Mortgage Designs, Inflation, and Real Interest Rates

The economic trends of the last decade have diminished the usefulness of the fixed-rate mortgage. High interest rates, substantial inflation, and the variability of both have created problems for borrowers and lenders. Prospective mortgage borrowers face payment obligations that have been raised dramatically by the rise in mortgage rates. Lenders, on the other hand, have experienced large reductions of net worth as the rise in interest rates has reduced the market value of their portfolios of long-term fixed-rate loans. Both sides of the mortgage market could benefit from the use of a different mortgage design.[1] Each of the alternatives to the fixed-rate mortgage has its advantages and disadvantages. This article reviews the economics of the fixed-rate mortgage and alternative designs, focusing on how each one deals with the problems of housing finance in the present environment.

On the lending side of the market, the major response to the developments of the last several years has been the adoption of mortgage designs that permit rate adjustments. Such loans protect lenders from the risk of unanticipated changes in interest rates. But borrowers may face the same difficulties with adjustable mortgages that they have had with fixed-rate loans. By itself, the rate-adjustment feature does not reduce a mortgage borrower's payment burden. Indeed, the adjustable mortgage presents borrowers with the additional problem of an unknown series of future payments

There are two ways in which the mortgage contract can be altered to protect lenders from interest rate risk while at the same time presenting borrowers with initial payment requirements smaller than those of the long-term fixed-rate loan. One is the use of inflation-linked contracts, or indexed loans. In contrast to adjustable mortgages, on which rates are periodically raised or lowered to reflect changes in (nominal) market yields, indexed loans have their outstanding balances raised or lowered to reflect movements in some measure of prices. The interest rate on an indexed mortgage would not contain an inflation premium. Thus, in an inflationary environment, an indexed loan would impose a substantially smaller payment burden on mortgage debtors in the early years of a loan agreement. An alternative approach would be to reduce required mortgage payments of adjustable loans during the early years of the loan by adopting more flexible schedules for the repayment of loan principal. In some cases, the two schemes are approximately equivalent. Both designs[2] achieve the twin goals of smoothing the borrower's real payment burden and allowing lenders to adjust mortgage returns in response to changes in economic conditions: indexed mortgages respond to inflation, while adjust-

[1] New mortgage designs are not the only method of coping with the problems of the fixed-rate mortgage Mortgage investors might resort to hedging in the futures market, for example, to reduce the interest rate risk associated with a portfolio of long-term fixed-rate assets Alternatively, mortgage investors might benefit from the establishment of an insurance facility in which they could buy protection from these risks Either of these devices could be used to support continued lending in fixed-rate loans, provided there were institutions or individuals (other than the lender) willing to accept the risks

[2] These and other mortgage designs are discussed at length in *New Mortgage Designs for Stable Housing in an Inflationary Environment*, a collection of papers edited by Franco Modigliani and Donald Lessard (Federal Reserve Bank of Boston Conference Series No 14)

able mortgages reflect changes in nominal interest rates

When variations in nominal interest rates are due largely to variations in (actual and expected) inflation, the two main alternatives to the standard mortgage design serve the purpose of reducing or eliminating inflation-induced risks and distortions But, recently, higher and more volatile real interest rates have become important factors in the mortgage market Each of these mortgage designs leaves one or both sides of the market exposed to the risk of variations in the real rate of interest Moreover, when real interest rates remain at high levels, neither of the alternatives to the long-term fixed-rate loan can reduce the costs of homeownership.

Shortcomings of the fixed-rate mortgage

The standard lending instrument in the housing finance industry has been the long-term fixed-rate mortgage [3] It is characterized by equal periodic payments. Part of each payment is interest on the loan, calculated by applying the contract rate of the loan to the unpaid balance The remainder of each payment constitutes repayment of principal, or amortization of the loan The term of the loan—the length of the amortization period—can be set at any number of years, but original maturities of twenty, twenty-five, and thirty years are commonly used.

Monthly payments on a mortgage loan are determined by the size of the loan, the contract rate, and the length of the amortization period Other things remaining equal, the monthly payment required to amortize a mortgage loan is higher with a higher contract rate, a shorter amortization period, or a larger loan amount Although all the monthly payments on a fixed-rate loan are for the same (nominal) dollar amount, their allocation between principal and interest varies considerably over the life of the loan Early payments are devoted almost entirely to the payment of interest But, as the relatively small repayments of principal accumulate and the loan balance declines, the proportion of the fixed payment that needs to be allocated to interest declines, and amortization proceeds more rapidly. Interest payments are tax deductible Thus, the increase in the proportion of each payment that is allocated to repayment of loan principal raises the aftertax cost of the mortgage

