Alternative Mortgage Designs

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I. INTRODUCTION[1]

This paper examines a number of potential innovations in the design of the residential mortgage instrument from the respective standpoints of both parties to the contract, household borrowers and institutional lenders.

The mortgage instrument is a debt contract that can be fully described by a surprisingly small number of parameters that determine the interest rate, the time shape of the payment stream, and the maturity. In view of the wide variety of feasible designs, it is perhaps strange that essentially only one of these designs flourishes in the United States today, namely, the level-payment, fully amortized mortgage, which we shall refer to in this paper as the "standard mortgage" contract.

The reasons for the failure of the standard mortgage to serve the needs of both borrowers and lenders have been discussed by Professors Modigliani and Lessard in their introductory paper[2] and therefore need not be pursued at length here. Suffice it to say that the standard mortgage does not perform well in an inflationary environment, nor was it designed to do so.

The plan of the paper is as follows. Section II presents and discusses the criteria that were employed in evaluating the various mortgage instruments that were studied. Section III provides an analysis of five nonstandard mortgage designs, employing the standard mortgage as a basis for comparison. Section IV seeks to respond to potential consumerist objections to the mortgage design innovations discussed in Section III. Some concluding remarks follow. Formulas for determining nominal and real payments and outstanding debt for each of the various instrument designs appear in the Appendix.

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[1]This paper is both a summary and an extension of the authors' analysis presented at the January Conference. The discussants' comments which follow are addressed to the original paper.

[2]"Inflation and The Housing Market: Problems and Potential Solutions," this volume.

II. CRITERIA FOR EVALUATING MORTGAGE INSTRUMENT DESIGN

In this section we discuss the mortgage instrument with four sets of considerations in mind. First, we briefly consider the impact of new designs on housing construction. Second, we assess the contract designs from the standpoint of household borrowers. Third, we analyze the potential effects of new instruments on thrift institutions, which are currently the predominant lenders in the single-family residential mortgage market. Fourth, we briefly discuss the appeal of a number of new mortgage designs for institutional investors, such as life insurance companies and corporate pension funds, that are no longer active or have never been active in the single-family residential mortgage market. In the remainder of this section, we present and explore a number of criteria for analyzing and evaluating proposed new designs that arise from consideration of these four considerations.

A. *Housing Construction*

The standard mortgage instrument has contributed to the cyclical instability of housing construction in the United States largely through its effects on the supply of mortgage funds. But the standard instrument has also made the demand for housing sensitive to the expected rate of inflation because changes in the expected rate of inflation are reflected in nominal interest rates and consequently in mortgage payments.

Deposit rate ceilings, which do not allow thrift institutions to pay competitive rates when they are binding, cause disintermediation at times of cyclically high short-term interest rates.[3] Consequently, mortgage credit is rationed at times of high short-term rates[4] and fluctuations in the supply of mortgages are typically more responsible for cyclical instability in construction than are changes in the demand for mortgages. The ceilings must be removed and lending institutions must be allowed to match the effective maturities of their assets and liabilities for them to be able to compete for deposits at all times and thereby avoid rationing credit.

The demand for mortgages is also, however, a function of nominal interest rates. A rise in nominal interest rates, even if only a reflection of a change in the anticipated rate of inflation, causes an increase in the real value of the initial payments. For reasons made clear by Modigliani and Lessard, the current mortgage instrument accordingly makes construction activity sensitive to changes in the expected rate of inflation. From the

[3]The intermediaries do not oppose these ceilings because they are locked into long-term assets — standard mortgage instruments — yielding lower returns because the bulk of the loans were made in periods of lower interest rates.

[4]Dwight M. Jaffee, "An Econometric Study of the Mortgage Market," in Gramlich and Jaffee (eds.), *Savings Deposits, Mortgages and Housing,* (Lexington, Mass.: Lexington Books, 1972).

viewpoint of stabilizing the demand for housing, a real annual payment per unit of housing that is independent of the expected rate of inflation is desirable.[5]

B. *Borrowers*

We distinguish four desirable characteristics of the mortgage instrument from the viewpoint of the household. First, it is desirable that the annual payment in real terms per unit of housing be independent of inflation. When interest rates rise in response to inflation, housing demand is adversely affected because some people cannot afford the housing they could acquire if there were no inflation. As Modigliani and Lessard emphasize, the increasing difficulties of financing the purchase of a house with the standard mortgage instrument as interest rates rise result from capital market imperfections which make it impossible for the household to borrow in such a way as to choose its most desired path of real payments over time.

Our second desirable characteristic is that the borrower be able to choose a particular payment-to-income ratio that can vary as desired over the life of the mortgage. This second characteristic is accordingly closely related to the first. For example, a young household might want this ratio to decline over the life of the mortgage because of anticipations of increasing childbearing and educational expenses. Other borrowers might desire a stable ratio of payment to income.

A third characteristic desirable for the borrower would be a low level of uncertainty about the real cost of the mortgage. The real cost in terms of a rate of interest can be thought of as the nominal rate of interest for the period in question less the actual rate of change in the price level for the period. This difference represents the rate of return measured in terms of constant purchasing power that the borrower has been obligated to pay the lender for the use of his funds.

Perhaps a more intuitively appealing notion of this risk involves the ratio of nominal mortgage interest, less any decrease in the value of the mortgage as a result of inflation, to borrower income. The ratio represents the proportion of the borrower's income that is owed for the use of borrowed funds. Furthermore, because both the numerator, which can be thought of as the net nominal interest obligation, and the denominator of this ratio are measured in current dollars, there is no need to distinguish between nominal and real concepts.

These two notions are closely related, however. Money incomes reflect inflation over reasonably long periods. Consequently, low uncertainty about the "real" rate of interest corresponds in large measure to low uncertainty about the ratio of the net nominal interest obligation to household money income.

[5]This is not the place to discuss the desirability of totally stabilizing construction activity; it is clear, though, that current fluctuations in construction are excessive.

A fourth characteristic which we regard as desirable in a mortgage is concerned with the ability of householders to budget their mortgage payments over the near-term future. A desirable mortgage would be one in which there was little short-run deviation from trend in the ratio of payment to income. The trend in the ratio could, of course, be either up or down.

On the basis of these four considerations for evaluating mortgages from the standpoint of the borrowing household, we argue that the principal criterion by which to judge alternative designs is the stability of the payment-to-income ratio. Our analysis emphasizes both long-run and short-run variability in this ratio. Long-run variability can be thought of in terms of trends in the ratio that differ from the trend desired by the borrower. Given the prevailing short-run stability of household incomes, short-run variability in the ratio can be thought of as payment-to-payment variability in the payment-to-income ratio.

C. *Thrift Institutions*

In [3] we present a model of a perfectly competitive financial intermediary which assumes that it would suffer real costs in the event of insolvency. Such a model is obviously simplistic, but it does contain two valuable features. First, we can discuss lender behavior in the context of a firm that seeks to maximize its market value without having to refer to an institutional utility or preference function to explain its behavior. And second, we capture neatly the asset-liability maturity hedging behavior that is characteristic of financial intermediaries. Indeed, the results of this model indicate that a value-maximizing intermediary in the context of this model will act as though it were seeking to minimize the variance of the real rate of return on equity. It will attempt to hedge interest rate risk perfectly by matching the maturity characteristics of its assets and liabilities.[6]

What is important to stress in evaluating alternative mortgage designs, however, is that they cannot be judged independently of the nature of the deposit liabilities which lenders employ to finance their residential mortgage asset portfolios. For an institutional lender to remain viable under changing market conditions, there must be a close relation between the interest it earns on its assets and the interest it pays on its deposits. Otherwise it is looking for trouble.

Thrift institutions have been encouraged to issue short-term deposits. They realize that it is risky to finance a portfolio consisting largely of standard mortgages with such deposits. While they would like to hedge,[7] they have been prevented by regulation from doing so.

[6]While perfect hedging by lending institutions may not be possible in the mortgage market, the significant result of the model is its emphasis on the importance of hedging for financial institutions.

[7]Efforts by thrift institutions to implement variable-rate mortgages are one indication of this desire.

It is virtually impossible to analyze proposed innovations in mortgage design from the standpoint of depository lending institutions without separately examining two different scenarios. In the first, we investigate the present liability structure. In the second, we allow for changes in the liability structure, in particular, the issuance of price-level-adjusted deposits. It must be emphasized here, however, that any viable improvement in mortgage design, and indeed the continued existence of the standard contract requires that deposit interest rate ceilings be eliminated. Otherwise imbalances will continue to result to the detriment of the lenders.

1) *Continuation of Present Liability Structure.* At the present time thrift institutions, both savings and loan associations and mutual savings banks, can be usefully characterized in terms of their liability portfolios as issuers of dollar-denominated deposit liabilities that are short term or intermediate term. Indeed, they serve the dual social function of both financing housing and providing households with liquid assets.

If the predominance of this liability structure is to continue, then a desirable characteristic of a mortgage design from the standpoint of an institutional lender would be the ability to provide a short-term rate of return. Such an instrument would be equivalent to a rollover series of short-term instruments in terms of interest yield. Because such an instrument yields a current interest rate at any point in time, it will tend to sell at par, independent of the current or anticipated rate of inflation. Such a design would avoid the well-known "lock-in" effect that leads institutional investors to want to avoid realizing losses by selling assets at significant discounts from par value. Such a design would allow thrift institutions to bid successfully for funds independent of the rate of interest or inflation, thereby contributing to the stability of housing.

A further desirable characteristic of a mortgage instrument from the lender viewpoint would be a low level of default risk and one that is independent of inflation. One risk of inflation is that it will not be so high as had been anticipated. Consequently, the actual burden of payments called for in a dollar-denominated contract could be higher than the borrower and lender had expected at the time the mortgage was negotiated.

2) *Allowing for Innovation in Liability Structure.* One of the mortgage designs analyzed below in Section III is a price-level-adjusted mortgage, a design which specifies a constant real rate of interest. Such an instrument would be a desirable asset holding for an institutional lender interested in issuing price-level-adjusted deposits, for it would hedge his risk on the liability side. In a period of historically high and variable rates of inflation, many savers might be interested in holding such deposits. These new liabilities could therefore provide an additional source of stability for the housing market.

Another potential innovation is the issuance of long-term fixed-rate nominal deposits. Standard mortgages, for example, would be better financed in the maturity matching sense by such deposits than they are

under the current system. There have been some recent innovations in this direction in the sale of six- or seven-year nominal deposits by the savings institutions.

D. *Attraction of Other Intermediaries to Residential Finance*

Price-level-adjusted mortgages could well prove to be a desirable holding for institutional lenders other than thrift institutions. They could be attractive assets for any intermediary that wishes to issue price-level-adjusted liabilities or has already issued such liabilities. Life insurance companies might want to issue price-level-adjusted insurance policies so as to provide constant-purchasing-power death claims for their clients. Price-level-adjusted mortgages could support the issuance of such policies.

