CHAPTER 1

Overview of Mortgages and the Consumer Mortgage Market

Over the past few decades, the residential mortgage market in the United States has emerged as one of the world's largest asset classes. At its peak in the first quarter of 2008, the total face value of household mortgage debt exceeded $10.6 trillion dollars. The growth of the residential mortgage market reflected the rapid growth in the aggregate value of real estate between 2001 and 2006, along with consumers' propensity to monetize their home equity through additional borrowing.

The composition and performance of the mortgage market has undergone profound shifts on several occasions, and can be divided into separate phases. The period between 2001 and early 2007 was characterized by numerous innovations in product features, pricing paradigms, and underwriting practices, which were underpinned by steady nationwide increases in home prices. The sudden and protracted decline in the credit performance of residential mortgage loans, which first became apparent in 2006, led to the recognition that many of the products and practices developed during the earlier period were fundamentally flawed, with their weaknesses masked by the strength in the residential real estate markets. This led to a retrenchment by mortgage lenders characterized by conservative lending practices and greater regulatory scrutiny. At this writing, most lending programs require high credit scores and (with the exception of some government-backed programs) relatively large down payments. Almost all programs currently require full documentation of income sources, while so-called "affordability products" (which allow obligors to borrow increasingly large amounts relative to their income) have fallen out of favor and, in some cases, been outlawed entirely.

Despite the changes and dislocations experienced by the mortgage industry, however, it remains critical to the health of the housing market. Since most home buyers need to finance at least some of the purchase price, the availability and cost of mortgage money is a key factor driving sales volumes for new and existing homes. Moreover, the events of the past few

years have demonstrated that familiarity with the primary mortgage market is important in understanding a variety of trends and factors influencing the market for securitized mortgage products.

The primary purpose of this chapter is to explain mortgage products and lending practices. The chapter introduces the basic tenets of the primary mortgage market and mortgage lending, and summarizes the various product offerings in the sector. In conjunction with the following chapter on mortgage-backed securities (MBS) and the mortgage-backed securities market, this chapter also provides a framework for understanding the concepts and practices addressed in the remainder of this book.

OVERVIEW OF MORTGAGES

In general, a ***mortgage*** is a loan that is secured by underlying assets that can be repossessed in the event of default. For the purposes of this book, a mortgage is defined as a loan made to the owner of a one- to four-family residential dwelling and secured by the underlying property (both the land and the structure or "improvement"). After issuance, loans must be managed (or serviced) by units that, for a fee, collect payments from borrowers and pass them on to investors. ***Servicers*** are also responsible for interfacing with borrowers if they become delinquent on their payments, and also manage the disposition of the loan and the underlying property if the loan goes into foreclosure.

Key Attributes that Define Mortgages

There are a number of key attributes that define the instruments in question, which can be characterized by the following dimensions:

- Lien status, original loan term
- Credit classification
- Interest rate type
- Amortization type
- Credit guarantees
- Loan balances
- Prepayments and prepayment penalties

We discuss each in the following subsections.

Lien Status

The ***lien status*** dictates the loan's seniority in the event of the forced liquidation of the property due to default by the obligor. A *first lien* implies that a

creditor would have first call on the proceeds of the liquidation of the property if it were to be repossessed. Borrowers have often utilized *second liens* or *junior loans* as a means of liquefying the value of a home for the purpose of expenditures such as medical bills or college tuition or investments such as home improvements.

Original Loan Term

The great majority of mortgages are originated with a 30-year original term. Loans with shorter stated terms are also utilized by those borrowers seeking to amortize their loans faster and build equity in their homes more quickly. The 15-year mortgage is the most common short-amortization instrument, although there has been fairly steady issuance of loans with 20- and 10-year terms.

Credit Classification

The majority of loans originated are underwritten to high credit standards, where the borrowers have strong employment and credit histories, income sufficient to pay the loans without compromising their creditworthiness, and substantial equity in the underlying property. These loans are broadly classified as ***prime loans***, and have historically experienced relatively low incidences of delinquency and default.

Loans of lower initial credit quality, which are expected to experience significantly higher rates of default, are classified as ***subprime loans***. Subprime loan underwriting often utilized nontraditional measures to assess credit risk, as these borrowers typically had lower income levels, fewer assets, and blemished credit histories. Issuance of the product declined precipitously after 2006, when it became evident that the sector was plagued by poor underwriting, fraud, and an excessive reliance on rising home prices.

Between the prime and subprime sector is a somewhat nebulous category referenced as ***alternative-A loans*** or, more commonly, *alt-A loans*. These loans were considered to be prime loans (the "A" refers to the A grade assigned by underwriting systems), albeit with some attributes (such as limited income or asset documentation) that either increased their perceived credit riskiness or caused them to be difficult to categorize and evaluate. As with subprime, issuance of alt-A loans fell sharply with the post-2006 decline in home prices and mortgage credit performance.

Mortgage credit analysis employs a number of different metrics, including the following.

