A wide variety of mortgage instrument designs have been created to meet the varying needs of borrowers and lenders. In general, there is no one ideal mortgage instrument for a market, although as explained below there are clearly instruments that are not appropriate for some markets or types of lenders and borrowers. A robust mortgage market will have a variety of instruments that can be tailored to the varying needs of borrowers and lenders.

What are the desirable attributes of a mortgage instrument from a borrower's and a lender's perspective? A borrower is interested in the affordability of the loan, both at inception and over its life. The lender is interested in getting an acceptable risk-adjusted rate of return over the life of the loan. This presents a conundrum—often an attempt to improve the attractiveness of the loan for the borrower or lender creates a problem for the other party. For example, an interest-rate cap on an adjustable-rate mortgage (ARM) reduces the potential payment shock and default risk for borrowers but can reduce the yield of the loan for lenders.
Fixed-Rate Mortgages

Perhaps the most important parameter in mortgage-instrument design is the determination of the periodic interest rate. The critical factor is the level of inflation in the economy. Inflation creates problems for housing finance as it increases the level of interest rates (to compensate for expected future price increases) and their variability. As shown in figure 3.1, the appropriate class of instruments for a market will depend on the inflationary environment (both the level and the volatility of prices and interest rates).

Fixed-rate mortgages (FRMs) are most suitable for low to moderate and stable inflation and interest-rate environments. In such environments, the premiums for expected inflation and its variability are relatively low and stable. In higher and more volatile inflation environments, FRMs become either prohibitively expensive or too risky for lenders to offer. There are some notable examples of spectacular failures for lenders offering FRMs in high-inflation environments. In the early 1980s, Mexican banks were required to use FRMs at rates set by the government. An inflation spike following currency devaluation bankrupted the banks and led to their nationalization.

Long-term FRMs present formidable risk-management challenges for lenders, which is why they can be safely offered only in countries with devel-

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**Figure 3.1. Instrument Alternatives**

<table>
<thead>
<tr>
<th>Inflation scenario</th>
<th>Instrument choice</th>
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</thead>
<tbody>
<tr>
<td>Moderate (low volatility)</td>
<td>Fixed rate</td>
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<tr>
<td>Moderate/Declining</td>
<td>Short-term fixed (rollover)</td>
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<tr>
<td>High (moderate volatility)</td>
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<tr>
<td>High/Accelerating</td>
<td>Foreign exchange (linked)</td>
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<td></td>
<td>PLAM/DIM</td>
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</table>

*Source: Adapted from Dübel 2005.*
*Note: PLAM = price-level adjusted mortgage; DIM = dual index mortgage.*
oped capital markets. There are two sources of risk for lenders—interest-rate risk arising from a mismatch between the durations of lender assets and liabilities and prepayment risk arising from the interest-rate sensitivity of borrower repayment. Interest-rate risk led to the bankruptcy of a majority of the savings and loan (S&L) industry in the United States in the 1980s. It is very difficult to manage in the absence of developed capital markets and investors with long-term liabilities (for example, pension and insurance companies). As such, these products are a luxury good unaffordable in most emerging markets.

In most countries offering long-term FRMs, borrowers are charged a prepayment penalty for the option to repay their loan early; however, a prepayment penalty limits the term over which the rate can be fixed—typically from 5 years (for example, Canada, Netherlands) up to 10 years (Germany). The magnitude and term over which a prepayment penalty can be charged is a matter of controversy. For example, in France the penalty is limited to 3 percent of the outstanding balance, which lenders claim does not adequately compensate them for the risk. In Germany, the lender can charge a yield-maintenance prepayment penalty—but the term over which the penalty can be applied is 10 years (for a 25–30 year amortization period). There has been considerable debate in Germany over whether borrowers can prepay when they move and how the penalty is calculated (for example, whether lender profits are an acceptable component in the penalty). Significantly, there are only two countries that have long-term FRMs with unlimited prepayment options for borrowers—Denmark and the United States. In those countries, almost all of the FRMs are financed in the capital markets, where sophisticated investors can price and manage the prepayment risk. The cost of the option is embedded in the interest rate and can vary substantially over time, as shown in figure 3.2.

