INFLATION AND THE HOUSING MARKET: PROBLEMS AND POTENTIAL SOLUTIONS

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Inflation and the Housing Market: Problems and Potential Solutions*

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The rising and variable rate of inflation over the past ten years has seriously destabilized the housing sector. The standard mortgage appears to be a major culprit given its limitations as a financing instrument in such periods of inflation. This article provides a review of the M.I.T. mortgage study sponsored by the U.S. Department of Housing and Urban Development and the Federal Home Loan Bank Board. The authors explain the shortcomings of the standard mortgage, describe five viable, alternative mortgage designs and propose a provocative package of recommendations. *Ed.*

Introduction

The increased rates of inflation accompanied by high and volatile interest rates experienced in recent years have affected the entire economy. The most drastic effect of these factors, however, has been on housing as shown by wide swings both in construction activity and in turnover of existing housing. There is a growing feeling that adequate housing is beyond the reach of an increasingly large number of households. The conclusions of the M.I.T. mortgage study are that (1) these effects can largely be attributed to the standard mortgage, and that (2) this instrument, in many ways therefore obsolete, should be supplemented by alternative mortgage designs.

The Shortcomings of the Standard Mortgage

The recurrent crises which have plagued the housing industry in the last decade can largely be traced to the interaction of a rising and variable rate of inflation with two major institutional features which have characterized the financing of housing in the U.S. These are (1) almost exclusive reliance on the traditional fully-amortized, level-payment mortgage as the vehicle

* This article is adapted from the introductory chapter in *New Mortgage Designs for Stable Housing in an Inflationary Environment* edited by Franco Modigliani and Donald Lessard, forthcoming in the Federal Reserve Bank of Boston Conference Series. It draws on the research of all members of the mortgage study which, in addition to the authors who were coordinators, included Richard Cohn—Sloan School at M.I.T., Stanley Fischer—Economics Dept. of M.I.T., Daniel Holland—Sloan School at M.I.T., Dwight Jaffee—Economics Dept. of Princeton, James Kearl—Economics Dept. of Brigham Young University, Ken Rosen—M.I.T. Harvard Joint Center, and Craig Swan—Economics Dept. of the University of Minnesota.

for financing the purchase of single family houses, and (2) overwhelming dependence for mortgage funds on thrift institutions which secure the bulk of their funds through relatively short-term deposits. This framework functioned satisfactorily in the period of relative price stability that prevailed until 1965. However, in the period of rising and fluctuating inflation since then, these same characteristics have had a devastating effect on both the demand for housing and the supply of mortgage funds.[1]

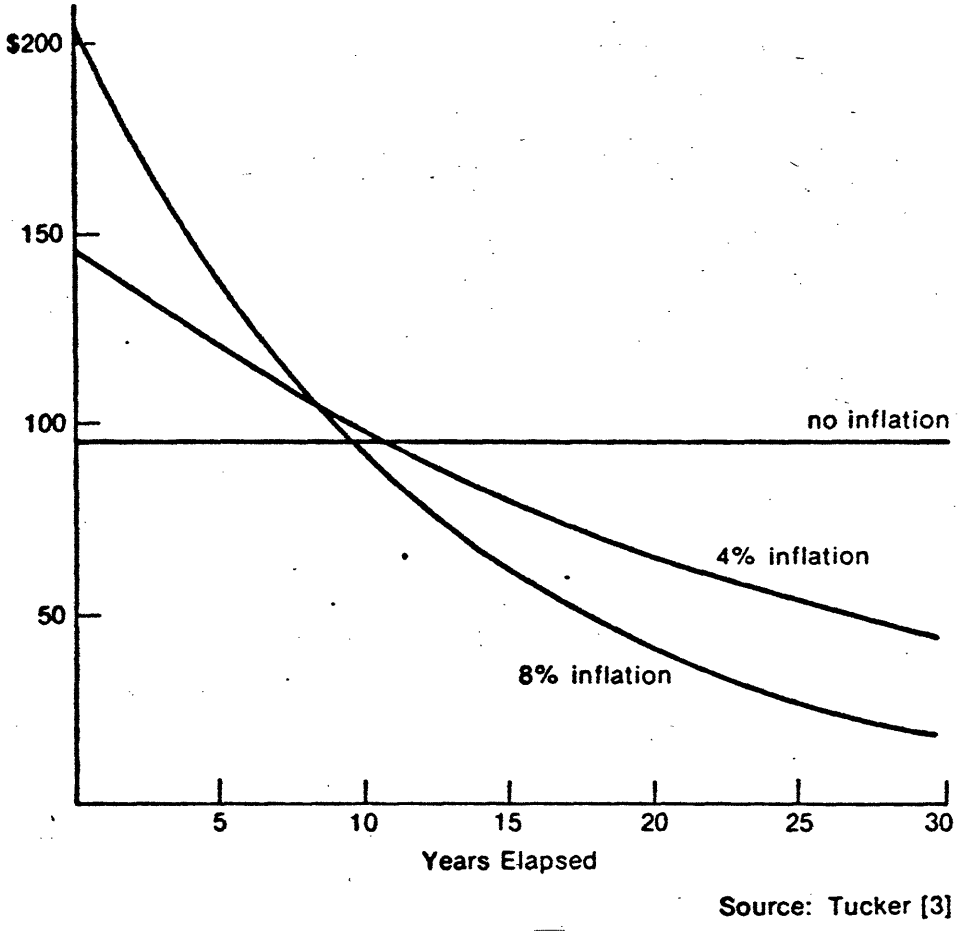
The Effects of Inflation on the Demand for Housing