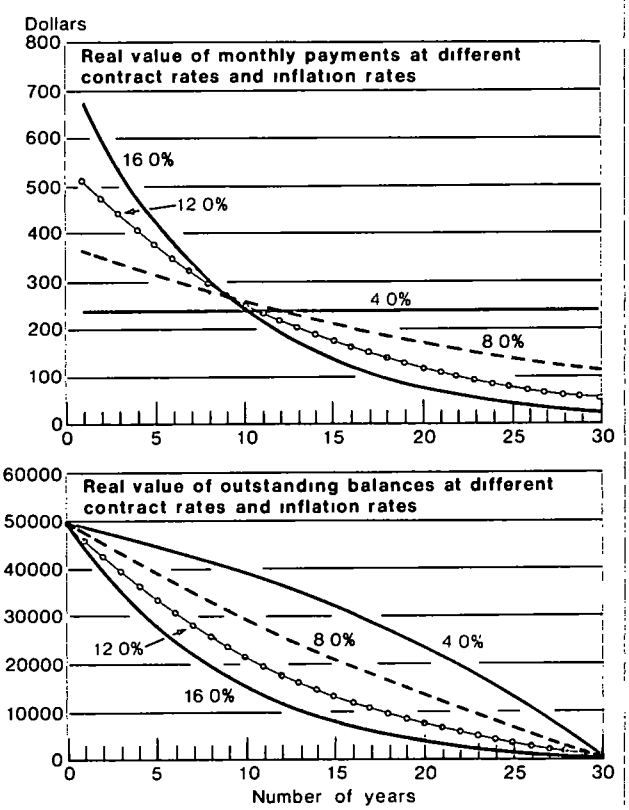
[3] In June 1981, for example, Federally insured savings and loan associations held $430 billion in mortgage loans on one- to four-family residential properties, of which less than $35 billion was subject to rate adjustment If recent trends continue, however, the fixed-rate loan may be the exception, not the rule Roughly one third of new conventional mortgage commitments made in the last half of 1981 were for adjustable loans

The effects of inflation

In the absence of inflation, the level payments required to repay a standard mortgage loan would impose a constant real payment burden on the borrower. This burden is illustrated by the solid horizontal line in the upper panel of the chart. With a stable price level, the 4 percent contract rate on the loan for which these payments are made produces a real return of 4 percent The amount of the loan is $50,000 The monthly payments are $238.71

But, when inflation and interest rates rise in tandem, the real cost of loan repayment is redistributed, with a higher real cost in the early years of the loan being offset by a reduced real cost in later years When lenders expect inflation to continue throughout the life of a fixed-rate loan, they must raise the rate at which such loans are offered by the expected rate of inflation The inflation premium, as this rate increase

The Effects of Inflation on the Fixed-Rate Mortgage



Source Adapted from Donald Tucker "The Variable-Rate Graduated-Payment Mortgage", Real Estate Review (Spring 1975)

is called, compensates lenders for the decline in purchasing power of their nominally fixed debt claims.

The effects of the inflation premium on mortgage borrowers are substantial, as can be seen by comparing the real values of mortgage payments for several loans that produce the same real return to the investor. The loans, all for $50,000, differ only in the size of the inflation premium contained in their nominal rates. They all produce a 4 percent real return. An 8 percent loan (associated with expectations of 4 percent inflation) requires monthly payments of $366.88, while the payments for the 12 percent loan (with expectations of 8 percent inflation) and the 16 percent loan (at 12 percent inflation) are $514.31 and $672 38, respectively.

While these payment obligations are fixed in nominal terms for the life of the mortgage, the cumulative effect of inflation reduces their real values as time progresses. The real value of the payments on the 8 percent loan, for example, declines by 4 percent per year, while that of the payments for the 16 percent loan declines by 12 percent per year. In general, higher inflationary expectations produce a higher initial real and nominal payment requirement. The real values of these payments, however, decline more rapidly the higher the rate of inflation. The effect of inflation on the real value of the remaining mortgage balance is similar. As shown in the lower panel of the chart, inflation increases the rate at which the real value of the mortgage debt is reduced.

Some analysts[4] have described these features of the fixed-rate mortgage in an inflationary environment as the mislabeling of principal and interest components of the level monthly payment. In the case of the 12 percent loan, for example, the real value of the outstanding loan balance at the beginning of the second year is 8 percent less than it would have been without inflation. But this reduction of the value of the lender's asset has been offset by the payment of an 8 percent inflation premium in addition to the 4 percent real return on the original balance. Since the 8 percent inflation premium is a deductible interest expense, the fixed-rate mortgage borrower receives a tax subsidy for what is essentially the repayment of principal.