In Canada and a number of European countries, the dominant instrument is a rollover or short-term FRM. The rate of these instruments is initially fixed and adjusts periodically (for example, every one to five years) with a longer amortization period. The borrower is subject to a prepayment penalty for repayment during the fixed-rate term, but can typically make partial prepayments without

1. For example, if interest rates fall, borrowers will refinance their loans, shortening the maturity and exposing the lender to reinvestment risk. If rates rise, borrowers may keep their loans longer, creating extension risk for lenders.
penalty. These instruments work well in markets where lenders can issue matching term debt or use swap markets to lengthen their liability maturities. As such, they may be useful in more mature emerging markets where lenders have access to medium-term funds. Borrowers benefit from a fixed rate during a limited period, and can typically choose the term over which their rate is fixed; however, they can be exposed to unlimited rate change at the end of their fixed-rate period, as the rate is market determined at adjustment.

Adjustable-Rate Mortgages

The most prevalent instrument class in the world is undoubtedly the adjustable- or variable-rate mortgage (ARM). These loans perform well in moderate inflation scenarios, as the rate can be adjusted to changes in inflation and real interest rates. Their popularity derives from two characteristics: depository lenders lessen their interest-rate risk by offering ARMs and borrowers improve initial affordability with ARMs because of the relatively low starting rate.\(^2\) For borrowers it is somewhat of a gamble that their income will keep

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2. Lenders seeking to originate ARMs often offer starting rates below the natural (for example, index + margin) rate to enhance initial affordability. These “teaser” rates can create payment problems for borrowers as the loans adjust to market.
pace with payment changes—this characteristic means that ARMs are not suitable for all borrowers (that is, borrowers with unstable or fixed incomes) or high-inflation economies. ARMs are well suited to moderately inflationary environments where interest rates, prices, and incomes move together with modest changes. They are more problematic in high-inflation environments characterized by large interest rate changes and sluggish income change.

The ability to change the interest rate makes ARMs appealing to lenders, as they allow lenders to better manage interest-rate risk (particularly for banks with short-term deposit funding). In turn, ARMs allow lenders to offer lower margins (reduced exposure to interest-rate risks) and extend their loan maturity (potential immediate and significant affordability gains).

Figure 3.3 shows the proportion of ARMs in developed markets.

There are two important ARM characteristics that deserve mention. First is the index used (if any) to determine rate adjustments. At one extreme there may be no index—the lender may adjust the rate at its discretion. This is

Figure 3.3. Mortgage Products: Percentage of Adjustable-Rate Loans


Note: Adjustable-rate loans are defined as those where the interest rate is floating for life or fixed for the first one to five years and then floating or reset.
the standard instrument used in the United Kingdom and other countries that adopted the building society model. In most cases, the lender changes the rate according to changes in its cost of funds. This can be advantageous to borrowers if the lender primarily raises funds through retail deposits. These liabilities adjust less rapidly than money-market rates and shield borrowers somewhat from interest rate fluctuations; however, in less competitive or developed markets this instrument can create problems for borrowers if lenders abuse their privilege by manipulating rates.

In many countries, lenders are obliged to use a published index which is beyond their control and transparent to borrowers and the market. While these characteristics are useful to borrowers, they can create complexity for borrowers and may lead to greater payment volatility if the indices are more volatile than retail funds. Spain has the most developed regulations on ARM indices, allowing a mix of indices as determined by the Bank of Spain. Amendments to the mortgage law in Turkey in 2007 allowed variable rate mortgages but required the use of indices as determined by the Central Bank.

The other important characteristics of ARMs are caps on the periodic rate or payment increase and the maximum (minimum) rate for the life of the loan. Caps represent an important consumer safeguard, but they come at a cost, as they potentially reduce the return on the loan to the lender and the attractiveness of the product and are expensive to hedge—which is anyway not possible in most emerging markets due to a lack of derivative instruments. Caps are more common in countries that require indexation of ARMs (United States, Spain, France) and less common in countries with discretionary ARMs (Australia, United Kingdom). The recent mortgage law in Turkey requires a life-of-loan cap but leaves it to the lender to determine the parameters. In some countries (Malaysia), caps are limited to social housing loans.