Credit Scores Several firms collect data on the payment histories of individuals from lending institutions and use sophisticated models to evaluate and quantify individual creditworthiness. The process results in a *credit score*, which is essentially a numerical grade of the credit history and creditworthiness of the borrower. There are three different credit-reporting firms that calculate credit scores: Experian (which markets the Experian/Fair Isaac Risk Model), Transunion (which supports the Emperica model), and Equifax (whose model is known as Beacon). While each firm's credit scores are based on different data sets and scoring algorithms, the scores are generically referred to as ***FICO scores***, since they are based on Fair Isaac's software and models. Underwriters typically purchase credit scores from all three credit bureaus, and apply the median figure to their analysis; in the event that only two scores are available, the lower of the two is used.

Loan-to-Value Ratios The *loan-to-value ratio* (LTV) is an indicator of borrower leverage at any point in time. The LTV calculation compares the face value of the desired loan to the market value of the property. By definition, the LTV of the loan in the purchase transaction is a function of both the down payment and the purchase price of the property. In a refinancing, the LTV is dependent upon the requested amount of the new loan and the market value of the property as determined by an appraisal. (Note that if the new loan is larger than the original loan, the transaction is referred to as a *cash-out refinancing*; a refinancing where the loan balance remains the same is described as a *rate-and-term* or *no-cash refinancing*.)

The LTV is important for a number of reasons. First, it is an indicator of the amount that can be recovered from a loan in the event of a default, especially if the value of the property has not appreciated. The level of the LTV also has an impact on the expected payment performance of the obligor; a high LTV indicates a greater likelihood of default on a loan. The recognition of this phenomenon has caused mortgage analysts to distinguish between the ***original LTV*** (i.e., the LTV at the time the loan was originated) and the ***current LTV*** (CuLTV), which accounts for changes in the home's price after the loan is issued. (Data indicate that borrowers have a increased propensity to voluntarily stop servicing their loans once their CuLTV exceeds 125%, even if they can afford making monthly payments. This behavior, called *strategic default*, was not contemplated before the post-2006 decline in home prices.)

Analysis must also account for the presence of subordinated mortgage debt. A common supplemental measure is the ***combined LTV*** (CLTV), which accounts for the presence of second and third liens. As an example, a $100,000 property with an $80,000 first lien and a $10,000 second lien will have an LTV of 80% but a CLTV of 90%.

Income Ratios In order to ensure that borrower obligations are consistent with their income, lenders calculate income ratios that compare the potential monthly payment on the loan to the applicant's monthly income. The most common measures are front and back ratios. The *front ratio* is calculated by dividing the total monthly payments on the home (including principal, interest, property taxes, and homeowners insurance) by pretax monthly income. The *back ratio* is similar, but adds other debt payments (including auto loan and credit card payments) to the total payments. In order for a loan to be classified as prime, the front and back ratios should be no more than 28% and 36%, respectively. (Because consumer debt figures can be somewhat inconsistent and nebulous, the front ratio is generally considered the more reliable measure, and accorded greater weight by underwriters.)

Documentation Lenders traditionally have required potential borrowers to provide data on their financial status, and support the data with documentation. Loan officers typically required applicants to report and document income, employment status, and financial resources (including the source of the down payment for the transaction). Part of the application process routinely involved compiling documents such as tax returns and bank statements for use in the underwriting process. Between 2001 and 2007, however, increasingly large numbers of loans were underwritten using relaxed documentation standards. While originally designed for self-employed borrowers that had difficulty documenting their income, these programs were extended to include wage earners that often were looking to borrow larger sums than could be supported by their incomes. Such programs ranged from simply not requiring pay stubs and bank statements from existing customers, to "stated-income" programs (where income levels and asset values were provided but not independently verified) to "no income–no asset" programs for which no income figures or bank balances were provided by the borrower. The devastating post-2007 decline in performance for these products forced lenders to return to requiring full documentation in almost all cases.

Characterizing Mortgage Credit

The primary attribute used to categorize mortgage credit has long been the credit score. Prime (or A-grade) loans generally had FICO scores of 660 or higher, income ratios with the previously noted maximum of 28% and 36%, and LTVs of 90% or less. Alt-A loans occupied a middle ground between prime and subprime products. The "alt-A" label was applied to a variety of products which typically combined relaxed documentation standards,

nonoccupancy by the obligor (i.e., the home was either an investment property or a second home), and credit scores between 660 and 700.

The alt-A category eventually occupied a wide band in the credit spectrum, ranging from loans that were close to prime in quality to products that were virtually subprime loans in character. The subprime sector was broadly understood to represent loans well below prime products in credit quality. However, the loan programs and grades were highly lender-specific. For example, one lender might consider a loan with a 620 FICO to be a B-rated loan, while another lender would grade the loan differently, especially if the other attributes of the loan (such as the LTV) deviated from average levels.

Interest Rate Type

Fixed rate mortgages have an interest rate (or *note rate*) that is set at the closing of the loan (or, more accurately, when the rate is "locked"), and is constant for the loan's term. Based on the loan's balance, interest rate, and term, a payment schedule effective over the life of the loan is calculated to amortize the principal balance.

