Improving housing finance in an inflationary environment: alternative residential mortgage instruments

George G. Kaufman and Eleanor Erdevig

Alternative mortgage instruments are mortgage plans designed to accommodate better than traditional mortgages the current needs of residential mortgage borrowers, mortgage lenders, or both. The long-term fixed-rate, fixed-payment mortgage became the prevalent type in the United States in the 1930s and served both borrowers and lenders well as long as price and interest rate movements were relatively small. But recent increases in the level and volatility of market interest rates have made this mortgage contract less desirable to lender and borrower alike.

A home is the largest single purchase that most Americans make and the largest single item in their wealth portfolio. Because of the magnitude of the expense—generally some two to three times the purchaser's annual income—a large portion of the purchase price of most homes is borrowed. The owner's downpayment, which represents the initial equity, is generally only 10 to 30 percent of the purchase price. As a result, the cost, terms, and availability of mortgage credit are an important part of the home purchase decision.

In recent years the cost of obtaining mortgage credit has increased sharply. For example, in 1971 the average interest rate on a 30-year single-family fixed-coupon, fixed-payment mortgage with a loan-to-value ratio of 90 percent was about 7¾ percent. In 1975 the rate on this mortgage had climbed to 9 percent, and in 1980 it reached 12½ percent. On a 90 percent fixed-rate, fixed-payment mortgage on a median price home of $24,800 in 1971, this represented monthly payments of $160. The payments on a new mortgage on a home of the same price would have increased to $182 in 1975 and $238 in 1980. But the median price of existing homes also increased, from $24,800 in 1971 to $62,200 in 1980. Thus, a rate of 12½ percent on a 90 percent fixed-rate, fixed-payment mortgage of $55,980 translates into monthly payments of $597.

Monthly payments have increased considerably faster than household income. In 1971 the annual sum of monthly payments was equal to 19 percent of the median family income of $10,285. In 1980 this percentage had almost doubled to 34 percent of an estimated median family income of $21,652.[1] Some households found this percentage too high to pay and, as a result, decided not to purchase a house. Because most homebuyers are already housed and will sell their homes when buying another, the higher mortgage rates reduce the turnover of existing homes and thus labor mobility, but have relatively little effect on the overall stock of housing. The demand for newly constructed housing is more severely impacted, but it accounts for only a small proportion of total housing. In the 1970s the average 1.7 million new units constructed annually accounted for only about 2.2 percent of the total housing stock of some 79 million units.

The heaviest burden of the increase in mortgage payments falls on first-time home buyers, who did not share in the rapid appreciation in home prices and the permissible tax-free transfer of gains from one home to another, and, in particular, on younger households, whose current incomes tend to be below the average for all households. In addi-

[1]Assumes an increase of 10 percent in 1980 over the reported median family income of $19,684 in 1979. Of course, the sizes and amenities of homes purchased in different years may be different.

tion, for these as well as other households, the burden of the mortgage payments may be expected to be greater at the beginning of the loan than later when the expected rate of inflation incorporated in the mortgage rate and in the monthly payment materializes and increases incomes. This payment pattern, which is generally referred to as the "tilt," will be analyzed more closely in later sections of the article. Because the tilt is common to many mortgage plans, a large number of borrowers would benefit from mortgage plans that would reduce the initial mortgage burden.

At the same time traditional mortgage lenders, such as savings and loan associations, commercial banks, and mutual savings banks, have become increasingly reluctant to make long-term, fixed-rate mortgage loans. Because of the operating characteristics of these institutions, many of the fixed-rate loans they have made in recent years have proven unprofitable. On the whole these institutions raise funds through short-term deposits. Through time, a series of successive short-term deposits, each at a fixed interest rate, is equivalent to a single long-term deposit at a variable interest rate. In order to charge an interest rate sufficient to cover the cost of the funds, other operating costs, and a competitive profit when they relend the funds as a long-term loan with the coupon or contract rate fixed for the maturity of the loan, the institutions must predict their future cost of funds over the life of the loan. If they predict their future deposit costs incorrectly, the loans may be unprofitable. Borrowing (or lending) on a fixed-interest rate basis for one maturity while lending (or borrowing) on a variable-rate basis for the same maturity is termed interest rate intermediation.

Interest rate intermediation

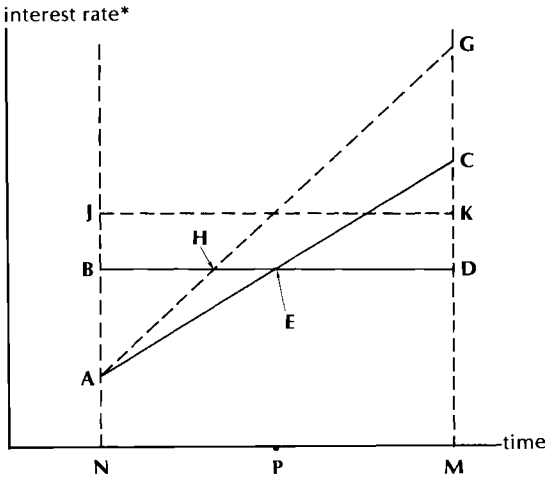
Economic theory suggests a relationship between short- and long-term interest rates. In equilibrium and assuming certainty of forecasts investors would be indifferent between buying two fixed-coupon rate securities differing only in term to maturity if the two securities were expected to yield the same interest return over the investors' expected holding period. If one fixed-rate security had a maturity less than that holding period, the proceeds would have to be reinvested in one or more successive securities. It follows that the investor must predict the rates on these successive securities in order to make a fully informed investment decision. If one alternative promised a higher return than the other, the funds would be invested in the one promising the higher return. By bidding up the price of the securities, this would serve to lower the expected interest rates on this alternative until the two alternatives promised the same average expected return.

In mathematical terms the yield on the long-term, fixed-coupon security is equal to an average of the current yield on the short-term security and the yields predicted on successive short-term securities over the life of the longer-term security. For a depository institution this relationship implies that the rate it charges on a long-term, fixed-coupon mortgage loan should be equal to the average of the rate it currently pays on short-term deposits and the rates it expects to pay on these deposits in the future plus operating costs and allowances for both the risk of default on the mortgage and a competitive profit.

This relationship is illustrated in figure 1. Interest rates are plotted on the vertical axis and time on the horizontal axis.[2] Assume that in the current period, N, the institution pays competitive interest rate A for one-period deposits and that this rate includes an allowance for operating costs and a competitive profit. The institution wants to make a fixed-rate loan for q periods to period M. What rate should it charge? The institution first needs to predict its one-period deposit rate in each period from N + 1 to M. If it expects the costs

[2]Because the interest on most securities is compound interest, it is necessary to plot the logarithm of (1 + i) on the vertical axis. But this may be interpreted as simply the interest rate. For the sake of simplicity, the diagram also assumes a nonamortized loan.

Figure 1. Determination of interest rate on fixed-rate mortgages depends on projection of future deposit rates



*Technically, interest rate on the vertical axis is measured in the form of ln(1+i).

of deposits to rise steadily to C along the straight line AC, the average deposit cost, B, is the rate it should charge on a long-term loan in order to make a competitive profit.

The expected total cost of the deposits is the area NACM. The expected revenue on the loan is the area in the rectangle NBDM. The two areas are equal, so that total expected revenues are equal to expected total deposit costs. This equality may also be seen by examining the differences between the interest rate earned on the loan and that expected to be paid on the deposits. In period N the profit is B - A. This profit, which is in addition to the competitive profit included in the deposit cost, is reduced steadily as deposit rates are expected to rise until the two rates are equal at E at time P. Thereafter, the deposit rate is expected to rise above the loan rate up to C - D at period M. Although the institution will experience losses from time P through time M, it breaks even over the entire period N - M as the loss triangle CDE is exactly equal to the earlier gain triangle ABE. These losses must be charged against the previous extra profits, which would be classified more accurately as reserves against future expected losses than as profits.

Note that if deposit rates had been expected to decline, the interest rate on the long-term, fixed-coupon loan would have been lower than the initial deposit rate. The institution would have experienced losses at the beginning of the period, but would have expected to recoup them later as deposit rates declined below the loan rate. During the loss period the institution is said to be experiencing a *liquidity problem* as its cash inflows are insufficient to satisfy its cash outflows. But this is expected to be only a temporary problem and may be accommodated by using the reserves accumulated in past periods of greater than competitive accounting profits.

Now assume that future deposit rates were predicted incorrectly. After a loan was made, the cost of deposits actually increased along line AG rather than AC, so that the cost of deposits was underestimated. The loan rate charged, B, is now insufficient to cover the actual cost of the deposits. The gain triangle ABH is smaller than the loss triangle DHG. This is a lasting loss and, if not offset quickly by unexpected gains experienced in periods in which the increase in deposit rates was overestimated and the loan rate charged was higher than necessary, will result in a *solvency problem*. In retrospect, the institution should have charged a loan rate of J.

