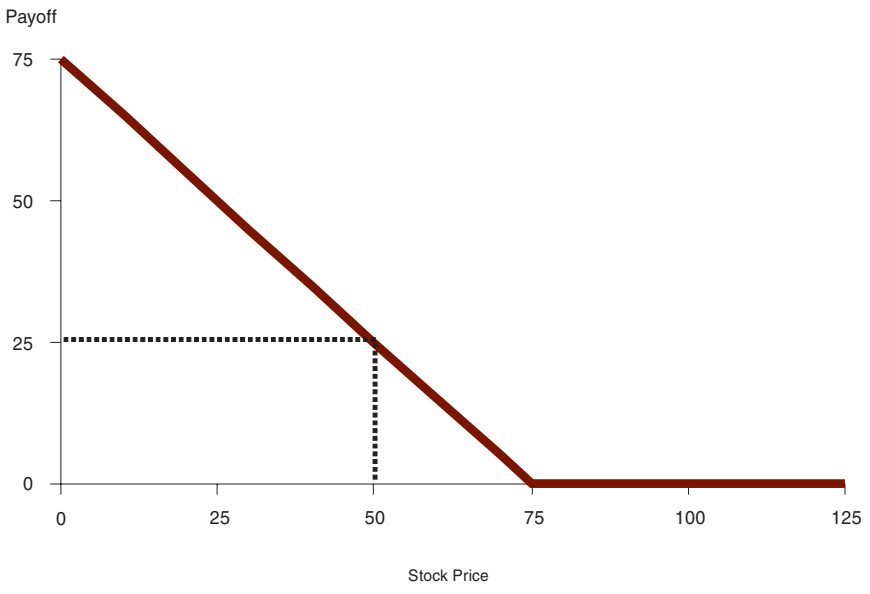
Viewing the right to default as an option also gives us qualitative insights

[3] Of course, it may be preferable to wait longer to exercise the option in the hope that the stock price and the profit from exercising the option go even higher before the option expires.

[4] Michael Asay was the first to formally model mortgage default as an option. For an overview of more recent literature, see the article by James Kau and Donald Keenan.

FIGURE 1

Payoff to the Holder of a Put Option



into mortgage default that might not otherwise be apparent. For example, options are more valuable when the underlying asset is more volatile. Consider the case of an investor holding a put option. Such an option will be in the money, i.e., profitable to exercise, when the asset price is below the strike price. When the asset price is more volatile, it is more likely to take both high and low values. This means that the option is more likely to be in the money (and by larger amounts). However, the greater likelihood of a very high asset price doesn't lead to a counteracting loss because the holder of the put option will choose not to exercise the option when the asset price is higher than the strike price. Thus, viewing the right to default on one's mortgage as a put option suggests that more volatile house prices should be associated with both a greater incidence and a greater severity of default. The study by James Kau and Donald Keenan has confirmed this.

Finally, the option-theoretic model also serves as a useful conceptual framework for extending our knowledge further. By testing this model, economists are able to assess the extent to which it accurately describes homeowners' behavior and, when it does not, to determine ways in which the model may be improved.

EMPIRICAL TESTS OF THE OPTION-THEORETIC MODEL

As we have discussed, one appeal of the simple option-theoretic approach is that it is parsimonious: Only a few factors play a role, most notably home equity.[5] Empirical testing of the option-theoretic model has confirmed the important role played by home equity.[6] It has also provided evidence that the homeowner's option is more complex than the simple model suggests. In addition, empirical work has uncovered evidence that default decisions also depend on factors outside the framework of an option-theoretic model.

Economists Extend the Model in Light of Empirical Findings. One important finding uncovered by testing of the option-theoretic model is that homeowners do not appear to default as soon as their equity becomes negative. In their 1985 study, Chester Foster and Robert Van Order found

One appeal of the simple option-theoretic approach is that it is parsimonious: Only a few factors play a role, most notably home equity.

For the most part, empirical work has focused on fixed-rate mortgages, in particular, those made to borrowers with good credit histories, known as prime loans. As the name suggests, the payment on these mortgages is fixed (in nominal terms) over the life of the mortgage. In addition, the borrower is typically permitted to refinance (prepay) the mortgage, for example, if interest rates drop.[7]

that even when the LTV rises to as much as 110 percent, only 4.2 percent of borrowers in their data set default. They suggest that this is evidence against a simple option-theoretic model in which homeowners default as soon as the equity in their house is negative. Other researchers have argued, however, that homeowners' behavior is still well described by the option pricing model if we extend the simple model to account for the panoply of options available to the homeowner.