Adjustable rate mortgages (ARMs), as the name implies, have note rates that change over the life of the loan. The note rate is based on both the movement of an underlying rate (the *index*) and a spread over the index (the *margin*) required for the particular loan program. A number of different indexes can be used as a reference rate in determining the loan's note rate the loan "resets," including the London Interbank Offering Rate (LIBOR), one-year Constant Maturity Treasury (CMT), or the 12-month Moving Treasury Average (MTA), a rate calculated from monthly averages of the one-year CMT. The loan's note rate resets at the end of the initial period and subsequently resets periodically, subject to caps and floors that limit how much the loan's note rate can change. ARMs most frequently are structured to reset annually, although some products reset on a monthly or semiannual basis. Since the loan's rate and payment can (and often does) reset higher, the borrower can experience "payment shock" if the monthly payment increases significantly.

Traditionally, ARMs had a one-year initial period where the start rate was effective, often referred to as the "teaser" rate (since the rate was set at a relatively low rate in order to entice borrowers.) The loans reset at the end of the teaser period, and continued to reset annually for the life of the loan. One-year ARMs, however, are no longer popular products, replaced by loans that have features more appealing to borrowers.

During the period between 2001 and 2007 when ARM issuance was at its height, the market was dominated by two different types of loans. One is the ***fixed period ARM*** or ***hybrid ARM***, which have fixed initial rates that

are effective for longer periods of time (3-, 5- 7-, and 10-years) after funding. At the end of the initial fixed rate period, the loans reset in a fashion very similar to that of more traditional ARM loans. Hybrid ARMs typically have three rate caps: initial cap, periodic cap, and life cap. The *initial cap* and *periodic cap* limit how much the note rate of the loans can change at the end of the fixed period and at each subsequent reset, respectively, while the *life cap* dictates the maximum level of the note rate.

At the opposite end of the spectrum was the ***payment option ARM*** or *negative amortization ARM*. Such products begin with a very low teaser rate. While the rate adjusts monthly, the minimum payment is only adjusted on an annual basis and is subject to a payment cap that limits how much the loan's payment can change at the reset. In instances where the payment made is not sufficient to cover the interest due on the loan, the loan's balance increases in a phenomenon called "negative amortization." (The mechanics of negative amortization loans are addressed in more depth later in this chapter.)

Amortization Type

Traditionally, both fixed and adjustable rate mortgages were *fully amortizing loans*, indicating that the obligor's principal and interest payments are calculated in equal increments to pay off the loan over the stated term. Fully amortizing, fixed rate loans have a payment that is constant over the life of the loan. Since the payments on ARMs adjust periodically, their payments are recalculated at each reset for the loan's remaining balance at the new effective rate in a process called *recasting the loan*.

Between 2001 and 2007, however, many loans were originated with nontraditional amortization schemes. The most straightforward of these innovations was the *interest-only* or *IO product*. These loans required only interest to be paid for a predetermined period of time. After the expiration of the interest-only or *lockout period*, the loan was recast to amortize over the remaining term of the loan. The inclusion of principal to the payments at that point, amortized over the remaining term of the loan, causes the loan's payment to rise significantly after the recast, creating payment shock analogous to that experienced when an ARM resets.

The interest-only feature was most common in the hybrid ARM market, where the terms of the interest-only and fixed rate periods were contiguous. A by-product of the interest-only ARM can be large changes in the borrower's monthly payment, the result of the combination of post-reset rate increases and the introduction of principal amortization. However, fixed rate, interest-only products have also been popular. These are loans with a 30-year maturity that have a fixed rate throughout the life of the loan,

but have a fairly long interest-only period (normally 10 years, although 15-year interest-only products are also being produced). The loans subsequently amortize over their remaining terms. These products were designed to appeal to borrowers seeking the lower payments of interest-only products without the rate risk associated with adjustable rate products.

Another variation is the *noncontiguous interest-only hybrid ARM*, where the interest-only period is different from the duration of the fixed rate period. As an example, a 5/1 hybrid ARM might have an interest-only period of 10 years. When the fixed period of a hybrid ARM is concluded, the loan's rate resets in the same fashion as other ARMs. However, only interest is paid on the loan until the recast date. These products were developed to spread out the payment shock that occurs when ARM loans reset and recast simultaneously.

Credit Guarantees

The ability of mortgage banks to continually originate mortgages is heavily dependent upon the ability to create fungible assets from a disparate group of loans made to a multitude of individual obligors. These assets are then sold (in the form of loans or, more commonly, MBS) into the capital markets, with the proceeds being recycled into new lending. Therefore, mortgage loans can be further classified based upon whether a credit guaranty associated with the loan is provided by the federal government or quasi-governmental entities, or obtained through other private entities or structural means.

Loans that are guaranteed by agencies of the Federal government are referred to under the generic term of ***government loans***. As part of housing policy considerations, the Department of Housing and Urban Development (HUD) oversees two agencies, the Federal Housing Administration (FHA) and the Veterans Administration (VA), that support housing credit for qualifying borrowers. The FHA provides loan guarantees for those borrowers who can afford only a low down payment and generally also have relatively low levels of income. The VA guarantees loans made to veterans, allowing them to receive favorable loan terms. These guarantees are backed by the U.S. Department of the Treasury, thus providing these loans with the "full faith and credit" backing of the U.S. government. Government loans are securitized largely through the aegis of the Government National Mortgage Association (GNMA or Ginnie Mae), an agency also overseen by HUD.