At first glance, it would appear that inflation should have little impact on the ability of households to acquire housing. The cost of owning and using a house for a predetermined period consists of the outlays to acquire the house less the value of the house when sold. Clearly, financing costs will rise because a given increase in the anticipated rate of inflation tends to raise long-term interest rates by an inflation "premium" needed to compensate the lender for the anticipated erosion in the purchasing power of his claim. However, as long as the value of the house changes with the general price level, the inflation "premium" paid to finance the house will be recaptured through an eventual capital gain. In fact, taking into account the asymmetric tax treatment of interest charges and capital gains on a primary residence, inflation should actually *lower* the real cost of ownership.

Nevertheless, inflation has an adverse effect on the demand for houses financed through mortgages, because the rise in the mortgage rate results in a distortion of the time pattern of real mortgage payments, that is, payments expressed in dollars of constant purchasing power. In a world with inflation, real mortgage payments are much higher in early years and much lower in later years than they would be in a world with no inflation. The reason for this distortion in real payments is that payments are spread over a long period of time. Since the essence of the standard mortgage is that payments are level in current dollar terms, i.e., with no adjustment for changes in purchasing power, they must be set at a very high level, relative to what they would be in the absence of inflation, to offset the decrease in their real value over time. The tilting effect of a rising inflation rate on the stream of annual payments expressed in constant purchasing power is shown vividly in Figure 1, which is a graph of the real payment required in *each* year on a $20,000, thirty-year mortgage with zero inflation, 4 percent inflation, and 8 percent inflation.

To the extent that households are constrained in the amount of housing they can afford by the size of the monthly payment relative to their income in the first few years of the contract, this distortion will depress the demand for housing and result in financial hardship. For example, for a household with a real income of $10,000 throughout the term of the

[1] Most studies of inflation and housing have focused on supply effects. See Poole [2] and Tucker [3] for discussions of demand effects.



Source: Tucker [3]

Figure 1 Real Value of Monthly Payments

mortgage and with zero inflation, $85 or roughly 10 percent of the household's $853 monthly income would be necessary to cover the payments in all years. With a 4 percent rate of inflation, over 15 percent of income is required in the first year, but this would fall to less than 3 percent by the final year. Finally, with an 8 percent inflation rate, over 20 percent of income is required in the first year, but this would decrease to less than 2 percent in the final year. As one would expect, a higher rate of inflation also results in a more rapid decline in the outstanding debt. Correspondingly, the owner's equity builds up more rapidly if the real value of the house remains the same. In reality, this distortion is even greater than indicated by the example since household real incomes tend to rise over time.

In a world of perfect markets and infinite ingenuity, this distortion of the relationship between the time-stream of mortgage payments and house-

hold income might not affect the demand for housing. Borrowers would raise the funds needed for the high initial payments through second mortgages or unsecured personal loans. But borrowers may be reluctant to enter into such arrangements and, in any event, current lending practices tend to limit borrowing to the amount that the household can cover in the initial years with level payments, ignoring the decrease in the real value of these payments over time.

Another shortcoming, though admittedly of secondary importance, is apparent in periods of significant uncertainty about the future rate of inflation. At such times the standard mortgage, as a fixed long-term contract, becomes a risk for the borrower as well as the lender. The risk to the borrower is mitigated to some extent by the prevailing early repayment provisions on mortgages, mandated by law in many states. However, this protection is not without cost since the rational financial intermediary recognizes this asymmetry by exacting an appropriate premium for this option.

Many countries including the U.S. have tried to relieve the demand problem with various schemes, such as controlling interest rates with ceilings and providing interest rate or housing subsidies. Other countries, particularly Brazil but also Finland and Israel, have adopted mortgage designs which provide streams of payment which are stable in terms of purchasing power. Only a few countries, notably Sweden, have experimented with a combination of subsidies and financial innovation and government guarantees. It is our view that subsidies are an unnecessary and wasteful approach. Since higher interest rates arising from inflation do not change the overall real cost of the house, inflation per se should not be a ground for subsidies. If our analysis is correct, the real demand problem arises from the idiosyncrasies of the standard mortgage, which requires borrowers to repay the debt at an unreasonably fast pace and, therefore, the solution lies in the redesign of the mortgage instrument.

The true solution to this demand effect must therefore lie in devising instruments such that the repayment of the loan (measured in terms of purchasing power) will be independent of the rate of inflation. This solution would amount to an elimination of the tilting effect of the standard mortgage.