In particular, some economists point out that the mortgage default option is essentially an "American" option, which the holder can exercise at any time up to its maturity. In contrast, a European option can be exercised only at a single prespecified date. We have already observed that it may not be optimal to exercise a put option on a stock as soon as the stock price dips below the strike price; one may prefer to wait in case it falls further. Similarly, if the house price is slightly below the mortgage balance, a fully rational homeowner may prefer to wait to default in order to give house prices a chance to fall further, making default even more profitable. Kau, Keenan, and Taewon Kim construct plausible numerical examples that show that it may be optimal to wait to default until the house price is as much as 15

[5] Home equity is defined here as the difference between the value of a house and that of all loans secured by the house.

[6] See, for example, the article by Yongheng Deng, John Quigley, and Robert Van Order.

[7] While a perfectly general analysis would take into account other types of mortgage products — most notably adjustable rate mortgages (ARMs) and subprime mortgages (which are loans made to riskier borrowers with poor credit histories) — we can still learn a lot by restricting our attention to prime fixed-rate loans. Despite the recent growth of other types of mortgages (particularly subprime loans), prime fixed-rate loans still represent approximately two-thirds of all outstanding mortgages, and models for subprime loans are in an earlier stage of development.

In addition, the main factors affecting default risk in prime fixed-rate mortgages are shared by other types of mortgages as well. For example, the risk from falling prices affects all types of mortgages. Nonetheless, we should be cautious in drawing general conclusions about the mortgage market as a whole from studies of prime fixed-rate mortgages alone because other types of mortgages have additional risk factors. For example, borrowers with ARMs are also exposed to the risk that interest rates will rise in the future, causing their required monthly payment to go up. Subprime borrowers are at greater risk for job loss than prime borrowers, which puts them at greater risk of default in response to a regional downturn that affects both housing prices and labor markets.

percent below the mortgage value.

Another reason that a rational homeowner may not default when it may appear to be optimal is that he actually has another option: prepaying his mortgage (for example, by refinancing).[8] This option may be viewed as a call option on the mortgage, since in prepaying the mortgage, the homeowner is taking the opportunity to buy back his outstanding debt by paying the remaining balance.[9] These two options interact. If someone has already prepaid his mortgage, he obviously cannot default. Similarly, someone who anticipates that he will refinance his mortgage shortly might decide that it is not worthwhile to default, since he does not plan to pay on the current mortgage for much longer.

A recent paper by Yongheng Deng, John Quigley, and Robert Van Order tests the extent to which mortgage default is driven solely by negative equity. They find that although negative equity is indeed an important determinant of default behavior, the existence of a prepayment option does have a statistically significant impact on the default decision. That is, a homeowner who is very likely to prepay his mortgage (for example, if his mortgage interest rate is much higher than current rates) is also less likely to default. Similarly, they also find that the default option has a significant impact on the exercise of the prepayment option; that is, households likely to default tend to prepay less often.

Empirical Work Also Points to Factors Outside the Option-Theoretic Framework. Other economists argue, however, that the reason homeowners do not default as soon as their equity turns negative is that defaulting involves significant *transaction costs*. For example, defaulting on a mortgage entails moving and losing one's home.[10] The impact that a default has on a borrower's reputation (for example, his credit score) may also be viewed as a form of transaction cost, since the defaulter sends a negative signal to potential lenders, a situation that makes any future borrowing more costly and difficult.[11] Finally, some borrowers may also have moral qualms that make them more reluctant to default. All of these may be viewed as factors outside the option-theoretic framework, which assumes that homeowners optimize in a perfectly frictionless manner or, at least, that transaction costs are small enough to be ignored.