Conventional loans have no explicit guaranty from the federal government. Qualifying conventional loans can be securitized as pools guaranteed by the two ***government-sponsored enterprises*** (GSEs), namely Freddie Mac (FHLMC) and Fannie Mae (FNMA). The GSEs are shareholder-owned

corporations that were created by Congress in order to support housing activity. While neither enterprise has an explicit government guaranty, market convention has always reflected the presumption that the government would provide assistance to the GSEs in the event of financial setbacks that threaten their viability. (In the summer of 2008, in fact, both GSEs were placed in conservatorship and eventually given unlimited support by the Treasury; through the second quarter of 2010, the two companies have received a total of roughly $150 billion in support from the Treasury.) As we see later in this chapter, the GSEs insure the payment of principal and interest to investors in exchange for a guaranty fee, paid either out of the loan's interest proceeds or as a lump sum at issuance.

Conventional loans that are not guaranteed by the GSEs can be securitized as private-label transactions. Traditionally, loans were securitized in private-label form because they were not eligible for GSE guarantees, although there have been times where private-label execution was superior to agency pooling for some agency-eligible loans. Beginning in late 2007, however, private-label issuance became uneconomical for a variety of factors growing out of the mortgage crisis. This meant that loans ineligible for securitization through Ginnie Mae or the GSEs are either held on the books by lenders or sold in the form of raw or "whole" loans.

Loan Balances

The agencies have limits on the loan balance that can be included in agency-guaranteed pools. The maximum loan sizes for one- to four-family homes effective for a calendar year are adjusted late in the prior year. The year-over-year percentage change in the limits is based on the October-to-October change in the average home price (for both new and existing homes) published by the Federal Housing Finance Board (or, after mid-2009, the Federal Housing Finance Agency). Since their inception, Freddie Mac and Fannie Mae pools have had identical loan limits, because the limits are dictated by the same statute. As of 2010, the single-family limit was $417,000; the loan limits are 50% higher for loans made in Alaska, Hawaii, Guam, and the U.S. Virgin Islands.

However, having a single loan limit throughout the United States caused large numbers of loans in states such as California, where housing is relatively expensive, to be ineligible for agency securitization. Legislation passed in 2008 created overrides or "ceilings" for the maximum balance of loans originated in "high-cost" areas. As of 2010, the maximum loan size for loans originated in high-cost areas was $729,750—that is, 175% of the national ***conforming balance limit*** of $417,000.

Loans larger than the conforming limits (and thus ineligible for inclusion in agency pools) are classified as ***jumbo loans*** and can only be securitized in private-label transactions. At its peak in 2006, the outstanding balance of the private-label market exceeded $1.5 trillion. However, the size of the market began to decline in 2007, as the decline in balances due to prepayments and defaults has not been offset by new issuance.

Prepayments and Prepayment Penalties

Mortgage loans can prepay for a variety of reasons. Virtually all mortgage loans have a "due on sale" clause, which means that the remaining balance of the loan must be paid when the house is sold. Existing mortgages can also be refinanced by the obligor if the prevailing level of mortgage rates declines, or if a more attractive financing vehicle is proposed to them. In addition, the homeowner can make partial prepayments on their loan, which serve to reduce the remaining balance and shorten the loan's remaining term. As we discuss later in this chapter, prepayments strongly impact the returns and performance of MBS, and investors devote significant resources to studying and modeling them.

To mitigate the effects of prepayments, some loan programs were structured with prepayment penalties. The penalties were designed to discourage refinancing activity, and required a fee to be paid to the servicer if the loan is prepaid within a certain amount of time after funding. Penalties were typically structured to allow borrowers to partially prepay up to 20% of their loan each year the penalty was in effect, and charge the borrower six months of interest for prepayments on the remaining 80% of their balance. Some penalties could be waived if the home is sold, and are described as "soft" penalties; hard penalties required the penalty to be paid even if the prepayment occurs as the sale of the underlying property.

As with many lending practices, prepayment penalties are controversial. Critics argue that the presence of penalties increases borrowers' costs of exiting what are already expensive loans, and unfairly targets vulnerable borrowers.

MORTGAGE LOAN MECHANICS

As described in the previous section, mortgage loans traditionally are structured as fully amortizing debt instruments, with the principal balance being paid off over the term of the loan. For a fixed rate product, the loan's payment is constant over the term of the loan, although the payment's breakdown into principal and interest changes each month. An amortizing fixed

rate loan's monthly payment can be calculated by first computing the *mortgage payment factor* using the following formula:

$$\text{Mortgage payment factor} = \frac{\text{Interest rate}(1+\text{Interest rate})^{\text{Loan term}}}{(1+\text{Interest rate})^{\text{Loan term}}-1}$$

Note that the interest rate in question is the monthly rate, that is, the annual percentage rate divided by 12. The monthly payment is then computed by multiplying the mortgage payment factor by the loan's balance (either original or, if the loan is being recast, the current balance).

As an example, consider the following loan:

Loan balance: $100,000
Annual rate: 6.0%
Monthly rate: 0.50% = 0.005
Loan term: 30 Years (360 Months)

The monthly payment factor is calculated as

$$\frac{0.005(1.005)^{360}}{(1.005)^{360}-1} = 0.0059955$$

Therefore, the monthly payment on the subject loan is $100,000 × 0.0059955, or $599.55.