The Effects of Inflation on Housing through the Supply of Mortgage Funds

Supply effects arise not from the rate of inflation as such, but rather from its variations and from its interaction with interest rate ceilings. Both are intimately related to the unique structure through which the bulk of funds to finance mortgages has been raised in the U.S. in recent decades.

By far the largest share of private mortgage funds, especially those financing owner-occupied housing, has come from the thrift institutions—savings and loan associations and mutual savings banks—and to some

extent from commercial banks and life insurance companies.[2] These institutions in turn have obtained the funds almost entirely from deposits through much of the postwar period. These deposits were mostly short-term and highly liquid and regarded as demand liabilities.

As a result of these practices, thrift institutions acquired an extremely unbalanced or mismatched financial structure, consisting of very long-term assets and very short-term liabilities. Such an unbalanced portfolio imposes risks of failure on these institutions.

Portfolio imbalance did not create any difficulty during the period of relative price stability which lasted until the mid-1960s. But the weaknesses in such a structure became apparent in the era of rising and variable inflation which followed. Rising interest rates, during periods of monetary stringency, made it difficult to attract depositors at the rates of the earlier period. If institutions competed to retain deposits, they would have had to offer rates which would have resulted in severe losses and ultimate collapse. To prevent this outcome, regulatory authorities imposed ceilings on all deposit intermediaries often well below short-term market rates.

Because of these ceilings, thrift institutions' liabilities lost their attractiveness. The unfavorable response of depositors became more pronounced at successive "crunches." These periods of famine were typically followed by periods of heavy inflows. The wide swings in deposit inflows resulted in similar swings in the supply of mortgage funds causing wide fluctuations in construction activity and housing markets.

Obviously, institutions financing housing should not continue to lend through traditional mortgages, which are long-term instruments, while relying on very short-term liabilities as a source of funds. Rather they must have a financing instrument which allows them to earn a return commensurate with changing short-term market rates. The basic principle that prudent financial structure requires matching the characteristics of assets and liabilities is a tenet recognized by the institutions which finance housing in other countries. Some examples of foreign remedies to mismatching pitfalls are the following.

1. Conventional mortgages are typically financed by mortgage bonds (Sweden and many other countries).
2. Interest rates of mortgages financed by short-term deposits are subject to change (U.K.).
3. When mortgages are financed by liabilities of intermediate-term, the balance still due at the end of that term is refinanced at the then prevailing rate (Canada).

In the next section a number of alternative mortgage designs are reviewed. Each alternative is assessed in terms of how well it fits matching requirements of the lending institution's portfolio and suits borrowers'

[2] Government funds, in particular mortgages by the FNMA, have played an increasingly important role in mortgage financing in recent years.

interests as well as how effectively it eliminates or reduces the demand effect of inflation-induced changes in interest rates and consequent instability in construction activity resulting from such changes.

Alternative Mortgage Designs

A mortgage is simply a loan contract which specifies a rule for (1) determining the interest rate applying in any year to the debit balance then outstanding, called hereafter the debiting rate, and (2) calculating the periodic payments through which the debtor is to pay the interest and amortize the principal over the life of the contract. The traditional mortgage can thus be viewed as a special case of a much broader class, and a large number of alternative designs can be constructed by varying the various parameters characterizing the instrument. The designs discussed are only those which are presently at least being promoted here or abroad and which provide a viable solution to the problems enumerated in the previous section.

The Variable Rate Mortgage (VRM)

The alternative to the traditional mortgage that has received by far the greatest attention is the variable rate mortgage. Already adopted in some parts of the country, VRM is being promoted primarily by lending intermediary interests.

The essential characteristic of the VRM is that the rate charged on the borrower's outstanding balance, i.e., the *debiting* rate, is not fixed at the outset but is allowed to float up or down, being tied to some agreed "reference rate." This specification is consistent with a variety of designs in terms of (1) choice of specific reference rates such as a short, intermediate or long-term market rate, or the deposit rate of the intermediary originating the loan; (2) frequency with which the debiting rate is changed; (3) limitations, if any, on the maximum permissible change at revision points or over the life of the contract; and (4) methods for computing the periodic payments.

Two major alternative designs fall within the VRM classification. In one design, which has been adopted in the U.K. and elsewhere, the periodic payment is fixed at the beginning of the contract as in the traditional mortgage. Because a discrepancy between the debiting rate and the rate used to compute the payment at the outset leads to a corresponding discrepancy between the amount *available* for the amortization of principal and the amount *scheduled* for that purpose, the payments do not necessarily terminate at the original scheduled maturity, but only when the principal has been fully amortized. Thus, the instrument is of variable maturity. In the other design, the maturity is fixed but the periodic payments change with the debiting rate.