Thus, the importance for long-term, fixed-rate lending of correctly predicting future deposit rates is clear. In making fixed-rate loans, the lender assumes all the risk of unfavorable interest rate changes over the life of the loan. It is effectively selling interest rate insurance to the borrower. Like any insurance company, it may be expected to charge a premium for this insurance, the size of which is dependent on the estimated degree of risk incurred. This premium is simply included in the interest rate charged the borrower.

Market interest rates also incorporate an inflation premium to compensate lenders for the expected loss in the value of their principal due to inflation over the period that the credit is outstanding. In recent years higher

and more volatile rates of inflation have caused market interest rates to be higher than most market participants—including most depository institutions—expected. As a result, many long-term loans made at fixed interest rates expected to be profitable at the time of origination have turned out to be unprofitable. That is, in retrospect the insurance premium charged was insufficient to compensate the lender for the loss incurred. In addition, the increased volatility of both inflation and interest rates has impaired the confidence of depository institutions in their ability to predict future deposit rates and therefore to estimate accurately the insurance premium to be charged.

Not only have depository institutions been faced with higher and more volatile market interest rates, but regulatory ceilings have limited the rates that they are permitted to pay on deposits. When market interest rates rise above the maximum interest rates permitted on deposits, savers withdraw their deposits to purchase unregulated financial instruments in the markets. To enable commercial banks and thrift institutions to compete more effectively for funds in the open market and to provide a more even flow of funds for home mortgage lending, the regulatory agencies authorized money market certificates (MMCs) in 1978 and small savers certificates (SSCs) in 1979, the rates on which are tied to market rates on Treasury securities. These moves were carried to their logical conclusion by the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA), which provides for phasing out interest rate ceilings on all time and savings deposits at depository institutions by March 31, 1986.[3] Consequently, the average cost of funds of depository institutions will increasingly reflect changes in market rates of interest and therefore be even more unpredictable in the future.

Because of the increased volatility in deposit rates, many institutions have become increasingly reluctant to engage in interest rate intermediation and to make long-term, fixed-rate loans. These institutions would benefit from long-term loans whose interest rates could vary more closely with their cost of funds. Unexpected increases in the cost of funds would be passed through to the borrower and leave the institution unaffected.[4]

Alternative mortgage instruments are designed to accommodate the new needs of both mortgage borrowers and lenders. Because the problems of borrowers and lenders differ, the mortgage plan best suited to one may not be the one best suited to the other. Risk averse mortgage lenders would benefit most from mortgages whose rates fluctuate closely with their cost of deposits, while younger mortgage borrowers stand to gain from mortgages whose initial monthly payments are low relative to their incomes. Unfortunately, these two objectives are not always mutually consistent. Mortgage plans with increased rate volatility may not reduce early monthly payments and will transfer interest risk from the lending institution to the borrower, who is often less willing and able to assume it. Mortgage plans with lower initial monthly payments need not increase rate flexibility and could result in monthly payments to the depository institution smaller than necessary to cover the monthly interest cost of the loan. Any shortfall would be added to the principal of the loan in the form of negative amortization and, by increasing the unpaid balance of the loan, would increase the risk of default. The increase in default risk may offset part or all of the benefit to the lender of the decline in interest rate risk from rate flexibility. The following sections describe a number of "alternative" mortgage plans, either already in use or proposed, and their advantages and disadvantages to lenders and borrowers.

[3]See "The Depository Institutions Deregulation and Monetary Control Act of 1980," *Economic Perspectives*, Federal Reserve Bank of Chicago (September/October 1980).

[4]Regulations adopted by the FHLBB, effective July 10, 1981, giving S&Ls broader latitude to engage in interest rate futures transactions, are also expected to reduce their net interest rate exposure. See *American Banker*, "Broad Powers Given S&Ls to Use Futures," Vol. 146, No. 130, Monday, July 6, 1981, page 1.

Adjustable-rate mortgages

Adjustable-rate mortgages (ARMs), as their name implies, are mortgage plans whose contract or coupon interest rates change periodically after origination according to some agreed upon conditions. Pure ARMs, that is, ARMs without any restrictions on rate changes, would eliminate the lending institution's interest rate exposure completely if the loan rate changed immediately every time the deposit rate changed and by exactly the same amount.[5] The change in the cost of funds effectively would be passed through to the mortgage borrower and not impact the institution at all. All the risk of unfavorable interest rate changes that was borne by the lender under fixed-rate mortgages (FRMs) would now be borne by the borrower. In terms of figure 1, the mortgage loan rate on an ARM would be superimposed on the deposit rate line. The institution would be freed of any need to forecast interest rates in order to price its mortgages correctly.[6]

But the ARM is not costless to either lender or borrower. Although mortgage lending institutions incurred risk in making long-term, fixed-rate mortgages, they charged a premium for this service which until recent years was sufficiently high to make this activity profitable. If the institutions eliminate this risk, they will also eliminate a line of business that could again be potentially profitable. Financial institutions, which are in the business of dealing with interest rate changes every day and are by nature familiar with finance and economics, may be expected to be better situated than individual households to make meaningful interest rate predictions and assume interest rate risk. Although household mortgage borrowers would benefit from ARMs if interest rates were to fall, many tend to be risk averse, putting greater weight on interest rate increases than decreases of the same magnitude. They are generally willing to pay some premium to insure themselves against the possibility of paying unexpectedly higher rates during the life of the mortgage. This is so even though the average borrower's income rises with the interest rate as might be expected if market rates incorporate a premium for expected inflation.

To achieve a compromise between these two positions, the cumulative change in interest rates on ARMs can be limited to a predetermined band, e.g., 2½ or 5 percentage points or 30 or 50 percent above and below the initial contract rate. Moreover, individual rate changes also can be restricted to some maximum amount—e.g., ½ or 1 percentage point—and limited as to frequency—e.g., once every six months, every year, or every five years. Thus, the interest rate risk is shared by the borrower and the lender. The cost of changes in market interest rates within the overall band is borne by the borrower; outside the band by the lender. Because the width of the band affects the premium the borrower pays for "interest rate insurance"—the lower the premium, the wider the band—the band acts like a deductability clause in an accident or fire insurance policy.

ARMS do not mitigate a particular form of the "tilt" problem that arises when market interest rates increase in response to upward revisions of inflationary expectations. These rate increases are translated immediately into increases in monthly payments, while the borrower's income increases only slowly with the realized rate of inflation. Thus, the burden of the mortgage increases immediately. Through time, as the borrower's income rises and monthly payments remain unchanged, the burden will decline. Nevertheless, the tilt of the burden to the early months of the mortgage may price some potential home buyers out of the market.

A variety of ARM plans have been used or proposed. In January 1979 the Federal Home Loan Bank Board (FHLBB) permitted

[5]Alternatively, the institution could eliminate interest rate risk by altering its deposit structure to match the characteristics of its fixed- and/or variable-rate mortgages.

[6]The appropriate mortgage rate would be the rate on deposits with a maturity equal to the period between permitted changes in interest rates on the mortgage, plus a premium for default risk and other costs associated with originating and servicing mortgage loans.

federally chartered savings and loan associations to make variable-rate mortgages (VRMs) on which the interest rate could change after origination with the cost of funds to all federally insured savings and loan associations, but by no more than ½ percentage point once a year, and by no more than 2½ percentage points over the life of the mortgage.[7] Monthly payments would change accordingly.

In 1980 the FHLBB permitted a variation on this theme termed the renegotiable-rate mortgage (RRM) in which the interest rate could again change by ½ percentage point annually but the maximum change over the life of the loan increased to 5 percentage points. Moreover, the changes in the rate could be translated into changed monthly payments only once every three to five years and were tied to changes in the national average rate on mortgages as measured by the FHLBB contract mortgage rate index for conventional mortgages for the purchase of existing homes, rather than to the cost of funds to the lenders. Because the new mortgage rate was based on loans by all lenders, not just savings and loan associations, and because it is highly publicized, the causes of rate changes on loans could be better understood by borrowers. However, the inability of the new mortgage rate to change in perfect synchronization with the cost of funds means that the lender is not fully protected from interest rate risk. In addition, as the remaining life of the mortgage declines through time, the applicable rate on the mortgage may be expected to differ more and more from the prevailing rate on new fixed-rate mortgages, which currently dominate the new mortgage index.

