ARMs: Their Financing Rate and Impact on Housing

When widespread use of adjustable rate mortgages (ARMs) was permitted in April 1981, some analysts expected housing demand to become stronger and less sensitive to interest rate fluctuations as prospective homebuyers turned to this new way of financing homes. Because housing is one of the most interest-sensitive sectors of the economy, this effect could influence the dynamics of the business cycle and the countercyclical effectiveness of monetary policy. Recent evidence suggests, however, that ARMs have not had a large impact on housing demand. This seems paradoxical because ARMs have captured a large share of new mortgages, particularly between mid-1983 and mid-1984. We offer a twofold explanation for this paradox. First, we show that ARMs have in effect generally not been priced much lower than fixed-rate mortgages (FRMs). Second, we examine some characteristics of ARMs that may explain their popularity over FRMs as a mode of finance, even though these features have not significantly increased the incentives to purchase a home.

Econometric evidence on housing demand

In several recent studies, analysts have found that adding variables representing ARMs contributes little, if any, tracking power to traditionally specified models of housing demand.[1] For example, the equation specified by Esaki and Wachtenheim, which has no ARMs variable, has a post-sample (1982-I to 1984-IV) mean absolute error of 77,000 units, about 8 percent of single-family housing starts (Table 1). And it shows no consistent tendency to underpredict, a tendency that would indicate a failure to capture the positive influence of ARMs in the housing market; instead the equation mostly overpredicts. The tracking performances of the Esaki/Wachtenheim and other recent models suggest that at most ARMs have had a minor impact on housing demand.

The econometric approach, however, may be of limited value for analyzing the impact of this financial innovation since there is not a long series of consistent data on ARMs. Thus, we obtain independent confirmation of these analysts' results by evaluating the long-term expected financing rate of a mortgage, *i.e.*, the average rate an owner expects to pay over the period of home ownership. If the long-term financing rate of ARMs has been significantly below the FRM rate, then housing demand should have been boosted substantially.

The financing rate of mortgages

The financing cost underlying the demand for housing is the interest an individual expects to pay over the

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[1]See Howard Esaki and Judy Wachtenheim, "Explaining the Recent Level of Single-Family Housing Starts", this *Quarterly Review* (Winter 1984-85), pages 31-38, James L Freund, "A Small Econometric Model for Predicting Residential Construction Activity Some Preliminary Results", Board of Governors of the Federal Reserve System, paper presented at the 1984 meeting of the American Real Estate and Urban Economics Association, and Michael J Stutzer and William Roberds, "Adjustable Rate Mortgages Increasing Efficiency More Than Housing Activity", Federal Reserve Bank of Minneapolis *Quarterly Review* (Summer 1985), pages 10-20

period of ownership In the case of an FRM, the expected cost, excluding the initial points that exist also for ARMs, never exceeds the amount determined by the contract rate and may be lower if market rates fall enough to make refinancing advantageous With an ARM, the expected cost is contingent upon future short-term rates Thus, the first-period rate discount of an ARM is only one element of the total financing cost, and has to be considered along with the likely course of future rates and the expected holding period in judging the costs of an ARM

Nonetheless, some analysts believe that this relatively low first period rate of ARMs boosts housing demand, regardless of the expected course of interest rates, by permitting more people to qualify for a mortgage Many more individuals will meet a stipulated maximum limit on the share of income earmarked for mortgage payments if the first-year ARM rate instead of the FRM rate is used to calculate the carrying costs for a prospective borrower[2] From the lenders' perspective, relaxing screening procedures may have been one way to encourage a faster reshuffling of their portfolios from FRMs to ARMs, the lower interest rate risk of ARMs to lenders may more than compensate for the higher credit risk Moreover, some market observers say that lenders may have eased qualification criteria in the belief that the default risk is carried by mortgage insurers and repurchasers Some of these insurers and repurchasers, however, have recently responded by encouraging or requiring lenders to tighten their qualification criteria for ARMs[3] Independently, borrowers may be "self-policing" by avoiding a commitment that might have a high risk of default[4] On balance, the extent of the effects of the ARM qualification criteria on housing demand are not clear

The low initial ARM rate also might raise housing demand through its effect on the pattern of mortgage payments over time When the market yield curve is upward sloping, the early years' payments with an ARM are less than with an FRM, but payments are likely to be higher in later years Similar to the advantages of graduated payment mortgages, this timing of ARM payments might be desired by some people because they feel that their incomes are also likely to rise in the future In this case, the carrying burden of a mortgage may be more uniform over time instead of being heavier initially as it is with an FRM It is not clear, though, whether this feature of ARMs, by itself, would significantly boost housing demand Esaki/Wachtenheim, for instance, do not find that variables representing the different payment streams of ARMs and FRMs, *e g*, the spread between the FRM and initial ARM rates, help their equation track housing in recent years Moreover, basing a purchase decision solely on this consideration would be risky given the uncertainty of future ARM rates