The adoption of the VRM could be expected to alleviate, if not solve,

the intermediaries' mismatching problem and, hopefully, the supply aspect of swings in housing markets. In terms of its effect on the borrower, however, the VRM appears to offer little relief to the housing problems and, in fact, is likely to make matters worse. This shortcoming is primarily due to the VRM's failure to come to grips with what we have labeled the demand effect of inflation. Since payments depend on a market rate of interest, the effect of inflation on these rates will cause higher initial payment to income ratios. Further, wider variations in short-term interest rates are likely to exacerbate swings in demand due to changes in initial periodic payments, although the generally lower level of these rates, relative to long-term rates, may stimulate demand over the long term.

A more common criticism of the VRM advanced by consumer advocates has been that making the interest rate variable increases the borrower's risk. This conclusion is open to question if one recalls that some of the risk of the VRM is offset by the long-term positive association between the borrower's money liability and his money income. However, it is true that with the fixed-maturity version of the VRM the borrower does face some additional risk. Although variations in the periodic payment are broadly associated with those in the rate of inflation and money income, in the short run the association is not close, partly because of the jerky nature of payment changes. As a result, the ratio of payment to income could vary substantially over the mortgage term. For example, if the rate of inflation rises from 3 to 5 percent, the scheduled payment under VRM rises by 24 percent, whereas the effect on the average homeowner's nominal income would be more like 2 percent. The reason for this much higher percentage change is that the higher inflation, by raising the nominal rate used in computing the constant payment for the rest of the contract, implies a further tilting of the real repayment schedule. For similar reasons, an absolute decline in inflation produces a much larger percentage decline in the scheduled payment.

The potentially large fluctuations in payments over time with the fixed-maturity VRM could be relieved by a variety of modifications. One modification is the fixed-payment variable-maturity version of VRM. But this version can afford only limited relief when the maturity is long, as is the case in the early years of the contract, and when most of the periodic payment consists of interest. Even small upward revisions in the debiting rate produce large changes in the scheduled maturity, and the point is soon reached where a fixed payment proves insufficient to ever amortize the debt. Thus the variable-maturity VRM is capable of "smoothing" minor fluctuations in the interest rate, but not major shifts such as those observed in recent years.

Various other modifications to improve the borrower's lot have been proposed for the variable-payment VRM. But conversely, these modifications reduce the benefits of the VRM to the lender and hence also its effectiveness in solving the supply problem. Indeed, any of these proposals

increase the probability that the market value of the mortgages will vary relative to their par value and thus deviate from the value of intermediaries' liabilities.

All of these proposals relate directly or indirectly to a basic dilemma in VRM design. From the perspective of the lender who obtains a significant proportion of funds with short-term liabilities, a short-term debiting rate is desirable, while from the borrower's perspective a longer-term rate is desirable because of its lower volatility. This dilemma, and the extent to which the various proposed modifications of the basic VRM instrument resolve it, can be best understood by considering the dual-rate VRM, a novel variant of the VRM which emerged during the course of our study.

The Dual-Rate VRM and Other Approaches to the VRM Dilemma

The dual-rate VRM endeavors to resolve the above dilemma by using two distinct interest rates. One, the debiting rate, is used to compute the interest on the outstanding balance; the other, which we term the payment factor, is used to compute the periodic payment. For the debiting rate, one would use as reference a short-term rate or preferably the deposit rate. The periodic payment, on the other hand, is recomputed at fixed intervals by applying to the principal then outstanding the standard annuity formula using some longer-term rate. This effectively reduces the magnitude and possibly the frequency of changes in payment.[3]

If the debiting rate differs from the payment factor, the actual amortization of the debt may differ from that implied by the payment factor. Thus, when a new periodic payment is computed, it could differ from the previous payment because of the discrepancy in principal and because of a change in the reference rate for the payment factor. Nonetheless, the variations could be expected to be appreciably smaller than for a standard VRM which used the same debiting rate. There are three reasons why this is so. First, the discrepancy in principal should not be large since the average debiting rates—short-term rates—should not differ markedly from the longer-term rate which is, after all, a forecast of the average short-term rates. Second, the discrepancy, if any, is spread over the remaining life of the contract and thus will not have a major impact on the payment. Finally, the payment rate, a longer-term rate, should be smoother than the debiting rate.

Thus a dual-rate VRM, with appropriately chosen reference rates and frequency of adjustment, can both enable the lending intermediary to earn a rate adequate to keep its deposit rate competitive with other short-term market instruments and still result in a smooth path of periodic payments in money terms. Its primary drawback, however, is its complexity.

Another approach to the dilemma is simply to use a longer-term rate

[3] The mechanics of this design are discussed in detail by Cohn and Fischer in "Alternative Mortgage Designs," in *New Mortgage Designs for Stable Housing in an Inflationary Environment*, *op. cit.*

for debiting as well as computing the payment. Insofar as its liabilities are of shorter term, this approach, as noted earlier, exposes the intermediary either to the danger of its revenue not keeping up with the rate it must pay on its liabilities or equivalently to the risk that the market value of its assets will fall short of that of its liabilities. Ideally, this risk would be avoided if the liabilities were term deposits with maturities matching that of the debiting rate.