Another potential major supplier of funds for price-level-adjusted mortgages is corporate pension funds. Many corporations have promised pensions to employees that represent something of an inflation hedge by being tied to nominal wage and salary levels. At the present time there is no obvious inflation-hedged asset available to ease the asset-liability portfolio management problems of pension funds. Price-level-adjusted mortgages could well meet their needs in this regard.

E. *Summary of Criteria*

Our analytical approach has been conceived with the stability of housing construction and with household borrowers, thrift institutions, and other intermediaries in mind. These four sets of considerations have led us to evaluate alternative mortgage designs in terms of the following desired criteria:

1) Independence of the annual payment per dollar of housing from the rate of inflation.
2) Ability of borrower to choose a ratio of payment to income over the life of the mortgage that is independent of the anticipated rate of inflation.
3) Low uncertainty with respect to the real rate of interest or with respect to the ratio of interest to income.
4) Low short-term variability in the ratio of payment to income.
5) Ability of lenders to hedge on the liability side.
6) Low default risk independent of inflation.[8]

Specific designs are analyzed with respect to these criteria in Section III.

[8]Item 6 has not been discussed above but is of obvious relevance.

III. ANALYSIS OF ALTERNATIVE DESIGNS

A. *Introduction*

Our study considered a wide variety of mortgage designs. We discuss six representative designs in this section. These six designs can be regarded as falling into three major classifications. First, under the heading of mortgages with fixed nominal interest rates, we examine both standard and graduated-payment mortgages. Second, we analyze two types of variable-rate mortgages (VRMs), what we term the "standard" VRM and a dual interest rate variety. Third, we examine two designs that attempt to smooth the real stream of mortgage payments over the life of the mortgage, both a price-level-adjusted mortgage (PLAM) and a design which we refer to as the constant-payment-factor variable-rate mortgage.

Interest rates are used to compute both mortgage payments and mortgage interest. It is not necessary that payments and interest be computed by employing a single rate. One rate may be used to calculate the mortgage payment and yet another rate employed to calculate the borrower's interest obligation. For convenience in describing the six mortgage designs, we shall refer to the interest rate used to compute the payment as the "payment factor" and to the rate used for computing interest as the "debiting factor" or "debiting rate."

We shall analyze each design in turn. Each will be described and then evaluated from the standpoint of both borrowing households and institutional lenders.

The analysis is illustrated and supported by reference to historical simulations of the various designs. Tables 1-6 present for each of the six designs a simulation of a 20-year $30,000 mortgage negotiated at the beginning of 1951. Table 7 attempts to capture recent experience by presenting, for each of the six designs, a simulation of the first four years of a 20-year $30,000 mortgage taken out at the beginning of 1971. These latter simulations show the impact of generally higher rates of inflation and larger changes in interest rates on the various designs in the early years when these factors have the greatest effect.

Table 8 summarizes this section. It presents a schematization of each of the six designs and a summary evaluation. As mentioned previously, formulas describing the contracts can be found in the Appendix.

B. *Fixed Nominal Interest Rate Mortgages*

1) *The Standard Mortgage.* This design should be viewed as the benchmark for our analysis. This type of mortgage uses the same interest rate as both payment factor and debiting factor. This rate is a long-term, nominal interest rate, and it does not change over the life of the mortgage. This design consequently is characterized by payments that are constant in nominal terms.[9]

[9]The analysis of this paper ignores the effect of the tax deductibility of interest on actual payments. This effect is discussed by Professor Holland in his contribution to this volume.

Table 1

STANDARD MORTGAGE

(Payment and Debiting Factor — 3.50%)

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Payment in 1951 Dollars (beginning of year)
			Interest	Principal	
1951	$30,000.00	$2,110.86	$1,050.00	$1,060.86	$1,956.13
1952	28,939.14	2,110.86	1,012.87	1,097.99	1,914.34
1953	27,841.15	2,110.86	974.45	1,136.43	1,900.19
1954	26,704.72	2,110.86	934.69	1,176.17	1,890.70
1955	25,528.55	2,110.86	893.51	1,217.35	1,897.66
1956	24,311.20	2,110.86	850.88	1,259.98	1,870.01
1957	23,051.22	2,110.86	806.79	1,304.07	1,805.63
1958	21,747.15	2,110.86	761.15	1,349.71	1,757.50
1959	20,397.44	2,110.86	713.92	1,396.94	1,743.57
1960	19,000.50	2,110.86	665.02	1,445.84	1,715.92
1961	17,554.66	2,110.86	614.41	1,496.45	1,698.82
1962	16,058.21	2,110.86	562.04	1,548.82	1,680.03
1963	14,509.39	2,110.86	507.84	1,603.02	1,659.77
1964	12,906.37	2,110.86	451.72	1,659.14	1,638.45
1965	11,247.23	2,110.86	393.66	1,717.20	1,610.80
1966	9,530.03	2,110.86	333.55	1,777.31	1,564.84
1967	7,752.72	2,110.86	271.35	1,839.51	1,522.14
1968	5,913.21	2,110.86	206.95	1,903.91	1,460.72
1969	4,009.32	2,110.86	140.33	1,970.53	1,386.62
1970	2,038.79	2,110.86	72.07	2,038.79	1,308.73

Table 2

GRADUATED-PAYMENT MORTGAGE

(Payment and Debiting Factor — 3.50%)
(Payment Rise at 5% a Year)

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Payment in 1951 Dollars (beginning of year)
			Interest	Principal	
1951	$30,000.00	$1,349.50	$1,050.00	$ 299.50	$1,250.58
1952	29,700.50	1,416.98	1,039.52	377.46	1,285.06
1953	29,323.04	1,487.82	1,026.31	461.51	1,339.34
1954	28,861.53	1,562.21	1,010.15	552.06	1,399.27
1955	28,309.47	1,640.33	990.83	649.50	1,474.66
1956	27,659.97	1,722.34	968.10	754.24	1,525.82
1957	26,905.73	1,808.46	941.70	866.76	1,546.96
1958	26,038.97	1,898.88	911.36	987.52	1,581.01
1959	25,051.45	1,993.82	876.80	1,117.02	1,646.90
1960	23,934.43	2,093.52	837.71	1,255.81	1,701.82
1961	22,678.62	2,198.19	793.75	1,404.44	1,769.10
1962	21,274.18	2,308.10	744.60	1,563.50	1,837.02
1963	19,710.68	2,423.51	689.87	1,733.64	1,905.61
1964	17,977.04	2,544.68	629.20	1,915.48	1,975.18
1965	16,061.56	2,671.92	562.15	2,109.77	2,038.94
1966	13,951.79	2,805.51	488.31	2,317.20	2,081.13
1967	11,634.59	2,945.79	407.21	2,538.58	2,124.21
1968	9,096.01	3,093.08	318.36	2,774.72	2,140.41
1969	6,321.29	3,247.73	221.25	3,026.48	2,133.43
1970	3,294.81	3,410.11	115.30	3,294.81	2,114.27

Table 3

STANDARD VARIABLE-RATE MORTGAGE

(Payment and Debiting Factor — 3-5 Year Government Bond Rate Plus 2.32%[1])

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Payment in 1951 Dollars (beginning of year)	Debiting Factor
			Interest	Principal		
1951	$30,000.00	$2,158.86	$1,145.99	$1,012.87	$2,000.61	3.82%
1952	28,987.13	2,173.43	1,231.96	941.47	1,971.08	4.25
1953	28,045.66	2,260.67	1,248.03	1,012.64	2,035.06	4.45
1954	27,033.02	2,300.31	1,319.21	981.10	2,060.39	4.88
1955	26,051.92	2,383.32	1,078.55	1,304.77	2,142.60	4.14
1956	24,747.15	2,247.63	1,190.33	1,057.30	1,991.18	4.81
1957	23,689.85	2,364.26	1,269.77	1,094.49	2,022.39	5.36
1958	22,595.36	2,457.82	1,339.92	1,117.91	2,046.38	5.93
1959	21,477.45	2,551.94	1,123.27	1,428.67	2,107.90	5.23
1960	20,048.78	2,442.90	1,335.25	1,107.65	1,985.83	6.66
1961	18,941.13	2,654.56	1,197.08	1,457.48	2,136.39	6.32
1962	17,483.65	2,606.41	1,036.79	1,569.62	2,074.44	5.93
1963	15,914.03	2,555.64	937.34	1,618.30	2,009.24	5.89
1964	14,295.73	2,550.86	863.46	1,687.40	1,979.98	6.04
1965	12,608.33	2,567.29	804.40	1,762.89	1,959.10	6.38
1966	10,845.44	2,601.35	709.31	1,892.04	1,929.68	6.54
1967	8,953.40	2,615.89	669.71	1,946.18	1,886.32	7.48
1968	7,007.22	2,693.56	517.83	2,175.73	1,863.94	7.39
1969	4,831.49	2,686.71	381.69	2,305.02	1,764.90	7.90
1970	2,526.47	2,753.34	226.87	2,526.47	1,707.07	8.98

[1]Payment factor is lagged one year.

Table 4

DUAL-RATE VARIABLE-RATE MORTGAGE

(Payment Factor — 3-5 Year Government Bond Rate Plus 2.32%[1]
Debiting Factor — One-Year Government Bill Rate Plus 2.00%)

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Payment in 1951 Dollars (beginning of year)	Debiting Factor
			Interest	Principal		
1951	$30,000.00	$2,158.86	$1,110.00	$1,048.86	$2,000.61	3.70%
1952	28,951.14	2,170.73	1,100.14	1,070.59	1,968.70	3.80
1953	27,880.55	2,247.34	1,143.10	1,104.24	2,022.93	4.10
1954	26,776.31	2,278.45	776.51	1,501.94	2,040.82	2.90
1955	25,274.37	2,312.18	985.70	1,326.48	2,078.67	3.90
1956	23,947.89	2,175.02	1,149.50	1,025.52	1,926.76	4.80
1957	22,922.37	2,287.63	1,260.73	1,026.90	1,956.75	5.50
1958	21,895.47	2,381.68	897.71	1,483.97	1,983.01	4.10
1959	20,411.50	2,425.27	1,245.10	1,180.17	2,003.11	6.10
1960	19,231.33	2,343.28	1,057.72	1,285.56	1,904.84	5.50
1961	17,945.77	2,515.06	879.34	1,635.72	2,023.88	4.90
1962	16,310.05	2,431.44	815.50	1,615.94	1,935.08	5.00
1963	14,694.11	2,359.73	778.79	1,580.94	1,855.54	5.30
1964	13,113.17	2,339.85	760.56	1,579.29	1,816.02	5.80
1965	11,533.88	2,348.51	703.57	1,644.94	1,791.98	6.10
1966	9,888.94	2,371.92	712.00	1,659.92	1,759.57	7.20
1967	8,229.02	2,404.25	559.57	1,844.68	1,733.59	6.80
1968	6,384.34	2,454.12	485.21	1,968.91	1,698.20	7.60
1969	4,415.43	2,455.35	401.80	2,053.55	1,612.36	9.10
1970	1,960.08	2,134.56	174.48	1,960.08	1,323.41	8.90

[1]Payment factor is lagged one year.

