Inflation and the Housing Market: Problems and Potential Solutions

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I. INTRODUCTION

Recent years have witnessed increasing rates of inflation accompanied by high and volatile interest rates. Although these factors have affected the entire economy, their most drastic effect has been on housing as shown by wide swings in construction activity and in the turnover of the existing stock of housing as well as by a growing feeling that adequate housing is out of the reach of an increasingly large number of households. The conclusions of the M.I.T. study are that (1) these effects can be largely traced to shortcomings of the standard mortgage and the institutional arrangements that surround it which, in an inflationary environment, have had a serious destabilizing impact on both the demand for and supply of housing and that (2) this instrument, in many ways obsolete, should be supplemented by alternative mortgage designs.

Given the persuasive case that the standard mortgage instrument is a major culprit, the study examines a variety of possible modifications of the traditional mortgage in order to assess the effectiveness of alternative designs in reducing or eliminating the demand and supply effects resulting from inflation and its variability. The alternatives examined include designs which have been advocated within the United States or actually implemented either here or abroad as well as a set of novel designs aimed directly at the two major types of inflationary effects.

Outline of the Study

The study was broken down into five subtasks, each of which appears as a paper in this volume.

The paper by Cohn and Fischer provides a detailed description and microeconomic analysis of the major alternative mortgage instruments from the perspectives of both borrowers and lenders. The types of mortgages considered include variable interest rate mortgages, which resolve

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the lender mismatch problem but in their standard form do not eliminate the inflation-related distortions in the time pattern of payments; graduated-payment mortgages with a fixed graduation geared to expected inflation, which do adjust the time stream of nominal payments for anticipated inflation but have no flexibility to cope with subsequent changes, and do nothing to resolve the supply problem; price-level-adjusted mortgages, where the outstanding principal is adjusted in line with changes in the price level, which address both problems; and a class of novel mortgage designs which are roughly as effective as the price-level-adjusted mortgage but which are deemed to be more easily implementable within the current institutional setting.

Kearl, Rosen, and Swan review existing empirical evidence regarding the potential impact on the demand for housing of changes in the mortgage instrument. They find general confirmation that basic elements of the mortgage do matter, though are led to conclude they find that existing studies are inadequate to provide quantitative information about the likely impact of the various proposed changes.

Experience in six countries with alternative types of mortgages is reviewed by Lessard with the collaboration of Anderson, Cohen, Cukierman, and Kouri. The countries studied include the United Kingdom and Canada, which employ variable-rate mortgages with level money payments; Brazil and Israel, which have adopted price-level-adjusted mortgages; Sweden, which has combined variable rates with a time stream of patterns tailored to remove inflationary distortions; and Finland, which has a hybrid scheme lying somewhere between that of price-level indexation and variable nominal interest rates.

Jaffee and Kearl present an examination, through simulation, of the macroeconomic impacts of various mortgage innovations. Relying on the MPS econometric model they estimate how construction activity, the profitability of thrift institutions and other related variables would have fared over the last ten years if the traditional mortgage had been replaced by a number of alternative mortgage designs.

Various tax, legal and regulatory barriers to innovation in the mortgage instrument are examined in the final paper by Holland.

The remainder of this paper provides an overview and synthesis of the results of the five studies.

II. THE CAUSES OF RECENT INSTABILITY IN THE HOUSING SECTOR

The recurrent crises which have plagued the housing industry in the last decade can be largely 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 United States in the postwar period. These are (1) almost exclusive reliance on the traditional fully amortized, level-payment mortgage as the vehicle for financing the acquisition

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 could and did work reasonably well in the period of relative price stability that prevailed until 1965, but has been a source of serious problems in the environment of rising and variable rates of inflation which have prevailed in the last decade through their effect on both the *demand* by potential buyers and the *supply* of mortgage funds.[1]

A. *The Effect of Inflation on Demand: Shortcomings of the Traditional Mortgages*

Our conclusions that inflation has an unfavorable effect on the *demand* for houses financed by mortgages and that fluctuations in the rate of inflation tend to lead to corresponding fluctuations in construction activity rests on the following considerations which are spelled out in the rest of this section.

1. Inflation and the anticipation of its continuation tends to raise interest rates, including mortgage rates, by an "inflation premium" needed to compensate the lender for the anticipated erosion in the purchasing power of his claim. The rise in interest in turn raises the annual payment needed to acquire a house of given value.
2. This higher interest rate and resulting annual payment do not *per se* change the real cost of carrying a house in that they are offset by the gain to the debtor resulting from the gradual decline in the purchasing power of his debt and of his annual payment.
3. Nonetheless the rise in interest rates resulting from inflation has an important effect on the time profile of the stream of annual payments, expressed *in terms of constant purchasing power.* Whereas in a world of constant prices these payments are constant over the life of the mortgage, the inflation-induced increase in interest rates results in an increase in the level of real payments in the early years of the contract with a commensurate reduction in the later years.
4. In a world in which the household's ability to meet the annual payment is constrained by its current income (there being no significant opportunities for second mortgages and the like) the increase in the annual payment in the early years of the contract is bound to have an unfavorable effect on the demand for housing by forcing many households to postpone or forego home-ownership or scale down their demand.

These propositions are illustrated by Table 1 and Figures 1 and 2. Column 2 of the table shows the effect of alternative rates of inflation on the annual payment for a $20,000 30-year mortgage. Assuming a 3 percent

[1]Most studies of inflation and housing have focused on the supply effects. Only Poole [1972] and Tucker [1975] have addressed the demand effects in any detail.

Table 1

EFFECT OF INFLATION ON THE STREAM OF PAYMENTS FOR DIFFERENT RATES OF INFLATION

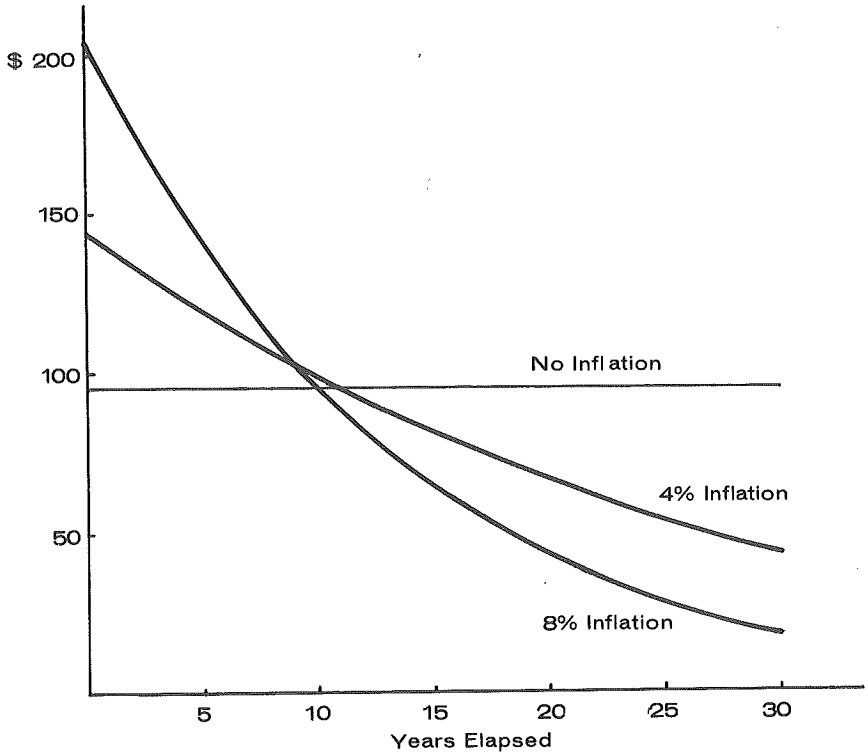
$20,000 — 30-Year Mortgage
$10,000 Initial Annual Income Increasing at Inflation Rate