To summarize, the VRM would be helpful to lenders and with ingenuity might not impose too great a burden on borrowers as compared with the standard mortgage. The dual-rate VRM appears to go furthest in mitigating the disadvantages to the borrower for a given gain to the lender by using a short-term debiting rate such as the deposit rate, while eliminating much of the inconvenience and risk placed on the borrower through large, sudden changes in the periodic payment. However, the VRM in any form still fails to resolve, and at least to some extent worsens, what we have called the demand effects of inflation, namely the capricious changes in initial level of payments due to inflation-swollen interest rates.

A quite different foreseeable shortcoming that might result from widespread adoption of the fixed-maturity VRM is of a macroeconomic character. A change in the debiting rate would result in an increase of the periodic payments for millions of homeowners. If the reference rate is a market rate, there would be public pressure on the central bank to hold down that rate when stabilization considerations would, on the contrary, call for higher rates (reflecting, e.g., inflationary expectations). This sort of pressure, which even now interferes with appropriate policy, would certainly be greatly magnified under the VRM. If the debiting rate for the VRM were the deposit rate, the same pressures would be directed toward holding that rate down in the face of rising market rates. If successful this pressure would, much like the imposition of ceilings, cause the intermediaries' deposits to lose attractiveness, thus recreating the very supply effect that the VRM was designed to solve. The recent experience of the U.K. provides an enlightening illustration of this scenario.

The Graduated-Payment Mortgage (GP)

Since a major impact of inflation on the homebuyer is the tilting of the time-stream of payments, one obvious solution to this problem is a mortgage which involves relatively lower money payments in early years. Clearly, unless such a mortgage is subsidized or of longer maturity, it must involve relatively higher money payments in later years in order to fully amortize the loan and provide the required return to the lender. Graduated-payment mortgages, with contractually rising payment streams, have been advocated in the U.S. and have been implemented in some other countries including the U.K. and Germany.

In a world with a steady rate of inflation, a graduated-payment mortgage, with payments which increase over time at a rate equal to the

rate of inflation, would eliminate the tilt effect in terms of constant purchasing power dollars and restore the basic feature of the traditional mortgage in a noninflationary environment—level payments over the life of the mortgage. Under normal circumstances, this would imply the same ratio of mortgage payments to household incomes and the same equity buildup as the traditional mortgage instrument.

One feature of the graduated-payment mortgage which might generate resistance on the part of both borrowers and lenders is that the outstanding principal in the early years of the contract would actually increase. The rising payments would eventually exceed interest charges and fully amortize the principal by the end of the contract period. While this situation raises some interesting tax questions, it should not be a cause for alarm on the part of either the borrower or the lender. The value of the house, and hence of the borrower's equity and the lender's collateral, can be expected to rise with the loan buildup.

Any resistance, then, would be the result of a failure to take into account the changing value of the dollar due to inflation. This is not to say that this "money illusion" will not be present or hard to overcome; hopefully it should be possible to overcome through information and education.

Unfortunately, the GP mortgage suffers from several serious shortcomings. First, with uncertainty about future rates of inflation, a contract calling for payments rising at the *expected* rate of inflation would be extremely risky for both the borrower and the lender. Additionally, a graduated-payment mortgage with a fixed interest rate over its entire life, being a long-term instrument, would do nothing to solve the supply problem stemming from the thrift institutions' reliance on short-term deposits as a source of funds. In fact, it would exacerbate the problem since it would lengthen the duration of the mortgage.

We must conclude that neither the VRM nor the GP is an attractive solution to the distortions in mortgage financing brought about by inflation and the accompanying high and uncertain interest rates. Each is a partial solution that benefits either the lender or the borrower, but at the expense of the other party.

In contrast to these partial solutions, one mortgage design which, in the abstract at least, has the potential of satisfying these requirements is the price-level adjusted mortgage (often referred to as a price-level indexed or index-linked mortgage).

The Price-Level Adjusted Mortgage (PLAM)

The basic mechanics of the PLAM involve a contractual interest rate which abstracts from inflationary anticipations, and a periodic revaluation of the outstanding principal in accordance with the change in the price-level index to which it is tied. In effect, the debiting rate on the PLAM is a *real* rate of interest, differing from the current money rate by the exclusion of the inflation premium, which reflects the anticipated change in the

price-level over the period of the contract. Payments are recomputed whenever the principal is revised, using the contract rate as the payment factor. As a result, the PLAM payment stream changes exactly in line with the reference price level.

To illustrate, assume that the rate of inflation is 6 percent, the current short-term interest rate is 9 percent, and thus, the real rate of interest (the rate of interest in dollars of constant purchasing power) is 3 percent.[4] For a $20,000, thirty-year PLAM, the payment at the end of the first year based on this 3 percent rate would be $1,020.[5] At the end of the year, the payment is subtracted from the adjusted principal—the beginning principal plus interest plus revaluation of the principal for inflation. Specifically:

Beginning principal	$20,000
Add: Interest (3%)	600
Add: Revaluation of principal for inflation (6%)	1,200
Subtract: Payment	1,020
Ending principal	$20,780

Thus, the lender has earned 9 percent (the 3 percent real rate plus the rate of inflation) and the principal is $780 higher at the end of the year than at the outset. The next payment is computed by applying the annuity formula to the $20,780 for the remaining twenty-nine years with a 3 percent interest rate. The resulting $1,083 is almost exactly 6 percent higher than the first payment. This process continues in each year and ensures that payments change in line with the price level.