Table 5

PRICE-LEVEL-ADJUSTED MORTGAGE

(Payment Factor — 3.00%)

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Principal Adjustment	Payment in 1951 Dollars (beginning of year)
			Interest	Principal		
1951	$30,000.00	$2,175.98	$971.19	$1,204.79	$ 2,372.95	$2,016.48
1952	31,168.16	2,223.37	955.41	1,267.96	678.71	2,016.48
1953	30,578.91	2,240.11	924.27	1,315.84	230.22	2,016.48
1954	29,493.29	2,251.20	889.18	1,362.02	146.05	2,016.48
1955	28,277.32	2,242.93	845.20	1,397.73	-103.72	2,016.48
1956	26,775.87	2,276.20	815.19	1,461.01	397.10	2,016.48
1957	25,711.96	2,357.27	798.83	1,558.44	915.81	2,016.48
1958	25,069.33	2,421.79	772.67	1,649.12	686.05	2,016.48
1959	24,106.26	2,441.35	729.03	1,712.32	194.90	2,016.48
1960	22,588.84	2,480.47	688.52	1,791.95	362.02	2,016.48
1961	21,158.91	2,505.68	641.22	1,864.46	215.03	2,016.48
1962	19,509.48	2,533.71	591.83	1,941.88	218.03	2,016.48
1963	17,785.63	2,564.36	540.02	2,024.34	215.19	2,016.48
1964	15,976.48	2,598.03	485.59	2,112.44	210.01	2,016.48
1965	14,074.05	2,642.60	429.46	2,213.14	241.41	2,016.48
1966	12,102.32	2,718.21	373.46	2,344.75	346.29	2,016.48
1967	10,103.86	2,796.45	311.84	2,484.61	290.79	2,016.48
1968	7,910.04	2,914.02	247.28	2,666.74	332.68	2,016.48
1969	5,575.98	3,070.70	176.27	2,894.43	299.79	2,016.48
1970	2,981.34	3,252.38	271.04	2,981.34	0.00	2,016.48

Table 6

CONSTANT-PAYMENT-FACTOR VARIABLE-RATE MORTGAGE

(Payment Factor — 3.00%
Debiting Factor — One-Year Government Bill Rate Plus 2.00%)

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown		Payment in 1951 Dollars (beginning of year)	Debiting Factor
			Interest	Principal		
1951	$30,000.00	$2,175.98	$1,038.00	$1,137.00	$2,016.48	3.46%
1952	28,863.00	2,058.98	1,085.25	973.73	1,867.39	3.76
1953	27,889.27	2,043.02	1,115.57	927.45	1,839.07	4.00
1954	26,961.82	2,058.08	935.58	1,122.50	1,843.49	3.47
1955	25,839.32	2,049.56	834.61	1,214.95	1,842.55	3.23
1956	24,624.37	2,093.23	1,115.48	977.75	1,854.39	4.53
1957	23,646.62	2,167.89	1,241.45	926.44	1,854.48	5.25
1958	22,720.18	2,194.92	1,095.11	1,099.81	1,827.49	4.82
1959	21,620.37	2,189.64	1,135.07	1,054.57	1,808.57	5.25
1960	20,565.80	2,258.27	1,433.44	824.83	1,835.84	6.97
1961	19,740.97	2,337.85	915.98	1,421.87	1,881.42	4.64
1962	18,319.10	2,379.15	930.61	1,448.54	1,893.47	5.08
1963	16,870.56	2,432.43	838.47	1,593.96	1,912.74	4.97
1964	15,276.60	2,484.15	867.71	1,616.44	1,928.09	5.68
1965	13,660.16	2,564.99	811.41	1,753.58	1,957.27	5.94
1966	11,906.58	2,674.22	788.22	1,886.00	1,983.84	6.62
1967	10,020.58	2,773.45	681.40	2,092.05	1,999.89	6.80
1968	7,928.53	2,920.71	589.88	2,330.83	2,021.11	7.44
1969	5,907.42	3,253.32	473.77	2,779.55	2,136.41	8.02
1970	3,127.87	3,427.21	299.34	3,127.87	2,124.87	9.57

Table 7

SIMULATIONS OF ALTERNATIVE MORTGAGE DESIGNS OVER THE RECENT PAST

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown: Interest	Payment Breakdown: Principal	Payment in 1971 Dollars (beginning of year)
I. Standard Mortgage (Payment and Debiting Factor — 8.00%)					
1971	$30,000.00	$3,055.57	$2,400.00	$ 655.57	$2,955.65
1972	29,344.43	3,055.57	2,347.55	708.02	2,855.43
1973	28,636.41	3,055.57	2,290.91	764.66	2,617.40
1974	27,871.75	3,055.57	2,229.74	825.83	2,337.51
1975	27,045.92	—	—	—	—
II. Graduated-Payment Mortgage (Payment and Debiting Factor — 8.00% Payments Rise at 8% a Year)					
1971	30,000.00	1,620.00	2,400.00	-780.00	1,567.35
1972	30,780.00	1,749.60	2,462.40	-712.80	1,635.00
1973	31,492.80	1,889.57	2,519.42	-629.85	1,618.61
1974	32,122.65	2,040.73	2,569.81	-529.08	1,561.16
1975	32,651.73	—	—	—	—

Year	Principal at Start of Period	Payment at End of Period	Payment Breakdown: Interest	Payment Breakdown: Principal	Payment in 1971 Dollars (beginning of year)	Debiting Factor	Payment Factor[1]
III. Standard Variable-Rate Mortgage (Payment and Debiting Factor — 3-5 Year Government Bond Rate Plus 2.32%[1])							
1971	30,000.00	3,449.45	2,427.00	1,022.45	3,337.32	8.09%	9.69%
1972	28,977.55	3,036.85	2,367.47	669.38	2,837.91	8.17	8.09
1973	28,308.17	3,057.28	2,332.59	724.69	2,618.66	8.24	8.17
1974	27,583.48	3,0720.80	2,794.21	278.59	2,350.67	10.13	8.24
1975	27,304.89	—	—	—	—	—	10.13
IV. Dual-Rate Variable-Rate Mortgage (Payment Factor — 3-5 Year Government Bond Rate Plus 2.32%[1] Debiting Factor — One-Year Government Bill Rate Plus 2.00%)							
1971	30,000.00	3,449.45	2,001.00	1,448.45	3,337.32	6.67%	9.69%
1972	28,551.55	2,992.20	1,932.94	1,059.26	2,796.19	6.77	8.09
1973	27,492.29	2,969.17	2,477.06	492.11	2,543.18	9.01	8.17
1974	27,000.18	3,007.82	2,621.72	386.10	2,300.96	9.71	8.24
1975	26,614.08	—	—	—	—	—	10.13
V. Price-Level-Adjusted Mortgage (Payment Factor — 3.00%)							
1971	30,000.00	2,084.23	930.24	1,153.99	1,007.93	2,016.48	6.46%[2]
1972	29,853.94	2,157.84	927.23	1,230.61	1,054.24	2,016.48	6.64
1973	29,677.57	2,354.24	971.35	1,382.89	2,701.25	2,016.48	12.38
1974	30,995.93	2,635.94	1,041.18	1,594.76	3,708.91	2,016.48	15.32
1975	33,110.08	—	—	—	—	—	—
VI. Constant-Payment-Factor Variable-Rate Mortgage (Payment Factor — 3.00% Debiting Factor — One-Year Government Bill Rate Plus 2.00%)							
1971	30,000.00	2,084.23	1,989.00	95.23		2,016.48	6.63%
1972	29,904.77	2,161.48	1,821.20	340.28		2,019.90	6.09
1973	29,564.49	2,345.23	2,196.64	148.59		2,008.92	7.43
1974	29,415.90	2,501.67	2,650.37	-148.70		1,913.78	9.01
1975	29,564.60	—	—	—		—	—

[1]Payment factor is lagged one year as described in the text. In 1971, for example, the payment factor was 9.69 percent — a spread of 2.32 percent above the average rate on 3-5 year government securities in 1970. In 1972, it was 8.09 percent, etc. Since the payment factors are lagged, the simulations have very high beginning payments, reflecting 1970s high rates, but they do not reflect the 1974 increase of rates until 1975. In the latter instance, the payment factor rises from 8.24 percent to 10.13 percent, leading to increases in the 1975 nominal payment over the 1974 level, of 14.5 percent and 14.0 percent, respectively.

[2](Interest and principal adjustment) / beginning principal

Table 8

ANALYSIS OF MAJOR MORTGAGE TYPES

	Characteristics of Contract Payment Stream									
	Debiting Rate			Ex Ante Time Shape	Payment Factor				Evaluation	
Name	Denomination	Term	Base		Denomination	Term	Base	Maturity	Borrower	Lender
Standard	Nominal	Long	Initial	Level nominal	Nominal	Long	Initial	Fixed	Poor	Poor
Graduated-payment	Nominal	Long	Initial	Graduated nominal	Nominal	Long	Initial	Fixed	Fair	Poor
Standard variable-rate	Nominal	Long	Current	Level nominal	Nominal	Long	Current	Fixed	Poor	Fair
Dual-rate VR	Nominal	Short	Current	Level nominal	Nominal	Long	Current	Fixed	Poor	Excellent
Price-level adjusted	Real	Long	Initial	Level real	Real	Long	Initial	Fixed	Good	Depends on liability structure[1]
Constant-payment-factor VR	Nominal	Short	Current	Level real	Real	Long	Initial	Fixed	Good	Excellent

[1]Excellent if financed by price-level-adjusted deposits. Fair otherwise.

Table 1, which simulates a standard mortgage over the 1951-70 period, shows that while the nominal payment is constant, the inflation-adjusted, or real, payments are obviously sensitive to changes in the price level. Viewing the column that presents payments in terms of their value in dollars as of the beginning of 1951, the time at which the contract was negotiated, the final payment is but two-thirds of the value of the initial payment. The effect of inflation is even more forcefully brought home by the recent experience presented in Table 7.I.

A constant nominal payment accompanied by anticipation of inflation necessarily implies an *ex ante* stream of declining real payments. Consequently, the initial payment must be high so as to make up for this "tilt" effect and maintain at issuance a given real present value for the mortgage.

Because the initial payment is high, the initial ratio of payment to income is high for the borrower in a period of anticipated inflation. Such a design is likely to produce cash flow difficulties for the borrower. Owing to these inflation-induced effects, we regard the standard mortgage design as poor from the standpoint of the borrower. Our empirical analysis did show, however, that short-run variability in the ratio of payment to income was relatively low. This perceived stability results from the stability of nominal income in the short run.