The large payments produced by high nominal rates give rise to the "affordability problem"—the inability of many households to qualify for mortgage loans. Using customary underwriting standards, the annual income required for approval of a mortgage loan application rises proportionately with the monthly payment. As shown in the chart, an increase in the expected rate of inflation from zero to 8 percent, assuming a 4 percent real return is to be obtained, raises the income threshold by 115 percent. (This is the percentage increase in the required monthly payment associated with a move from a 4 percent loan to a 12 percent loan.) As payment requirements have increased faster than household incomes, there has been a decline in the proportion of households able to qualify for mortgage loans.[5] In recent years, however, the relaxation of loan approval standards has mitigated the impact of rising mortgage rates. Thus, the rule of thumb that mortgage and other housing costs should be less than 25 percent of household income has given way to current limits that approach 40 percent at some lending institutions.

Interest rate risks

The fixed-rate mortgage contract also suffers from its inability to protect lenders from interest rate risks. Until recently, this sort of risk was associated with the occurrence of higher than expected inflation rates. But the rate of inflation has declined fairly steadily since early 1980, while nominal interest rates have remained high. This more recent experience has awakened borrowers and lenders alike to the existence of real interest rate risks.

The difficulties caused by unanticipated inflation are easily explained. In the examples discussed so far, it has been assumed that inflation turns out to be what had been expected when the mortgage rate was set. But the actual rate of inflation experienced during the life of the mortgage loan may be different from the inflation premium included in the nominal mortgage rate. When inflation exceeds this premium, borrowers benefit from a faster than anticipated reduction of the real value of payments on the mortgage loan. And, when the actual rate of inflation falls short of the inflation premium, borrowers are faced with a slower than expected reduction of the real value of mortgage payments. Lenders face the opposite results, benefiting when actual inflation is less than the inflation premium and losing when actual inflation exceeds expectations.

The fixed-rate mortgage also leaves borrowers and lenders exposed to the risk of variations in the real rate of interest. This risk may arise in conjunction with—or apart from—the failure of actual inflation to match expectations. Assume, for example, that a mortgage loan was made at a 15 percent contract rate

[4] See, for example, Milton Friedman, "How to Save the Housing Industry", *Newsweek* (May 26, 1980), page 80 An earlier, more formal treatment is in D Tucker, "The Variable-Rate Graduated-Payment Mortgage", *Real Estate Review* (Spring 1975)

[5] It should be noted, however, that an increase in the real rate of interest, with the inflation premium unchanged, would have the same effect, reducing the proportion of qualifying households.

when both borrower and lender expected inflation of 10 percent per year for the entire term of the loan. They implicitly agreed to a real interest rate of 5 percent. Even if their inflationary expectations are correct —that is, if prices rise by 10 percent per year—the prevailing nominal (and hence real) rate of interest might rise (benefiting the borrower) or fall (providing the lender with a windfall). Alternatively, with the nominal level of interest rates constant, there could be an increase or decrease in the rate of inflation expected to prevail in the economy, reducing or increasing the real cost of the long-term mortgage loan.

The long-term fixed-rate mortgage offers protection from neither real nor inflation-based interest rate risks. Thus, for very different reasons, mortgage borrowers and lenders face strong incentives to find alternatives to the standard mortgage contract. Borrowers' primary concern is to minimize the cash flows required to repay mortgage debt, particularly in the early years of the loan Lenders, on the other hand, are concerned mainly with the nominal yield flexibility of the mortgage instrument. For both groups, the long-term fixed-rate mortgage is largely incapable of coping with interest rate risks, whether they are due to changes in inflationary expectations or to changes in the real rate of interest [6]

Alternative mortgage designs

The mortgage designs that have been used or proposed as replacements for the fixed-rate loan are variants or combinations of two basic alternatives—adjustable and indexed loans An adjustable mortgage is a loan agreement under which the contract rate, monthly payments, and remaining maturity of the loan all may be changed in response to the movement of a predetermined interest rate. These changes in the mortgage loan are made at the end of each adjustment period (In practice, adjustment periods have been as short as six months or as long as five years) The adjustable mortgage can thus be viewed as a series of short-term loan agreements based on a single longer amortization period or as a single long-term loan with provisions for rate adjustments. Several adjustable mortgage designs have been introduced in recent years (Box 1).