PLAM has a number of advantages for borrowers. First and foremost, it completely eliminates the tilting effect of inflation on the stream of payments in purchasing power terms which results from the traditional mortgage (or the VRM); under PLAM the stream of real payments is constant over the life of the contract and is, in fact, equal to the payment required by a traditional mortgage in the absence of inflation. Second, a constant stream of payments in real terms, in contrast to one decreasing at a rate capriciously determined by the happenchance of the rate of inflation, could be expected to suit the bulk of potential homeowners. A third important property of PLAM is that, by contractually establishing the total payment in terms of purchasing power, it eliminates the risk to borrowers associated with unanticipated variations in the price level.

To summarize then, PLAM (in contrast to VRM or GP) does appear to offer a more complete solution to the range of problems which we have labeled the demand effects of inflation. It does so through a contract which, in effect, produces the same real consequence for the borrower (and the lender) as would the traditional mortgage in the absence of inflation—

[4] This is only an approximate result but is adequate for purposes of illustration.

[5] For simplicity we assume a single annual payment at the end of each year.

and does so no matter what the rate of inflation either anticipated or realized.

While some form of PLAM has actually been adopted in several countries (Brazil, Israel, Finland, Colombia and Chile), its novelty presents a drawback in the U.S. Borrowers and lenders are used to contracting in money terms with nominal rather than "real" rates. Rates of inflation have not been so high and persistent in the U.S. as to make people fully aware of the pitfalls of money illusion. Thus, fixing the payments in real terms with the actual payment depending on inflation may be regarded by many as increasing rather than decreasing risk. This hurdle could presumably be surmounted with an educational effort. To the extent that consumers are acquainted with wage escalators and other such price-level-indexed contracts, this task will be made somewhat easier.

There is however one further, and in the short run, more serious difficulty. Reaping the full benefits from PLAM would require substantial changes in the type of liabilities issued by financial intermediaries and possibly some changes in existing laws. Specifically, if thrift institutions are to be encouraged to offer PLAMs, they should be enabled to hedge this asset by a price-level adjusted deposit—or PLAD—that is, a deposit whose principal would be revalued periodically on the basis of the reference price-index, and which accordingly would pay a real rate.

In our view, the addition of PLADs to the menu of presently existing assets would be highly desirable in the presence of substantial and uncertain inflation, as it would make it possible for savers to hedge against the risk of price level changes. Such an opportunity is not presently available, especially where *small* savers are concerned. One further advantage of empowering thrift institutions to offer PLADs is that it would go a long way toward also solving the supply problem, assuming of course that supervisory authority would refrain from placing ceilings on PLAD rates. Indeed, there are sound reasons for supposing that PLADs could effectively compete with other instruments even in periods of interest rates swollen by inflationary expectations.

As for the straightforward solution involving PLAMs hedged by PLADs, despite its great attractiveness in principle, we fear that its introduction and acceptance would face serious obstacles and resistance, at least in the near future. First, as already indicated, this solution would require substantial changes in the thinking of both borrowers and lenders, as well as substantial changes in regulations affecting thrift institutions. Second, authoritative financial circles have frequently expressed strong opposition to the introduction of price-level adjusted deposits, fearing that this would disrupt the market for other instruments and/or force widespread adoption of price-level adjusted securities. They further argue (though wrongly in our view) that any reform that would reduce the pains of inflation should be opposed, as it would sap the will to fight inflation. Finally, the adoption of PLAMs and PLADs might well require some changes or reinterpretation of the tax laws.

For all of these reasons, we believe that a more promising solution to the problem may be found in the adoption of a somewhat different instrument which we label the "constant-payment-factor VRM." This instrument combines most of the advantages of the PLAM-PLAD approach, while requiring a minimum of institutional changes.

The Constant-Payment-Factor Variable Rate Mortgage

This instrument may be thought of as either a variant of the dual-rate VRM outlined earlier or as a hybrid of the variable rate and the graduated payment mortgage.[6] Just like the dual-rate mortgage, the constant-payment-factor VRM makes use of two separate rates: a debiting factor which is charged on the outstanding balance and a payment factor which is used to recompute the periodic payment at regular intervals by applying to the then outstanding principal the standard annuity formula. As in all VRMs, the debiting rate varies in accordance with an appropriate reference rate reflecting market conditions. There is some room about the choice of this reference rate, but ideally it should be chosen with reference both to the frequency with which the rate is adjusted and to the term of the instrument with which the mortgage is financed.