The standard design also rates poorly from the borrower viewpoint with respect to the risk dimension. Inasmuch as inflation can just as easily be less than anticipated as more than anticipated, the real cost can turn out to be more than anticipated.

This design also rates poorly from the standpoint of institutional lenders because of their unhedged deposit position. As experience has shown time and again, borrowing short and lending long can lead to severe difficulty for the lender. A portfolio of standard mortgages should be financed by long-term fixed nominal rate deposits if it is to remain viable in the long run.

2) *The Graduated-Payment Mortgage.* This design is an attempt to cope with the "tilt" problem inherent in the standard mortgage. While it too has a fixed nominal interest rate serving both as payment factor and as debiting rate, it is so geared as to have a payment that uses, in nominal terms, a fixed rate over the life of the mortgage.

The higher the rate of graduation, the lower the initial payment. If the rate of graduation turns out to be the average rate of inflation over the life of the mortgage, then the inflation-adjusted payments will fluctuate but will not have an upward or a downward trend. If the graduation rate turns out to be less than the average rate of inflation, then the real payments will exhibit a declining trend over time. If the rate of graduation turns out to be more, then the converse result holds with respect to the payment stream.

Largely because this design results in a lower initial payment, and consequently initial payment-to-income ratio, we regard it as fair from the

borrower standpoint. While it does overcome the cash flow problems induced by the standard design, to some extent it fares even more poorly along the risk dimension. Owing to its stream of nominally fixed rising payments, its real burden is even more sensitive to changes in interest rates than is the case with the standard mortgage.

We found the short-run variability of the payment-to-income ratio to resemble that of the standard design, which is to say relatively modest. But the borrower has little control over the long-term path of this ratio with this design.

Historical simulations of graduated-payment mortgages appear in Tables 2 and 7.II. Table 2 shows a 3.5 percent mortgage with a 5 percent rate of graduation and Table 7.II depicts an 8 percent mortgage with an 8 percent graduation rate. The real dollar payment depicted in the final column of Table 2 rises steadily from 1951 to 1967, a period during which the average rate of inflation was considerably less than 5 percent, and then levels off. The real payment in Table 7.II rises from 1971 to 1972 and then declines as rates of inflation moved above the 8 percent level in 1973 and 1974.[10]

From the standpoint of lenders, the graduated-payment design appears even worse than the standard mortgage. Its design implies, because of its rising payment stream, an even longer duration of real maturity than a standard mortgage with the same term to maturity and payment-debiting factor. Hence its value in the secondary market will be even more sensitive to fluctuations in interest rates than the value of the standard mortgage. Consequently, lenders will be even less hedged. Furthermore, the rising stream of payments implies greater default risk because of the slower accumulation of equity and the heavier payment burden for the borrower in the later years of the mortgage. With respect to lenders, we regard the graduated-payment design as poor.

C. *Variable Interest Rate Mortgages (VRMs)*

During the course of our study, we examined a wide variety of mortgage designs with fluctuating payment and/or debiting factors. Such designs are usually referred to as variable-rate mortgages or VRMs. Here we examine two such designs which we consider representative.

1) *Standard Variable-Rate Mortgage.* The design which we term the "standard" VRM uses the same rate for both the payment and debiting factors. But this rate is tied to some long-term reference interest rate, such as a market rate or a deposit rate, that can fluctuate. As the payment-debiting factor fluctuates, the nominal payment moves in the same direction.

[10]Throughout this study we measured rates of inflation as percentage changes in the Consumer Price Index from yearend to yearend. The yearend value of the index was approximated by the mean of the published levels for December and January.

The VRM design raises a number of implementation problems. What reference rate should be employed? Should there be an adjustment lag so as to allow an advance notification to the borrower of a change in the nominal payment? If so, how much? How often should nominal payments be allowed to change? How much of an advance notice of a change should be given to the borrower? What limits, if any, should be placed on the extent to which a nominal payment can change at any one time? What limits, if any, should be placed on the borrower's ability to refinance or otherwise repay his outstanding debt?

The historical simulations of a standard VRM depicted in Table 3 and Table 7.III represent one possible contract design. In this simulation the payment factor is the previous year's average three- to five-year government bond rate plus a spread of 2.32 percent.[11] The debiting rate is the current year's value for the same factor. The lag in the payment factor is designed to capture the adjustment lag needed so as to allow sufficient advance notice to the borrower.

The simulations serve to show that the standard VRM does not eliminate the "tilt" effect induced by inflation. For example, as shown by Table 7.III, the real payment falls by 30 percent between 1971 and 1974. The difficulty is essentially that a nominal interest rate rather than the price level is used at each point in time to calculate the payment. The standard VRM is similar to the standard mortgage in this respect.

Payments for the standard VRM are highly sensitive to changes in the nominal payment factor. Small changes in the rate of interest can lead to large changes in the payment in the early years of the mortgage.

Because of these two aspects, we regard the standard VRM as poor from the standpoint of borrowers. The ratio of payment-to-income is unstable in both the long and short runs. Payments are not independent of inflationary anticipations. We also found the payment-to-payment variability to be virtually an order of magnitude higher than was the case for the fixed-rate designs. Borrowers would also view this design as risky in terms of the net nominal interest obligation.

This design rates better from the lender viewpoint. Because the debiting rate responds to general interest rate movements, the lender is in a fairly well-hedged position. The hedging is less than perfect, however, because the debiting rate is a long-term rate while deposits bear, in principle, short-term rates of interest. But in practice the lack of a fully hedged position is not likely to be a source of serious difficulty because an intermediate rather than a long-term rate is usually proposed as the reference rate and, furthermore, thrift institutions today have a large part of their deposit liabilities in the form of term deposits.

[11]This spread results from the derivation of Table 3 from a simulation of a 25-year mortgage with an initial interest rate of 3.5 percent that is presented in the original paper by the authors.

2) *The Dual-Rate Variable-Rate Mortgage.* This VRM design represents an attempt to correct for the remaining lack of hedging that characterizes the standard VRM from the institutional lender viewpoint because both the payment and debiting factors are three- to five-year rates. In the dual-rate VRM, the payment factor has a long-term rate as its reference rate while the debiting factor has a short-term reference rate. Because short-term interest rates are more volatile than long-term rates, the use of a long-term payment factor results in a smoother payment stream than would a short-term payment factor. But because the debiting rate is a short-term one, the lender earns a short-term rate of interest on his investment, and institutional lenders could finance a portfolio of such mortgages with short-term deposits and still be hedged.

The historical simulations of the dual-rate VRM presented in Tables 4 and 7.IV employ the same payment factor (and adjustment lag) that was used to simulate a standard VRM. The debiting factor is the current year's average one-year government bill rate plus a spread of 2 percent.

The dual-rate VRM, when viewed from the standpoint of borrowing households, fares essentially the same as the standard VRM, for it suffers from the same drawbacks. While we view this design favorably with respect to institutional lenders, it rates poorly from the borrower viewpoint. This design is also more complicated than that of the standard VRM.

D. *Smoothed Real Payment Designs*

All of the designs examined above are characterized by an *ex ante* declining stream of real payments under conditions of anticipated inflation. Here we explicitly examine two designs that attempt to overcome this inflation-induced problem. It must be emphasized, however, that a wide variety of designs are capable of overcoming the tilt effect. We regard the two designs examined below as not only representative but also as containing a number of desirable characteristics.

1) *The Price-Level-Adjusted Mortgage (PLAM).* The PLAM is essentially equivalent to a standard mortgage in a world of no inflation or deflation. It has payments that are constant in real terms. The lender earns, and the borrower pays, a fixed real rate of interest.

The mechanics can be illustrated by referring to the historical simulation in Table 5 and Table 7.V. In this design the payment factor is constant and represents the real rate of interest. In this simulation we assume no adjustment lag.[12] If there were an adjustment lag, the payments would not be strictly constant in real terms, and the degree of instability would increase with the length of the lag.

In the simulations 3 percent is employed as the payment factor. This payment factor is used to calculate an initial payment in dollars as of the

[12]Consequently, our simulations of the PLAM differ from the illustrations presented by Lessard and Modigliani.

time the contract is negotiated. Consequently, even the first payment reflects inflation in the first year. "Interest" is also in real terms in the sense that it represents 3 percent of the principal at the start of the period escalated by the actual rate of inflation in that period. The column labeled "Principal Adjustment" represents the amount that the initial principal must be escalated so as to remain constant in real terms over the period.

The PLAM has some straightforward advantages for the borrower. The payment is, by design, independent of the anticipated rate of inflation. If borrower incomes are stable in real terms, then the long-run variability in the ratio of payment-to-income will also be low. Our empirical results indicate that the short-run variability in this ratio is quite low, approximately the same as that which characterized the fixed-rate nominal mortgages. Because the borrowers' interest obligation is fixed in real terms, the PLAM represents less risk. On the whole the PLAM appears quite good from the viewpoint of borrowers. Borrowers may regret their choice, of course, if real rates fall.

The appeal of PLAMs for lenders depends on their liability structures. If supported by price-level-adjusted deposits (PLADS), the lenders will be well hedged. While the PLAM earns a long-term real rate of interest and PLADS would pay a short-term real rate of interest, the short-term real rate is not likely to fluctuate widely, and little difficulty is consequently likely to result.

Because short-term nominal interest rates capture inflation reasonably well, PLAMs could also be financed by ordinary deposits although there would, of course, be more risk for the lender. It should be emphasized, though, that the PLAM should at least be considered under the current liability structure.

While the PLAM does contain more default risk than the standard mortgage, owing to its rising stream of payments, it also has the advantage of perhaps attracting new lenders to residential finance. This point was discussed in Section II.

2) *The Constant-Payment-Factor Variable-Rate Mortgage.* This design seeks to smooth the stream of real payments while employing a short-term nominal debiting factor.[13] Consequently, a portfolio of such mortgages could easily be financed by ordinary short-term deposits.

The historical simulations show how this design would work. They appear in Tables 6 and 7.VI. At each point in time the payment is calculated as though the instrument were a PLAM. The method is that described above; once again no adjustment lag is employed. But the debiting

[13]The constant-payment-factor VRM is essentially the same as the graduated-payment VRM proposed by Donald F. Tucker, "The Variable-Rate Graduated-Payment Mortgage," *Real Estate Review,* Spring 1975, pp. 71-80. The constant-payment-factor VRM, which seeks by design to smooth the stream of real payments, can be viewed as a mortgage with graduated nominal payments and a variable short-term debiting factor, the rate of graduation at any point in time being approximately the difference between the debiting factor and the constant-payment factor.

factor is the one-year government bill rate[14] plus a spread of 2 percent. The payment in the last year, as is also the case for the dual-rate VRM, is whatever payment is required to extinguish the loan.[15]

Table 6 shows that this design had a real payment that showed no clear trend over the 1951-1970 period. It can consequently be viewed as having achieved the purpose of smoothing the stream of real payments.