Researchers have also found evidence that variables that capture crisis or "trigger" events for households, such as unemployment rates and divorce rates, all seem to lead to defaults. Similarly, personal characteristics of the homeowner associated with greater income risk, such as whether the borrower is self-employed, also help explain default behavior.[12] By contrast, recall that in the option-theoretic model, only variables directly related to the mortgage or house value should matter.[13]

These findings are consistent with the plausible hypothesis that at least some homeowners are *liquidity constrained*; that is, a borrower cannot borrow freely against his expected future income or wealth.[14] Consider the example of a homeowner who loses his job but knows he is likely to find a new one in the near future. Suppose that he would like to continue paying his mortgage so as to retain his home but that he has no equity in the house against which to borrow. If he could find a lender willing to lend on his assurances that he will find a new job, and if he could commit to repay the loan from this as yet unrealized future income, he would be able to borrow enough to continue making his mortgage payments during this temporary spell of unemployment. In practice, however, it is likely to be difficult to find a lender willing to lend under these circumstances, and the home-

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[8] Note that while the prepayment option is nearly universal for prime mortgages, this is not necessarily the case for subprime loans.

[9] In addition, he would also have to pay any costs associated with prepaying, for example, closing costs, if he were to refinance his mortgage.

[10] In their 1984 study, Foster and Van Order were the first to find evidence that these costs have an impact on the default decision.

[11] This would imply that borrowers with lower credit scores, who thus have less of a reputation to protect, would be likelier to default. This has been confirmed by several studies, for example, the one by Anthony Pennington-Cross. But note that low credit scores are also associated with less access to credit and riskier income; so this evidence is also consistent with theories (discussed below) that relate default to credit constraints.

[12] See the article by Kerry Vandell and Thomas Thibodeau.

[13] While it is fairly straightforward to test for the impact of trigger events empirically, incorporating them into a theoretical model requires a framework that focuses on consumer decisions, rather than a simple modification of the option pricing approach. See the paper by Peter J. Elmer and Steven A. Seelig for an example.

[14] Many studies find evidence of liquidity constraints in other arenas; see, for example, the article by Tullio Jappelli.

owner may well be forced to default.

Further support for the existence of liquidity constraints can be found in the paper by Deng, Quigley, and Van Order. First, these authors confirm that high state unemployment and divorce rates are associated with a higher incidence of default. Second, they find that higher *initial* loan-to-value ratios are associated with greater default risk. This finding is also consistent with the existence of liquidity constraints, since borrowers who have less wealth available for a down payment are likelier to be constrained. Last, these authors also find support for the existence of transaction costs that discourage homeowners from defaulting.

Finally, in addition to transaction costs and liquidity constraints, state laws may also affect homeowners' default behavior. (See *State Laws and Mortgage Default*.)

State Laws and Mortgage Default

In principle, the existence of state laws governing mortgage default (in particular, those laws that govern *deficiency judgments*) may also impede the free exercise of homeowners' default option. Some states prohibit lenders from pursuing deficiency judgments, which means that they cannot try to collect any deficiency between the value of the house and the mortgage balance from the homeowner's other assets. In principle, this would make defaulting on a mortgage more attractive for a homeowner with negative equity. Despite considerable effort, economists have uncovered little evidence that laws that prohibit deficiency judgments make homeowners more likely to default. The reason may be that deficiency judgments are rare even when they are permitted[a] because the defaulting homeowner is unlikely to have many assets aside from his house and because even in states where deficiency judgments are permitted, the homeowner may often protect himself against them by filing for bankruptcy.[b]

[a] See the article by Charles Capone.

[b] For more on the empirical significance of these laws, see the article by Karen Pence and the one by Terrence Clauretie and Thomas Herzog.

EMPIRICAL MODELING OF MORTGAGE DEFAULT

Competing Risks Models: An Empirical Framework for Modeling Mortgage Default. One framework researchers use to test the option-theoretic model of mortgage default and to assess the significance of additional variables is the *proportional hazard model*. D.R. Cox first applied this model in the biomedical sciences,[15] where it was used to study the effect of various treatments on patients' survival. The proportional hazard model explains the likelihood of exiting the sample in the next instant of time, given that the patient has survived up to this time. For example, it has been used to explain mortality from cancer, given the patient's age, gender, treatment history, and whether the patient is a smoker. Proportional hazard models have also been applied extensively to explain mortgage default.

As we have discussed above, however, the homeowner typically has another option as well, which is to prepay his mortgage. In light of this, the model by Deng, Quigley, and Van Order uses an extension of the proportional hazard model with two "competing risks": default and prepayment. In this case, the mortgage will terminate when the borrower either prepays or defaults, whichever occurs first. This extension allows them to study the interaction between default and prepayment and to estimate the relative significance of trigger events such as unemployment and divorce rates.[16]

Predicting Default Rates in a Hypothetical Housing Market Downturn. One immediate application of the models we have presented is to forecast default rates in a hypothetical downturn in the housing market. This is obviously of interest to policymakers.