In any case, the long-term expected financing rate of ARMs is likely to be a key element in a home purchase decision However, individuals' expectations of future rates—the main component of this expected financing rate—are not observable And there is no consensus on how these expectations are formed Some analysts believe that people base their expectations on the most recent movements of rates Others believe that individuals tend to accept the expectations built into the market yield curve, *i e*, the relationship between long-

Table 1

Tracking Performance of the Esaki/Wachtenheim Econometric Model of Housing Demand*

Predicted less actual, thousands of units at an annual rate

	Post-sample prediction errors
1982-I	40
1982-II	122
1982-III	59
1982-IV	4
1983-I	60
1983-II	143
1983-III	140
1983-IV	12
1984-I	−92
1984-II	94
1984-III	105
1984-IV	57

Positive errors indicate overprediction, *i e*, predicted level exceeds actual level

*Howard Esaki and Judy A Wachtenheim, *op cit* The equation tracks single-family housing starts The sample period is 1959-IV–1981-IV, and the mean absolute error of the sample period is 55

[2]See John L Goodman, Jr, "Adjustable Rate Home Mortgages and the Demand for Mortgage Credit", Board of Governors of the Federal Reserve System, presented at the 1984 meeting of the American Real Estate and Urban Economics Association He shows that the use of a 10 percent first-year ARM rate allows 38 percent of households to qualify for a mortgage, while a 13 5 percent FRM rate allows only 25 percent to qualify Both are representative rates for the period July 1983-May 1984 Esaki and Wachtenheim, *op cit*, though, do not find that a variable representing such an ARM-related reduction of mortgage carrying costs helps their econometric model predict single-family housing starts

[3]See Dennis Jacobe, "Mortgage Insurers Mix ARMs and GPMs to Justify Rates", *Savings Institutions* (October 1984), pages 41-45

[4]See John L Goodman, Jr, *op cit*, for evidence supporting this view

and short-term rates.[5] For example, when long-term rates exceed short-term rates, people generally expect that short-term rates will increase but on average will be equal to the current long-term rate. This second viewpoint may well describe a prospective homebuyer. Because a house represents a large share of a typical homeowner's total assets, the consequences of basing a purchase decision on wrong expectations can be quite costly. To reduce this risk, people probably are most comfortable relying on market expectations in making the decision Our analysis of the long-term financing rate of ARMs, thus, is based on the assumption that the market yield curve essentially represents the average of expected future interest rates held by prospective homebuyers.

Whether most borrowers view the long-term financing rate of ARMs as being higher or lower than the FRM rate, therefore, depends on how lenders price ARMs and FRMs relative to the market yield curve. The relative pricing of these mortgages, in turn, depends on the net balance, from the lenders' perspective, of the risks and other characteristics of each type of mortgage Specifically, ARMs are more attractive than FRMs to lenders because they eliminate or reduce risks related to balance sheet considerations—*i e.*, the possibility of lower income when the return from mortgage-type assets does not rise as quickly as the cost of funds to a lender—and mortgage prepayment. On the other hand, increased credit risk, a less developed secondary ARM market, and interest rate caps may push up the relative cost of ARMs

One important factor that would cause lenders to lower the financing rate of ARMs is the shift of interest rate risk to the borrower. If the expected financing rate of an ARM, however, is below that of an FRM only because of this shift, then ARMs would not boost housing demand. the risk of greater-than-expected increases in rates still would have to be compensated for by the return from home ownership Indeed, given the size of investment a home purchase represents, as well as the substantial costs and discomfort of having to default if rates climb much higher than expected, individuals might require a relatively large cut in the ARM rate to compensate them for assuming the interest rate risk. In other words, a significant increase in housing demand might result only if lenders price ARMs much below FRMs

On the basis of the analysis which follows, however, we conclude that, at least since the start of 1984, the net effect of the various factors that distinguish an ARM from an FRM has been small. That is, the long-term expected financing rate of an ARM for most people has been about the same as an FRM. To arrive at this result, we first look at the various factors underlying ARM pricing.

Balance sheet considerations of lenders

By reducing the interest rate exposure of an entire asset portfolio, ARMs may significantly improve the viability of thrift institutions since for tax purposes they are required to hold a large portion of their assets as mortgages.[6] When financial deregulation, particularly the phasing out of Regulation Q, allowed rates on deposits to vary with market conditions, the large concentration of FRMs in these institutions' assets made them vulnerable to substantial income losses when interest rates rose.[7] ARMs permitted a better match between their return on assets and their cost of funds This may be an additional gain beyond the reduction of interest rate risk inherent in each mortgage, and thus may persuade these lenders to price ARMs attractively.