ARMs have become more heterogeneous over time. In Australia and the United Kingdom, the most common instrument is the standard variable-rate mortgage (a reviewable instrument), which is often preceded by a one-to two-year initial fixed-rate period. In the United States, hybrid ARMs are common. In a hybrid ARM, the rate is fixed for one to five years, after which

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3. See http://www.bde.es/tipos/tipos.htm as well as the legal database on the Bank of Spain Web site.
Box 3.1. The Limits of Adjustable-Rate Mortgages (ARMs)

Excessively risky ARMs are at the heart of the subprime crisis in the United States. As underwriting standards were relaxed beginning in 2004 (in anticipation of continued house-price inflation), lenders began offering loans with fixed rates for two to three years, after which the loan rate became adjustable (so-called 2/28 and 3/27 loans). The initial fixed rate was below market and the margin to which the loan adjusted was large, guaranteeing a payment shock upon adjustment. The loans were made with the assumption that they would be refinanced at the end of the fixed rate period. The combination of funding problems for non-prime lenders and falling house prices invalidated this assumption. Another potential problem loan is the pay-option ARM.* Many borrowers that take this loan are qualified and make their initial payments based on a deeply discounted rate (1 percent). The unpaid interest is capitalized and the loan negatively amortizes. Although this loan was typically provided to borrowers with a good credit history, the combination of high initial loan-to-value, negative amortization, and potential payment shock makes it exceedingly risky in a falling house-price environment. The differential experience of these instruments is shown in the figure below.

* A typical pay-option ARM gives the borrower four amortization choices: minimum (typically, the first month below market rate), interest only, 15- or 30-year amortizing). Most pay-option ARMs have a very low initial rate used to qualify the borrower. The rate adjusts after one month to one year, subject to a payment cap. These features generate negative amortization. The loans will recast to full amortization either at the end of five years or when a negative amortization cap is applied (110%–125% of the original balance), which can generate significant payment shock.
the loan becomes an indexed adjustable rate instrument. ARMs in Thailand can be of flexible term. The payment remains constant and the term adjusts with interest rates. A disadvantage of this instrument is the requirement for the initial term to be less than the maximum to allow flexibility to increase the term if rates rise.5

Indexed Mortgages

A final class of products is instruments designed for high and volatile inflation environments. These instruments attempt to reduce the impact of inflation on nominal interest rates to make loans initially more affordable. They also index payments to inflation or income in an attempt to make loans more affordable over time. The most popular are the price-level adjusted mortgage (PLAM) and the dual index mortgage (DIM).

The PLAM is an FRM in real terms—the rate is set at the beginning of the contract and fixed for the life of the loan, and principal balance and payment are adjusted periodically for changes in a price index. Typically, the balance

Figure 3.4. Mexican Mortgage Instrument Payment Performance

Source: Lea and Bernstein 1996.
Note: Based on actual data through March 1996; projected thereafter. PLAM = Price-level Adjusted Mortgage; DIM = Dual Index Mortgage.

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5. The shorter initial term increases the initial monthly payment, reducing affordability.
is adjusted frequently (monthly) and the payment less frequently (annually), leading to negative amortization on the loans. PLAMs have been used successfully in Chile since the early 1980s. They are primarily financed through the issuance of matching mortgage bonds purchased by institutional investors (particularly pension funds that find that the real rate bonds are a very good match for the real rate pension liabilities). Chile has fortunately benefited from a stable and declining inflation environment since widespread use of the instrument began.

The experience with PLAMs in other markets has not been as satisfactory. Commercial banks in Mexico were using PLAMs in the early 1990s. The sharp devaluation of 1994 (the “Tequila crisis”) led to a rapid increase in inflation (from 10 percent to 50 percent and higher within a year). The resulting payment shock was unbearable for borrowers and led to massive defaults (over 50 percent of mortgages went into default). Figures 3.4 and 3.5 show the relative performance of PLAM and DIM mortgages before and after

\[\text{Balance outstanding (N$)}\]


Source: Mortgage Bankers Association 2006.