	(1) Year	(2) Annual Payment	(3) Real Payment	(4) Payment/ Income (%)
Case A:		0% Inflation	3% Interest Rate	
	1	1,020.39	1,020.39	10.00
	5	1,020.39	1,020.39	9.24
	10	1,020.39	1,020.39	8.37
	15	1,020.39	1,020.39	7.58
	20	1,020.39	1,020.39	6.87
	25	1,020.39	1,020.39	6.22
	30	1,020.39	1,020.39	5.63
Case B:		2% Inflation	5% Interest Rate	
	1	1,301.02	1,275.52	12.50
	5	1,301.02	1,178.38	10.67
	10	1,301.02	1,067.30	8.79
	15	1,301.02	966.68	7.22
	20	1,301.02	875.56	5.94
	25	1,301.02	793.02	4.88
	30	1,301.02	718.26	4.01
Case C:		4% Inflation	7% Interest Rate	
	1	1,611.73	1,549.74	15.21
	5	1,611.73	1,324.72	12.04
	10	1,611.73	1,088.83	8.99
	15	1,611.73	894.94	6.73
	20	1,611.73	735.57	5.03
	25	1,611.73	604.59	3.76
	30	1,611.73	496.93	2.81
Case D:		8% Inflation	11% Interest Rate	
	1	2,300.49	2,130.01	20.91
	5	2,300.49	1,565.68	14.28
	10	2,300.49	1,065.59	8.87
	15	2,300.49	725.21	5.50
	20	2,300.49	493.57	3.42
	25	2,300.49	335.91	2.12
	30	2,300.49	228.62	1.32

Assumes 2% real growth in income

Figure 1

REAL VALUE OF MONTHLY PAYMENTS



Source: Donald Tucker, "The Variable-Rate Graduated-Payment Mortgage" Real Estate Review, Spring 1975.

interest rate in the absence of inflation, the annual payment is $1,020. As the inflation rate rises to 2, 4, and 8 percent, raising the mortgage rate by corresponding amounts, the annual payment is seen to increase by 30, 60, and 130 percent respectively.

The reason for the higher annual payment is that the payments are spread over a long period of time and, in the presence of steady inflation, these payments are made in dollars which are worth less and less in terms of purchasing power. This proposition is illustrated in column (3) of the Table, which expresses the annual payment in dollars of "constant purchasing power." This column is obtained by dividing the figures of column (2) by the price level relative to that prevailing in the year the contract was initiated, which is implied by the assumed rate of inflation for each of the years indicated in column (1).

In Case A, where no inflation is assumed, the figures of column (3) are of course identical to those of column (2) with stable prices, a standard mortgage calls for a stream of payments which is constant both in current dollars and in terms of purchasing power.

In Case B, with a 2 percent rate of inflation, the payments of column (3) decline at a rate of 2 percent per annum; thus while they start higher than in Case A, they end appreciably lower, with the terminal rate of payment only about half as high as the initial rate. This effect of inflation in "tilting" the real stream of repayments becomes more and more pronounced as we move to 4 and 8 percent rates of inflation in Cases C and D. In this last case, the payments start twice as high, but end up one-fifth as large.

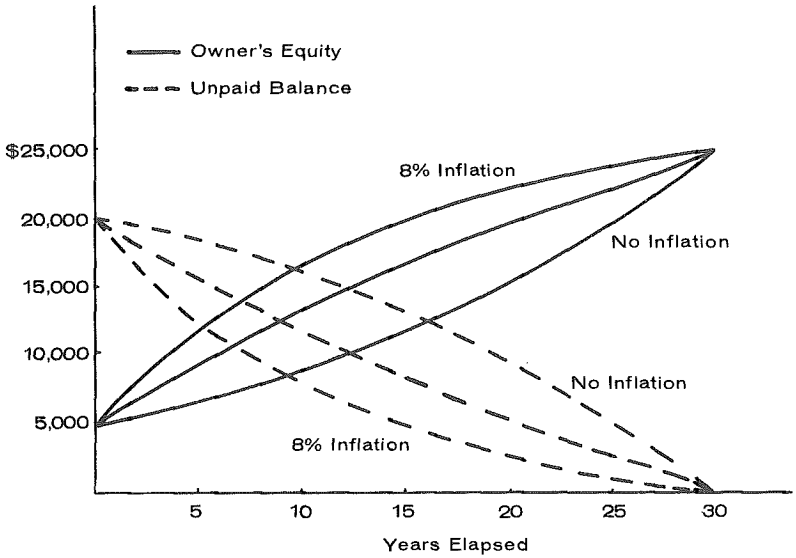
This tilting effect of a rising rate of inflation on the stream of annual payments expressed in constant purchasing power is brought out vividly in Figure 1 which shows a graph of the real payment required in *each* year of the contract (the information reported in column (3) is only for selected years), for zero inflation, 4 percent inflation, and 8 percent inflation.

The Level of Inflation and the "Real" Cost of Housing. While the payment streams corresponding to different rates of inflation differ radically in shape, they do have one feature in common: the present value of each of the payment streams measured in dollars of constant purchasing power is the same — $20,000 — when discounted at the rate of 3 percent which we have assumed represents the interest rate which would prevail in a world of no inflation (and hence is appropriate to dollars of constant purchasing power).

It is precisely in this sense that the higher rate of interest and the higher initial level of money payments resulting from inflation merely compensate the lender but do not *per se* increase the *real* overall cost of acquiring a house. The same conclusion may be arrived at in a different way. The cost of owning and using a house for a determined period consists of the outlays to acquire the house less the value of the house when sold. As long as the value of the house maintains a reasonably close correspondence to the general price level (or better yet exceeds it), the inflation premium paid to finance the house will be recaptured through an

Figure 2

REAL VALUE OF OWNER'S EQUITY AND UNPAID BALANCE



Source: Donald Tucker, "The Variable-Rate Graduated-Payment Mortgage" Real Estate Review, Spring 1975.

eventual capital gain. In fact, taking into account the assymetric tax treatment of interest charges (fully deductible) and capital gains on a primary residence (totally exempt if reinvested in another residence and taxed at the capital gain rate otherwise), inflation should actually *lower* the real cost of home ownership.

The Level of Inflation and the Ability of Households to Purchase Housing. Even though inflation does not increase the sum of discounted payments, it will have an effect on the value of housing which a household is able to acquire, for this depends not only on the sum of payments but also on their time profile. The typical household must meet payments from current income and lenders generally limit the size of a mortgage in order to maintain a desired payment-to-income ratio in the early years of the contract. Thus, the amount of housing which a household can acquire will be limited by its current income and the fraction thereof it can devote to housing.