Because this design has a fairly stable real payment over the long run, it has some appeal for the borrower, but this appeal is somewhat diminished by short-run variability in the stream of real payments. From the lender standpoint, because it has a short-term debiting factor, it would appear to be an excellent design.

IV. RESPONSES TO POTENTIAL CONSUMER OBJECTIONS

Political acceptability is an issue that dominates most of the other problems involved in implementing nonstandard mortgage designs. The public's reaction to the variable-rate mortgages that have been issued in the United States has been, on the whole, negative. Consumer organizations have raised what amount to the following six objections to the variable-rate instrument, and they may serve to indicate the reaction that may be engendered by other innovations:

1) Mortgage-lending institutions can manipulate the reference interest rate and thereby cause the borrower's monthly payment to rise.
2) The instrument is so complicated that individuals cannot understand it adequately and will not realize what they are getting into.
3) The role of a financial intermediary should be to bear risk, not to pass it on.
4) Introduction of such instruments would endanger the continuation of government subsidies to housing, and the elimination of such subsidies would cause the cost of housing to increase.
5) Variable-rate mortgages are so preferred by lenders that their widespread adoption will cause the standard mortgage to vanish.
6) The introduction of the variable-rate mortgage will lead to a reduction in the portion of residential mortgage credit going to the poorer classes generally and to racial minorities in particular.

[14]In the case of the dual-rate VRM, the debiting represented the average of this series for the year. Here we employ an *ex ante* rate, specifically the mean of the January and preceeding December rates.

[15]The payments for this design would be identical to that of the PLAM if at every point in time the debiting factor equaled the product of one plus the payment factor and one plus the rate of inflation during the period.

It is probably safe to say that no one, except perhaps most recently who has financed the purchase of a house with a variable-rate mortgage has turned out to be pleased with his or her choice of financing. Nominal interest rates have trended upward for the past two decades; and, judging from the performance of the bond market, this rise has been largely unanticipated. This experience has undoubtedly had a negative effect on the public's willingness to consider the variable-rate mortgage and recent experience with inflation probably entails similar implications for the price-level-adjusted mortgage.

It must be emphasized, however, that it is certainly not obvious that as of today interest rates are expected to rise or that the rate of inflation is expected to increase. Abstracting from refinancing clauses in the mortgage contract, it might be much riskier for a borrower to take on a standard mortgage during a period of historically high nominal interest rates, such as the present, than would be the case with a PLAM or a variable-rate instrument.

Objection (1) could be met by requiring that the reference rate be the lender's deposit interest rate. A unilateral increase in the deposit rate above the competitive level would cause a large increase in deposits, thus squeezing lender profits. This objection could also be met by a number of external reference rates.

Objection (2) implies that full and fair disclosure is essential to the successful introduction of new designs. There is a significant burden of education that properly falls on the mortgage-lending institutions, both individually and in association, that must be forthcoming. Furthermore, it is probably reasonable that the borrower be required to sign a disclosure statement appropriate to the particular design in addition to the mortgage contract itself.

With respect to objection (3), there is ample evidence that savings and loan associations are not an efficient vehicle for coping with interest rate risk. If PLAMs and variable-rate mortgages are introduced into the mortgage market and deposit rate ceilings are eliminated, the resulting potential reduction in interest rate related risk may lead to an increase in the default risk that lenders are willing to undertake. Some borrowers who are marginal risks under the current system might then be able to obtain financing.

Objection (4) probably has some merit. One should keep in mind, however, that some of these indirect subsidies, such as the tax deductability of mortgage interest payments and local property taxes, may tend to benefit the higher income classes relative to the poorer classes.

Objection (5) is questionable. Presupposing the introduction of new mortgage designs together with an elimination of deposit rate ceilings, it is likely that some lenders will choose to specialize in issuing standard mortgages, financing them with long-term, fixed-rate deposits. Consumers will then be able to choose a mortgage design on the basis of their own expectations of future inflation and interest rates and their own credit requirements. Some consumers will desire the standard mortgage when it is

priced in equilibrium along with other designs. Its scheme of declining real payments under inflation will probably appeal to some households in later stages of the life cycle.

Objection (6) is based on the hypothesis that the money incomes of poor people do not respond to inflation. But this hypothesis is open to most serious question. Furthermore, the validity of this objection is presumably lessened if the standard mortgage survives the introduction of new designs.

If innovations increase the supply of mortgage credit, poor people may benefit as a result. While new designs were not developed with poor people in mind, they are unlikely to hurt them. Some lenders in fact might be more willing to lend on a fixed real rate basis with declining real payments than on a fixed nominal rate basis.

V. CONCLUDING REMARKS

Recent events argue strongly against a continued reliance on the conventional mortgage instrument as the sole vehicle for financing the housing needs of the United States. The price-level-adjusted mortgage and some variable-rate mortgage designs seem to provide significant advantages to both borrowers and lenders. Borrowers would be able to service a significantly larger mortgage debt with a given initial monthly payment than is the case with the conventional mortgage loan.

The introduction of nonstandard mortgages into the U.S. financial market requires that deposit rate ceilings be removed. Obviously, major changes in laws and regulations at both federal and state levels would be required in order to implement new designs.

In closing, we wish to emphasize that none of the perceived design improvements we analyze is meant to drive the standard mortgage out of existence. Nor is it our judgment that they would be likely to do so. We simply wish to see the household's housing financing choice enlarged.

APPENDIX

Description of Alternative Contracts

I. Notation

Q_t = Nominal payment required at end of t – th tim period

q_t = Real payment at end of period t

M_t = Nominal debt outstanding at end of period t

m_t = Real debt outstanding at end of period t

R_t = Nominal long-term interest rate appropriate to period t

r_t = Real long-term interest rate at period t

$\bar{R}(t)$ = Nominal short-term interest rate at period t

g_Q = Fixed rate of graduation

P_t = Price level at end of period t with P_0 set equal to one

T = Original amortization period or term to maturity

II. Terms of the contracts (discrete time)

A. Standard mortgage

1. Nominal payment

$$Q_t = R_1 M_0 [1 - (1 + R_1)^{-T}]^{-1}$$

2. Real Payment

$$q_t = Q_t / P_t$$

3. Nominal debt outstanding

$$M_t = M_0[1 - (1 + R_1)^{t-T}]/[1 - (1 + R_1)^{-T}]$$

4. Real debt outstanding

$$m_t = M_t / P_t$$

B. Graduated payment mortgage

1. Nominal payment

$$Q_t = \{[(1 + R_1)/(1 + g_Q)] - 1\} M_0(1 + g_Q)^{t-1}/$$
$$\{1 - [(1 + R_1)/(1 + g_Q)]^T\}$$

2. Real payment

$$q_t = Q_t/P_t$$

3. Nominal debt outstanding

$$M_t = Q_1 \sum_{i=t+1}^{T} [(1 + g_Q)^i(1 + R_1)^{t-i}]$$

4. Real debt outstanding

$$m_t = M_t/P_t$$

C. Standard variable-rate mortgage

1. Nominal payment

$$Q_t = \begin{cases} R_t M_{t-1}/[1 - (1 + R_t)^{t-T-1}], & t < T \\ M_{t-1}(1 + R_t), & t = T \end{cases}$$

2. Real payment

$$q_t = Q_t/P_t$$

3. Nominal debt outstanding

$$M_t = M_0 \prod_{i=1}^{t} (1 + R_i) - Q_t - \sum_{i=1}^{t-1} Q_i[\prod_{j=i+1}^{t} (1 + R_j)]$$

4. Real debt outstanding

$$m_t = M_t/P_t$$

D. Dual-rate variable-rate mortgage

1. Nominal payment

$$Q_t = \begin{cases} R_t M_{t-1}/[1-(1+R_t)^{t-T-1}], & t<T \\ M_{t-1}[1+\bar{R}(t)], & t=T \end{cases}$$

2. Real payment

$$q_t = Q_t/P_t$$

3. Nominal debt outstanding

$$M_t = M_0 \prod_{i=1}^{t}[1+\bar{R}(i)] - Q_t - \sum_{i=1}^{t-1} Q_i \prod_{j=i+1}^{t}[1+\bar{R}(j)]$$

4. Real debt outstanding

$$m_t = M_t/P_t$$

E. Price-level-adjusted mortgage

1. Nominal payment

$$Q_t = P_t q_t$$

2. Real Payment

$$q_t = r_1 M_0 [1-(1+r_1)^{-T}]^{-1}$$

3. Nominal debt outstanding

$$M_t = P_t m_t$$

4. Real debt outstanding

$$m_t = M_0 [1-(1+r_1)^{t-T}]/[1-(1+r_1)^{-T}]$$

F. Constant-payment-factor variable-rate mortgage

1. Nominal payment

$$Q_t = \begin{cases} r_1 M_{t-1}[1 - (1 + r_1)^{-T}]^{-1} P_t / P_{t-1}, & t < T \\ M_{t-1}[1 + R(t)], & t = T \end{cases}$$

2. Real Payment

$$q_t = Q_t / P_t$$

3. Nominal debt outstanding

$$M_t = M_0 \prod_{i=1}^{t} [1 + \bar{R}(i)] - Q_t - \sum_{i=1}^{t-1} Q_i \prod_{j=i+1}^{t} [1 + \bar{R}(j)]$$

4. Real debt outstanding

$$m_t = M_t / P_t$$

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Discussion

Henry B. Schechter*

Richard Cohn and Stanley Fischer have provided a useful classification and comparative analysis of the major types of nonstandard mortgages. The models of debt service payment streams which they developed to analyze effects upon the financial positions of borrowers and lenders will be valuable for further research, with substitute variables to reflect different empirical conditions.

My comments will deal primarily with implications of the major types of nonstandard mortgages for household borrowers. I will also touch upon the responsiveness of households to changes in interest rates, both as mortgage borrowers and as investors. This will lead to some concluding considerations of the potential effects of proposed mortgage innovations upon the capability of the thrift institutions to provide a more stable supply of mortgage funds.

Implications for Household Borrower

A borrower who would receive a price-level-adjusted mortgage, or PLAM, would have to make periodic payments that were adjusted by a predetermined inflation factor, or that reflected a readjustment of principal each period by a price change factor, such as the percentage change in a price index during the period. There are variations in the design, but essentially the periodic payments are adjusted to reflect inflation rates or price-level changes. In an inflationary economy, the borrower's repayments of principal and interest, in nominal dollar terms, would increase to protect the lender against a decline in real value of scheduled repayments. The borrower would bear the full risk of inflation.