As a response to inflation-induced interest rate variations, the indexed mortgage seems to be fundamentally different from the fixed-rate loan and its adjustable variants. The contract rate on an indexed loan contains no inflation premium and is, therefore, lower than the nominal interest rate in an inflationary period. This rate is not subject to periodic adjustment. Instead, the outstanding balance of an indexed loan is periodically raised or lowered in line with movements in some measure of housing prices or the general level of prices If the series used to adjust an indexed loan is an accurate measure of inflation, and these adjustments are made frequently enough, the real value of mortgage payments will be constant throughout the life of the loan.[7] While the basic features of an indexed mortgage loan are fairly simple, the selection of an appropriate price index might pose a problem Among the candidates for use in adjusting the remaining balance on indexed loans are such general measures of price changes as the consumer price index or the gross national product price deflator, nationwide measures of housing prices, similar measures aggregated on a regional or local basis, and individual house prices

There are a number of factors that might impede the widespread introduction of the indexed mortgage contract Chief among these is the unwillingness of financial institutions to hold indexed assets that are not hedged by indexed liabilities.[8] It is a useful reference device, however, because it eliminates the distortions that characterize a fixed-rate mortgage in an inflationary environment.

Suppose, for example, that lenders desire a real return of 4 percent and expect inflation to proceed at a 12 percent rate over a thirty-year period. Under these conditions, long-term fixed-rate loans and adjustable loans would be offered at a 16 percent rate and indexed loans would be offered at 4 percent. In the first year of a thirty-year loan for $50,000, payments on the standard loan and the adjustable loan would be $672.38, while those on an indexed loan would be $238.71—roughly 35 percent of the payments on the competing fixed-rate loan The payments on the fixed-rate loan would remain at $672.38 throughout the life of the loan. But, if the price index rose by 12 percent in the first year of the indexed loan, its balance would be raised (from $49,119.45 to $55,013.79) at the end of the first year. The monthly payments on the indexed

[6] The single exception is the borrower's ability to refinance mortgage debt at lower nominal rates Refinancing is sensible when the present value of the reduction in mortgage payments exceeds the transactions costs of the new mortgage loan

[7] In practice, these adjustments might be made at annual intervals, creating the possibility of significant deviations from a constant real payment burden

[8] In *New Mortgage Designs for Stable Housing in an Inflationary Environment*, several authors advocated the issuance of indexed deposits at commercial banks and thrift institutions More recently, Michael Lovell has proposed indexed annuities, which would be the appropriate liability hedge for a different group of mortgage investors See "Unraveling the Real-Payments Twist", *Brookings Papers on Economic Activity* (1981 1)

Box 1: Adjustable Mortgage Instruments

In the last three years, Federal and state regulators of mortgage lending institutions have authorized a variety of adjustable mortgages. The successive designs have allowed lenders increasing discretion in selecting the features of adjustable loans. They also have relaxed or removed the limits on interest rate changes that can be made on adjustable loans.

Table 1 summarizes the features of five different mortgage designs authorized by the Federal Home Loan Bank (FHLB) Board, the agency that regulates Federally chartered savings and loan associations. The first four columns describe different kinds of adjustable mortgages. The last column describes a hybrid design, the shared-appreciation loan.

The first design listed in the table, the California variable-rate mortgage, allowed Federally chartered thrift institutions in that state to issue loans with features identical to those being offered by state-chartered lenders in the state. Under these regulations, the contract rate on an outstanding loan could be changed at six-month intervals in response to changes in the average cost of the funds in the eleventh FHLB district. Limits on the rate adjustments were imposed to protect mortgage borrowers from sudden large increases in required mortgage payments. The maximum allowable rate increase was set at 50 basis points per year, and a limit of 250 basis points was imposed for the cumulative total of rate increases. To assure the continued availability of long-term fixed-rate loans, lending institutions were barred from issuing more than 50 percent of their mortgage loans in the variable-rate instruments.

In the California mortgage design and other early mortgage plans, limits on rate adjustments were viewed as an important consumer protection device. A borrower that signed a variable-rate contract with an initial interest rate of 8 percent, for example, was certain that the rate on the loan could never exceed 10.5 percent. The limits on rate increases, however, could have the effect of converting a variable-rate loan to a fixed-rate loan after the maximum interest rate increases have been applied. Not surprisingly, subsequent designs have included higher limits on interest rate adjustments, expanding the range of interest rate risk that could be assigned to mortgage borrowers.

The California and nationwide variable-rate mortgages each called for rate adjustments tied to move-

Table 1 **New Mortgage Instruments Authorized by the Federal Home Loan Bank Board**

Instrument	California variable-rate mortgage (VRM)	Nationwide variable-rate mortgage (VRM)	Renegotiable-rate mortgage (RRM)	Adjustable-rate mortgage	Shared-appreciation mortgage
Index	Average cost of funds, San Francisco FHLB district	Average cost of funds, all FSLIC insured savings and loan associations	FHLB average contract rate on existing homes	Any index that is "readily verifiable"	Net appreciation is based upon net sales price appraisal
Adjustment period	6 months	12 months	3, 4, or 5 years	Any period up to 5 years	10 years or less
Maximum adjustments.					
Individual	50 basis points per year	50 basis points per year	50 basis points per year	No limitations	40 percent of net appreciated value
Life of loan	250 basis points	250 basis points	500 basis points	No limitations	
Effective date	January 1979	July 1979	April 1980	April 1981	September 1980
Other features or comments	Minimum adjustment of 10 basis points 50 percent portfolio limitation Authorized for Federally chartered thrift institutions in California	Maturity extension up to one third of original maturity 50 percent portfolio limitation	No maturity extensions	Replaced FHLB regulations for VRMs and RRMs Negative amortization without limit 30-year loan term may be extended to 40 years	Guaranteed (and mandatory) refinancing of remaining balance and contingent interest at end of appreciation period

FSLIC = Federal Savings and Loan Insurance Corporation.