It can be seen from Table 1 that a household with an annual income of say $10,000 and a mortgage of $20,000 could, in the absence of inflation, service the debt throughout the life of the mortgage with 10 percent of its income; with a 2 percent inflation, the initial payment would require over 13 percent of his income; with 4 percent inflation nearly 16 percent; and the figure would rise to nearly 23 percent if inflation reached 8 percent. Furthermore, as is apparent from Table 1 and Figure 1, with inflation the traditional mortgage will require higher real payments through most of the first half of the contract than would be required in a world of no inflation for which the mortgage instrument was designed. Looked at from a different angle, the traditional mortgage requires of the borrower quite different time shapes of repayments of his "real" debt, depending on the rate of inflation. This point is illustrated in Figure 2, which compares the behavior over time of the unpaid balance, measured in terms of purchasing power, for alternative rates of inflation. As one would expect from Figure 1, a higher inflation results in a more rapid decline in the outstanding debt. Correspondingly, the owner's equity also builds up more rapidly, if the value of the house remains constant in real terms.

Our conclusions about the unfavorable effects of the tilting induced by inflation are reinforced by the consideration that a major group of potential home buyers are young households who can look forward to an increase in income even in the absence of inflation, both because of the general effect of productivity growth, which tends to raise all incomes, and because typically, even in the absence of productivity growth, income tends to rise with age, at least for a while. For such households, the optimal time profile of real payments might be one rising over time; inflation instead will tilt the ratio of mortgage payments to income even further than indicated by Figure 1.[2]

[2]For this reason, young families with expectations of rapid increases in income might prefer a mortgage with rising real payments while other families, facing retirement and a drop in income, might prefer the opposite.

A faster repayment schedule and the resulting higher ratio of payment to income in the early years of the contract need not of course be a problem for those households who had intended to save at a rate sufficiently high to satisfy the schedule; but would be a problem for other households and their number would grow rapidly with rising inflation and the resulting speedup of repayments.

Even for these households, the problem could be handled in a world of perfect markets, no money illusion, and infinite ingenuity in devising financial instruments suited to changing circumstances. In this ideal world, the borrowers would be able to raise otherwise the funds needed for the high early payments, for example, through second mortgages or unsecured personal loans. But, obviously, our world does not meet these ideal specifications. Indeed, there is little evidence of any significant tendency on the part of lenders to make full use even of the flexibility in the existing mortgage contract to counteract the higher initial payments resulting from inflation by lengthening maturity or by raising the loan-to-value ratio. In any event, these devices would not go very far in counteracting the effect of inflation on the early payments.[3]

On the basis of this analysis, we conclude that, under traditional mortgage financing, inflation is likely to affect adversely the demand for houses by inducing potential buyers — especially first owners — to scale down their demand in terms of quantity and/or quality or to forego acquisition, at least until they have accumulated enough assets for a larger downpayment. It also follows that marked fluctuations in the actual and anticipated rate of inflation such as have occurred in the last decade, tend to change the demand for housing and thus contribute to the observed swings in residential construction activity. The Kearl, Rosen, and Swan paper endeavored to find empirical evidence on the quantitative magnitude of this impact, through a search of the empirical literature of factors controlling the demand for housing. Unfortunately, the existing contributions did not provide this evidence as none of the authors of previous empirical studies has explicitly treated these effects.

Uncertainty About the Level of Inflation and the Demand for Housing. In addition to the effects just discussed, which depend on the level of inflation, the demand for housing may also be affected by *uncertainty* about the future of inflation. Consider, for instance, the case illustrated in Case D of Table 1, when the rate of inflation anticipated over the 30 years of the contract is 8 percent, and on this basis the mortgage rate is set at 11 percent. If the actual path of inflation turned out to be appreciably different from 8 percent, the path of actual payments expressed in terms of purchasing power would also be different from that of column (3). In particular, if the deviations were prevailing in one direction, the

[3]Lengthening maturity from prevailing practices could accommodate, at best, only a very moderate rate of inflation and changing the loan-to-value ratio increases the lender's risk in the early years of the contract.

present value of the stream of real payments could deviate significantly from the intended $20,000. Thus, in the presence of significant uncertainty about the future rate of inflation, the mortgage instrument, as a fixed long-term contract, becomes a risky one for the borrower as well as the lender. If inflation turns out to be higher than expected, the borrower reaps a windfall gain (and the lender suffers a windfall loss); and if lower, the opposite occurs.

In our recent history, inflation typically has turned out to be higher than expected and, in addition, interest rates have frequently been kept artificially low by government policy, all of which has worked out to the advantage of the borrower. Thus there has been a tendency to assume that inflation is detrimental to the lender, but is good for the borrower and has a favorable impact on housing demand. Actually, once inflation has developed for a while, and interest rates are left free to incorporate expectations of hefty rates of inflation, anyone borrowing on a long-term basis to invest in a house bears a substantial risk of inflation turning out lower than anticipated.

This risk is mitigated to some extent by the prevailing early repayment provisions on mortgages, mandated by law in many states. Often borrowers are allowed to repay ahead of schedule with minimal penalties. This is viewed as a social necessity to allow people to buy and sell houses freely; but it also results in a "one-way option" in which the borrower can always get out of the original contract if interest rates fall, thereby reducing his risk of a lower than expected rate of inflation — but the lender cannot get out if they rise. Of course, a rational financial intermediary that recognizes this assymetry should exact a premium for this option during periods of high and uncertain inflation and interest rates with the result that borrowers would have to pay for the reduction of risk inherent in the prepayment clause in the form of an even higher interest rate.

One might conclude that insofar as households are prevailingly averse to risk, prepayment options are correctly priced, and interest rates freely reflect expected inflation. A high and uncertain rate of inflation could tend to reduce the demand for housing through its effect on the expected cost and risk to the borrower. It must be acknowledged however that, since these circumstances also increase the risk of investment in long-term fixed-rate financial assets, they may encourage wealth holders to invest in physical assets such as houses, especially since much evidence suggests that equities are not a particularly good hedge against inflation. The empirical relevance of this phenomenon is supported by the experience of countries with high rates of inflation.

These considerations make it hard to reach firm conclusions about the overall impact of uncertainty about the future of inflation on the demand for houses, especially since this depends in part on the nature of financial instruments available to investors. One conclusion that seems warranted, however, is that, if alternative instruments could be devised to finance housing which reduce the price-level risk inherent in the standard

mortgage, this would also have some favorable impact at least on the demand for owner-occupied housing. However, the shortcomings of the traditional mortgage arising from the uncertainty of inflation are likely to be of secondary importance compared with those arising from the tilting of the stream of payments discussed earlier.[4]

Inadequacies of Current Remedies. Several countries which at one time or another experience double-digit inflation have come to realize that at these high rates the traditional mortgage instrument requires such an exorbitant initial rate of repayment of principal that it becomes practically useless as a financing device. They have accordingly been led to try out basic reforms in this instrument involving some form of "price-level adjustment" along lines detailed in the reviews of Finland, Israel and Brazil and discussed further in IV.D below. Many other countries, including the United States and the United Kingdom have tried to relieve the problem by holding down interest rates through ceilings or by providing interest rate or housing subsidies. Only a few countries, notably Sweden, have tried to combine subsidies with financial innovation and government guarantees.

Typically, the approaches implemented or proposed in the United States have aimed at making mortgages available to qualified borrowers at below equilibrium interest rates. It should be apparent from our analysis that such schemes constitute an inefficient approach: they would be unnecessary if the right cure were provided.