The basic difference with respect to the dual-rate VRM, and also the essential ingredient of the instrument, is the choice of the payment factor. This factor would be chosen to *approximate the "real" rate and would be kept fixed for the duration of the contract.* If there is inflation, the debiting rate will exceed the payment factor, and the payment will be insufficient to cover the interest and the "scheduled" amortization implicit in the annuity computation. If inflation is very high, the payment will not even cover the interest. In any case, when the payment is next recomputed, it will rise even though the payment factor is not changed.

For the sake of illustration, suppose that a homebuyer takes out a $20,000, thirty-year mortgage with an initial variable debiting rate of 9 percent. The annual payment on a 9 percent level-payment mortgage would be $1,947.[7] With the constant-payment-factor VRM the payment would be $1,020, based on a 3 percent rate. With the debiting rate of 9 percent, however, the total payments made in the first year would fall short of the interest charge by $780. At the end of the year, this "shortfall" would be added to the loan principal. Specifically:

Beginning principal	$20,000
Add: Interest (9%)	1,800
Subtract: Payment	1,020
Ending principal	$20,780

[6] Tucker [3] advocates a graduated-payment VRM with either a fixed schedule of graduation or a schedule which varies with changes in the reference interest rate. Cohn and Fischer, *op. cit.*, show that the latter version, which calls for recomputing the entire stream of payments whenever the reference rate changes, is identical to the constant-payment-factor VRM.

[7] Again, we assume a single annual payment to simplify the illustration.

The new annual payment would be computed so as to amortize this new balance over the remaining twenty-nine years. This would give a new figure of $1,083, an increase of 6 percent, which is equal to the difference between the debiting and payment factors. This process would continue over time, provided that the real rate is reasonably stable, or equivalently, that the debiting rate less the rate of inflation does not deviate widely or systematically from the payment factor. The annual payment in current dollars would tend to change over time at roughly the rate of inflation or, equivalently, the payment in constant purchasing power would remain unchanged over the life of the contract.[8]

Further analysis revealed that moderate "errors" in the choice of the payment factor would not produce serious consequences for either the lender or the borrower. This conclusion, when combined with the evidence that the real rate is quite stable, has one implication of considerable practical importance: an institution that chose to offer a constant-payment-factor VRM could afford to post a payment rate that changed at very infrequent intervals if at all.

If the lender were anxious to avoid the risk of too slow a rate of repayment and/or the borrower were anxious to avoid the risk of his payment stream rising in time, one could readily reduce the risk to any desired extent by choosing for the payment rate an upward-biased estimate of the real rate. This would of course imply a higher initial payment, and on the average a correspondingly declining real payment stream. Further, this option would be greatly preferable to the traditional mortgage in which both the initial payment and the anticipated rate of decline are determined by the happenchance of inflationary expectations.

It is apparent that with this instrument thrift institutions could offer an array of short-term and longer-term deposits, matching their asset maturity structure, and could always afford to pay rates competitive with the market. This is because the debiting rate, which is the rate they earn on their assets, would be based on the rate which they need to pay to attract deposits. The scheme is thus fully consistent with the intermediaries performing the function for which they were designed, while eliminating the supply effects of inflation.

To summarize, the constant-payment-factor VRM relies on two basic ingredients: a payment factor related to the "real" rate and hence independent of the rate of inflation, and a variable debiting rate tied to an appropriate market rate, with maturity related to the frequency of rate revisions. By combining these ingredients in different ways one can readily put together a wide variety of specific contracts capable of suiting the needs and preferences of both borrowers and lenders, providing thereby a solution to many of the present problems of housing and of the thrift institu-

[8] If these conditions hold, the time-pattern of payments and outstanding principal of a PLAM and a constant-payment-factor VRM with a payment factor equivalent to the real rate used in the PLAM will be identical.

tions. The instrument achieves this result because it combines the desirable features of a VRM from the viewpoint of the lending intermediaries and the main positive aspects of the PLAM from the viewpoint of the borrowers.

Transition Problems

The adoption of either the PLAM or the constant-payment-factor VRM (or any other VRM for that matter) would allow lenders to better match asset and liability maturities, thus reducing the periodic profit squeezes and related problems that have contributed to interruptions in mortgage supply. However, supply difficulties will be resolved fully only if deposit rates paid by institutions are competitive. If rate ceilings continue or if rates are repressed in any other fashion, fluctuations in supply will continue.

A major obstacle to competitive deposit rates is that most thrift institutions still have large proportions of their assets tied up in low yielding fixed-interest rate mortgages. Therefore, an immediate shift to fully competitive, and presumably on the average higher, deposit rates would worsen their profit position and would threaten the solvency of many of them.

It seems clear to us, at least, that the entire burden of this adjustment should not be imposed on the thrift institutions. While part of the current problem no doubt can be blamed on their shortsightedness, it is quite clear that it resulted primarily from behavior patterns forced on them by government regulation as well as major changes in the economic environment over which they had no control.

To achieve a rapid phasing out of rate ceilings would require not only the adoption of new types of mortgages along the lines presented in the previous section, but also some form of one-time government transfers to compensate institutions for the losses they would incur in the short run and thus maintain their solvency. While such a subsidy program might appear to be expensive, its cost would be modest when measured against that of wild gyrations in construction and the fact that an increasing proportion of Americans cannot acquire adequate housing. In addition, this once and for all subsidy should make it possible to eliminate many of the costly housing subsidy programs which have come into being in an effort to counteract these difficulties.