An examination of the allocation of principal and interest over time provides insights with respect to the buildup of owner equity. As an example, Exhibit 1.1 shows the total payment and the amount of principal and interest for the $100,000 loan with a 6.0% interest rate (or *note rate*, as it is often called) for the life of the loan.

The exhibit shows that the payment is comprised mostly of interest in the early period of the loan. Since interest is calculated from a progressively declining balance, the amount of interest paid declines over time. In this calculation, since the aggregate payment is fixed, the principal component consequently increases over time. In fact, the exhibit shows that the unpaid principal balance in month 60 is $93,054, which means that only $6,946 of the $35,973 in payments made by the borrower up to that point in time consisted of principal. However, as the loan seasons, the payment is increasingly allocated to principal. The crossover point in the example (i.e., where the principal and interest components of the payment are equal) for this loan occurs in month 222.

Loans with shorter amortization schedules (e.g., 15-year loans) allow for buildup of equity at a much faster rate. Exhibit 1.2 shows the outstanding

EXHIBIT 1.1 Monthly Payment Breakdown for a $100,000 Fixed Rate Loan at 6.0% Rate with a 30-Year Term (fixed payment of $599.55 per month)

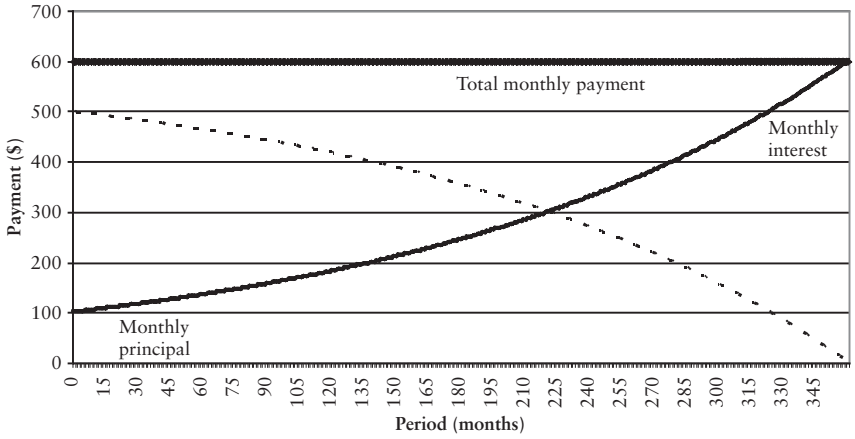
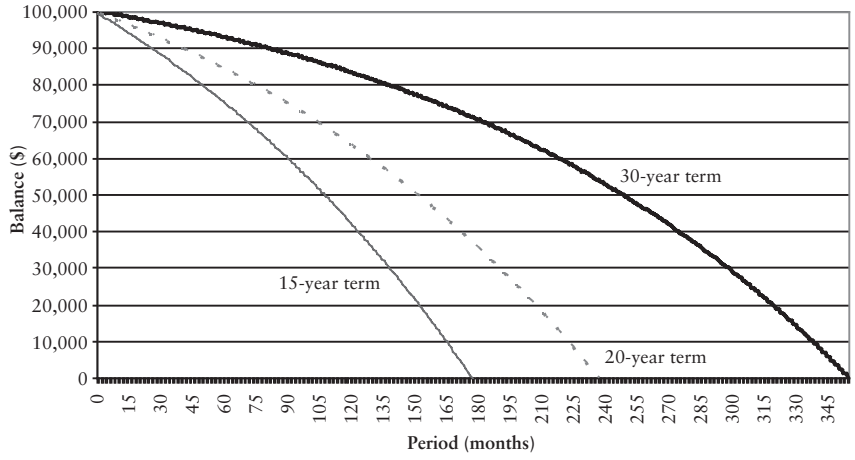
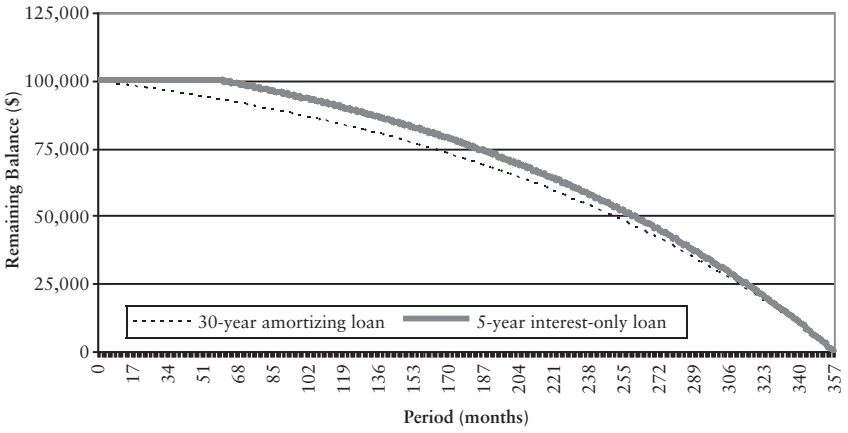


EXHIBIT 1.2 Balances for $100,000 6.0% Fixed Rate Loan over Different Original Terms



balance of a $100,000 loan with a 6.0% note rate using 30-, 20-, and 15-year amortization terms. In contrast to the $93,054 remaining balance on the 30-year loan, the remaining balances on 20- and 15-year loan in month 60 are $84,899 and $76,008, respectively. In LTV terms, if the purchase price of the home is $125,000 (creating an initial LTV of 80%), the

EXHIBIT 1.3 Remaining Principal Balance Outstanding for $100,000 6% Loan, Fully Amortizing versus Five-Year Interest-Only Loans



LTV in month 60 on the 15-year loan is 61% (versus 74% for the 30-year loan). Finally, while 50% of the 30-year loan balance is paid off in month 252, the halfway mark is reached in month 154 with a 20-year term, and month 110 for a 15-year loan.