If our analysis is correct, the problem does not arise from the fact that, with a higher inflation, the borrowers can no longer afford to pay the interest rate on the principal and amortize the debt at a reasonable and prudent rate. Indeed, we have shown that higher interest rates arising from inflation *do not change the overall real cost of the house;* hence, inflation *per se* should not be a ground for subsidies, especially to potential home purchasers who on the average do not come from the poorest classes of society. The problem arises instead from the fact that, with high inflation, use of the standard mortgage requires borrowers to repay the debt at an unreasonably fast pace.

The true solution to this demand effect must therefore lie in devising instruments such that the path of repayment of the loan (measured in terms of purchasing power) will be independent of the rate of inflation — say the same as it would be under a traditional mortgage in the absence of inflation thus eliminating the tilt effect of the standard mortgage.

B. *Effect of Inflation on Housing Through the Supply of Mortgage Funds*

Supply effects can be dealt with briefly as they are already fairly generally understood and agreed upon. They arise not from the rate of inflation as such, but rather from its variations, and from its interaction

[4]To the extent that the risks transferred to the lender via the "one-way" prepayment options result in higher mortgage interest rates, they will exacerbate the "tilt" effects.

with interest rate ceilings. Both are intimately related to the rather unique and not altogether satisfactory structure through which the bulk of funds to finance mortgages have been raised in the United States in recent decades.

As is well known, 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.[5] These institutions in turn have obtained the funds almost entirely from deposits. Through much of the postwar periods these deposits were almost entirely short term and highly liquid — indeed, for all practical purposes they could be and were regarded as demand liabilities. This practice was on the whole looked upon with favor, as one of the basic functions of these institutions was viewed as that of providing the public with a highly liquid investment. Only recently has this type of liability been supplemented to a growing extent by deposits with longer maturities.

Consequences of Maturity Mismatching. 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. This unbalanced portfolio did not reflect a conscious endeavor to speculate on the term structure, which would have involved shifting asset and liability maturities at various points in time. This becomes clear when one recognizes that mortgages are not very attractive instruments for speculating on the term structure since in many states the borrower can easily avail himself of the option to repay at no significant penalty in the event that interest rates fall. Rather, at least in the case of S&Ls, mortgages were one of the few investments that regulation allowed them to make. That thrift institutions were thus forced into an unbalanced asset-liability structure must be regarded as unfortunate since it would hardly seem socially desirable for these institutions to incur the risks of failure associated with extensive term-structure intermediation.

This portfolio imbalance did not create any difficulty during the period of relative price stability which lasted until the mid-60s as interest rates changed slowly, the term structure was prevailingly a rising one, and in addition, deposit rates were not under serious competitive pressure thanks to the low ceilings imposed on commercial bank time deposits. Accordingly, the thrift institutions and the S&Ls in particular were able to attract a large flow of funds and provide ample financing for residential mortgages. They were in fact so successful that home mortgages became less attractive for other intermediaries, such as life insurance companies, causing the market to rely on thrift institutions to a growing extent. Thus, the thrift institutions' share of all privately held home mortgages increased from the early 50s to the early 70s from roughly one- to two-thirds; and

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

because of this growth, their share of the annual flows was even more impressive, frequently reaching 80 percent and over.

But the weaknesses inherent in such a structure become apparent in the era of rising and variable inflation that began in the mid-60s. Rising interest rates during periods of monetary stringency made it difficult to attract depositors at rates of the earlier period. And the problem became more acute at each successive monetary crunch — 1966, 1969-70, 1974 — when short-term rates rose even more than long-term ones. Supervisory authorities became concerned that if institutions competed to retain deposits, they would have had to offer rates which would have resulted in severe losses and ultimate collapse — especially in view of the reduced market value of their portfolios which were very illiquid anyway. To prevent this outcome the regulatory authorities imposed ceilings on all depository intermediaries.

Since the level of ceilings was constrained by what the thrift institutions could afford to pay, it was frequently well below short-term market rates. Because no other assets of similar characteristics yielded more, the thrift institutions were spared a mass withdrawal. Nonetheless, their liabilities lost attractiveness for savers and their net inflows slowed down dramatically and even became negative for brief periods (the so-called "disintermediation"). Furthermore, this unfavorable response of depositors tended to become more pronounced at successive "crunches" as they became sensitive to rate differentials and as financial innovations provided them with better alternatives, such as the short-term money-market funds. These periods of famine were typically followed by periods of heavy inflows as each crunch was followed by a period of very low short-term rates as monetary policy eased off. The wide swings in deposit inflows resulted in similar swings in the supply of mortgage funds which played a major role in the wide fluctuations in construction activity and housing markets.

Solutions to the Supply Problem. The lessons to be learned from this experience are fairly obvious and broadly agreed upon: if there is a substantial risk of inflation, the institutions financing housing must not be allowed to continue the present practice of lending through traditional mortgages — a very long-term instrument — while relying on very short-term liabilities as a source of funds.

Hence, if the thrift institutions are to continue to provide the public with a highly liquid, conventional, deposit-type asset and to use the bulk of the funds so obtained to finance housing, they must have a financing instrument which will allow them to earn a return commensurate with changing short-term market rates. If they continue to invest part of their portfolio in instruments of long maturity with fixed interest rates, they should hedge them by liabilities of commensurate maturity, as well as matching characteristics in terms of prepayment options and the like. If instruments of an entirely new type were made available to them (such as the price-level-adjusted mortgages discussed below), they should again finance investments in this asset with liabilities of similar characteristics. It

should be added that the basic principle that prudent financial structure requires matching the characteristics of assets and liabilities has long been a tenet of financial theory and practice and is recognized by the institutions which finance housing in other countries. Thus (1) where conventional mortgages are used, they are typically financed by mortgage bonds, (e.g., Sweden, as well as many other countries); (2) where mortgages are financed by short-term deposits, their interest rate is subject to change (e.g., United Kingdom); (3) where the mortgage is financed by liabilities of intermediate term, the balance still due at the end of that term is refinanced at the then prevailing rate (e.g., Canada).

In the next section, drawing on the more detailed and rigorous analysis of the Cohn-Fischer paper, we review a number of alternative mortgage designs, assessing how well each design could fit into the portfolio of thrift institutions in terms of matching requirements, how well it would suit borrowers' interests, and how effective it would be in eliminating or reducing the demand effect of inflation-induced changes in interest rates, and hence in reducing instability in construction activity resulting from such changes.

III. ALTERNATIVE MORTGAGE DESIGNS AND THEIR EFFECTIVENESS IN ELIMINATING DEMAND AND SUPPLY EFFECTS OF INFLATION

A. *The Basic Elements of the Mortgage Contract*

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. In the course of the Cohn-Fischer study, as well as in the Jaffee-Kearl simulations, many designs have been given at least passing consideration. In what follows, we concentrate on a few of these, chosen on the basis of two criteria: (1) the extent to which they have already received attention and are being applied here or abroad, or are at least being actively promoted, and (2) the extent to which they appear to provide a viable solution to the problems discussed in Section II.

B. *The Variable-Rate Mortgage*

The alternative to the traditional mortgage that has received by far the greatest attention and already has been adopted in some parts of the country, is the variable-rate mortgage (VRM). It is being promoted primarily by lending intermediary interests as a solution to their problem and thus also to the supply component of the housing problem

The essential characteristic of the VRM is that the debiting rate charged on the borrower's outstanding balance 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.