Box 1: Adjustable Mortgage Instruments *(continued)*

Table 2 **Adjustable Mortgages in the Secondary Market**

Plan	Interest rate index*	Interest rate adjustment period	Payment adjustment period	Maximum interest rate adjustment (percent)	Maximum payment adjustment (percent)
Federal National Mortgage Association					
1†	6 months	6 months	6 months	—	7½
2†	6 months	6 months	3 years	—	—
3†	1 year	1 year	1 year	—	7½
4†	3 years	2½ years	2½ years	—	18¾
5	3 years	2½ years	2½ years	5	—
6	5 years	5 years	5 years	—	—
7	FHLB‡	1 year	1 year	—	—
8	FHLB‡	1 year	1 year	2	—
Federal Home Loan Mortgage Corporation					
1	FHLB‡	1 year	1 year	—	—
2	FHLB‡	1 year	1 year	2	—

* Treasury yields for Federal National Mortgage Association plans 1 through 6, Federal Home Loan Bank Board conventional mortgage rate for others

† Negative amortization permissible, so long as the loan balance does not exceed 125 percent of the original loan amount

‡ FHLB average contract rate on existing homes

ments in the average cost of funds at savings and loan associations. In subsequent regulations, the FHLB authorized the use of a current mortgage rate as an index, reflecting the concerns of many lenders that yields on outstanding mortgages should be kept in line with those of newly originated loans.

In principle, the adjustable-rate mortgage authorized by the FHLB Board satisfies both concerns that seemed important to lenders. It imposes no limits on the size of contract rate adjustments, satisfying lenders' concerns with yield flexibility. In addition, the regulations for adjustable-rate mortgages do not specify a particular index for contract rate adjustment. The rules allow lenders to choose virtually any interest rate series as the basis for mortgage rate adjustments.

The regulations for adjustable-rate mortgages may provide substantial benefits for mortgage borrowers as well. They permit, but do not require, the use of negative amortization. This provision allows lenders to reduce the increases in monthly payments associated with any given contract rate increase. Similarly, the regulations permit lenders to extend the remaining maturity of a loan, thus providing another means of reducing required increases in monthly payments.

In the short run, the use of adjustable mortgages promises to benefit consumers by increasing the willingness of lenders to provide mortgage loans. Indeed, a secondary market for adjustable-rate loans has already materialized. In July 1981 both the Federal National Mortgage Association (FNMA, or Fannie Mae) and the Federal Home Loan Mortgage Corporation (FHLMC, or Freddie Mac) announced plans to purchase adjustable-rate mortgage loans in the secondary market. Fannie Mae will accept eight different loan designs, while Freddie Mac will buy only two. Table 2 summarizes the main features of the acceptable loan designs. Both agencies announced that nonconforming loans will be considered for purchase on a case-by-case basis.

FNMA will buy loans that have adjustment periods ranging from six months to five years. Many of the FNMA plans include limits on interest rate changes and monthly payment increases. Four of the eight plans allow for negative amortization. In none of these cases, however, will the loan balance be allowed to exceed 125 percent of the original loan amount.

The designs that are acceptable to Freddie Mac are identical to two of the Fannie Mae options. Both use the FHLB mortgage-rate index and have annual adjustment periods. Unlike most of the other plans that FNMA will accept, both of the plans approved for FHLMC purchase prohibit negative amortization.

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loan would also rise by 12 percent, to $267.36. This larger nominal amount, however, would have only the same purchasing power as the original payment of $238.71.

If in subsequent years the price index continued to rise at a 12 percent annual rate, the outstanding balance and monthly payments on the indexed loan would continue to be raised by 12 percent each year. This pattern of price increases would produce large nominal payment requirements—$7,151.73 per month in the thirtieth year, for example. Presumably, however, a borrower's nominal income would also have risen in line with the price level, allowing these large nominal payments to be handled as easily as the initial payments of $238.71.[9]

With an annual adjustment period for the adjustable mortgage loan, payments in the second and subsequent years would depend on the change in the interest rate to which the loan was tied. Thus, changes in market conditions—whether due to a change in the inflation premium or in the underlying real rate of interest—would be transmitted through the mortgage contract.