On March 23, 1981, the Comptroller of the Currency (COC) authorized national banks to offer, within specified guidelines, adjustable-rate mortgage loans for the purchase of one- to four-family owner-occupied homes. Under the regulation the interest rate on a mortgage loan may change in accordance with any one of three specified refer-

[7]Federally chartered associations in California were granted this authorization in 1978.

Federal regulation of mortgage lending

Some have questioned whether the Comptroller of the Currency has the authority to promulgate adjustable-rate mortgage regulations for national banks and to preempt state laws that restrict such mortgages. Two recent federal court decisions support Federal Home Loan Bank Board preemptive regulations establishing uniform standards for real estate lending by federally chartered savings and loan associations.

In *Conference of Federal Savings and Loan Associations v. Stein*, 604 F.2d 1256 (9th Cir. 1979), *affirmed* 445 U.S. 921 (1980), the state of California had required federal savings and loan associations to abide by the provisions of the state's anti-redlining act. The court concluded that where federal regulation such as the regulatory control of the FHLBB over federal S&Ls is so pervasive as to leave no room for state regulatory control, implicit preemption can be found.

In *Glendale Federal Savings and Loan Association v. Fox*, 459 F. Supp. 903 (C.D. Cal. 1978), *appeal pending*, the court reasoned that the Congress had given the FHLBB complete authority to charter and regulate federal S&Ls so as to prohibit states from regulating them. (A number of other circuit courts have reached similar conclusions.) Therefore, with respect to mortgage loans extended by federal S&Ls, federal law can preempt state regulation of the validity and exercisability of "due-on-sale" clauses requiring complete repayment of the mortgage when the home is sold.

Federal law governing mortgage lending by national banks is contained in the general and specific rule-making authority granted by Title 12 of the United States Code on banks and banking, 12 U.S.C. §1, et seq. (especially §371(g), which states that loans are subject to conditions and limitations prescribed by the Comptroller of the Currency by rule or regulation), the National Bank Act, other federal banking laws, and the Housing and Community Development Act of 1974 (which liberalized the powers of national banks to make real estate loans). Taken together, these provisions suggest that it was the intent of the Congress that the Comptroller of the Currency regulate real estate lending by national banks, thus preempting state regulations.

ence rates by a maximum of 1 percentage point every six months with no limit on the cumulative change over the life of the mortgage. At the option of the bank, monthly payments may be maintained at a fixed dollar amount for a specified time up to five years, regardless of changes in the interest rate. If the bank chooses this option, increases or decreases in the interest rate will result in changes in the proportions of the monthly payment credited to interest and repayment of principal. If the required interest payment is greater than the amount of the fixed monthly payment, the difference may be added to the outstanding principal in the form of negative amortization within a specified limit. Upon expiration of a period of fixed monthly payments, the monthly payment is adjusted up or down for the next period to provide full amortization of the outstanding principal balance within the remaining time to maturity of the loan.

The FHLBB adopted regulations April 30, 1981, that granted federally chartered thrift institutions broader flexibility in the design of adjustable-rate mortgages. Interest rate adjustments on the loans may be tied to any reference rate provided that it can be verified easily by the borrower and it is not controlled by the lender. The interest rate may be adjusted through changes in the monthly payment and/or in the loan term, subject only to the conditions that the loan term from the date of closing be limited to 40 years and that the payment amount be adjusted at least every five years to a level sufficient at the existing interest rate to amortize the loan fully over its remaining life. (The restrictions imposed by the two agencies are summarized on page 22.) In allowing such a broad range of options, the FHLBB and the COC are clearly assuming the development of a large variety of individual mortgage plans with varying degrees of risk sharing. Because many borrowers may not wish to assume the risk of a fully adjustable mortgage rate and many mortgage lenders may not wish to spin off their interest rate risk insurance business altogether, this forecast is likely to be correct.

Development of mortgage plans

The new regulations of both the COC and the FHLBB permit lenders to develop mortgage plans designed to meet both their own needs and those of borrowers. The variety of mortgage plans that can be designed and offered under the regulations of both the COC and the FHLBB is virtually infinite. In practice, however, variations in the design are likely to depend primarily on differences in a relatively few key characteristics. These include: (1) the choice of a reference rate; (2) the frequency and amount of adjustment of the interest rate; (3) the frequency and amount of change in the monthly payment; (4) the limitations on additions to the outstanding principal balance, i.e., negative amortization; and (5) permitted extensions of the maturity of the original loan.

Using a computer, it is possible to simulate the behavior of several critical variables such as the frequency and amount of interest rate adjustments of different mortgage plans. Such simulations are useful in evaluating the impact of each mortgage plan on both the borrower and the lender. For example, the simulations allow the borrower to compare the behavior over time of the expected monthly payment and the outstanding principal balance of each plan. In addition, they enable the lending institution to project its cash flow and interest income over the life of the loan.

Simulations can be run using either data from some past period—in which case they show how particular types of mortgages would have performed if they had been made at the beginning of that period—or hypothetical data believed useful in illuminating the likely future performance of mortgages with differing characteristics. The relative desirability of the various types of mortgages depends heavily on the actual behavior of inflation and market interest rates in the future, and that may not resemble either the past or any other assumed behavior. Nevertheless, given one's expectations about the future, simulations provide a useful way of examining the impli-

cations of those expected conditions for the performance of different mortgages.

Choice of reference rate

Both the COC and the FHLBB require that adjustments in the mortgage interest rate be tied to a specific reference rate. National banks are authorized to use the six-month Treasury bill auction rate, the three-year constant maturity Treasury note rate, and the FHLBB national average contract mortgage rate on conventional mortgages for the purchase of existing homes. A federal S&L may use any agreed-upon published rate, but not its own mortgage rate or its own cost of funds.

Simulations of mortgage plans with the interest rate tied to each of the three reference rates authorized by the COC for the period from January 1970 through December

Table 1
Simulations of ARM plans with alternative reference rates
1970-1980
($20,000 mortgage)[1]

Six-month period	FHLBB contract rate[2]		Six-month T-bill[3]		Three-year T-note[3]		S&L cost of funds[3]	
	Monthly payment	Ending balance	Monthly payment	Ending balance	Monthly payment	Ending balance	Monthly payment	Ending balance
				(dollars)				
1970.1	148.57[4]	19,920	148.59	19,920	148.57	19,920	148.57	19,920
.2	149.68	19,838	147.07	19,835	150.03	19,839	152.76	19,842
1971.1	145.97	19,749	132.75	19,727	138.19	19,739	154.43	19,762
.2	140.06	19,647	109.56	19,572	120.16	19,605	154.70	19,679
1972.1	139.40	19,541	117.80	19,430	125.27	19,476	154.57	19,593
.2	138.36	19,430	107.64	19,261	120.83	19,336	154.84	19,503
1973.1	140.42	19,317	118.93	19,113	126.20	19,201	155.24	19,409
.2	142.60	19,203	135.98	18,993	135.47	19,078	155.78	19,312
1974.1	152.54	19,000	156.75	18,898	142.12	18,961	159.23	19,215
.2	157.09	18,997	155.43	18,797	146.77	18,847	162.94	19,119
1975.1	163.61	18,899	156.39	18,692	152.71	18,737	166.64	19,022
.2	158.05	18,789	130.45	18,541	141.68	18,604	167.01	18,922
1976.1	160.34	18,676	137.12	18,397	149.48	18,480	167.43	18,817
.2	157.58	18,555	125.81	18,224	140.95	18,335	167.55	18,707
1977.1	157.46	18,428	122.87	18,040	133.32	18,171	168.19	18,592
.2	157.34	18,295	120.89	17,844	132.87	17,999	168.07	18,472
1978.1	158.78	18,159	132.77	17,671	139.35	17,835	169.18	18,348
.2	164.29	18,025	141.21	17,508	149.41	17,684	169.92	18,218
1979.1	172.35	17,897	157.87	17,369	159.03	17,543	172.97	18,087
.2	179.47	17,772	170.45	17,243	166.19	17,406	178.31	17,956
1980.1	192.96	17,658	184.86	17,129	175.13	17,276	184.12	17,827
.2	198.47	17,544	196.45	17,023	189.93	17,160	197.03	17,708
Average	157.97		141.26		144.71		164.98	

[1]Assumes 30-year $20,000 adjustable-rate mortgage at 8.13 percent closed in January 1970 and tied to indicated reference rate. Mortgage interest rate and monthly payment are adjusted every six months without restriction on either.

[2]Mortgage loan interest rate for each six-month period is the actual FHLBB mortgage loan contract rate on loans closed in January and July.

[3]Mortgage loan interest rate for each six-month period after the first is the average rate during the prior six months plus the spread between 8.13 percent and the average rate during the last six months of 1969.