Within this class, two major alternative designs have received consideration. In one design, which has been adopted in the United Kingdom 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 alternative design, the maturity is fixed and the periodic payments change with the debiting rate, that rate being used to recompute a new level payment over the remaining life of the contract which applies until a new change occurs in 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, especially if the reference rate were of the same maturity as the funds used to finance the mortgage. For intermediaries financed by short-term deposit liabilities, whose market value is always par, the appropriate rate would be a short-term rate or the deposit rate itself provided it was not distorted by ceilings. This would keep the value of the mortgages close to par. 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 is because the rate used to compute payments with a VRM is a nominal rate which responds to the rate of inflation and hence does not eliminate the tilt effect. Actually the relatively 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 (Cf. the simulation results of Jaffee and Kearl).

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. It is true that if the reference rate should turn out to rise above the initial mortgage rate, the debtor would end up paying more, but presumably this would tend to happen if inflation were also higher than the expectation built into the long-term rate, in which case the debtor's money income would also tend

to be higher in the long run. On the other hand, the reference rate could also decline, reducing payments, and this would tend to happen in the event that the rate of inflation turns out lower than anticipated and hence less growth in money income is realized than was expected. In other words, 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, with the fixed maturity version some of this risk remains. 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, in part because of the jerky nature of payment changes, and as a result the ratio of payment to income could be subject to substantial variability. This can be seen by inspecting columns (1) and (2) in the last row of the VRM block. If the rate of inflation rises from 3 to 5 percent, the scheduled payment under VRM rises from $1,453 to $1,798 or 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. (Cf. col. (3) and (4)).

The potentially large fluctuations in payments over time with VRMs 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 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 even to amortize the debt.[6] 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 have been proposed for the variable payment VRM such as using as reference a longer-term interest rate which presumably is less volatile than a short-term rate; limiting the frequency with which the debiting rate can be changed; allowing the maturity to vary and limiting its maximum permissible change at revision dates or over the entire life of the contract. But while such modifications would certainly improve the borrower's lot, they might by the same token reduce the benefits of 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.

[6]For example, an increase in the debiting rate to 8.8 percent from an initial level of 8 percent would result in the entire payment going toward interest.

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 a novel variant of the VRM which emerged during the course of our study.

C. *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, which we call hereafter 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 the deposit rate; the latter would seem preferable because it is directly related to the cost of funds to the intermediary, and because this mechanism is likely to be more readily understood, verified, and accepted by borrowers. The periodic payment, on the other hand, is recomputed at fixed intervals by applying to the principal still outstanding with the standard annuity formula using some longer-term rate, say an intermediate rate or the rate on the longest-term deposit offered by the intermediary.[7] Using longer rates for computing the periodic payment would have the effect of reducing the magnitude and, possibly, the frequency of changes in the payment.

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 aforementioned 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 for three reasons. 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.

[7]Section III.F and the Cohn-Fischer paper illustrate mechanics of this design.

Another approach to the dilemma is simply to use a longer-term rate for debiting as well as computing the payment. Insofar as its liabilities are of shorter term, this approach, as noted earlier, again exposes the intermediary 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 themselves term deposits with maturities matching that of the debiting rate. This approach is actually used in Canada, where mortgage rates are adjusted at five-year intervals and funding is obtained through five-year term certificates. As a result, Canadian institutions are perfectly hedged, that is, changes in the market value of assets are perfeclty matched by changes in the value of liabilities. Because of this, they have been able to avoid most of the supply (but not the demand) problems which have plagued U.S. housing markets.

If the debiting rate were a three-year rate fixed for three years, the risk to an intermediary financed by short-term liabilities might not be appreciably larger than if the debiting rate were a short-term one (a three-year instrument is unlikely to fall significantly below par), while the smoothing from the point of view of the borrower would be appreciable. It may be argued that bearing this limited risk is an appropriate function of the intermediary in order to reduce the borrower's risk.

The Federal Home Loan Bank Board has recently proposed a modification of this approach in which the debiting rate would be a three- to five-year rate, but instead of being fixed for this term, it would be adjusted every six months in accordance with movements in this same rate. There would also be a limitation to the maximum change in the debiting rate to one-half of 1 percent every six months and 2.5 percent over the life of the contract. This instrument is a hybrid that is neither short nor intermediate term. By adjusting the rate at more frequent intervals than the term of the rate, it would appear to create situations where market values would fluctuate around par and might provide borrowers with arbitrage opportunities. However, the more frequent adjustments would insure that mortgage yields would be sensitive to general shifts in the level of interest rates, thus reducing the chance of the mortgage portfolio going to a significant discount.

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 would worsen 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, a great deal of public pressure might be brought to bear for 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. And if the VRM were the deposit rate, the same pressures would be directed toward holding that rate down in the face of rising market rates. This pressure, if successful, would, much like the imposition of ceilings, cause the intermediaries' deposits to lose attractiveness, and thus recreate the very supply effect that VRM was designed to solve. The recent experience of the United Kingdom provides an enlightening illustration of this scenario.

D. *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 United States and have been implemented in some other countries including the United Kingdom, where they are known as "low-start" mortgages, and Germany. The Federal Home Loan Bank Board moved part way in this direction when it authorized S&Ls to write mortgages with payments covering only interest for the first five years and amortizing the principal over the remaining term of the mortgages.

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 mortgages. By and large, this would imply the same ratio of mortgage payments to household incomes and the same equity buildup (measured in real terms or simply as a ratio of the value of the property to the loan outstanding) as the traditional mortgage instrument, since wages and house values should, on average, also increase at the rate of inflation relative to their levels in the noninflationary environment.

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. For example, if the rate of inflation was 6 percent and the current

nominal interest rate 9 percent, reflecting an interest rate of 3 percent in dollars of constant purchasing power, a $20,000, 30-year graduated-payment mortgage with payments geared to rise at the rate of inflation would call for a payment of $1,020 in the first year.[8] The interest charge on the other hand would be $1,800. The "shortfall" of $780 would be added to the loan balance. The principal would continue to increase for several years, although the rising payments would eventually exceed interest charges and would fully amortize the principal by the end of the contract period.

While this situation raises some interesting tax questions, which are discussed by Holland, it should not be a cause for alarm on the part of either borrower or lender. The value of the house, and hence of the borrower's equity and the lender's collateral, can be expected to rise along with the loan buildup. In fact, if the rate of increase in the property value was exactly 6 percent greater than under noninflationary conditions, the borrower's equity position every time, measured by the ratio of outstanding debt to the value of property, would be identical to that in the zero inflation environment.

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 it 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 risky for both the borrower and lender. If inflation turned out to be less than anticipated, the borrower would face payments rising relative to income and a slimmer equity position. This, of course, would also increase lender risk. For this reason, the graduated payment mortgage with a rising schedule of payments set forth at the outset is generally viewed as appropriate only for young families with expectations of wage growth substantially in excess of the rate of inflation. While it is true that the risk is less for such families, this view confuses two issues — the need for a nonlevel payment in money terms simply to remove the distortions in the payment pattern of the traditional mortgage resulting from inflation and the need for a nonlevel payment in real terms, either rising or falling, to match a household's position in the life cycle.