The treatment of inflation and risk

The differences in payment schedules reflect different arrangements for the sharing of interest rate risk. At one extreme, the fixed-rate loan saddles mortgage lenders with the entire risk of variations in nominal rates. Because of the asymmetry established by the borrower's option to refinance, changes in nominal interest rates can work only to the disadvantage of lenders Moreover, since the fixed-rate loan can assign only nominal interest rate risks, it exposes both borrowers and lenders to the risk of offsetting changes in the real rate of interest and the inflation premium.

At the other extreme of risk-sharing arrangements, adjustable mortgages assign all the risk of variations in nominal rates to borrowers. Like fixed-rate loans, they entangle the risks of real and inflation-based variations in interest rates. Thus, adjustable loans guarantee lenders that their mortgage yields will always reflect the prevailing level of real interest rates as well as the current inflation premium.

In contrast to fixed-rate loans, indexed mortgage contracts disentangle the real and inflationary components of nominal interest rate risk. They assign all the risk of inflationary developments to the borrower, while forcing lenders to bear the risk of variations in the real rate of interest. In an environment of rapid and variable inflation, perfectly indexed contracts are economically equivalent to fixed-rate loans in a world of stable prices.

The three designs thus have very different implications for risk sharing. But all of them accommodate inflation The indexed mortgage, however, has two distinct advantages over the fixed-rate and adjustable designs First, since it allows the inflation adjustment to be based on the price changes experienced during the life of the contract, it does not require borrowers and lenders to commit to a specific inflation forecast. In addition, since its payment schedule is based only on the real component of the prevailing level of interest rates, it avoids the inflation-induced distortions—and the associated affordability problem—of the fixed-rate loan.

Adjustable mortgages suffer from some of the basic shortcomings of the standard fixed-rate loan During any particular adjustment period, the payments on an adjustable loan are identical to those of a long-term fixed-rate loan with the same contract rate, outstanding balance, and remaining maturity. Since the contract rate on an adjustable loan is a nominal rate, the payments required for its amortization are subject to the same inflation-induced bias. In fact, if there is no change in the interest rate to which an adjustable mortgage is tied, the associated payments would be identical (in nominal terms) to that of a fixed-rate loan Moreover, if the real and inflationary components of this constant rate on the adjustable mortgage do not vary over time, the *real* value of the series of payments would also be identical to that of a fixed-rate loan made at that rate. Under these circumstances, adjustable mortgages would not alleviate the inflation-induced distortion of the mortgage borrower's payment burden .

From the lender's point of view, the attractiveness of adjustable loans may be deceptive. While such loans offer lenders protection from the risk of variations in interest rates, they may raise the default risk of mortgage assets. This default risk is the analogue of the affordability problem· just as prospective mortgage borrowers can be disqualified by rising payment requirements, holders of adjustable mortgage loans facing substantially increased payment requirements might be forced into delinquency and default.

An approximation of the indexed loan

The adjustable mortgage contract can be respecified in a manner that redistributes the allocation of interest rate risks and avoids the possibly severe initial payment requirements of the fixed-rate design Federal regulations for adjustable-rate mortgages include two provisions that would allow lenders to reduce or to eliminate the increase in monthly payments associated with an increase in the contract rate of the loan. One

[9] This is too generous a presumption for those households whose incomes fail to keep pace with inflation

of these provisions permits negative amortization.[10] For intervals as long as five years, mortgage lenders may set the monthly payment on a loan below the amount required to pay interest on the outstanding balance. The difference between these amounts is accumulated as an increase in the loan's outstanding balance—hence the term negative amortization.

When negative amortization is used, the size of required payments is independent of the rate of interest that is applied to the outstanding loan balance. As a result, lenders may be able to increase the proportion of prospective mortgage borrowers that qualify for mortgage loans by maintaining low payment requirements Under these arrangements, the loan balance would be increased by the difference between actual payments and those required by strict application of the mortgage contract rate.

In an inflationary environment, the results could be qualitatively similar to the use of an indexed mortgage. The real interest rate that would apply to an indexed loan would be significantly below the nominal rate on a competing fixed-rate loan, producing much lower monthly payments Similarly, the monthly payments on an adjustable loan would be reduced substantially by the negative amortization feature. The outstanding balance of an indexed loan would be raised periodically to reflect increases in the chosen measure of inflation. In a similar fashion, the outstanding balance of an adjustable loan with negative amortization would be raised periodically to reflect the difference between actual and required payments. But, when the pretax cash flows involved in the two loan designs are similar, the deductibility of interest payments—including deferred interest when it is paid—would make the adjustable loan less costly on an aftertax basis (Box 2).