[4]Monthly payment for comparable fixed-rate mortgage; ending balance in 1980.2 would be $17,228.

1980 are shown in table 1. For the sake of simplicity, all of the simulations in the table assumed that a 30-year mortgage loan for $20,000 was closed in January 1970 at 8.13 percent, the actual FHLBB national average contract rate on fixed-rate mortgage loans for the purchase of existing homes at that time. The mortgage loan interest rate was adjusted every six months and the monthly payment changed accordingly without restriction. The amount of the adjustment in the interest rate was equal to the change in the reference rate.[8]

The simulations indicate that an adjustable-rate mortgage closed in January 1970 and tied to the six-month Treasury bill rate would have required the lowest average monthly payment during the 11-year period and would have resulted in the lowest ending principal balance of the three adjustable mortgage plans. The average monthly payments and the ending principal balances for the mortgage plans with interest rates tied to the six-month Treasury bill rate and to the three-year Treasury note were both lower than those for the fixed-rate mortgage. The results of a simulation of a mortgage plan with the interest rate tied to the FHLBB mortgage contract rate were very similar to those of a mortgage plan tied to the S&L's average cost of funds. S&Ls' cost of funds has increased steadily since 1970, and mortgage interest rates, although declining over short periods of time, have also been in a generally upward trend. Both of these plans would have had payments higher than those on a fixed-rate mortgage.

These results are specific to the period used, however. Interest rates were at a relatively high level in 1970 and the subsequent decline in rates would have required a corresponding reduction of the interest rate on an adjustable-rate mortgage. The wider fluctuations of the six-month Treasury bill rate require greater changes in the mortgage loan interest rate. Simulations of mortgage plans beginning when interest rates were relatively low and for shorter periods of time will show different results. In addition, all mortgage plans would not be expected to have the same initial interest rate.

Adjustment of the interest rate

Although the above simulations adjusted the mortgage loan interest rate every six months by the full amount of the change in the reference rate, the interest rate may be adjusted more or less frequently and the amount of the adjustment may be limited both at each adjustment period and over the term of the loan. More frequent adjustment translates changes in market interest rates into changes in mortgage loan rates more quickly. Restrictions on the amount of the adjustment will reduce the correlation of mortgage loan rates with market interest rates.

The regulations of the COC limit the adjustment of the mortgage interest rate in either direction to 1 percentage point every six months with no limit on the cumulative change over the life of the mortgage. In the above simulations this restriction would have had little effect on the use of the FHLBB contract mortgage rate and the three-year Treasury note rate. It would, however, have reduced the amount of permitted change if the six-month Treasury bill had been used as the reference rate. A comparison of mortgage plans with the six-month Treasury bill rate as the reference rate with and without the limitation to a 1 percentage point change every six months is shown in table 2. During the period from 1970 to 1980, the limitation on the adjustment to the interest rate in this instance resulted in a slightly lower average monthly payment and ending balance outstanding because the higher market interest rates were not fully translated into higher mortgage loan interest rates.

The FHLBB regulations impose no spe-

[8]The monthly rates were averaged over the six-month periods in the above simulations except when the reference rate was the FHLBB mortgage contract rate. The use of averaging generally reduces the amount of fluctuation in the reference rate and may also prevent tying a mortgage loan interest rate to a reference rate, particularly a short-term interest rate, that is temporarily distorted.

Table 2
Simulation of ARM plan with COC limitation on adjustment of interest rate[1]
1970-1980

Six-month period	No limitation		COC limitation	
	Monthly payment	Ending balance	Monthly payment	Ending balance
	(dollars)			
1970.1	148.57	19,920	148.57	19,920
.2	147.07	19,835	147.07	19,835
1971.1	132.75	19,727	133.61	19,729
.2	109.56	19,572	120.81	19,596
1972.1	117.80	19,430	117.95	19,454
.2	107.64	19,261	107.77	19,285
1973.1	118.93	19,113	119.07	19,137
.2	135.98	18,993	131.59	19,009
1974.1	156.75	18,898	144.06	18,896
.2	155.43	18,797	155.42	18,795
1975.1	156.39	18,692	156.38	18,691
.2	130.45	18,541	143.90	18,563
1976.1	137.12	18,397	137.28	18,418
.2	125.81	18,224	125.96	18,246
1977.1	122.87	18,040	123.02	18,062
.2	120.89	17,844	121.04	17,866
1978.1	132.77	17,671	131.78	17,690
.2	141.21	17,508	141.36	17,527
1979.1	157.87	17,369	153.96	17,381
.2	170.45	17,243	165.35	17,247
1980.1	184.86	17,129	176.91	17,123
.2	196.45	17,023	188.60	17,008
Average	141.26		140.52	

[1]Assumes 30-year $20,000 adjustable-rate mortgage at 8.13 percent closed in January 1970 and tied to six-month Treasury bill rate as reference rate. Mortgage interest rate and monthly payment are adjusted every six months.

cific limitations on the frequency or amount of the adjustment of the mortgage loan interest rate. The frequency and amount of change will thus depend on the reference rate used and how often it is available and on any limitations and terms that are incorporated in the mortgage contract by the lending institution.

Changes in the monthly payment

Changes in the monthly payment may be made whenever the interest rate is changed or at some other agreed upon time. In the latter instance the monthly payment may be held constant for a given period during which the interest rate is permitted to fluctuate in accordance with the specified reference rate and any specific limits in the contract. If the required monthly interest payment exceeds the total monthly payment, the monthly payment must be increased to cover the interest, unless negative amortization is permitted. When the monthly payment is changed, it is generally increased or decreased, as necessary, to amortize the loan fully over the remaining term of the mortgage.

The earlier FHLBB regulations authorizing VRMs and RRMs required a corresponding change in the monthly payments whenever the interest rate on the mortgage was increased or decreased. The dollar amounts of the changes in the monthly payment were limited by the restrictions on the periodic and overall increases in the mortgage loan interest rate. However, no such interest rate limitations are included in the FHLBB regulations issued in April 1981, and the COC regulations limit the change in the mortgage interest rate to 1 percentage point every six months. Thus, unless restrictions are imposed on changes in monthly payments, interest rate changes will be translated immediately into changes in monthly payments.

Restrictions on changes in the monthly payment—so-called payment caps—are an alternative to or may be used in conjunction with limitations on changes in the interest rate. For example, the monthly payment may be held constant for a given period, say three years, but the interest rate on the loan may change every six months. Or the monthly payment may change simultaneously with changes in the interest rate, but any increase may be limited to some dollar or percentage increase over the payment in the prior period.

Specific restrictions on payment caps were not included in the recent regulations of either the COC or the FHLBB. However, several commercial banks and thrift institutions have been offering 30-year ARMs since the fall of 1980 with limitations on payment changes.

Negative amortization

Any upward adjustment in the mortgage interest rate that is not accompanied by a change in the monthly payment sufficient to

amortize the loan over the remaining life of the loan may require negative amortization, i.e., an addition to the outstanding loan balance. As noted above, this may be necessary when the monthly payment is held constant for a given period of time but the interest rate increases or when the increase in the monthly payment is limited to a specified percentage or amount.

Although the regulations of both the COC and the FHLBB permit negative amortization in ARMs, the two differ somewhat. The FHLBB regulation requires that the monthly payments be adjusted at least once every five years to amortize fully, within 40 years from the date of closing, the outstanding principal at the interest rate indicated by the reference rate. The COC regulation limits negative amortization, for periods during which the monthly payments are fixed, to no more than 1 percent of the principal outstanding at the beginning of the fixed-payment period times the number of six-month intervals within the fixed-payment period. Monthly payments must be adjusted at least every five years to an amount sufficient to amortize the outstanding principal over the remaining term. Thus, the maximum negative amortization permitted over a five-year period would be 10 percent of the principal outstanding at the beginning of the period.

During the period of negative amortization the ratio of the loan to the value of the house increases and may become greater than 1.00. When this occurs, the lending institution incurs significant risk of default because the borrower may "walk away" from the loan. Because housing prices tended to rise sharply in recent years, greater than 100 percent loan-to-current-value ratios would have been unlikely. Nevertheless, all housing prices did not rise and even the average house price may not rise as rapidly in future years. As a result, the initial loan-to-value ratio takes on additional significance.

Simulations of mortgage plans that incorporate the limitations on interest rate changes and negative amortization prescribed by the COC regulations indicate that, with an interest rate of 14 percent, the limit on negative amortization is not breached, even when the interest rate changes by the maximum allowable 1 percentage point every six months, unless the monthly payment remains constant for at least two years. In table 3 the interest rate on a $1,000 mortgage loan with an original rate of 14 percent was increased 1 percentage point every six months, the maximum permitted. When the monthly payment was held constant for at least one year, negative amortization always occurred in the second and subsequent six-month periods until the monthly payment was adjusted. However, the permitted limit on negative amortization was not reached unless the monthly payment was unchanged for at least two years and then not until the second half of the sixth year of the mortgage term. In all simulations, when the monthly payment was held constant for a year or more, the outstanding balance of the loan was above $1,000, the original amount of the loan, at the end of 12 years.