The scenario we consider is motivated by the work of Joshua Gallin. He argues that, based on an analysis of historical rent-price ratios, housing is currently overvalued by more than 20 percent. One way to understand this is to note that given today's house prices and rents, a savvy homeowner could profit by selling his house, investing the money in a relatively safe asset such as long-term Treasury bonds, and using the interest income to rent a comparable house.[17] He would profit because at today's inflated prices, his interest income would exceed his rent.

[15] See the book by D.R. Cox and D. Oakes.

[16] This model is also used in other areas of economics. For example, someone may leave unemployment either because he finds a job or because he drops out of the labor force altogether.

[17] This process may not necessarily be as straightforward as we describe. In particular, it is not always easy to find comparable rental accommodation. Indeed, Gary Smith and Margaret H. Smith argue that if one carefully matches owner-occupied and rental housing, prices do not appear to be out of line relative to rents in most cities.

Such selling pressure would tend to lower house prices, and the increased demand for rental units might also raise rents. This process would continue until all such opportunities for easy profits are exhausted. At this point, the market would be in equilibrium.[18]

Gallin finds that when prices are high relative to rents — as in the past few years — there has indeed been a tendency for this equilibrium relationship to be re-established. Figure 2 shows the rent-price ratio since 1970.[19] Observe first that in late 2005 this index was at its lowest level since 1970; in addition, periods in which this ratio moved away from its long-run mean (roughly 100) appear to be followed by reversals. Gallin also shows that this adjustment process generally involves both rents rising more rapidly than usual and prices rising more slowly (or even falling). In particular, assuming that housing is overvalued by 20 percent, Gallin's work predicts that over the next three years, real rents[20] should rise about 1.2 percent per year faster than usual, and real house prices should rise 3.4 percent per year more slowly than usual.

Gallin's argument that the housing market is out of equilibrium is statistical; that is, he compares the rent-price ratio to its historical average. He makes no conjectures as to why the market moves out of equilibrium in the first place. Furthermore, although Gallin finds evidence that this adjustment has taken place in the past, this does not necessarily mean that it is certain to occur in the future because the equilibrium house-price–rent ratio may have permanently changed for various reasons. In particular, an argument often made is that the current high level of prices (relative to rents) can be justified because financial innovations have made borrowing easier and cheaper. For example, increased subprime lending allows households to buy homes when they would previously have been forced to rent. This increased demand for owner-occupied housing should raise house prices relative to rents.[21]

To examine the potential impact of price declines on mortgage default, we will consider a more extreme trajectory for house prices than the one suggested by Gallin. We will begin with a benchmark case in which prices increase at a steady 4 percent a year.[22] However, rather than stagnation in prices, as Gallin suggests, we then consider the impact of an immediate 20 percent drop in prices (followed by 4 percent growth thereafter). While such a scenario is admittedly extreme,[23] it nevertheless provides useful insights by establishing bounds on the possible impact of mortgage default. We also consider a more conservative scenario.

We use the empirical model of Yongheng Deng and John Quigley to generate forecasts of mortgage de-

[18] More precisely, according to this argument, the equilibrium price of a house should be roughly equal to the present value of the expected future income one could earn by renting out the house, after adjusting for taxes and maintenance.

[19] The rent-price ratio is constructed by dividing the rent index from the CPI-W (reported by the Bureau of Labor Statistics), by Freddie Mac's conventional mortgage home price index; we make several minor adjustments as suggested by Gallin.

[20] That is, after adjusting for inflation.