Patterns of borrower equity accumulation due to amortization are important in understanding the attributes of interest-only loans. Exhibit 1.3 compares the remaining balances over time for the previously described fully amortizing $100,000 loan with a 6% rate, versus an interest-only loan with the same rate and term. A fully amortizing loan would have a monthly payment of $599.55, and would have reduced its principal balance by $6,946 at the end of five years. The interest-only loan, by definition, would amortize none of the principal over the same period. It would have an initial monthly payment at the 6% rate of $500, which would increase to $644 when the loan recasts in month 60. The 29% increase in the payment results from the loan's balance being amortized over the remaining term of 300 months. As Exhibit 1.3 indicates, the remaining balance of the interest-only loan amortizes faster than the fully amortizing loan because of the higher payment, although the interest-only loan's remaining balance is greater than that of the amortizing loan. The LTV of the amortizing loan (assuming a purchase price of $125,000 and an original LTV of 80%) declines to roughly 74% by month 60 and 72% in month 80. The interest-only loan has an 80% LTV through the first 60 months after issuance, but by month 80 the LTV declines to 77.5%.

For amortizing ARM loans, the initial payment is calculated at the initial note rate for the full 360-month term. At the first reset, and at every

subsequent adjustment, the loan is recast, and the monthly payment schedule is recalculated using the new note rate and the remaining term of the loan. For example, payments on a five-year hybrid ARM with a 5.5% note rate would initially be calculated as a 5.5% loan with a 360-month term. If the loan resets to a 6.5% rate after five years (based on both the underlying index and the loan's margin), the payment is calculated using a 6.5% note rate, the remaining balance in month 60, and a 300-month term. In the following year, the payment would be recalculated again using the remaining balance and prevailing rate (depending on the performance of the index referenced by the loan) and a 288-month term. In this case, the loan's initial monthly payment would be $568; in month 60, the loan's payment would change to $624, or the payment at a 6.5% rate for 300 months on a $92,460 remaining balance.

The payments on an interest-only hybrid ARM are similar to those of a fixed rate, interest-only loan. Using the rate structure described above, an interest-only 5/1 hybrid ARM would have an initial payment of $458. After the 60-month fixed rate, interest-only period, the monthly payments would reset at $675, an increase of roughly 47%. This increase represents the payment shock discussed previously. Depending on the loan's margin and the level of the reference index, borrowers seeking to avoid a sharp increase in monthly payments often attempt to refinance their loans into cheaper available products. The desire to mitigate payment shock was also largely responsible for the growth in hybrid ARMs with noncontiguous resets. Since these loans essentially separate the rate reset and payment recast, the payment increases were spread over two periods, reducing the impact of a large one-time increase in payment.

The payment structure for negative amortization ARM loans is different and highly complex. The most commonly issued form of products that allow negative amortization are so-called "payment-option loans," which are variations on traditional annual-reset ARMs. The loans have an introductory rate that is effective for a short period of time (either one or three months). After the initial period, the loan's rate changes monthly, based on changes in the reference index. The borrower's minimum or "required" payment, however, does not change until month 13. The initial or teaser payment is initially calculated to fully amortize the loan over 30 years at the introductory rate. After a year, and in one-year intervals thereafter, the loan is recast. The minimum payment is recalculated based on the loan's margin, the index level effective at that time, and the remaining balance and term on the loan. However, the increase in the loan's minimum monthly payment is subject to a 7.5% cap.[1]

[1]Note that this cap functions differently than those in the hybrid market, which are based on changes in the loan's rate rather than payment.

The minimum payment may not be sufficient to fully pay the loan's interest, based on its effective rate. This may occur if the loan's index and margin are such that the minimum payment is lower than the interest payment, or if the minimum payment is constrained by the 7.5% payment cap. In that event, the loan undergoes negative amortization, where the unpaid amount of interest is added to the principal balance. Negative amortization is typically limited to 115% of the original loan balance (or 110% in a few states). If this threshold is reached, the loan is immediately recast to amortize the current principal amount over the remaining term of the loan. Under all circumstances, the loan is automatically recast periodically, with payments calculated based on the current loan balance and the remaining term of the loan. At this point, the payment change is not subject to the 7.5% payment cap—a condition that also holds true if the loan recasts because the negative amortization cap is reached. (The first mandatory recast is generally at the beginning of either year 5 or 10; in either case, the loan will subsequently recast every five years thereafter.)