Extension of loan maturity

In order to lessen the impact of an increase in the interest rate on the required monthly payment, the FHLBB regulations permit extension of the maturity of the loan up to a maximum of 40 years from the date of closing. However, when interest rates are high, an increase in the mortgage interest rate, by even a small amount, quickly results in the extension of the loan term to the full 40 years, as shown in figure 2. This is especially true in the early years when interest represents substantially all of the monthly payment. The immediate benefit to the borrower is, therefore, limited, and the monthly payments continue for 40 years instead of the original 30.

Graduated-payment mortgages

Graduated-payment mortgages (GPMs) are adjustable-payment mortgages on which the monthly mortgage payments increase

Simulations of ARM plans with COC negative amortization limit and selected constant payment periods

a. average monthly payment ($1,000 mortgage)

Six-month period	Interest rate	Constant payment period			
		6 mos.	1 year	2 years	3 years
	(percent)	(dollars)			
1.1	14	11.85	11.85	11.85	11.85
.2	15	12.64	11.85	11.85	11.85
2.1	16	13.44	13.51	11.85	11.85
.2	17	14.24	13.51	11.85	11.85
3.1	18	15.05	15.19	15.52	13.32*
.2	19	15.85	15.19	15.52	14.93*
4.1	20	16.67	16.92	15.52	17.60
.2	21	17.48	16.92	15.52	17.60
5.1	22	18.29	18.66	19.49	17.60
.2	23	19.11	18.66	19.49	17.71*
6.1	24	19.92	20.43	19.49	20.06*
.2	25	20.74	20.43	19.73*	21.20*
7.1	26	21.56	22.22	23.71	23.98
.2	27	22.37	22.22	23.71	23.98
8.1	28	23.19	24.03	23.71	23.98
.2	29	24.01	24.03	24.21*	24.51*
9.1	30	24.83	25.86	28.19	26.82*
.2	31	25.65	25.86	28.19	28.08*
10.1	32	26.47	27.72	28.19	31.00
.2	33	27.29	27.72	28.89*	31.00
11.1	34	28.11	29.59	32.93	31.00
.2	35	28.93	29.59	32.93	31.81*
12.1	36	29.75	31.48	32.93	34.22*
.2	37	30.57	31.48	33.82*	35.60*

b. end-of-period outstanding balance ($1,000 mortgage)

Six-month period	Interest rate	Constant payment period			
		6 mos.	1 year	2 years	3 years
	(percent)	(dollars)			
1.1	14	999	999	999	999
.2	15	998	1003	1003	1003
2.1	16	997	1002	1012	1012
.2	17	996	1006	1028	1028
3.1	18	996	1006	1027	1041
.2	19	995	1010	1032	1051
4.1	20	995	1010	1042	1050
.2	21	994	1014	1059	1055
5.1	22	994	1014	1059	1066
.2	23	993	1019	1064	1084
6.1	24	993	1018	1075	1094
.2	25	993	1023	1092	1105
7.1	26	993	1023	1092	1104
.2	27	992	1028	1097	1110
8.1	28	992	1028	1109	1122
.2	29	992	1033	1126	1139
9.1	30	992	1033	1126	1150
.2	31	991	1038	1131	1161
10.1	32	991	1038	1144	1161
.2	33	991	1043	1161	1167
11.1	34	991	1043	1161	1180
.2	35	990	1048	1166	1197
12.1	36	990	1048	1180	1209
.2	37	990	1053	1197	1220

*Limit on negative amortization requires increase in monthly payment.

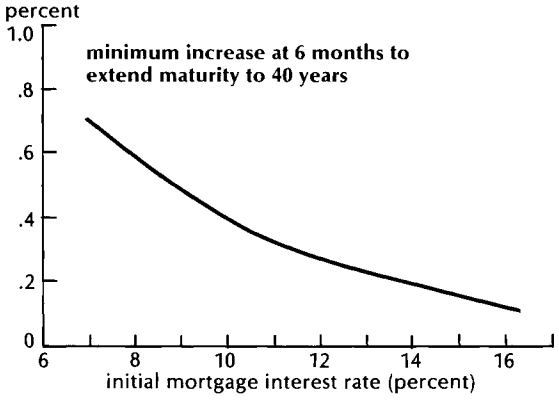
according to a predetermined schedule. These plans are designed primarily for younger families whose incomes are currently low but may be expected to rise faster than average as they enter the more productive years of their lives. Graduated-payment mortgages were originally authorized by the Housing and Community Development Act of 1974, and five plans were subsequently offered by HUD-FHA. The plan in which monthly payments could increase by 7½ percent annually for five years proved to be the most popular. Since then, a number of private lending institutions have offered conventional graduated-payment mortgage plans similar to this plan.

Under many of these plans, the low early monthly payments may be smaller than the monthly interest on the outstanding balance. If so, the difference is added to the principal of the mortgage loan. As the monthly payment increases, it eventually rises above the amount necessary to pay the interest on the outstanding principal and the principal begins to amortize. The later payments are sufficiently higher than the required interest in order to offset the earlier negative amortization.

Default risk is potentially a serious problem with graduated-payment mortgages. The higher the initial ratio of loan to house value, the lower must be the graduation in order to avoid having the loan value rise above the house value. The risk of default may also be greater on GPMs than on other mortgages because the borrower's income may fail to increase as rapidly as the monthly payments.

Although the dollar amount of the

Figure 2. Increase in mortgage interest rate necessary to extend loan term from 30 to 40 years



monthly payment varies on all GPMs, the interest rate may or may not. Almost all GPMs that have been offered are fixed-rate mortgages. Thus, these plans do not assist lending institutions in reducing their interest rate risk. Graduated-payment adjustable-rate mortgages (GPAMs) have recently been proposed by the FHLBB. Although GPAMs would offer institutions better protection from interest rate risk, rapid increases in interest rates in the early years would raise sharply the effective rate of graduation, thereby increasing default risk. In addition, the variability in monthly payments would be increased to a greater extent than with regular ARMs under like circumstances. Nevertheless, GPAMs may be a workable compromise instrument that reduces both the interest rate risk exposure of thrift institutions and the early monthly payments burden of economically promising younger home buyers.

Price level-adjusted mortgages

In periods of rapid inflation, the mortgage plans discussed so far (except GPMs) require, at the time of their origination, large monthly payments relative to the mortgage borrower's income. As the borrower's income increases through time in line with the rate of inflation, the burden of the monthly payments declines and offsets the previous increase so that, for the entire life of the mortgage, the burden to the borrower is no higher. As discussed earlier, the mortgage payment-to-income ratio is said to be tilted downward. This troublesome "tilt" problem can be reduced or eliminated by a price level-adjusted mortgage (PLAM) which ties the monthly payments on the mortgage to the price level rather than to the interest rate. Thus, accelerations in the rate of inflation are translated into higher mortgage payments only as they occur rather than all at once when they are first anticipated and become embodied in interest rates as an inflation premium.

In addition, monthly payments under a PLAM reflect actual rates of inflation, rather than expected rates of inflation. As a result, neither mortgage lenders nor mortgage borrowers are injured (or rewarded) financially if the expected rate of inflation impounded in the interest rate is not realized. Like almost everyone else, participants in mortgage markets badly underestimated the future rate of inflation throughout most of the 1960s and 1970s. In retrospect, the rates on fixed-rate mortgages in these years were lower than necessary to maintain the purchasing power of the principal. The resulting loss to the lending institutions is the major cause of the financial difficulties these institutions are now experiencing. In contrast, mortgage borrowers enjoyed windfall gains.

Because PLAMs both protect lenders from unexpected increases in the rate of inflation and reduce the initial burden to mortgage borrowers, it might appear that they are superior to ARMs, which do only the first. But this is not necessarily so. PLAMs protect lenders from unexpected interest rate increases only to the extent that those increases are attributable to unexpected increases in the rate of inflation. ARMs protect lenders from unexpected interest rate increases regardless of the cause of those increases. Thus, ARMs provide greater interest rate risk protection to lenders than PLAMs but less protection to borrowers.