The PLAM provides, in effect, for an indexing of required repayments, without any guarantee to the individual borrower that his income would be similarly indexed. (I am *not* advocating price and wage indexing for the entire economy.) During periods when wages lag behind

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price increases, as in 1973-74, the PLAM would exaccerbate the adverse impact upon those mortgagors whose incomes lagged behind prices. I agree with an observation by Cohn and Fischer that recent large increases in the rate of inflation would have a negative effect on willingness to consider the price-level-adjusted mortgage.

The authors found, on the basis of data for 1964-73, using per capita disposable income as the income measure, that the PLAM would provide a more stable stream of payments as a share of income than the other nonstandard mortgage types, as well as a more stable equity-debt ratio. They believe that "if a single characteristic of the payments pattern has to be singled out as affecting the desirability of the alternative mortgage types from the viewpoint of the borrower, it is the payment as a share of income." Maintenance of a stable debt service-to-income relationship — in real income and payment terms — is also looked upon favorably in other parts of the paper.

Stability of their mortgage debt service payments-to-income relationship, while occupying the same house, may not strike mortgage borrowers as desirable. Based on experience of their own and preceding generations, households look forward to upgrading their housing and other living standards as incomes increase.

In historical perspective, it seems reasonable to expect increases in real income in the future. Assuming that there will be increases in productivity and real income, nominal income should increase at a rate in excess of the inflation rate over the life of the loan. An adjustment of payments designed to correct for inflation should, therefore, result in a declining payments-to-income relationship.

A declining payments-to-income relationship provides a better cushion against risk of default than a stable relationship, and is beneficial for both the borrower and lender. In fact, credit underwriting of the borrower might tend to be more rigorous in the context of a stable payments-to-income outlook, which could make it more difficult for certain income or age groups to qualify for PLAMs than for standard mortgage loans.

Risk of default and lender loss of part of the adjusted outstanding balance would also increase where the principal is adjusted each period, while a constant real interest rate is applicable. In an inflationary economy, the outstanding principal amount could rise above the initial principal for five to ten years, as shown in a PLAM payments schedule developed by the authors. Under these conditions lender selectivity among prospective household borrowers would tend to increase.

A set of broader issues relates to a change in the attributes of home ownership that the mortgage borrower would be asked to accept along with a PLAM. Home ownership has been distinguished from rental housing, primarily because homeowners have had some protection against increases in their nominal housing costs reflecting changes in housing capital values. The homeowner has been the sole beneficiary of the capital gain arising from an increase in the housing value. For many, if not most

homeowners, the residential property is their only means of sharing in inflation-generated capital gains which are enjoyed by owners of other types of equities.

The homeowner's equity position has been based on payment of a specified price at time of purchase, and a loan to be repaid in dollars unadjusted for changes in price or value. While it may be argued that purchasing the fee ownership to the house is separate from agreeing to repay a loan obtained to finance that purchase, the first transaction is generally dependent upon the second, and they are executed simultaneously. As a practical matter, therefore, it would be difficult to draw a convincing distinction between a price-level-adjusted mortgage payment plan and a sharing by the lender of any increase in property value. The lender would, in effect, become a partner of the equity owner in a prevailing benefit of ownership.

The standard variable-rate mortgage, under which the interest rate is adjusted in accordance with the movement of some reference rate, shares with price-level-adjusted mortgages a major drawback from the perspective of households. There would be a required rise in mortgage debt service payments when the economy is subject to significant inflationary pressures. Assuming that the use of VRMs becomes widespread, large numbers of home-owning mortgagors would be subject to increased claims upon their income when other prices are rising. Demands for higher wages and salaries to offset the effects of inflation would be intensified as a result of the required increases in mortgage payments.

Modifications of the VRM design can produce graduated-payment schedules which are similar to those of the price-level-adjusted mortgage. As in the latter case, individual household mortgagors would still be subject to risks of incomes lagging behind increased payment requirements. In a 20-year graduated, smoothed, variable-rate mortgage simulation for 1954-1973, presented by the authors, the payment for the 20th year is 90 percent greater than in the 15th year. Empirical data for the same five-year period show an increase of 40 percent in the median total money income of families and 49 percent in per capita disposable income. Although the simulation represents an extreme or "worst" case for a smoothed, graduated VRM, it indicates the type of difficulty that household borrowers would face.

Extension of maturity to lessen the burden of increased payments has its practical limits of acceptability by lenders, provides only marginal relief of the payments-increase burden, and increases the cumulative interest payments total for the borrower.

To provide some protection against large, upward adjustments of the required payments, most VRM proposals include a limit on upward adjustments within a given time period. The authors suggest that the limit on upward adjustments be reasonably high: 6 percent semi-annually. Otherwise, fixed-maturity instruments might have rapidly rising payments toward maturity. The possibility of a 12 percent annual increase in payments would probably make such mortgages unacceptable to most household borrowers.

As Cohn and Fischer observe, the trend of nominal interest rates over the past two decades "has undoubtedly had a negative effect on the public's willingness to consider the VRM alternative."

Households As Borrowers and Investors

The authors also observe that the standard mortgage contract worked reasonably well into the 60s, but that its contribution to stability of mortgage financing eroded substantially since the mid-1960s. I question whether it is the standard mortgage form or the movement and level of interest rates at cyclical peaks which has been the key factor in mortgage financing instability. Marked instability was experienced during the tight money periods of 1956-57 and 1959, as well as during 1966 and later periods. In addition to the interest rate elasticity effects upon housing and mortgage demands, the cyclical behavior of mortgage interest rates has probably influenced household acceptance of standard mortgages.

Both of these influences were operative in 1974, judging from the experience record of government mortgage assistance programs. To compensate for the significant decrease in the flow of savings funds for mortgage financing, about $10 billion was committed to mortgage lenders under government mortgage assistance programs. These commitments were made over the last 11 months of the year, for mortgages bearing interest rates of 7 3/4 to 8 3/4 percent. A sizable amount of funds, thus, was made available to finance home purchases with mortgages at interest rates that were between 1 and 2 percentage points lower than on mortgages that could be obtained with funds emanating from private sources. Yet, households did not rush to purchase homes with 7 3/4 to 8 3/4 percent mortgages. By the end of the year only about 20 percent of the dollar amount of commitments had been delivered. There was still a 12-month sales inventory of unsold new homes after a year in which housing unit production was well below the volume required for household growth and replacement of losses from the existing housing stock.

A large proportion of households were, no doubt, precluded from purchasing homes because the combination of high home prices and mortgage interest rates placed available homes beyond their means. On the other hand, households with sufficient income to upgrade their housing had reason to defer purchases. Many of them are comfortably housed, if not as well as might be desired, and have mortgages at significantly lower than prevailing interest rates. In addition, past experience and a growing sensitivity to fluctuations in interest rates, created a negative attitude toward home purchases under 1974 conditions.

The increasing sensitivity of households toward changes in interest rates is reflected in the role of households as investors during high interest rate periods. Thus, in the high interest year of 1966, households, personal trusts and nonprofit organizations made net investments of $17.3 billion in market credit instruments compared with $4.5 billion in the preceding year. In 1969, another tight money year, the comparable net investment

figure was $35 billion; in the second half of 1973, it was at a seasonally adjusted annual rate of $41.5 billion, and in the third quarter of 1974 the comparable rate was $66 billion. The figures represent primarily household investments.

Potential Effects of Proposed Mortgage Innovations

The pattern of household responsiveness to cyclical high interest rates — both as borrowers and as investors — bears upon the question of the potential of the proposed mortgage innovations to bring greater stability to mortgage financing.

The proposed nonstandard mortgages are designed to increase portfolio interest income, so that the thrift institutions could pay higher interest rates on savings, thereby continue to attract a relatively stable inflow of savings from households, and be in a position to maintain a relatively stable volume of mortgage lending. A prerequisite for this intended sequence of operations would be the elimination of "Reg Q" ceilings on savings interest rates.

The thrift institutions would then be able to compete more aggressively in the market for savings. This would, incidentally, serve to accelerate the competitive escalation of interest rates. It is doubtful, however, in the light of recent experience, whether the thrift institutions would be able to compete for funds with borrowers of funds for nonhousing purposes more successfully than in the past. To illustrate, from June 1973 to the end of 1974, the yields on AAA recently offered utility bonds rose by about 2 percentage points to about 9.65 percent. A comparable adjustment, such as from 8 to 10 percent in the mortgage interest rate on a $30,000, 30-year mortgage, would increase the mortgagor's monthly payment by $41 per month. Most of the proposed VRM or adjusted payment mortgage plans would limit upward adjustments of the monthly payment to a much smaller amount in order to provide consumer protection that would make the proposals acceptable. The change in yields on a mortgage portfolio, thus, is likely to lag behind rising security market yields during a tight money period, so that thrift institutions could not afford to compete effectively with other bidders for funds.

Assuming that the thrift institutions *were* able to increase portfolio yields sufficiently to raise their interest rates on savings to, let us say, 8 or 8 1/2 percent levels, they would probably have to make new mortgage loans at 9 1/2 or 10 percent. The record of mortgage credit and housing construction cycles over the past two decades suggests that mortgage interest rates of above 9 percent would induce sharp cyclical declines of housing.

With a PLAM they could offer a lower interest rate and relatively low initial payments, with contractual adjustments of payments or principal in accordance with some price change or inflation factor. In a period of rising prices, however, it is questionable whether many informed households would accept such loans.

VRMs or PLAMs would not affect the strong competitive demands for more credit from corporations, consumers, and government during tight money periods. Such credit demands reflect the underlying demands for the nonhousing goods and services at prices which can absorb higher interest rates and exact a higher priority than housing in the marketplace for available credit resources.

When inflationary pressures increase, the resultant competitive escalation of interest rates is reinforced by restrictive general monetary policies. Although such monetary policies are regarded as nonselective in a pragmatic sense, they do produce selective allocation of credit. There have been five demonstrations in the past 20 years of the effects of reliance upon restrictive general monetary policy and high interest rates to cool off an overheating economy. Housing repeatedly has borne a disproportionate share of the burden of reduction in economic activity through credit restriction, reflecting the greater sensitivity of household mortgage borrowers than other borrowers to rising interest rates.

As long as general tight money policy is the only tool used to cool off the economy in an overheating period, capital funds flow to the issuer of credit instruments yielding the highest return for acceptable, comparable risks. Such flows of funds, moreover, are not dependent upon financial institution intermediaries. In the high interest rate years, households have directly invested large amounts of funds in U.S. Treasury bills, notes and bonds; in Federal agency bonds; in corporate bonds, and in flotation rate notes issued by nonfinancial corporations. In recent months, short-term investment mutual funds have attracted household savings. Other innovative mechanisms will, no doubt, be devised to channel funds away from mortgage-lending institutions to higher-yield outlets in the future.

To assure more adequate housing credit, restraints have to be imposed upon some of the nonhousing demands, requiring deliberate policy decisions with respect to national social priorities. The restraints can be brought about through selective credit regulation in capital and consumer finance. They could help to allocate credit resources to support a more adequate and stable volume of housing production. Such restraints could reduce pressures for interest rate increases and disintermediation. Thrift institutions would then be in a better position to remain viable while making standard mortgage loans that would not require a radical change in related risks and benefits for household borrowers.