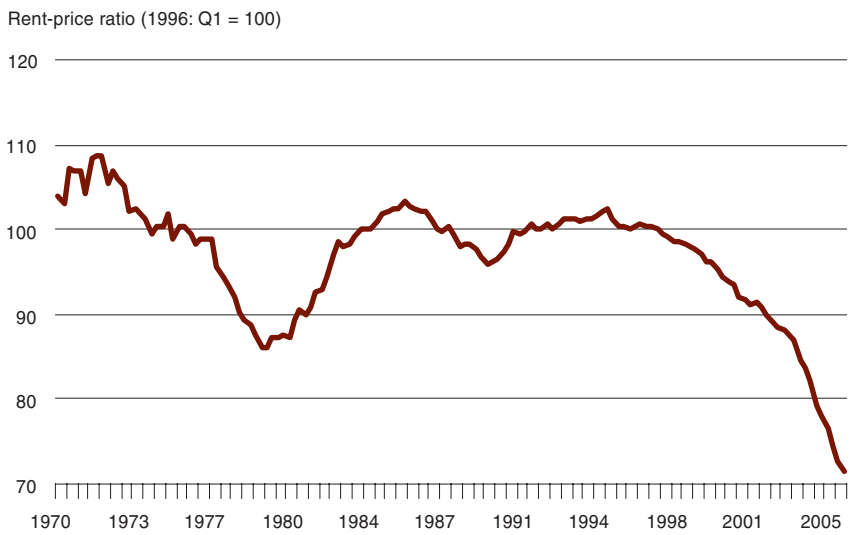
[21] Indeed, the homeownership rate in 2005 was at a historical high of 69 percent. This view was articulated by Janet Yellen, president of the San Francisco Fed, in a speech on October 21, 2005.

[22] This is consistent with the average real rate of increase in house prices over the past 30 years. That is, adjusting for inflation, the average rate of increase has been 1.5 percent a year. Given a current inflation rate of roughly 2.5 percent, we arrive at a 4 percent nominal rate of increase.

[23] However, there were drops of roughly this magnitude in New England and California in the early 1990s.

FIGURE 2

Rent-Price Ratio: 1970-2005



Source: Bureau of Labor Statistics and Freddie Mac

fault rates under these scenarios. We consider a representative homeowner who has just taken out a mortgage at an interest rate of 6 percent (which we assume is also the current market interest rate) and who has an initial LTV of 80 percent. According to data from the 2004 Survey of Consumer Finances, the fraction of homeowners with LTVs at or below 80 percent is 80 percent.[24] Further detail on the distribution of LTVs is presented in Figure 3.

Aside from the contemporaneous loan-to-value ratio, which we can calculate from the initial LTV and the interest rate, the other variables used in the model are the volatility of house prices, state unemployment rates, and state divorce rates. We also assume that interest rates are constant; so given that the mortgage is taken out at the market interest rate, there is no reason for homeowners to prepay their mortgages.[25]

For the benchmark scenario of an 80 percent LTV mortgage, the risk of default over the 360-month life of the mortgage is about 1.8 percent.[26] Figure 4 plots the cumulative default rate as a function of time (in months).

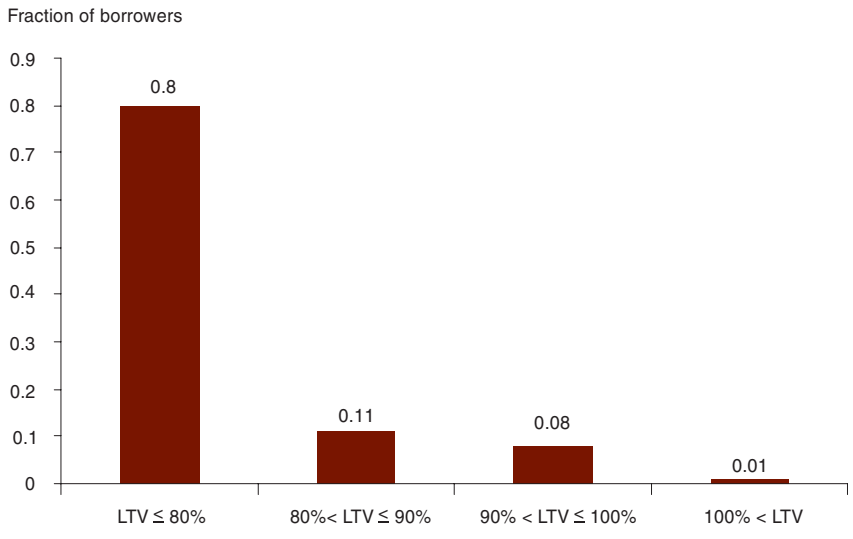
Now consider an instantaneous drop in house prices of 20 percent just after the mortgage has been taken out, so that this mortgage now has an LTV of 100 percent. Over the life of the mortgage, the default rate, at 6 percent, is over three times as high as the benchmark scenario because even a small drop in house prices in the future will lead to negative equity. As can be seen in the figure, most of the acceleration in default rates comes in the early years of the mortgage, before amortization lowers the LTV significantly. Once the LTV has fallen, the value of the option to default declines substantially.