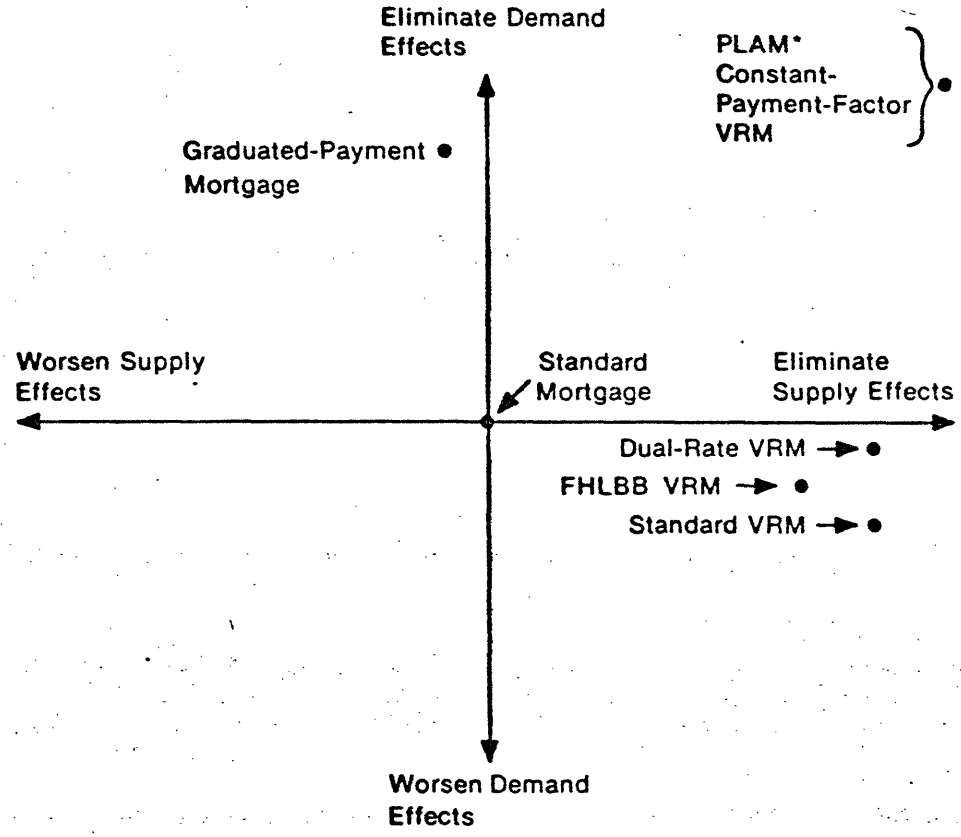
Obviously, there are many issues to be dealt with in the transition to new mortgage lending patterns. Inasmuch as these transition issues were not part of the study, we do not pretend to present a complete set of recommendations. However, it is clear that they must be dealt with in relation to any potential changes in patterns of mortgage lending.

Conclusions and Recommendations

The analyses summarized in this article support the conclusion that the standard mortgage has been a major contributor to the problems which

have plagued housing during the recent inflationary period. Further, they provide the basis for the hopeful conclusion that innovations in mortgage financing could substantially alleviate these problems, eliminating the need for further resort to housing subsidies or to greater direct government intervention.

Alternative mortgage designs were analyzed along two dimensions: (1) the extent to which they resolve the demand problem by eliminating inflation-related distortions in the time pattern of real payments and (2) the extent to which they resolve the supply problem by allowing closer asset liability matching. The position of each instrument along these dimensions



* If price-level adjusted deposits are issued.

Figure 2 Classification of Mortgage Designs by the Extent to Which They Eliminate Supply and Demand Effects of Inflation

is shown in Figure 2. Of all the mortgage innovations studied, only the price-level adjusted mortgage and the class of variable rate mortgages with smoothed real payment streams (of which the constant-payment-factor VRM appears to be best) rate well on both dimensions.

Based on these analyses, we offer the following four recommendations which should be considered as a package.

1. Price-level adjusted mortgages and/or variable rate mortgages with constant-payment-factors should be offered to the public. Federal and state regulations, as well as institutional practices, should be changed where necessary to allow for these instruments.
2. Thrift institutions should maintain a much closer balance between asset and liability maturities by both shortening effective asset maturities through PLAMs or VRMs (hopefully with constant-payment-factors), and lengthening liability maturities through more extensive use of term deposits and mortgage bonds.
3. Regulation Q ceilings should be abandoned as quickly as possible in order to restore the allocative mechanism of financial markets and reduce fluctuations in the supply of funds through traditional mortgage lenders.
4. Some form of once and for all subsidy (or other form of public intervention) should be granted to thrift institutions which will erase past mistakes and will not penalize housing and depositors of these institutions for past errors of financial policy.

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