Note: Based on actual rates through March 1996, forecast thereafter by CCS. CCS = Cardiff Consulting Services; PLAM = Price-level Adjusted Mortgage; DIM = Dual Index Mortgage.
Box 3.2. Colombia: Difficulties with Indexed Mortgages

Colombian savings and loans, the Corporaciones de Ahorro y Vivienda, had a relatively long and successful experience with PLAMs until the late 1990s. A sharp deterioration in the economy, however, along with a Supreme Court ruling that required a change in the index, led to high levels of default and a serious asset-liability mismatch for lenders. By the late 1990s, the Corporaciones de Ahorro y Vivienda had developed a sizeable interest rate imbalance between their deposit liabilities that paid a nominal peso rate of interest and their mortgage loans that were indexed to the inflation rate through the Unidad de Poder Adquisitivo Constante (Constant Purchasing Power Unit of Exchange; UPAC) price index. The dramatic increase in deposit interest rates in 1998 led the government to modify the UPAC formula to incorporate both changes in interest rates and inflation in the determination of the value of the UPAC index applied to mortgage loans. Colombia’s Constitutional Court subsequently ruled against the change in the indexation mechanism and instructed banks to restate the value of mortgage loans back to the time when the original change to the UPAC index was made, applying only the inflation index to the newly named Unidad de Valor Real (Real Value Unit; UVR) index. The downward adjustment to the value of the banks’ mortgage loans that this caused further exacerbated loan portfolio problems that were already severe after debtor defaults resulted from rising indexed interest rates.

the devaluation (Lea and Bernstein 1996). While the DIM had more modest payment increases, the negative amortization was considerably greater. The DIM attempts to address the affordability problem by indexing the payments to wages but allowing the accrual rate on the loan to vary with inflation or a nominal interest rate. Once again, the basic mortgage design dilemma arises—in an attempt to maintain affordability for the borrower over time, a new problem is created: if the wage and rate indices diverge for a period of time the loan may not amortize. This happened to several vintages of DIMs in Mexico during the 1990s because of the Tequila crisis and aggressive initial terms (although these loans performed better than the PLAMs). DIMs were

6. A particular issue in Mexico is the use of the administratively determined minimum wage for payment indexing.
also used in Brazil. Another problem occurred there, however—the government manipulated the payment index for political reasons, bankrupting the mortgage finance system. DIMs were introduced in Poland with more conservative parameters but never achieved consumer acceptance because of their inherent complexity (Chiquier 1998).

DIMs create asset-liability management problems for borrowers and lenders. They can experience large negative amortization, which can result in negative equity and greater default risk if house prices are not rising as fast as the balance on the loan. Additionally, DIMs may have extended durations (the term can lengthen to accommodate the negative amortization, but typically up to a limit), potentially creating a positive remaining balance at final maturity. The Mexican government has attempted to deal with both of these problems. In the early years of DIM usage, the government underwrote the risk of a positive balance at maturity for (government-owned) lenders. More recently, the national mortgage bank (Sociedad Hipotecaria Federal; SHF) developed a novel scheme to reduce the funding risk of DIMs, allowing them to be financed through the issuance of price-level adjusted securities. SHF offers a wage-price swap for DIMs. The borrower pays an up-front premium of 60 basis points to a fund that balances the differences between the cash flows from a pool of DIM mortgages and those of price-level adjusted securities. If wages lag prices, the fund contributes additional cash to the security pool to make up the shortfall. If wages rise faster than prices, the fund balance increases, in effect providing a great insurance against future real-wage decreases.

Several lessons can be drawn in examining the experience with high inflation mortgages. First, although they can ameliorate the impact of inflation on mortgage payments, improving affordability and reducing the risk of default, they can only do so within a range of inflationary outcomes. Severe shocks like those seen in Colombia and Mexico will overwhelm the instrument, leading to adverse results. Second, there must be a matched funding source for the instruments. Lenders without a matching liability will not be able to manage the cash-flow risk they generate. Finally, these instruments are very complex, presenting challenges to both lenders and borrowers. It is likely that many borrowers with these loans do not really understand their dynamics—past experience has suggested the lender’s staff may not understand them as well.
Another indexed instrument gaining popularity in relatively high interest rate environments are loans indexed by foreign exchange (FX). These loans adjust balances and payments to changes in the exchange rate or are denominated in foreign currency. FX-indexed loans have been especially popular in transition economies (over 50 percent of loans in Poland, Romania). These loans carry great risks for borrowers and lenders. A sharp devaluation can lead to a payment shock for borrowers whose incomes are in the domestic currency. Similarly, a devaluation can lead to significant losses for unhedged lenders. The potential for this occurrence was demonstrated in Turkey, with a 24 percent devaluation of the Turkish lira in 2006. Fortunately, there were relatively few Euro-denominated mortgages in Turkey at the time.