It is also useful to explore what happens for less dramatic scenarios. If house prices decline only 10 percent, for example, lifetime default rates increase from 1.8 percent to 3 percent. So a decline in prices that is twice as large (20 percent as compared to 10 percent) results in default rates that are *three times* as large. In other words, drops in housing prices have a nonlinear effect on default rates, with large declines increasing default rates more than proportionally. This nonlinearity can also be seen in Figure 4; observe that the default rates corresponding to a 10 percent drop are much closer to those with no drop than they are to those when prices drop 20 percent.

Since we saw in Figure 1 that the price of an option does not have a linear relationship to the price of the underlying asset (because of the option holder's right to not exercise the option when prices fall), it is not surprising that drops in house prices have a similarly nonlinear effect on default rates. The reason is that if the value of a house falls only slightly below the outstanding mortgage balance, the homeowner will be unlikely to default on his mortgage, since there is a significant

FIGURE 3

LTV Distribution for Those with Mortgages



Source: 2004 Federal Reserve Board Survey of Consumer Finances

[24] These figures for LTVs include first mortgages as well as home equity loans.

[25] We assume house price volatility of 11.5 percent, following the study by John Campbell and Joao Cocco. Unemployment and divorce rates are set at roughly current U.S. levels: 5 percent and 4.8 percent, respectively. We calculate the default rates by simulating many paths for house prices under our assumptions, use these paths to calculate the probability of negative equity in every period, and then apply the model in Deng and Quigley to these simulated probabilities. Deng and Quigley's model is closely related to that in the published paper by Deng, Quigley, and Van Order; it has the advantage for us that only publicly available data are required to generate predictions.

[26] This is higher than the 1 percent foreclosure rate we reported at the start of the paper. The difference may be attributed to the fact that actual prices have risen more rapidly in the past than our scenario specifies, as well as the fact that we impose assumptions that rule out prepayment.

likelihood that the house's value will rise above the mortgage balance in the near future. By contrast, for large drops in prices, default will be much likelier, since equity will still be negative even if prices go up in the future.[27]

Although homeowners gain financially when they exercise their option to default in the face of falling house prices, this gain obviously comes at the expense of other market participants. The incidence of losses is also of interest to economists and regulators. (See *Who Is Hurt When Homeowners Default?)*