The operation of the price level-adjusted mortgage plan is shown in table 4. Assume that in the absence of inflation the rate on a 30-year fixed-rate, fixed-payment mortgage would be 5 percent. The monthly payments on a loan of $60,000 on an $80,000 home would be $322. If the borrower's income remained at, say, $30,000 per year, the monthly mortgage payments would be equal to 12.9 percent of pretax income. Ignoring taxes, if the rate of inflation were suddenly expected to accelerate to 8 percent annually, the mortgage rate on new loans might jump to 13 percent in order to maintain the purchasing power of the loan and the monthly payment on new loans would rise to $664. Assuming that the new borrower's income does not increase immediately, the payments would represent 26.5 percent of income. A similar pattern exists for ARMs.

Table 4
Simulations of price-level adjusted mortgages
($60,000 mortgage)

	No tilt[1]		¼ expected inflation[2]		¾ expected inflation[3]	
Year	Monthly payment	Ending balance	Monthly payment	Ending balance	Monthly payment	Ending balance
			(dollars)			
1	322.09	59,115	399.18	59,391	571.39	59,730
2	347.86	62,839	423.13	62,261	582.82	60,617
3	375.69	66,725	448.52	65,209	594.48	61,480
4	405.74	70,768	475.43	68,227	606.37	62,311
5	438.20	74,959	503.96	71,303	618.49	63,104
6	473.26	79,287	534.19	74,425	630.86	63,851
7	511.12	83,735	566.25	77,576	643.48	64,541
8	552.01	88,282	600.22	80,737	656.35	65,164
9	596.17	92,903	636.23	83,883	669.48	65,708
10	643.87	97,562	674.41	86,987	682.87	66,157
11	695.38	102,219	714.87	90,012	696.52	66,496
12	751.01	106,824	757.76	92,920	710.45	66,706
13	811.09	111,313	803.23	95,661	724.66	66,766
14	875.97	115,612	851.42	98,179	739.16	66,651
15	946.05	119,633	902.50	100,409	753.94	66,333
16	1021.73	123,268	956.65	102,272	769.02	65,781
17	1103.47	126,392	1014.05	103,679	784.40	64,959
18	1191.75	128,853	1074.90	104,523	800.08	63,825
19	1287.09	130,477	1139.39	104,684	816.09	62,333
20	1390.06	131,057	1207.75	104,019	832.41	60,429
21	1501.26	130,349	1280.22	102,366	849.05	58,052
22	1621.37	128,071	1357.03	99,535	866.03	55,132
23	1751.07	123,892	1438.45	95,308	883.36	51,590
24	1891.16	117,427	1524.75	89,434	901.02	47,337
25	2042.45	108,231	1616.24	81,623	919.04	42,270
26	2205.85	95,785	1713.21	71,544	937.42	36,270
27	2382.32	79,488	1816.00	58,814	956.17	29,206
28	2572.90	58,646	1924.96	42,994	975.29	20,926
29	2788.73	32,459	2040.46	23,582	994.80	11,256
30	3001.04	0	2162.90	0	1014.70	0

[1]Assumes 5 percent real interest rate and 8 percent inflation.

[2]Assumes 5 percent real interest rate and 8 percent inflation but incorporates 2 percent expected inflation in mortgage rate.

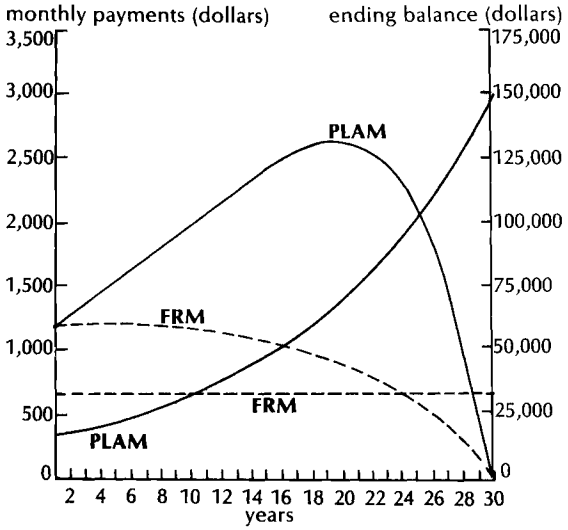
[3]Assumes 5 percent real interest rate and 8 percent expected inflation but incorporates 6 percent inflation in mortgage rate.

The PLAM, however, would increase the monthly payment by only the actual inflation realized in the period. If this were also 8 percent, the payment would increase by 8 percent from the contract amount of $322 to $348 after 12 months. At the same time the principal on the loan also would be adjusted by the 8 percent rate of inflation. If the borrower's income increased at the average rate of inflation, the payment would remain at 12.9 percent of income. In the next period both the mortgage payment and income would again increase by equal percentages so that the mortgage burden remains constant.

As indicated by figure 3, the loan principal rises sharply through the early and middle years of the mortgage and declines sharply in the later years. This occurs because a large part of the early payments represents interest. Thus, little of the principal is paid back and the principal increases by almost the full amount of the rate of inflation. Near the end, almost all of the monthly payment represents principal reduction and the outstanding principal declines sharply.

PLAMs have three potential problems. First, the ratio of the monthly payment to the

Figure 3. Comparisons of monthly payments and outstanding balances of FRM* and PLAM**



*Assumes $60,000 mortgage loan with loan term of 30 years and 13 percent mortgage interest rate.
**Assumes $60,000 original mortgage loan with 5 percent real interest rate and 8 percent rate of inflation.

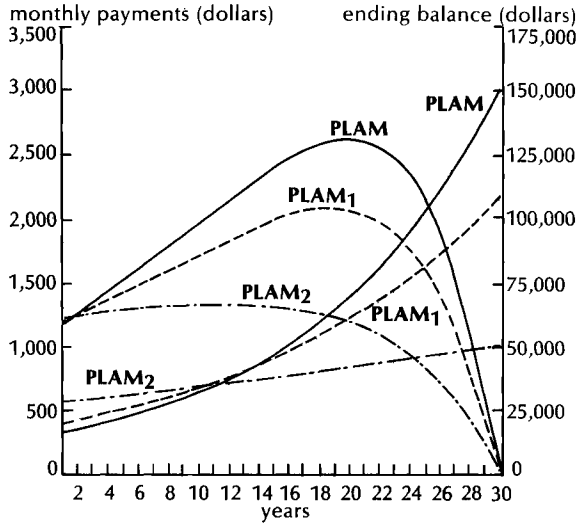
income of a given borrower will remain constant only if that borrower's income changes more or less in line with the particular price index used. If increases in the borrower's income lag substantially behind the index, the mortgage burden will increase through time and might increase the risk that the borrower will default. The possibility of default might be reduced by choosing an appropriate price index and, possibly, by modifying the payments schedule to reintroduce some but not all of the tilt.

The price index to which the mortgage payments are tied should reflect the ability of households to service their mortgage debt. Thus, it would be appropriate to use a wage index. But, as noted, everyone's income does not change by the average amount. Furthermore, under most circumstances, some increases in labor productivity might be expected through time. If so, prices will increase more slowly than wages. Because income is the desirable characteristic to track, it would be more desirable to use a price index associated with income, such as the GNP deflator, than a price index associated with a fixed market basket of goods, such as the consumer price index.

The maintenance of some tilt in the mortgage payment-to-income ratio may be desirable as a means of reducing the risk of default. This can be achieved by indexing only part of the difference between the nominal market and real mortgage interest rates rather than all of the difference. The real mortgage rate may be defined as the constant purchasing power mortgage rate or the rate that would exist if prices at the end of the loan period were expected to be the same as at the beginning. Assume, as before, that the annual rate of inflation over the next 30 years is expected to be 8 percent, so that in the absence of income taxes the market rate might be 13 percent if the real rate is 5 percent. The mortgage plan might add to the real rate one-quarter of the interest rate component attributable to the expected rate of inflation. This would increase the initial monthly payment and change the subsequent monthly payment and principal amounts by only three-quarters of the actual rate of inflation. For the example above, the initial interest rate would be 5 plus 2, or 7 percent. The monthly payments on this "modified" PLAM would be higher initially than on the "pure" PLAM, but would increase more slowly through time and eventually become smaller. They would also increase more slowly than average income, so that for most borrowers the burden of the mortgage payments would decline. Because the initial monthly payments are higher, the principal outstanding on the loan would not increase as rapidly. The amounts for the $60,000 mortgage loan discussed earlier are shown in figure 4. Note that, unlike for the pure PLAM, the borrower's payment-to-income ratio declines, but by less than for the fixed- or adjustable-rate mortgage plans.

The second difficulty concerns the cash flow to mortgage lenders. If the lender's primary source of funds is regular interest-bearing deposits, then a liquidity problem may arise. In the absence of deposit rate ceilings, an acceleration in the expected rate of

Figure 4. Comparisons of monthly payments and outstanding balances of PLAM* and modified PLAMs**



*Assumes $60,000 original mortgage loan with loan term of 30 years and 5 percent real interest rate and 8 percent rate of inflation.