Finally, 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 thrift instituions' 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, i.e., a larger balance

[8]This payment is equivalent to the payment required to amortize the loan with level payments at 3 percent, the difference between the debiting rate and the rate of graduation.

would be outstanding at each payment date than would be the case with a standard 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. 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).

E. *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.

This is illustrated in Case C of Table 2, which also shows the mechanics of the calculations. The contract rate is taken as 3 percent, the rate assumed to hold in the absence of inflation premia, and this results in an initial payment of $1,020, as compared with $1,453 at the 6 percent rate for the standard mortgage at the market rate shown in Case A of the exhibit. This payment is subtracted from the sum of the beginning principal plus interest plus the revaluation of principal (the rate of inflation times the beginning principal). Thus, at the end of the period the borrower owed the amount shown in row 5, an amount greater than the beginning principal much as with a GPM.

When account is taken both of the 3 percent interest charged on the oustanding principal and of the 3 percent writeup of the debt to reflect inflation, the total return to the lender and cost to the borrower is 6 percent, the same as the nominal rate.[9] The low contract rate, however, makes it possible to hold the initial payment down. Moving to the second year, the revalued principal is used to compute the next year's payment at the 3 percent rate. Because the principal has been increased precisely by the rate of inflation the new payment based on it also increased at that

[9]More precisely the return is (1 + payment rate) x (1 + rate of change in reference price index) -1.

Table 2

EXAMPLES OF COMPUTATION OF ANNUAL MORTGAGE PAYMENTS UNDER STANDARD MORTGAGE AND THREE ALTERNATIVE TYPES

Year	1	2	3	4
Real Interest Rate	3%	3%	3%	3%
Rate of Inflation	3%	5%	5%	4%
Nominal interest rate[1]	6%	8%	8%	7%
Years to Maturity	30	29	28	27
A — STANDARD MORTGAGE				
1. Beginning Principal	20,000.00	19,747.00	19,478.82	19,194.55
2. Plus Interest (6%)	1,200.00	1,184.82	1,168.73	1,151.67
3. Less Annual Payment[2]	1,453.00	1,453.00	1,453.00	1,453.00
4. Ending Principal	19,747.00	19,478.82	19,194.55	18,893.22
5. Memo: Annual Payment in Constant Purchasing Power as of Beginning of Each Year[3]	1,453.00	1,410.68	1,342.89	1,279.53
B — VARIABLE-RATE MORTGAGE (VRM)				
1. Beginning Principal	20,000.00	19,747.00	19,557.06	19,351.93
2. Plus Interest (nominal rate)	1,200.00	1,579.76	1,564.57	1,354.64
3. Less Annual Payment[2]	1,453.00	1,769.70	1,769.70	1,614.45
4. Ending Principal	19,747.00	19,557.06	19,351.93	19,092.12
5. Memo: Annual Payment in Constant Purchasing Power as of Beginning of Year	1,453.00	1,718.16	1,636.34	1,421.70
C — PRICE-LEVEL-ADJUSTED MORTGAGE (PLAM)				
1. Beginning Principal	20,000.00	20,179.61	20,742.33	21,296.29
2. Plus Interest (3%)	600.00	605.39	622.27	638.89
3. Plus Revaluation of Principal for Inflation	600.00	1,008.98	1,037.12	851.85
4. Less Payment[2]	1,020.39	1,051.65	1,105.43	1,162.02
5. Ending Principal	20,179.61	20,742.33	21,296.29	21,625.01
6. Memo: Annual Payment in Constant Purchasing Power as of Beginning of Each Year[3]	1,020.39	1,021.02	1,021.65	1,023.29
D — CONSTANT-PAYMENT-FACTOR VARIABLE-RATE MORTGAGE				
1. Beginning Principal	20,000.00	20,179.61	20,742.33	21,296.29
2. Plus Interest (nominal rate)	1,200.00	1,614.38	1,659.39	1,490.74
3. Less Annual Payment[2]	1,020.39	1,051.65	1,105.43	1,162.02
4. Ending Principal	20,179.61	20,742.33	21,296.29	21,625.01
5. Memo: Annual Payment in Constant Purchasing Power as of Beginning of Each Year[3]	1,020.39	1,021.02	1,021.65	1,023.29

[1]For simplicity, we simply add the rate of inflation, q, and the real rate of interest, r, to obtain the nominal rate of interest, i. The precise rate is the product of the two — $i = (1 + r)(1 + q)-1$.

[2]The payment due at the end of each year is calculated at the beginning of the year by applying the appropriate payment factor, either a constant *or* the nominal rate of interest, to the principal outstanding at the beginning of the year. This is done in order to provide the borrower with adequate notice of a change in payments. In practice, such a "notification" lag would more likely be on the order of three months.

[3]Payments are expressed in terms of constant purchasing power at the time they are scheduled (and the borrower is notified). This is consistent with the need for a "notification lag," although the one-year interval is undoubtedly excessive. In the cases of the PLAM and the constant-payment-factor VRM, whose objective is to produce a stream of payments which is stable in terms of constant purchasing power, it might be more desirable to compute payments so that they would be stable in terms of purchasing power at the time of payment. This could be done by first restating the principal for inflation over the year, computing the payment which would amortize the resulting balance over the remaining life of the mortgage, adding the interest on the restated principal, and then subtracting the payment. In our example, this would result in a year one payment of $1,051.00 which is precisely $1,020.39 in terms of year-end purchasing power, $1,103.55 in the second, with the identical year-end constant purchasing power. The same result could be obtained simply by "inflating" the payment based on the original principal by the cumulative price-level change since the date of the contract. But this would mean that the exact payment could not be determined until the end of the period when the realized rate of inflation is known. Fortunately, our example exaggerates the severity of the problem since it is based on one-year intervals. Shorter periods, such as three months, would result in much smaller discrepancies. The choice between a longer notification lag or a more stable real payment depends upon whether households' incomes are more stable in money or in real terms over the short run. Although we clearly believe that the answer is in real terms over the long run, it very likely is the opposite in the short run.

rate. This of course means that the payment expressed in constant purchasing power, shown in row 6, remains at the initial level.[10] This result holds for all remaining years of the contract.

Advantages of PLAMs for Borrowers. 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 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. In terms of the example of Table 1, the initial payment would be $1,020, whether the expected inflation be 0, 2, 4 or 8 percent. Second, a constant stream of payments in real terms, in contrast to one decreasing at a rate capriciously determined by the happen-chance of the rate of inflation, could be expected to suit the bulk of potential homeowners, particularly the younger households, whose real income is largely independent of the rate of inflation.[11]

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. As pointed out earlier, though in the past these unanticipated variations have tended to benefit borrowers, this need not be the case in the future as interest rates have adjusted to reflect expectations more adequately. As shown by Cohn and Fischer, this property is again especially important in reducing uncertainty for those households who can expect their real income to be largely independent of the rate of inflation.

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 consequences for the borrower (and the lender) as would the traditional mortgage in the absence of inflation — and does so no matter what the rate of inflation either anticipated or realized.