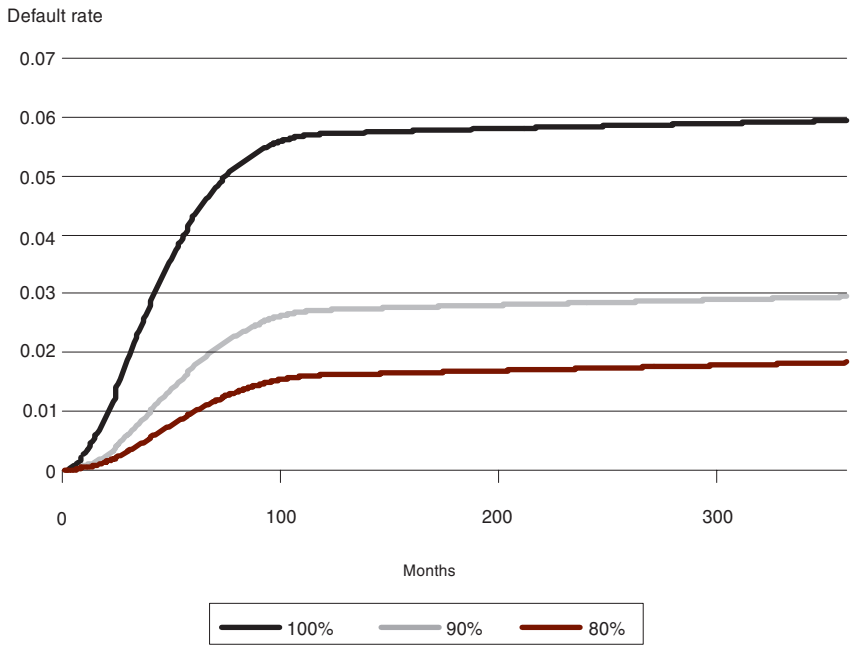
SUMMARY

One of the risks to mortgage lending is that the homeowner will default on his promise to continue making payments. One of the primary drivers of mortgage default is declines in house prices. Economists have developed option-theoretic models that can quantify the impact that falling prices have on mortgage default. These models have had some success in explaining homeowners' defaults; however, there is evidence that they fail on three dimensions. First, they do not recognize that default is costly, which makes homeowners more reluctant to stop paying. Second, they do not account for the fact that some homeowners are credit constrained, so that if they experience a "trigger event," such as a job loss, they may not be able to continue paying on their mortgage even if they expect to find new employment in the near future; this increases the risk of default. Finally, homeowners may be less reluctant to default than is suggested by the option-theoretic models because they also have another option: prepaying their mortgage.

As a result, economists have developed empirical models that seek to account for mortgage default through a combination of explanatory variables, both ones related to home equity and ones that account for transaction costs, trigger events, and the prepayment option. We have seen that such models can be used to predict the effect that falling prices would have on mortgage default rates. Further research is needed on the determinants of default for newer mortgage products, such as subprime loans, as well as the impact of default on other market participants, particularly investors in MBS.

FIGURE 4

Mortgage Default Rates for Three Scenarios



[27] Default rates are similarly nonlinear in LTVs. For example, a 20 percent drop in prices would have a negligible effect on a borrower with an initial LTV of 60 percent, raising his lifetime default rate from 1.1 percent to 1.3 percent. By contrast, for a borrower with an initial LTV of 100 percent, the default rate would rise from 23 percent to nearly 100 percent.

Who Is Hurt When Homeowners Default?

There are four main parties that are exposed to the risk of homeowners defaulting on their mortgages.

Banks and thrifts hold approximately 30 percent of all home mortgages. Although banks would obviously take significant losses if prices fell dramatically, and some might even find themselves under severe stress, the banking sector as a whole is currently well capitalized and could sustain a drop of the magnitude we considered in the text. In particular, depository institutions have approximately $850 billion in capital, against liabilities of $9.6 trillion. Of these liabilities, no more than $2.75 trillion are nonguaranteed mortgage loans of some sort (first mortgages, home equity loans, and private mortgage-backed securities).

To determine the impact of falling prices on banks, we need information on the LTVs of the mortgages in their portfolios; we will make the simple assumption that the distribution of LTVs for those loans held by banks is roughly the same as that for the population of mortgages as a whole (see Figure 3 in the text). In this case, an application of our model allows us to conclude that the default rates that banks experience on their mortgage portfolios would rise roughly 2 percent (over and above the current U.S. foreclosure rate of 1 percent) within one year of a 20 percent price decline. Given the currently sound state of banking institutions, this would not appear to pose a dramatic risk to the stability of this sector.[a]

Of those mortgages not held by depository institutions, the vast majority are packaged into mortgage-backed securities (MBS). Most are "agency MBS": They are backed by a government-sponsored enterprise (GSE), most notably Fannie Mae and Freddie Mac. So investors in these securities are protected against default. The GSEs themselves bear very little credit risk, however, because they require private mortgage insurance (PMI) for borrowers with LTVs above 80 percent. Thus, the vast majority of the default risk on agency MBS falls on the PMI industry, which insured approximately 13 percent of all conventional mortgages issued in 2004.[b]

In addition, approximately one-quarter of all MBS are "private-label MBS," which are not backed by any agency. Although these securities feature some sort of credit enhancement to mitigate the risk of default, this protection is typically incomplete, so that investors generally end up bearing some default risk. These investors include hedge funds, life insurance companies, pension funds, and private individuals. The extent to which these participants are exposed to mortgage credit risk and the degree to which this risk is concentrated in a few entities are unknown, and further research on this issue would be instrumental for policymakers.

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[a] This has not always been the case. In particular, some people have suggested that declines in the value of banks' real estate portfolios led to a "credit crunch" that aggravated the recession of the early 1990s. See the article by Joe Peek and Eric Rosengren.

[b] Source: micanews.com and HMDA data. This represents a trend down from earlier years, since financial innovations such as "piggyback loans" have reduced the importance of PMI.

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