**Assumes $60,000 original mortgage loan with loan term of 30 years and 5 percent real interest rate and 8 percent rate of inflation, but $PLAM_1$ incorporates 2 percent expected rate of inflation and $PLAM_2$ incorporates 6 percent expected rate of inflation in mortgage interest rate.

inflation will immediately increase the cost of deposits by the full amount of any accompanying increase in interest rates. But revenues from PLAMs will increase more slowly in line with the actual rate of inflation. Over the life of the mortgage, of course, the increases in income inflow and expenditure outflow will be equal. Thus, the "tilt" risk has been shifted from the borrower to the lending institution. The institution may protect itself by offering similarly indexed deposits—price level-adjusted deposits or PLADs—or by temporarily dipping into reserves to finance the difference. Because the institutions are larger, better positioned in the financial markets to borrow funds, and more knowledgeable in the area of finance, they may be expected to be better equipped to manage the tilt problem than most mortgage borrowers.

The third difficulty arises because most mortgage lenders and borrowers are subject to income taxes. Lenders must share part of their interest income with the government, while borrowers may deduct their interest costs from their taxable income. Thus, as mortgage payments increase with the rate of inflation, the aftertax income of taxable lenders from the mortgage loan will increase more slowly and be less than is required to maintain the purchasing power value of the payments. At the same time the aftertax cost of the mortgage payments to taxable borrowers will increase by less than is required to maintain the purchasing power value unchanged. That is, on an aftertax basis, the lenders are not fully protected, while the borrowers benefit. This asymmetry may be corrected by indexing the mortgage payments and principal payments to the price index by a factor to correct for the tax effects.[9]

Although the income tax brackets of the individual participants in the mortgage market may be expected to vary, a factor based on the estimated average marginal tax rate for all participants may be a workable solution in practice. Simulations of monthly payments and principal amounts for a PLAM plan assuming an average marginal tax rate of 25 percent are shown in table 5. In these simulations the aftertax ratio of mortgage payments to income remains constant while the pretax ratio increases.

Shared-appreciation mortgages

The recent period of high rates of inflation and interest has also been characterized

[9]The appropriate factor for bonds is $1/1-t$ where t is the marginal tax rate; the factor for amortized mortgages is more complex because the monthly payments are divided between interest and principal. For the ratio of aftertax mortgage payments to income to remain constant for a PLAM plan, the factor, g', for increasing the outstanding mortgage balance must be less than the inflation factor and is:

$$g' = \frac{1 - t + t\,(1+i)^{-n}}{1 - t + t\,(1+i)^{-n+1}} \times g$$

where t = marginal tax rate
i = interest rate
n = number of payments
g = 1 + inflation rate.

The derivation of this factor has been provided by Henry J. Cassidy, Office of Policy and Economic Research, FHLBB.

Table 5
Simulation of PLAM
with constant ratio of aftertax mortgage payments to income[1]
($60,000 mortgage)

Year	Annual income	Annual pretax payments	Ending balance	Annual aftertax payments	Ratio of pretax payments to income	Ratio of aftertax payments to income
			(dollars)			
1	30,000	3,903	59,097	3,153	13.0	10.5
2	32,400	4,200	62,566	3,405	13.0	10.5
3	34,992	4,518	66,155	3,677	12.9	10.5
4	37,791	4,859	69,855	3,970	12.9	10.5
5	40,815	5,226	73,651	4,287	12.8	10.5
6	44,080	5,619	77,529	4,629	12.7	10.5
7	47,606	6,040	81,469	4,998	12.7	10.5
8	51,415	6,491	85,444	5,397	12.6	10.5
9	55,528	6,975	89,426	5,827	12.6	10.5
10	59,970	7,493	93,377	6,292	12.5	10.5
11	64,768	8,047	97,255	6,794	12.4	10.5
12	69,949	8,641	101,007	7,335	12.4	10.5
13	75,545	9,276	104,574	7,920	12.3	10.5
14	81,589	9,954	107,884	8,552	12.2	10.5
15	88,116	10,680	110,855	9,233	12.1	10.5
16	95,165	11,455	113,392	9,969	12.0	10.5
17	102,778	12,283	115,384	10,763	12.0	10.5
18	111,001	13,167	116,703	11,621	11.9	10.5
19	119,881	14,110	117,203	12,547	11.8	10.5
20	129,471	15,115	116,718	13,546	11.7	10.5
21	139,829	16,187	115,056	14,625	11.6	10.5
22	151,015	17,329	112,001	15,789	11.5	10.5
23	163,096	18,545	107,306	17,046	11.4	10.5
24	176,144	19,838	100,692	18,403	11.3	10.5
25	190,235	21,214	91,845	19,868	11.2	10.4[2]
26	205,454	22,676	80,409	21,449	11.0	10.4
27	221,891	24,230	65,983	23,156	10.9	10.4
28	239,642	25,879	48,119	24,998	10.8	10.4
29	258,813	27,628	26,313	26,986	10.7	10.4
30	279,518	29,483	0	29,132	10.5	10.4

[1]Assumes 5 percent real interest rate and 8 percent inflation.

[2]Change due to internal computer rounding.

by very high rates of appreciation in residential property values. To the extent that mortgage lending institutions underestimated the rate of inflation and, in retrospect, charged a lower fixed mortgage rate than warranted, a greater share of the appreciation in value accrued to the home owner. In light of this experience, some mortgage lenders have begun to view appreciation in home values as protection against the risk of unexpected inflation and would prefer to index their mortgage interest rates to this appreciation. This may be achieved in a shared-appreciation mortgage (SAM).

The SAM is more complex than the other types of alternative mortgages. The interest rate consists of two components. Because the amount of the appreciation, if any, is uncertain at the time a loan is extended, part of the interest must be specified as a percentage, say, 30 or 50 percent, of the amount of appreciation accrued, either at the time the home is sold or at some designated earlier date. This interest is received only at that time. Thus, shared appreciation represents contingent deferred interest. Until the settlement date the amount of this interest is uncertain. The other component of the interest is determined at the origination of the loan and is paid regularly through either fixed or graduated monthly payments.

The two components of the interest payments are related. The higher the amount of contingent interest expected at origination, which depends both on the expected amount of appreciation and on the appreciation sharing ratio, the lower the immediate interest rate and the corresponding monthly payments. Conversely, the lower the expected contingent interest, the higher the immediate interest rate and monthly payments. As either the amount of appreciation expected or the sharing ratio declines, the SAM approaches a fixed-rate, fixed- or graduated-payment mortgage.

Potential home buyers may find a SAM desirable if they cannot afford the high monthly payments associated with other mortgage plans. They would be able to defer a part of their interest payments until the necessary liquidity could be obtained through the sale of the house or through an improvement in their cash flow situation.

Although appealing, the SAM presents a number of significant drawbacks for the lender, particularly if it is a thrift institution, for the borrower, and for the relevant regulatory agency. With respect to the lender, SAMs

do not alleviate the liquidity problem arising from interest rate intermediation. Indeed, to the extent that the regular monthly mortgage payments are lower than on other mortgage plans, higher deposit costs from inflation are more difficult to pay out of current revenues, even in comparison with fixed-rate mortgages. The liquidity problems of the institutions are exacerbated.

SAMs are also likely to increase substantially the degree of credit risk assumed. The future value of residential real estate is not known and the degree of confidence with which values can be predicted declines as the time to maturity of the mortgage increases. Thus, at the time of origination, the actual return is uncertain. Moreover, the price of real estate has not always increased rapidly and, over some periods, it has not increased at all. Between 1947 and 1978, the average return realized on residential real estate was about 7 percent per year. This was twice as great as the average annual increase in consumer prices, but less than half the average return on the stock market. By decades, the return on residential real estate was 5 percent in the 1950s, 6 percent in the 1960s, and 10 percent in the 1970s through 1978. Thus, the double-digit rates of home appreciation in recent years were not typical of past experience. Most of us know of individual homes or individual neighborhoods that have declined in value.

If the lender's expected appreciation is not realized, the immediate interest rate charged on the loan will prove in retrospect to have been too low and the lender's realized return may well be lower than on other mortgage plans. Determination of future housing values by geographical and neighborhood area is also likely to require personnel with different skills than those the institutions currently employ.

Because of neighborhood effects, two otherwise identical homes owned by economically comparable households may have different expected rates of appreciation. Thus, at origination, the same lending institution would charge different immediate interest rates on the two properties. This is likely to lead to resentment on the part of the borrower being charged the higher rate and to charges of "redlining" if entire neighborhood areas are charged higher initial mortgage rates.