Feasibility of PLAMs. Some form of PLAM has actually been adopted in several countries, most notably Brazil, but also Israel, Finland, Colombia, and Chile. Experience with PLAMs appears to have been extremely successful in a few cases, though they have been abandoned in

[10]The payments in the example are constant in purchasing power as of the time when they are scheduled, *i.e.*, at the beginning of the year. As noted in footnote 1 of Table 2, payment could be scheduled so as to be constant in terms of purchasing power at the time of payment. However, this would not provide the borrower with any prior notice regarding the exact money amount of his payment. The problem is exaggerated in our example since there is a one-year interval between the scheduling date and the date when the payment is due.

[11]Actually, as noted earlier, for many households, real income may be expected to have a rising trend over time, and to this extent, even under PLAM the ratio of periodic payments to income would tend to decline over time. In principle, this variation too could be reduced by combining the PLAM with the GP mechanism.

others (but the reviews of country experience included in this volume suggest that this occurred for reasons largely unrelated to the basic mortgage instrument itself.)

Unfortunately, as a practical short-run solution to the U.S. problems, the novelty of the PLAM is a drawback. Borrowers and lenders are used to contracting in money terms with nominal rather than "real" rates and to payments fixed in nominal terms. Rates of inflation have not been so high and persistent in the United States 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 be surmounted as it has been in other countries, but it might require an education 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 — as well as 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 high interest rates. The U.S. experience suggests that much of the variation in interest rates, especially longer-term ones, can be traced to variations in actual and anticipated inflation. Thus keeping PLADs competitive with other assets would not require appreciable changes in the rate offered depositors, even in the face of large changes in market rates.[12]

Unfortunately, the straightforward solution involving PLAMs hedged by PLADs, despite its great attractiveness in principle, is likely to face serious obstacles and resistance, at least in the near future. First, as already

[12]Cohn and Fischer point out that thrift institutions could even finance PLAMs with short-term PLADS or with ordinary deposits with a risk substantially smaller than they presently incur in financing the traditional mortgage with short-term deposits.

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 for fear 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. Thus, for a PLAM borrower, the revaluation of principal would have to be treated, for income tax purposes, as a deductible expense on a par with interest if he is not to be at a disadvantage vis-à-vis a borrower relying on the standard mortgage; and if this treatment were accorded to him, then the revaluation of principal of a PLAD would have to be treated as ordinary income to avoid a special advantage to this asset and minimize disruption of capital markets, as well as avoid a net loss of revenue to the Treasury. These issues and related ones are reviewed in the Holland paper.

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, described in the next section, combines most of the advantages of the PLAM-PLAD approach, while requiring a minimum of institutional changes.

F. *The Constant-Payment-Factor Variable-Rate Mortgage*

This instrument may be thought of as a variant of the dual-rate VRM outlined in Section IV.C, or also as a hybrid of the variable-rate and the graduated-payment mortgage.[13] 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 balance still outstanding 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 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

[13]Donald Tucker [1975] 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 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.

respect to the dual-rate VRM, and also the essential ingredient of the instrument, is in the choice of the payment factors. This factor would be chosen to *approximate the "real" rate and would be kept fixed for the duration of the contract.* To the extent 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, as past evidence suggests, the payments on a constant-payment-factor VRM will approximate those of a PLAM. The initial payment, being based on the real rate, will be the same as under PLAM — a "low-start" payment which regardless of the actual rate of inflation is equal to what it would be in the absence of inflation. The behavior of the periodic payment in subsequent years will depend upon the difference between the payment factor and the debiting rate. If there is inflation, the debiting rate will exceed the payment factor. Therefore, principal will not be amortized at the rate implied by the annuity formula and under highly inflationary conditions it would actually rise. Thus, when the payment is recomputed, it will rise, even though the payment factor remains unchanged. *In fact, if the debiting rate exceeds the real rate by a differential roughly equal to the rate of inflation, then the periodic payment will also rise roughly at the rate of inflation.*

This conclusion is illustrated by a specific example in Part D of Table 2. In the first year the payment is $1,020.39, the annual amount required to amortize the $20,000 balance over 30 years with a 3 percent interest rate. (Note that it is the same as the initial PLAM payment, also computed at the 3 percent rate.) This $1,020.39, however, falls short of the actual interest charge of $1,200 at the 6 percent debiting rate. Hence, the "shortfall" or $179.61 is added to the principal (the amortization is negative). In the second year, a new payment of $1,051.65 is computed by applying the 3 percent annuity factor for 29 years to the $20,179.61. Note that the payment is 3.06 percent greater than the payment in year 1, approximately the rate of inflation.[14][15]

Differences from the PLAM. The debiting rate could not be expected to equal the rate used as payment factor plus the rate of inflation in every

[14]It would have been exactly the same if we had used the precise nominal rate rather than the simple sum of the real rate and the rate of inflation.

[15]In order to be consistent with the PLAM illustration, the payments are computed so as to be constant in terms of purchasing power at the time they are scheduled (the beginning of the year in our example). In the case of the PLAM this was necessary if the borrower required one-period advance notice of the exact money payment. With the constant-payment-factor VRM, however, payments could be set to be roughly constant in purchasing power terms at the time of payment since the interest rates, which implicitly forecast inflation, are known at the start of the period. Payments would vary only in that debiting rates did not properly forecast inflation. The minor increases over time in the payment stated in terms of purchasing power result from the fact that the compounding of interest and inflation is ignored in the example and thus payments rise to adjust for the minor discrepancy.

year, though one would expect this relation to hold approximately, and on the average, as long as the payment rate had been chosen judiciously. If, in fact, the debiting rate for a given year differs from the constant payment factor plus the inflation that actually materialized in that year, the annual payment in successive years will differ from that under PLAM — and hence will not quite be constant in terms of purchasing power — but the differences will tend to be small.[16] Furthermore, such differences would not produce serious consequences since the effective cost to the borrower would be unaffected. The interest rate paid on the balance is the same, namely the debiting rate. The choice of the payment rate affects only the path of periodic payment and hence the path of repayment of principal. If the rate chosen is too low, the repayments are more gradual than expected, being initially lower and eventually high — and conversely, if too high. The evidence for the United States cited earlier, indicating a reasonably stable real interest rate over the postwar period, suggests that it should not be difficult to select a payment factor such that the resulting stream of payments will be approximately level in real terms.

The conclusion that moderate "errors" in the choice of the payment factor would not produce serious consequences for either the lender or the borrower, 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. The convenience of such an arrangement should be obvious.

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.[17] 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 happen-chance of inflationary expectations.

Flexibility of the Constant-Payment-Factor VRM. One further feature of the constant-payment-factor VRM should be noted. By intentionally setting the payment rate different from the estimated real rate,

[16]To a very good approximation, a 1 percent deviation of the debiting rate from the sum of the payment rate plus the rate of inflation will result in the annual payment rising by 1 percent relative to the PLAM payment.

[17]Tucker [1975] advocates this approach as a means to gain acceptance of this type of mortgage.

one can approximate any desired rate of graduation in real terms. Setting the payment rate at x percent above or below the real rate would result in a real payment stream with a declining or rising trend of x percent per year.[18]

Further flexibility is to be obtained through appropriate choice of the debiting rate. If intermediaries issued term deposits of substantial length, say three to five years, then they could afford to offer a borrower anxious to minimize changes in the debiting rate, a contract in which the debiting rate would itself be fixed for that length of time. If that length were say five years, then over that period the contract would behave precisely like a GP mortgage in nominal terms, with the annual payment rising over the term of the debiting rate at a predetermined rate equal to the difference between the fixed payment rate and the fixed debiting rate. Of course while this arrangement would eliminate uncertainty about money payment, it would correspondingly enhance uncertainty about real payments; yet for reasonably short periods of time, the uncertainty of inflation may be fairly limited and households may be more able to estimate their money income over such a span. In such circumstances the use of a medium-term fixed debiting rate may serve to reduce risk.