[10] The other provision allows the remaining maturity of an outstanding loan to be extended, so long as the entire term of the loan does not exceed forty years After the first year of a thirty-year adjustable-rate mortgage, for example, the remaining maturity can be increased from twenty-nine to thirty-nine years

The outlook

The economic characteristics of indexed mortgage loans and adjustable loans with negative amortization can be similar. The difference in the mechanisms they employ to reduce the risks and distortions of inflation are more apparent than real. In comparison to the standard fixed-rate loan, however, both of these designs reduce the cash receipts of mortgage lenders in the early years of a mortgage loan. In view of the sizable losses they have incurred in recent years, it may be unreasonable to expect mortgage lenders quickly to exploit the negative amortization feature to the extent required to replicate the indexed contract.

The preceding analysis, however, underscores the point that the more fundamental problem in the mortgage market may be the persistence of high real rates of interest In markets of all kinds, high real rates of interest discourage leveraged purchases of long-lived assets by raising financing costs (*e g.*, the cost of borrowed money) and opportunity costs (*e.g.*, the purchasing power of foregone interest earnings) New mortgage designs may remove the inflation-induced distortions that have disrupted the mortgage market. But, if high real rates of interest persist, they will continue to encumber the housing market.

Beyond the immediate future, there is a more sanguine prospect for the allocation of interest rate risks. With sufficient flexibility in the construction of payment schedules—that is, with negative amortization—adjustable mortgages permit the separation of real and inflation-induced interest rate risks. The direction of recent changes in the design of mortgage contracts suggests a reasonable allocation of these risks, with borrowers absorbing the risk of variable inflation, while lenders—in their basic role as financial intermediaries—absorb the risk of variations in real interest rates.

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Box 2: Cash Flows and Tax Consequences

For the sake of simplicity, the analysis in the text of the article ignores the tax treatment of mortgage debt. The deductibility of interest payments reduces the borrower's cost of debt repayment in all the mortgage designs. In the cases of adjustable and indexed loans, these arrangements mean that the tax authorities absorb some of the impact of increases in interest rates or the price level. Indeed, the sensitivity of household aftertax costs to changes in interest rates or the price level is a declining function of the marginal tax rate. Lenders face an additional complication. When taxes are paid on interest earnings accrued (rather than interest earnings received), negative amortization schemes confront lenders with taxable incomes that exceed their interest receipts. Thus, accrual-basis lenders have a strong incentive to avoid the use of loan designs that involve negative amortization.

Consider a twenty-year mortgage loan for $50,000. The four panels of Table 3 illustrate the cash flows and aftertax costs associated with each of four agreements that might be used to effect the transaction.[1] At the time any one of these contracts is written, the prevailing fixed-rate mortgage rate is 15 percent and includes a 9 percent inflation premium. The variations in interest rates that are assumed to follow are all due to changes in inflationary expectations. The real before-tax interest rate remains at 6 percent.

Two measures of the aftertax cost of the loan appear in Columns 5 and 6. They apply to borrowers with marginal tax rates of 50 and 20 percent, respectively. Each is calculated as the sum of interest payments (net of tax benefits) and amortization. Since loan repayment is actually a form of saving, these figures overstate the economic cost of the loan payments.

Fixed-rate mortgage

In the simplest case, equal annual payments of $7,988.07 (Column 1) amortize the loan over its twenty-year term. In the first year, $7,500 of the payment is allocated to interest (0.15 x $50,000, Column 2), leaving only $488.07 for the repayment of principal. By the twentieth year, however, only $1,041.92 of the payment is allocated to interest.

Adjustable mortgage

In its unconstrained form, the adjustable mortgage is equivalent to a series of one-year loans made at the values of the reference rate listed in Column 7. In the example provided, the reference rate rises to 21 percent in the third year of the loan, making the required payment one-third more than the first annual payment. Aside from the irregularity of the series of annual payments and relatively minor changes in the amortization pattern, the adjustable mortgage shown here maintains all the cash flow and tax features of the fixed-rate loan.

Adjustable mortgage with negative amortization

Any number of schemes can be devised to achieve negative amortization. One such method establishes two mortgage rates—a payment rate used to calculate periodic payments and a debit rate used to compute interest due on the loan. Whenever the payment rate is less than the debit rate, negative amortization occurs. The figures in panel C arise from such a dual-rate scheme. The payment rate is set at a constant 6 percent, while the debit rate is the hypothetical reference rate.

The tax consequences of the negative amortization scheme are somewhat different from those of the first two designs. Loan payments are allocated first to current interest (*i.e.*, interest accrued during the period), then to deferred interest, and finally to principal. As a result, for each year in which the loan balance remains above the original $50,000, the entire loan payment is tax deductible.