RISKS ASSOCIATED WITH MORTGAGES AND MORTGAGE PRODUCTS

Holders of fixed income investments ordinarily deal with interest rate risk, or the risk that changes in the level of market interest rates will cause fluctuations in the market value of such investments. However, mortgages and associated mortgage products have additional risks associated with them that are unique to the products and require additional analysis. We conclude this chapter with a discussion of these risks.

Prepayment Risk

In a previous section, we noted that obligors have the ability to prepay their loans before they mature. For the holder of the mortgage asset, the borrower's prepayment option creates a unique form of risk. In cases where the obligor refinances the loan in order to capitalize on a drop in market rates, the investor has a high-yielding asset pay off, and it can be replaced only with an asset carrying a lower yield. Prepayment risk is analogous to "call risk" for corporate and municipal bonds in terms of its impact on returns, and also creates uncertainty with respect to the timing of investors' cash flows. In addition, changing prepayment "speeds" due to interest rate moves cause variations in the cash flows of mortgages and securities collateralized by mortgage products, strongly influencing their relative performance and making them difficult and expensive to hedge.

While we address both the factors driving prepayment behavior and the metrics used to measure prepayment speeds later in this text, a brief introduction at this juncture will be helpful. Prepayments are phenomena resulting from decisions made by the borrower and/or the lender, and occur for the following reasons:

1. The sale of the property (due to normal mobility, as well as death and divorce).
2. The destruction of the property by fire or other disaster.
3. A default on the part of the borrower (net of losses).
4. Curtailments (i.e., partial prepayments).
5. Refinancing.

Prepayments attributable to reasons 1 and 2 are referred to under the broad rubric of "turnover." Turnover rates tend to be fairly stable over time, but are strongly influenced by the health of the housing market, specifically the levels of real estate appreciation and the volume of existing home sales. Refinancing activity can be, as noted earlier in this chapter, categorized as either "rate and term" or "cash-out" refinancings. Rate-and-term (or "no cash") transactions generally depend on a borrower's ability to obtain a new loan with either a lower rate or a smaller payment. This activity is therefore dependent on the level of interest rates, the shape of the yield curve (since short interest rates strongly influence ARM pricing) and the availability of alternative loan products. These factors also impact cash-out activity, although a primary driver of cash-out refinancings remains home price appreciation; the ability to borrow additional funds against a property is contingent on the property having appreciated in price.

The paradigm in mortgages is thus fairly straightforward. Mortgages with low note rates (that are "out-of-the-money," to borrow a term from the option market) normally prepay fairly slowly and steadily, while loans carrying higher rates (and are "in-the-money") are prone to experience spikes in prepayments due to refinancings when rates decline. In turn, the relationship between a loan's note rate and the prevailing level of mortgage rates dictates whether the borrower has an incentive to refinance.

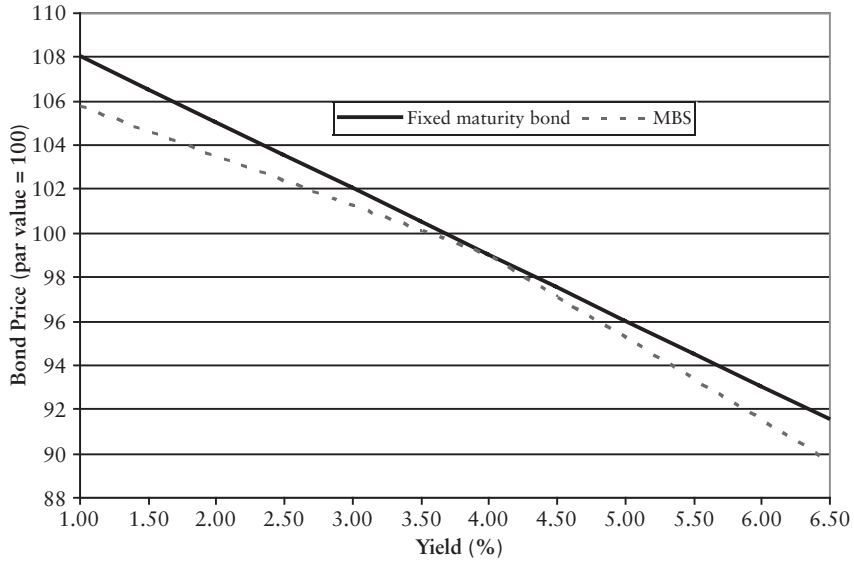
It is important to understand how changes in prepayment rates impact the performance of mortgages and MBS. Since prepayments increase as bond prices rise and market yields are declining, mortgages shorten in average life and duration when the bond markets rally, constraining their price appreciation. Conversely, rising yields cause prepayments to slow and bond durations to extend, resulting in a greater drop in price than experienced by more traditional (i.e., option-free) fixed income products. As a result, the price performance of mortgages and MBS tends to lag that of comparable

fixed maturity instruments (such as Treasury notes) when the prevailing level of yields increases.

This phenomenon is generically described as ***negative convexity***. The effect of changing prepayment speeds on mortgage durations, based on movements in interest rates, is precisely the opposite of what a bondholder would desire. (Fixed income portfolio managers, for example, extend durations as rates decline, and shorten them when rates rise.) The price performance of mortgages and MBS is, therefore, decidedly nonlinear in nature, and the product will underperform assets that do not exhibit negatively convex behavior as rates decline.