Lenders can generally reduce the degree of default risk they assume by diversifying among a number of different loans whose default probabilities may not be expected to be closely related. But many thrift institutions make loans in a limited geographical area. All the houses in the area may reasonably be expected to be subject to similar underlying changes in value. Thus, any one lender may not be able to diversify this risk away. Real estate is also relatively illiquid so that the estimated market price may not be realized quickly. In terms of a hedge against unexpected inflation, SAMs may not be much less risky than equities, which have generally been considered too risky for thrift institutions.

Because the lender's return is dependent on the amount of appreciation in the home's value after the loan is originated, anything that affects the potential for appreciation is of concern to the institution. Thus, the lender is likely to require minimum maintenance standards and to engage in periodic surveillance to see that they are met. If the standards are not maintained, then costly enforcement and legal actions may be necessary. Capital improvements made by homeowners generally add value to the house that is greater or smaller than the cost of the improvements themselves. Separation of the appreciation in the value of a home between the unimproved home and the capital improvements is difficult and may also result in controversy and litigation.

Lastly, to reduce the liquidity strains, SAMs generally provide for the lender to receive instalments on the deferred contingent income from appreciation before the final maturity, say, every five or ten years. (Regulations recently proposed by the Federal Home Loan Bank Board effectively require that the maximum period for adjust-

ment be no longer than ten years.) If the home is not sold before this period ends, interim settlement is based on the appraised value at that time. The accrued interest may be paid in cash as a lump sum or be refinanced by a mortgage not providing for shared appreciation.

These features present two potential problems for the lender. First, the amount of the appraised value may not be accepted by the borrower, causing ill feelings, loss of good will, and possibly litigation. (Of course, the appraised value at times may be less than the institution would like.) Even sale prices may be controversial. A seller may sell the house at an artificially low price to a friend for other compensation to avoid paying the lender its share. The lender can protect itself against this possibility by reserving a right of first refusal.

Second, the refinancing of the accrued interest delays further the cash inflows to the lending institution, intensifying any liquidity pressures. Moreover, if the appreciation is large so that the accrued interest is large, the increase in monthly payments may cause financial strains on the borrower at the time the mortgage is refinanced. This increases the risk of default on top of any increase in liquidity pressures. The Federal Home Loan Bank Board proposes that the refinancing be guaranteed by the lending institution "without regard to the . . . borrower's income . . . for a term of not less than thirty years."

The disadvantages of SAMs to the lending institutions are not necessarily advantages to the borrower. Because of the lender's interest in the appreciation of the home, the borrower loses partial control over the management of the home. Changes in the house, capital improvements, and even color of paint may need to be approved by the lender in advance. Freedom to make decisions of this nature independently is often viewed as one of the major advantages of home ownership. Disagreements with respect to maintenance, contribution of capital improvements, and assessed value at interim adjustment dates are likely to be, at minimum, nuisances and, at worst, may involve the borrower in expensive, time consuming, and unpleasant litigation. Lastly, SAM borrowers experiencing a large appreciation in the value of their homes and wishing to sell and move may not be able to purchase another home of equal value without financial strain because part of any appreciation must be paid to the lender on sale.

The regulatory agencies supervising banks and thrift institutions are charged with the responsibility for protecting the financial solvency of the institutions. To do so, they evaluate the quality of the institutions' loans. It is difficult, if not impossible, to judge accurately the correctness of the institution's predicted rate of appreciation for a large number of widely different homes and, therefore, the quality of the loans. Moreover, even to try to do so would require a staff with both skills and training different from those that examiners currently possess, as well as substantial familiarity with the characteristics of the geographical areas served by each lending institution. This would increase significantly both the cost and difficulty of the agency's task.

In light of these problems, the SAM is probably not a viable alternative mortgage instrument at this time for depository institutions. Further work is required to correct some of these limitations before it can make a major positive contribution to the mortgage market.

Conclusions

It is evident that the traditional fixed-coupon rate, fixed-payment mortgage is no longer king of the hill. Primarily because of the dual impact of rapid inflation and high and volatile interest rates, it no longer serves the needs of all borrowers and lenders. Some borrowers find the high initial monthly payments required by this mortgage an undue burden, while many lenders view making long-term loans at a fixed rate financed by deposits at an adjustable rate as too great a risk. Thus, fixed-rate, fixed-payment mortgages are being supplemented by a large

number of alternative mortgage plans tailored to the specific needs of individual mortgage borrowers and lenders. These mortgage plans include adjustable-rate mortgages, graduated-payment mortgages, price level-adjusted mortgages, shared-appreciation mortgages, and a variety of combinations thereof.

All of these mortgage plans differ in at least one common way from the fixed-rate,

Major characteristics of recent federal regulations governing adjustable-rate home mortgage lending

Major characteristics	Federal savings and loans and mutual savings banks	National banks
Requirement to offer fixed-rate mortgage instrument to borrower	None	None
Limit to amount of ARMs that may be held	None	None
Indexes governing mortgage rate adjustments	Any interest rate index that is readily verifiable by the borrower and not under the control of the lender, including national or regional cost-of-funds indexes for S&Ls.	One of three national rate indexes—a long-term mortgage rate, a Treasury bill rate, or a three-year Treasury bond rate.
Limit on frequency of rate adjustments	None	Not more often than every six months.
Limit on size of periodic rate adjustments	None	1 percentage point for each six-month period between rate adjustments, and no single rate adjustment may exceed 5 percentage points.
Limit on size of total rate adjustment over life of mortgage	None	None
Allowable methods of adjustment to rate changes	Any combination of changes in monthly payment, loan term, or principal balance.	Changes in monthly payment or rate of amortization.
Limit on amount of negative amortization	No limit, but monthly payments must be adjusted periodicially to amortize fully the loan over the remaining term.	Limits are set, and monthly payments must be adjusted periodically to amortize fully the loan over the remaining term.
Advance notice of rate adjustments	30 to 45 days prior to scheduled adjustments.	30 to 45 days prior to scheduled adjustments.
Prepayment restrictions or charges	None	Prepayment without penalty permitted after notification of first scheduled rate adjustment.
Disclosure requirements	Full disclosure of ARM characteristics no later than time of loan application.	Full disclosure of ARM characteristics no later than time of loan application.

SOURCE: David F. Seiders, "Changing Patterns of Housing Finance," *Federal Reserve Bulletin*, Board of Governors of the Federal Reserve System (June 1981), p. 468.

fixed-payment mortgage—they are considerably more complex. This hampers both the design and operation of efficient plans and their acceptance by household borrowers. Partially in response to this problem, the agencies with primary responsibilities for regulating the major residential mortgage lending institutions—the Federal Home Loan Bank Board for savings and loan associations and the Comptroller of the Currency for national banks—have issued regulations prescribing the major features and restrictions of these mortgage plans. Initially, the regulations specified very carefully the permissible characteristics of each mortgage plan, in particular, the degree of flexibility in changing interest rates and/or monthly payments. More recently, the agencies have issued more general regulations with greatly reduced restrictions, in particular, on rate and payment flexibility for adjustable rate mortgages. These changes reflect, in part, the current trend toward deregulation of firms and markets and, in part, the belief that competition in the market will foster the development of mortgage plans satisfactory to both borrowers and lenders.

The more liberal regulations place the burden of developing marketable mortgage products on the lenders. For example, to the extent that borrowers are risk averse and do not wish to assume the total interest rate risk, lenders will need to design plans that share that risk. To the extent that borrowers' incomes do not change as rapidly as interest rates, lenders will need to design plans that maintain monthly payments unchanged for some time when interest rates change without incurring undue default risk from increases in the value of the loan. It is likely that individual lending institutions will design a number of differentiated mortgage plans, as is the case with other products sold by a large number of producers in a competitive market. The design of the mortgage plans will also be greatly influenced by the policies established by the Federal Home Loan Mortgage Corporation and the Federal National Mortgage Association for purchases in the secondary market.[10] The simulations presented in this article illustrate the major characteristics of the mortgage plans that have been permitted or proposed and may be useful to institutions in designing their plans.

---

[10]The Federal National Mortgage Association announced on June 25, 1981, that it would make commitments to purchase eight types of adjustable rate mortgages based on five different indices beginning in late July. The program announced by the Federal Home Loan Mortgage Corporation in late May was more limited. See *American Banker*, "FNMA Unveils Adjustable Rate Mortgage Plan," Vol. 146, No. 125, Friday, June 26, 1981, page 3, and "FNMA's Adjustable-Rate Mortgage Proposal," Vol. 146, No. 132, July 8, 1981, page 2.