Discussion

Kenneth J. Thygerson*

Let me begin by saying that I appreciate the opportunity to review and comment on what in my opinion is some very important research. It is particularly important with respect to the business I represent — the savings and loan business. It is well acknowledged that thrift institutions are contemplating some significant changes in the years ahead largely because the environment in which they operate has in the last decade become far more adverse. Moreover, I think it is generally recognized that a large and growing proportion of the savings and loan business has come to view new forms of mortgage instruments as one possible partial remedy to the asset-liability structural imbalance they face, while at the same time presenting a new opportunity to tailor a mortgage contract which will better serve the needs of the borrowing public. Thus, the task of this MIT study group is particularly relevant and timely.

I would like first to make some very generalized comments. The paper entitled: "An Analysis of Alternative Non-Standard Mortgages" is an important addition to a literature which has grown rapidly during the last several years and which concerns itself with developing and analyzing alternatives to the fully amortized, fixed rate standard mortgage contract. In some respects, this is one of the first papers to provide a broad analytical framework by which each of the various mortgage contracts that have been proposed and some that have not yet been proposed can be evaluated and compared against a consistent set of criteria. A major value of the paper is, therefore, the generalized analytical framework within which each of the various instruments is compared and contrasted. Thus, the paper helps to eliminate many of the biases that tend to be reflected in proposals made by the various vested interest groups who have turned out to be the major contributors to research in this emotionally charged and sensitive area. As such, it brings us a long way toward being able to develop an instrument that will have as its major feature "marketability" or in other words acceptance by large numbers of borrowers and lenders.

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Another major and important feature of the paper is the development of a number of models which are used to establish criteria for the acceptability of the mortgage instruments in question. To do this, the authors develop two primary models; the first describing the role of mortgages in the household portfolio and the second describing the behavior and maximization function of the financial intermediary. From these models the authors derive a set of criteria which they use later to evaluate a group of alternative, non-standard mortgage contracts. This approach is sound and I think it significant to note that this paper is one of the few that has taken a broad approach to this problem.

There is, of course, a problem with this approach. The authors subject themselves to potential criticism from those who do not agree with them as to the appropriateness of the models developed, their specifications, and the inherent assumptions of each. It is here that I will begin the process of commentary and discussion.

The Household Model

I would like to begin by reviewing the analysis of the role of non-standard mortgages in relation to household borrower optimization. Although the analysis of the role of mortgages in the household portfolio is not rigorously developed — a heuristic approach is employed — the authors conclude that (1) the relationship between mortgage payments and household income, and (2) the ratio of household equity to mortgage debt represent two primary concerns of the household as they evaluate their borrowing decision. Thus, the authors conclude that each alternative mortgage contract under study must be evaluated in terms of the effects that each has on these two primary behavioral requisites. Certainly, most studies of the demand for mortgage credit and for housing would seem to indicate that these two requisites are important factors affecting the behavior of both households and lenders. Thus, I would accept that these are appropriate factors to be included in the analysis, and I find that I have no serious reservation with this particular formulation of the criteria function from the standpoint of the borrower.

Having arrived at these conclusions, the authors proceed to evaluate each of the various non-standard mortgages with regard to the effects that they have on these two requisite variables of household optimization behavior. They do this by providing a simple analysis of the effects of implementing each of these instruments during the period from 1946 to 1970. This is followed in Section IV by the development of the generalized cases for each of these instruments.

At this point, several limitations become apparent. One relates to their testing of the generalized cases. One would assume, for example, that in their testing of a generalized formulation that the authors would be consistent with the basic assumption they make at the outset, namely, the premise that price expectations are highly uncertain. Yet, when they provide the empirical results of testing the instrument formulations, they

resort to using 1954-73 data as the appropriate test distributions for measuring the key variances for nominal payments for each instrument. If price expectations are as uncertain as they suggest, then it is clear that the distributions of the relevant variables are unknown and any testing of these generalized models against distributions relevant during the 1954-73 period may not be particularly relevant to the evaluation of these instruments in an uncertain future.

An alternative approach would be to compute the variances for hypothesized distributions which are significantly different from that of the 1954-73 period. One can conceive of having hypothesized distributions which represent substantially different states of the world — an unstable deflationary environment, an unstable inflationary environment, and a stable inflationary environment, for example. Having arbitrarily tested these models for the period 1954-73, the authors leave themselves open to the criticism that "while one instrument may have performed relatively well during 1954-73, there is no assurance it will in another environment."

Equally important is the fact that the reader is hard pressed to measure the importance of the variances they compute, since as readers we are forced to compare the variance of one instrument with the variance of another. This is fine for evaluating relative differences, but it does not indicate whether any of the variances are meaningful in an absolute sense. In other words, "is the variance for that instrument with the highest variance something to be concerned about or are they all insignificant?" The empirical results don't answer this question.

The Intermediary Model

The other primary model, developed in Section V, relates to institutional behavior. This model assumes as its objective function "the minimization of the variance of the real rate of return on shareholder equity." This objective function in my opinion is open to debate. We could, for example, assume as an alternative, that these firms maximize the present value of the wealth of their owners. Or, if we want to simply look at mutual institutions, we might choose an objective function which "maximizes growth, subject to some suitable level of increase in reserves." Either of these alternative objective functions would lead to substantially different conclusions from those derived by the authors.

Not surprisingly their specification of the objective function necessarily leads to the result that intermediaries will strive to be perfectly hedged. On the surface, this result may not appear hard to accept, unless one evaluates it with respect to the behavior of mortgage-lending specialized institutions over the last 20 years. Taking the Post-War II period, from say 1950 to the early 1960s, for example, one observes that a large number of state-chartered savings and loans — with the authority to develop a more perfectly hedged liability structure prior to the imposition of Regulation Q ceilings — did not do so. What one finds is that these institutions tended to emulate the federally chartered associations, which offered only passbook accounts. Thus, these institutions did not choose to

be fully hedged and in fact, they choose to operate by selling short-term liabilities against long-term assets — presumably because of the substantial returns associated with borrowing short and lending long during an extended period of positively sloped term structures.

This particularly is a key point, since the formulation used in the paper implies that lenders do not wish to speculate on changes in the term structure. Thus, I pose the question to the authors that if their model does not adequately represent the appropriate maximization function of the financial intermediary, and I suspect it doesn't, then one of the major criteria which they use to evaluate the benefits of the various non-standard mortgages is inappropriate for evaluating each instrument — namely, relation of interest return distribution to that of lender interest rate structure. (Criterion No. 2)

This leads to a final disconcerting comment. It appears that each of the alternative mortgage instruments has been evaluated by a set of criteria that basically precludes the possibility that both lenders and borrowers are willing to incur interest-rate induced, principal risk despite the opportunity they have to profit from such speculation. My feeling is that criterion two is not important. I suspect that the preferred portfolio and liability composition of any lender cannot be generalized. These decisions will be determined by the lender's expectations as to the level and shape of the yield curve, demands for various types of credit, risk expectations, the cost of acquiring various types of liabilities and his risk-return preferences concerning anticipated gains that might accrue from term structure speculation.

The Problems with a Partial Equilibrium Approach

The models developed in the paper and the general structure used do not allow us to evaluate the results in terms of general equilibrium. Each alternative contract studied as well as the empirical results developed are offered in a partial equilibrium context. Thus, we find ourselves in the unsettling position of having to evaluate — either as a lender or as a borrower — the simulated results of testing the hypothetical contract without discussion of general equilibrium.

The authors begin their discussion of the implementation problem by assuming that the contracts must have an index — "a price index, a reference rate, an equilibrium spread." Having imposed this constraint — the necessity of an index — the authors ignore the possibility that non-standard mortgage contracts can be offered in a market environment without an index. Clearly, one alternative to those analyzed in this paper is to develop a contract (say one calling for a renegotiation of rate every three or six months or every five years) and allowing the interaction of buyer and seller to agree on a price for the contract. Having precluded this alternative, however, the question emerges: "Will any of these instruments with fixed contractual terms hold up in the market?"

If these instruments are to be successful, by this I mean used in large numbers, then we must address the problem of how these instruments will

compete in a larger market context. The problem with indices of any sort is that they imply that a rather stable relationship exists between the index, the indexed rate or terms, and other market rates. Previous study of this problem suggests that no such stable relationships exist.[1] What does occur is that rate differentials between the various credit instruments change over time as do regional rate differentials. As a result, an indexed instrument is likely in period t + 1, 2, 3 . . . to have a non-marketable rate, even though it had an equilibrium rate in period t. The result will be that if the return is relatively too low, lenders will stop offering it. If the return is relatively too high, all borrowers will repay and refinance (at virtually no penalty, according to the authors). Take the example of the variable-rate mortgage providing a 3 percent return plus the percentage gain in prices during the quarter. During 1974, this would have earned 15.8 percent, well above other comparable risk debt instruments. The likely outcome would have been wholesale refinancing of these instruments by borrowers. At best then, the indexed rate can only approach a market negotiated rate.

One possibility would be to establish an index which is expected to be above the market clearing price but not well above it. This would help prevent borrower concern over usurious lenders and still allow market forces to establish price.

The point to be stressed here is that without any knowledge of the general equilibrium results there is no guarantee that any of the contracts can exist in the long run in the contractual forms assumed. Rather, each is likely to evolve into free market instruments of negotiable form.

Transition Problem

Another difficulty, which the authors glossed over, deals with the transition costs of moving to a non-standard mortgage contract world. The authors' assumption of a perfectly hedged intermediary necessitates their recommending the elimination of Regulation Q ceilings for savings and loan associations. The elimination of these ceilings, however, points up the problem of how savings institutions will respond in the short run, given the fixed-rate portfolio they currently hold. The authors solve this problem with the recommendation ". . . that the government would have to mitigate the effects on deposit institutions perhaps by buying existing mortgages." This heroic assumption is, however, at the heart of the institutional dilemma. It thus deserves greater treatment than that offered in the paper.

It is significant to point out that uncertainty over transition costs is a major impediment to altering of the structure of financial institutions today. Such new mortgage contracts as advocated in this paper suggest

[1]See Kenneth J. Thygerson and Joe R. Thompson, "Implementation of the Variabl Rate Mortgage: Some Considerations" Working Paper No. 7, U.S. Savings and Loa League, October 21, 1971.

the need for major structural alteration. Taking these transition costs into account, however, it may have been more useful to give thought to which non-standard contracts could provide most benefit under the present institutional structure and statutory authority of the savings and loan business.

Summary

To summarize, I believe this paper is a very valuable addition to the literature dealing with alternatives to the standard, fully amortized, fixed-rate mortgage used today. It provides a relatively unbiased analysis of the various proposals that have been offered. Even more important, this research provides a very important generalized analytical structure to evaluate the merits of each proposed contract. By considering both the needs of borrowers and lenders, it provides the structure for determining the correct approach to resolving the problems of implementing a new instrument.