It is apparent that with such arrangements, thrift institutions could themselves 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, as these would be the rates they would in turn earn on their assets. The scheme is thus fully consistent with the intermediaries performing the function for which they were designed, while eliminating the supply effects of inflation.[19]

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 institutions. The instrument achieves this result because it combines the desirable features of a VRM from the point of view of the lending

[18]As noted earlier the same result could be achieved with a PLAM.

[19]A variant of this instrument considered in the Cohn-Fischer paper involves a periodic payment which is fixed at the outset in terms of purchasing power and thus a variable maturity. Because large sustained discrepancies between the rate of inflation and the inflation premium reflected in the debiting rate are unlikely, this variable-maturity instrument does not suffer from the difficulty which was outlined in connection with variable-maturity VRM in Section III.B.

intermediaries with the main positive aspects of the PLAM from the point of view of the borrowers.[20]

These considerations lead us to conclude that while the PLAM is in some ways the most straightforward, rational solution of the problem in an abstract sense, the constant-payment-factor VRM provides an alternative which is not significantly inferior in any sense and is superior in many respects, particularly in terms of its ease of implementation in the light of existing institutions and attitudes.

IV. 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, i.e., sufficiently high to attract the deposits needed to satisfy mortgage demand at the deposit rate plus an equilibrium spread without resorting to outright rationing or to indirect rationing devices such as very high downpayments and excessively strict lending standards. If rate ceilings continue, or if rates are repressed in any other fashion, fluctuations in supply will continue although thrift institutions might no longer bear much of the brunt.

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 is for this reason that we have seen a number of proposals, such as tax exemptions for interest paid on thrift institution deposits, which would increase their ability to compete for funds without threatening their profitability or their solvency.

[20]There are some differences between the constant-payment-factor VRM and the PLAM which should be recognized, and which depend in part on the specific form of the constant-payment contract. If the borrower opts for a short-term debiting rate, he ends up by paying over the life of his contract a real rate equal to the average rate which actually materializes over that life. That rate is of course uncertain and need not coincide with the payment factor. By contrast, under a PLAM the real rate *is* the payment factor and is thus fixed and known in advance. Furthermore, under PLAM the periodic payments, are by construction, constant in terms of purchasing power (as measured by the reference price index) whereas with the alternative instrument they would exhibit at least some fluctuations because of fluctuations in the realized real rate. Accordingly, the PLAM might be a somewhat preferable instrument for the majority of borrowers in that it would enable them to hedge against future movements of the real rate. The alternative contract would be superior only for those who had reason to expect a positive association between their real income and the real rate. While this disadvantage relative to PLAM should be acknowledged, we do not believe that it is a major one.

Such proposals — as well as attempts to protect thrifts by maintaining deposit rate ceilings even if alternative mortgages are adopted — create distortions in current financial transactions in order to avoid the consequences of past errors. Further, they would very likely be planting the seeds for future supply crises if conditions changed. A superior approach would be to deal directly and separately with the problems arising from past practices and allow current transactions to take place on a sound basis. 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.

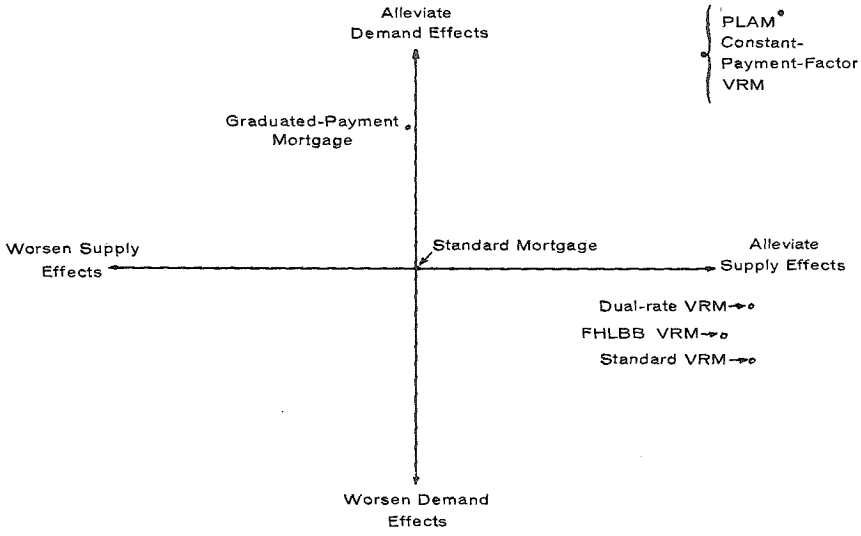
It would seem that to achieve a rapid phasing-out of rate ceilings would require not only the adoption of new types of mortgages along the lines presented in section IV but also some form of one-time government transfers to compensate institutions for the losses they would incur in the short run and thus maintain their solvency. While such a subsidy program might appear to be expensive, its cost would probably be modest when measured against that of wild gyrations in construction and the fact that an increasing proportion of Americans cannot acquire adequate housing.[21]

Clearly, there are many issues which will have to be dealt with in the transition to new mortgage lending patterns. The new instruments would have to be described in terms intelligible to consumers so that they can make appropriate choices. In particular, since they would presumably face a variety of choices, they would have to give careful attention to the benefits and costs of alternative features including prepayment provisions, the level of initial payments and the potential variability of payments. In a similar vein, lenders would have to rethink credit standards, downpayments, and desirable real payment patterns for different types of households. Since thrift institutions would face a situation in which cash inflows might fall short of accounting income, especially during early years of the transition, changes would be required in liquidity planning and might require further recourse to advances or secondary market operations. Along similar lines, regulatory authorities would undoubtedly have to rethink reserve and liquidity requirements for thrift institutions in response to different asset characteristics. Details of mortgage design, including the choice of appropriate reference rates for VRMs or price indices for PLAMs, adjustment intervals, and so on would have to be worked out.

[21]Such a subsidy would have a more favorable impact on the distribution of income than tax exemptions on thrift deposits. It would benefit all depositors proportionately rather than providing the greatest benefits to those in the highest income brackets.

Figure 3

CLASSIFICATION OF MORTGAGE DESIGNS BY EXTENT TO WHICH THEY ELIMINATE



* If price-level adjusted deposits are issued.

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

V. CONCLUSIONS AND RECOMMENDATIONS

The analyses summarized in this introduction and detailed in the following five papers 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.[22]

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 the various instruments along these dimensions is shown in Figure 3. Of all the mortgage innnovations studied, only the price-level-adjusted mortgages 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 four recommendations which should be considered as a package. These are:

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.

[22]We refer here to general mortgage subsidies which are likely to benefit largely those groups that are able to borrow most as opposed to subsidies or other mechanisms targeted at income groups which could not afford adequate housing even with appropriate innovations in mortgage financing. We wish to stress that subsidies should not be wasted in correcting problems which can be dealt with more efficiently and at lower cost through financial innovation.

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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