Indexed mortgage

The series of payments and the amortization pattern of the indexed loan are very much like those for the adjustable mortgage with negative amortization. But differences in the composition of loan balance changes (recall the mislabeling of principal and interest, page 22) have a dramatic effect on the aftertax cost comparisons. While most of the payments on the adjustable loan with negative amortization are fully deductible, only a portion of each payment on the indexed loan qualifies as an interest expense. Thus, in the mortgage market, the tax code's treatment of indexation constitutes an important barrier to the introduction of indexed contracts.

[1] For illustrative purposes, all the figures in the table are based on a schedule of annual payments made at the end of each year. Complete tables and a mathematical summary of the calculations are available from the author on request

Box 2: Cash Flows and Tax Consequences *(continued)*

Table 3: **Cash Flows and Aftertax Costs in Four Mortgage Designs**

Nominal dollar amounts, loan amount is $50,000 and loan term is 20 years

Year	Payment	Interest	Amortization	End-of-year balance	Aftertax cost 50%	Aftertax cost 20%	Hypothetical reference rate (R) or inflation rate (I)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Fixed-rate mortgage							
1	7,988 07	7,500 00	488 07	49,511 93	4,238 07	6,488 07	
2	7,988 07	7,426 79	561 28	48,950 64	4,274 68	6,502 72	
3	7,988 07	7,342 60	645.48	48,305 16	4,316 78	6,519 55	
19	7,988 07	1,947 94	6,040 13	6,946 15	7,014.10	7,598 49	
20	7,988 07	1,041 92	6,946 15	0 00	7,467.11	7,779 69	
B. Adjustable mortgage							R*
1	7,988 07	7,500.00	488 07	49,511 93	4,238 07	6,488.07	0 15
2	9,765 62	9,407 27	358 35	49,153 58	5,061 98	7,884.16	0.19
3	10,667 33	10,322 25	345 08	48,808 50	5,506 20	8,602 88	0 21
8	6,364 92	4,521 23	1,843 69	43,368 58	4,104 30	5,460 67	0 10
9	5,754 79	3,469 49	2,285 31	41,083 27	4,020 05	5,060 90	0.08
10	6,325 31	4,108.33	2,216 98	38,866 29	4,271 15	5,503 64	0.10
19	7,170 62	1,350 78	5,819.83	6,460 02	6,495 23	6,900 46	0 11
20	7,106 02	646 00	6,460 02	0 00	6,783 02	6,976 82	0.10
C. Adjustable mortgage with negative amortization							R*
1	4,359 23	7,500 00	(3,140 77)	53,140 77	2,179 61	3,487 38	0 15
2	4,762 52	10,096 75	(5,334 22)	58,475 00	2,381 26	3,810 02	0 19
3	5,400 55	12,279 75	(6,879 20)	65,354 20	2,700 27	4,320 44	0.21
8	9,340 25	8,268 63	1,071 62	81,614 65	4,670 13	7,472 20	0.10
9	9,734 75	6,529 17	3,205 58	78,409 07	4,867 38	7,787 80	0.08
10	9,941 72	7,840 91	2,100 81	76,308 26	4,970 86	7,953 38	0.10
19	21,589 16	4,353 96	17,235 21	22,346 21	19,412 19	20,718 37	0.11
20	24,580 83	2,234 62	22,346 21	0 00	23,463.52	24,133 91	0.10
D. Indexed mortgage†							I‡
1	4,359 23	3,000 00	1,359 23	53,018 44	2,859 23	3,759 23	0 09
2	4,751 56	3,181 11	1,570 45	58,136 23	3,161 01	4,115 34	0.13
3	5,369 26	3,488 17	1,881 09	64,693 41	3,625.17	4,671 63	0 15
8	9,105 33	4,836 40	4,268 93	79,391 19	6,687.13	8,138 05	0 04
9	9,469 54	4,763 47	4,706 07	76,178 82	7,087 81	8,516 85	0 02
10	9,658 94	4,570 73	5,088 21	73,934 23	7,373 57	8,744 79	0 04
19	18,747 69	2,062 31	16,685 38	18,570 83	17,716 54	18,335 23	0.05
20	19,685 08	1,114 25	18,570 83	0.00	19,127 95	19,462 23	0 04

* The values of the reference rate in years 1 through 20 are 0 15, 0.19, 0 21, 0 21, 0.18, 0.13, 0 13, 0.10, 0 08, 0 10, 0 12, 0.14, 0.16, 0 17, 0 15, 0 14, 0 13, 0 12, 0 11, and 0.10

† End-of-year balances for the indexed loan include an adjustment for inflation This adjustment is not shown in the table.

‡ The inflation rate is assumed to be the difference between the reference rate and 0 06