Extremely important is the authors' conclusion that whatever non-standard contract is developed must recognize the fact that borrowers require the assurance that the ratio of the nominal mortgage payment to income not be subject to substantial volatility. Thus, it seems to me the institution must be given great flexibility in developing contract terms. This will allow borrowers and lenders to negotiate those terms which best fit the life cycle of the borrower, his net worth, and his future expectations.

As a starting point, this research represents a sound springboard upon which additional work can be done. I think that essential extensions of this work are: (1) further analysis of the financial intermediary model; (2) consideration of the response these instruments will have in the capital markets generally; (3) additional consideration to the appropriate criteria to evaluate the merits of the non-standard instruments; and (4) a more elaborate analysis of the transition costs.

Discussion

Donald P. Tucker*

Ken Thygerson's final comment, to the effect that what borrowers really seem to want in the mortgage area is subsidized below-market interest rates on mortgages, gives me a good starting point. It can't be denied that low subsidized mortgage rates would be very nice for borrowers, but I would argue, as have many others, that the size of the monthly payments are equally important, if not more important, to borrowers. It follows from this that any mortgage innovation that reduces their monthly payments relative to their income will be very attractive to borrowers, and if Ken's remark is meant to express doubt about this point, then I must disagree with him.

If this point is correct, namely if each borrower sees his mortgage primarily as a stream of monthly payments, and if his biggest concern is how big the payments will be relative to his income, then this has important implications for the design of new mortgage instruments. Its importance arises from the fact that lenders are primarily concerned with a different aspect of each mortgage, namely the accrual of interest income, since that is what governs the profitability and the main risk characteristics of this financial relationship. The mortgage terms that govern the accrual of interest can, within limits, be set independently of the terms that govern the monthly payments of the borrower. Thus, it is possible to consider alterations in the standard mortgage form that are beneficial to one side without seriously affecting the interests of the other side.

This is certainly not a new point, nor is it entirely accurate either in this simple form. Lenders are clearly interested in the payments stream in relation to borrower income because of what it implies about default risk, and borrowers have a genuine concern about the accrual of interest, even if it has no effect on their current or immediate future payments, because it then impacts directly on the maturity date of their loan if nothing else.

But in spite of this lack of complete separation, I think it fair to say that the *weight* of the borrower's concern is primarily on the level of the present and future monthly payments, whereas the lender, once his needs for protection against default risk have been taken care of, is most heavily concerned with the accrual of interest.

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Cohn and Fischer are certainly aware of this point, and they have made use of it in their analysis. Nevertheless, I feel that their treatment of these issues could benefit by a more explicit emphasis on this separation of interests.

In particular, this separation can form the basis for a different classification of mortgage alternatives, as shown in the table. The columns in the table represent the range of choices of primary interest to borrowers, and the rows represent the range of choices of primary interest to lenders. The various types identified by Cohn and Fischer in their table are classified here. You will note that this table does not distinguish between VRMs pegged to a short rate or index from VRMs pegged to a long rate or index. Thus it is possible to subdivide column 2 into several distinct alternatives to represent these choices. It is the columns of this table, and particularly the subcategories under column 2, that are the primary focus of Cohn and Fischer's analysis of the lender's preferences. This table also does not distinguish between the numerous ways in which the time profile of a graduated payment schedule could be determined, and thus the rows can be further subdivided to represent this range of choices. It is these rows and their subdivisions that are the primary focus of Cohn and Fischer's analysis of the borrowers' preferences.

Now I want to turn to some concrete points of criticism. The element that concerns me most about Cohn and Fischer's study is the rather narrow and unsatisfactory treatment they have given to the lenders' portfolio preferences and what these tell us about the choice of mortgage instruments.

There are two rather different questions that need to be asked:

1. What sort of mortgage instrument would be *ideal* for lenders?
2. What other sorts of mortgage instruments, although not ideal from their point of view, would they accept and find preferable to the current fixed-rate level-payment mortgage, at least for limited use?

Let me deal first with the question of the ideal.[1] In the first place, the question of the ideal from the lenders' point of view is not independent of borrower preferences in the general case, since borrowers do have some concern in general with the pattern and method of interest rate accrual, aside from the level of the interest rate. Not only are they obviously concerned about the maturity date of their mortgage obligation and the variance of that maturity date, but I would assume that many of them will be concerned, perhaps irrationally, with the variance of current and immediate future interest accruals. They may simply be frightened of the volatility of a short-term rate even if it does not affect their current payments and even if the volatility itself has very little effect on the variance of the maturity date. Because of considerations like this, borrowers might

[1]The earlier Cohn-Fischer paper devoted considerable attention to the hedging preferences of lenders and argued strongly for pegging a VRM to a short-term reference rate. [Ed.]

well be reluctant to accept mortgages pegged to a short-rate index if they had the choice of taking instead a mortgage pegged to a long-rate index, unless there were a rate differential in favor of the short-rate mortgage. But if the expected earnings from the short-rate mortgage were going to be less, because of these demand factors, than the earnings from long-rate VRMs, many lenders would undoubtedly regard the mortgage pegged to a *long* rate as the ideal.

This line of reasoning can even be extended to argue that, under certain conditions, some lenders would prefer fixed-rate mortgages to variable-rate mortgages. This would occur if borrowers had a sufficiently strong preference for fixed-rate mortgages that lenders could earn a substantially greater return on them, enough to compensate for the greater risk.

I don't intend to argue that this would necessarily be the case, for I don't know. The point I am making is that trying to determine the lenders' ideal mortgage by examining only the lenders' hedging preferences, as Cohn and Fischer have done, is not valid.

The second point to be made about the lenders' ideal mortgage involves some observations about what the lenders would be hedging against in choosing their ideal mortgage. I have no quarrel with Cohn and Fischer's general point that lenders will have a preference for mortgages whose maturity structure and whose method of interest accrual match those of the liabilities that are financing the mortgages. But Cohn and Fischer appear to have made some incorrect assumptions about the kinds of liabilities that savings institutions will have outstanding.

In applying the hedging principle, they conclude that lenders will not want mortgages pegged to a long-rate index. In their paper they say, and I quote, "Hedging considerations point up the folly of tying interest to the current long-term rate, as does the 'standard' VRM." Then a few moments ago you heard Rich Cohn refer to a VRM pegged to a long-rate as a rather "peculiar" instrument.

Perhaps they are not aware that certificate deposits having an initial term of at least four years already make up almost 25 percent of all deposits in federally insured S&Ls, and that certificate accounts having a shorter term make up another 25 to 30 percent of deposits. But I doubt that they would dispute the conjecture that intermediate-term deposits of this general character will continue to be an important source of funds for savings institutions in the future, with or without Regulation Q ceilings, and clearly the ideal mortgage for savings institutions to use as hedges to these deposits will *not* have its rate pegged to the passbook rate or to some short-rate index. Nor will it be pegged to the current rate on new four-year certificates, for that would make the earnings on the portfolio of mortgages more volatile than the costs on the outstanding certificates. Instead, the appropriate rate or index for pegging these mortgages would behave like the *average yield on outstanding* four-year certificates, and this would have to be called a long-rate index, at least in contrast to the

passbook rate. The FHLBB's proposal of a weighted average of the yields on three- to five-year governments and AAA corporate bonds might be very close to perfect for hedging these accounts.

Another way to state this same point is the following: As one criterion for judging the different mortgage alternatives, Cohn and Fischer have chosen to rate them according to the stability of the ratio of market value to book value; mortgage forms with the most stable ratio rank the highest according to this criterion. My criticism amounts to the observation that this is *not* an appropriate criterion for mortgages that are intended to hedge intermediate-term or long-term liabilities. The market value of these liabilities fluctuates with changes in interest rates, and a mortgage whose market value does not also fluctuate would not be an adequate hedge to these deposits. You *want* a mortgage that fluctuates in value.

More generally, the principle of hedging will imply a *mix* of mortgages in the asset portfolio of the typical savings institution, to complement the mix of deposit liabilities of differing maturity.

Finally, I think something needs to be said about the question of second best. In the real world of institutions, conflicting interests, historical accidents, and occasional irrationality, people very seldom get their ideal. Cohn and Fischer's analysis would be more helpful if it could tell us not only what is *ideal* from the lenders' point of view but also what *compromises* they would be able to live with and get some benefit from. In raising this question of second best and compromises, I still have in mind the question of what sort of index a VRM could be pegged to. More specifically, I am raising the question of whether VRMs pegged to a long-rate index, such as that proposed by the FHLBB, would be of interest to lending institutions as *partial* hedges against their *passbook* deposits, even though they would obviously not be ideal from the point of view of hedging.

This question is of particular interest because there has been a difference of opinion of some importance between the MIT group on the one hand and the HUD and Home Loan Bank Board sponsors of the study on the other over whether VRMs pegged to a long-term interest rate would really be of enough interest to be analyzed. As I understand the MIT point of view, they have been inclined to believe that a VRM pegged to a long-rate index would not be of any interest as a portfolio asset to lenders relying heavily on passbook deposits, and that it might not even be viable in the market place. I have learned of this disagreement primarily from the HUD side, however, and second hand at that, and I was looking forward to having this issue laid out explicitly for comment in the Cohn and Fischer paper, since that is where it would logically have appeared. Unfortunately, it is not treated there, and I am left in the fuzzy position of dealing with an important issue that I sense in the background and that may color their work and their conclusions, but that is not discussed openly in the paper.

As Cohn and Fischer themselves have mentioned, one important criterion that must be applied in judging mortgage alternatives is the criterion of suitability for the secondary mortgage market. The secondary market is heavily dependent on standardization of mortgage instruments, and thus from the point of view of facilitating the secondary market for mortgages, the fewer the distinct types of mortgages in use, the better. In deference to this consideration, the Home Loan Bank Board may decide to impose a regulatory constraint that says that all VRMs, whatever their other characteristics may be, must have their rates pegged to one specific index. They may not allow S&Ls the choice of how to peg their rates.

If that is going to occur, then it may make a lot of difference whether the officially sanctioned index is an index of short rates or of long rates. If Cohn and Fischer have a case to make that a long-rate index would be an unwise choice, even as a second-best or compromise alternative from the point of view of lenders, then it would be important for them to bring forth the analysis that supports that position.

I have indicated several respects in which I feel this paper does not deal adequately with the problem of how to compare the merits of the various mortgage alternatives. However, let me add that this problem is an extraordinarily complex one to treat in true theoretical splendor, and it would be unreasonable to expect it to be completely solved in one pass. I am not disappointed in this paper for not solving that; I am only disappointed that it did not put into better perspective, with more explicit qualifications, the results and analysis it does have to offer, which are very real and valuable.