Several central banks, including Poland and Romania, have attempted to get banks to reduce their FX lending through imposition of higher reserve or capital requirements on FX-indexed loans (see chapter 8 on consumer protection, which deals with this subject in greater depth).

**Interest-Only Mortgages**

Another key characteristic of mortgage design is the amortization formula. The standard mortgage instrument is a level-payment, fully amortizing loan.\(^7\) This rather rigid design calls for equal monthly payments over the life of the loan.\(^8\) The dominance of the level payment loan has been dictated by the servicing systems available to lenders and the desire to keep borrowers on a steady payment schedule. This design, however, is not suitable for borrowers with uneven incomes or who are suffering from a temporary income shortfall.

In recent years, there has been a rise in interest-only mortgages in the United Kingdom, the United States, and several other developed markets. A

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7. There are variants to this design, including the constant amortization mortgage, which has a level principal payment and declining total payment over time, and the graduated payment mortgage, which has a rising payment over the first few years (and resultant negative amortization) before leveling out at a constant payment higher than a standard mortgage loan for the remaining life. The constant amortization mortgage has the disadvantage of higher initial monthly payment, reducing affordability. The graduated payment mortgage enhances affordability at the beginning of the loan—with the disadvantages of possible payment shock, negative amortization potentially deflating borrower equity, and longer duration.

8. For ARMs, the payment is recalculated at the new rate upon adjustment based on amortization of the loan in equal payments over the remaining term.
Figure 3.6. Amortization by Interest Rate Type in the United States (U.S. H1 2006)

Source: Mortgage Bankers Association (United States) 2006.

Figure 3.7. Method of Repayment in the United Kingdom

Source: Council of Mortgage Lenders (United Kingdom) 2006.
primary motivation has been to enhance affordability. The structures differ (figures 3.6 and 3.7). In the United States, the loans are interest only for a number of years (for example, five to ten), after which they revert to amortizing (with concomitant increase in payments to reflect amortization over the remaining term). The loans can be fixed or variable rate. In the United Kingdom, interest-only mortgages are variable rate, but the majority do not have an identified repayment vehicle (perhaps a legacy of the endowment mortgage, which was an interest-only loan with a companion insurance policy designed to repay the principal upon maturity—but which often did not during the 1990s).

In recent years, the flexible mortgage has been introduced in a number of developed countries. The flexible mortgage allows borrowers to take payment holidays (typically limited) without penalty. This feature is attractive to borrowers with uneven income (for example, teachers and commissioned salespersons, or those subject to short-term unemployment). More advanced versions (for example, the pay-option ARM) in the United States allow borrowers to choose from a menu of payment options, including negative amortization, to accelerated amortization. While providing affordability benefits, flexible mortgages may carry more risk for borrowers and lenders. As they have not yet gone through an interest rate cycle, it is too early to judge their performance. Default rates on pay-option ARMs have been strongly increasing in the United States.

**Reverse Mortgages**

Another class of mortgage, the reverse-annuity mortgage or shared equity loan, is targeted at aging populations. These loans allow homeowners to consume some or all of their housing equity to support their retirement income needs. The borrower can take a lifetime annuity, term annuity, or lump-sum payment at funding and the lender gets a portion of the property value (or appreciation) upon sale or death. The amount of the payment depends on the equity in the home and whether the payments are for a fixed term or for the life of the borrower. In the United States, the borrower can remain in the home until they die, and the loans are insured by the government mortgage insurer (U.S. Federal Housing Administration [FHA]). Such loans are likely to gain in popularity as the population ages.
Lessons for Emerging Markets

The choice of mortgage instrument should be consistent with the macroeconomic environment. FRMs will not work for lenders in volatile macroeconomic environments. The risks are too great for lenders to manage and their mandated use will greatly restrict the flow of mortgage credit or lead to large losses for lenders. ARMs can work with moderate inflation, but the potential for payment shock is great in volatile environments. Indices increase transparency but also complexity. Interest rate and payment caps can reduce payment shock but at the cost of reduced expected yields for lenders, particularly if no hedging instruments are available. Loans have been designed for high-inflation environments with limited success. There is no free lunch—PLAMs, DIMs, and FX-linked mortgages carry many risks and will not substitute for the benefits of a low-inflation environment. With macroeconomic stability and financial deepening, a wider variety of instruments can be made available, including fixed-rate and non-constant amortization mortgages. Capital market funding, however, should be available before long-term FRMs are offered.