Exhibit 1.4 shows a graphic representation of this behavior. Investors are generally compensated for the lagging price performance of MBS through higher base-case yields. However, the necessity of managing negative convexity and prepayment risk on the part of investors involves fairly active management of MBS portfolios, and creates both higher hedging costs and the possibility of losses due to estimation and modeling error. In turn, this creates the desire on the part of some investors to limit their exposure to prepayments by investing in bonds where prepayment risk is transferred within the structure. This type of risk mitigation is central to the structured MBS market, and will be discussed in depth later in this book.

EXHIBIT 1.4 Performance Profile of Hypothetical Fixed Maturity Bond versus MBS



Credit and Default Risk

Analysis of the credit exposure in the mortgage sector is different from the assessment of credit risk in most other fixed income instruments because it requires:

- Quantifying and stratifying the characteristics of the thousands of loans that underlie the mortgage investment.
- Estimating how these attributes will translate into performance based on standard metrics, and the evaluation of reasonable best-, worst-, and likely-case performance.
- Calculating returns based on these scenarios.

In a prior section, some of the factors (credit scores, LTVs, etc.) that are used to gauge the creditworthiness of borrowers and the likelihood of a principal loss on a loan were discussed. Many of the same measures are also used in evaluating the creditworthiness of a mortgage pool. For example, weighted average credit scores and LTVs are routinely calculated, and stratifications of these characteristics (along with documentation styles and other attributes) are used in the credit evaluation of the pool. In addition to these characteristics of the loans, the following metrics are also utilized in the a posteriori evaluation of a mortgage pool or security.

Delinquencies

These measures are designed to gauge whether borrowers are current on their loan payments or, if they are late, stratifying them according to the seriousness of the delinquency. The most common convention for classifying delinquencies is one promulgated by the Office of Thrift Supervision; this "OTS" method classifies loans as follows:

- Payment due date to 30 days late: *Current*
- 30–60 days late: *30 days delinquent*
- 60–90 days late: *60 days delinquent*
- More than 90 days late: *90+ days delinquent*

Defaults

At some point in their existence, many delinquent loans become current, as the condition leading to the delinquency (e.g., job loss, illness, etc.) resolves itself. However, some portion of the delinquent loan universe ends up in default. By definition, default is the point where the borrower loses title to the

property in question. Default generally occurs for loans that are 90+ days delinquent, although loans on which the borrower goes into bankruptcy may be classified as defaulted at an earlier point in time.

The decline in mortgage credit performance after 2006 required new terminology to describe behavior that had not been previously been experienced to any significant degree. As noted previously, one new phenomenon was strategic default, which resulted from the severe decline in home prices after their 2006 peak. Another was the advent of *early-pay defaults* (EPDs). Mortgage credit analysis has traditionally assumed a significant lag between the issuance of a loan and the point in time that a borrower would default. Beginning in 2006, however, investors began to see large numbers of defaults on very new loans; in some cases, borrowers never made even their first loan payment. (The latter phenomenon came to be known as *first-pay defaults*, or FPDs.) Theses behaviors were attributed to several factors, including widespread speculation on real estate, outright fraud, and home purchases that were completely and immediately unaffordable.

Loss Severity

Since the lender has a lien on the borrower's property, some of the value of the loan can be recovered through the foreclosure process. Loss severity measures the face value of the loss on a loan after foreclosure is completed. Loss severities are heavily influenced by a loan's current LTV, which is a function of both the original LTV and any appreciation (or depreciation) in the property's value. However, in the event of a default, loans with relatively low current LTVs can also result in losses, generally for two reasons:

- The appraised value of the property may be high relative to the property's actual market value.
- There are costs and foregone income associated with the foreclosure process.

As with prepayments, the measurement of estimated and historical credit performance is discussed later in this text.

In light of these factors, the process of evaluating the credit-adjusted performance of a group of loans involves first gauging and modeling the expected delinquencies, defaults, and loss severities of the pool or security based on its credit characteristics. Subsequently, loss-adjusted yields and returns can be generated. It should be noted that investors in some segments of the MBS market do not engage in detailed credit analysis; buyers of agency pools, for example, generally rely on the guaranty of the agency in question. However, investors in private-label MBS that relied on the ratings

provided by the credit rating agencies experienced capital losses when their bonds were downgraded and/or the bond's credit support proved to be inadequate. This means that even the most senior securities in private-label deals must undergo credit analysis, as their returns will be tied to the performance of the underlying loan collateral.

CONCEPTS PRESENTED IN THIS CHAPTER (IN ORDER OF PRESENTATION)

Mortgage
Servicers
Lien Status
Original Loan Term
Credit Classifications (Prime/Subprime/Alternative-A)
FICO (credit) Scores
Loan-to-Value Ratio (LTV)
Current LTV (CuLTV)
Combined LTV (CLTV)
Income Ratios
Documentation
Fixed Rate Mortgages
Adjustable Rate Mortgages (ARMs)
Hybrid (Fixed Period) ARMs
Payment-Option ARMs
Amortization
Government (FHA/VA) Loans
Conventional Loans
Government-Sponsored Enterprises (GSEs)
Conforming Balance Loans
Jumbo Loans
Prepayments
Negative Convexity
Delinquencies
Defaults
Loss Severity