Lenders that are not required to hold mortgages in their portfolios, *e.g* , commercial banks, credit unions, and insurance companies, presumably were less affected by the introduction of ARMs. If in response to financial deregulation these institutions chose to hold fewer fixed-rate instruments, they had a broader choice of variable-rate assets, *e.g.*, commercial loans, from which to select. The major impact of ARMs on these lenders may have been to maintain their presence in the mortgage market, thus helping to prevent mortgage rates from rising relative to other interest rates. It is not surprising, then, that thrift institutions have been the most active lenders of ARMs. In 1984, for instance, ARMs accounted for about two-thirds of the mortgages originated by thrifts, but less than 40 percent of those issued by commercial banks.[8]

[5]For an analysis of "term structure" theory, see Franco Modigliani and Robert J Shiller, "Inflation, Rational Expectations, and the Term Structure of Interest Rates", *Economica* (February 1973), pages 12-43 Recent tests indicate some slight variation in the behavior of interest rates from that implied by term structure theory However, this variation might be explained in terms of a variable risk premium in long-term rates, which would not be inconsistent with our approach to analyzing ARMs See Robert J Shiller, John Y Campbell, and Kermit L Schoenholtz, "Forward Rates and Future Policy Interpreting the Term Structure of Interest Rates", *Brookings Papers on Economic Activity I* (1983), pages 173-223

[6]See Robert Van Order, "A Simple Model of Variable-Rate Mortgages", *Housing Finance Review* (July 1982), pages 299-311

Because of the large losses sustained by many thrift institutions in recent years, some have enough loss carryover that they do not pay any taxes As a result, these institutions do not feel compelled to hold the required portion of their portfolios as mortgages Nevertheless, according to Flow of Funds data, mortgages (including ARMs) and U S government agency issues (mostly mortgage pass-through securities) constituted substantially more than half of thrift institutions' assets during 1984

[7]Some thrift institutions have addressed this interest rate risk by hedging in futures markets and engaging in interest rate "swaps" These activities, though, have not been widespread

[8]See Federal Home Loan Bank Board, *News* (February 4, 1985)

Prepayment risk

Lenders also may price ARMs more favorably than FRMs because of the reduced risk of borrowers prepaying before maturity. Since individuals are often permitted to prepay a mortgage at face value without penalty, the expected return from an FRM is uncertain even though its rate is fixed. The FRM rate, therefore, may embody a charge to cover this uncertainty.[9] In contrast, ARMs are less likely to be prepaid when market interest rates fall since their rates, assuming there are no binding caps, would decline as well. Moreover, even if an ARM is prepaid, its rate would likely be the same as that on the newly issued ARM that replaces it. Thus, ARM rates are likely to contain no prepayment premium, or at most one that is not as large as that embodied in the FRM rate.

Credit risk

Other factors, however, may reduce the attractiveness of ARMs to lenders. Both ARMs and FRMs are vulnerable to the typical factors behind borrower default, *e.g.,* cuts in income and net worth, but ARMs are also subject to rising interest rates, which may raise the probability of default. The prospect of higher interest rates in the future does not necessarily mean that defaults on ARMs will increase, particularly if the rise in rates is a result of higher inflation. In this case, most household incomes should expand as well, permitting borrowers to handle the larger carrying costs of ARMs. Indeed, to the extent that lenders use some measure of the long-term expected financing rate of ARMs (which embodies expectations of future rates) to screen borrowers, the default risk may be kept down. Relatively tough qualification criteria and rate caps also may help reduce this risk. Nevertheless, future interest rates might rise substantially more than was expected when the loan was originated and result in an increase in defaults, particularly if the increase in rates is not matched by comparable income gains.

So far, defaults on ARMs do not appear to be a major problem. Since January 1985, when separate data on ARMs were first reported, the ARM delinquency rate has been below that of FRMs, possibly because interest rates were falling.[10] Nonetheless, ARMs may not always have the better record, particularly if interest rates climb steeply For example, the default rate for ARMs could jump sharply if their rate rises faster than individuals' incomes, particularly among borrowers with relatively little accumulated equity in their homes.[11] Thus, the credit riskiness of ARMs may represent a potential problem.

Mortgage liquidity

Another factor that could impinge on the advantages of ARMs to lenders is the absence of a large secondary market for these mortgages. As a result, ARMs are much less liquid than FRMs, for which a well-developed secondary market exists. According to market observers, the growth of a secondary market has been slow because ARMs lack uniformity and because investors are concerned that ARMs may carry more credit risk than FRMs

Caps on ARM rates

Unlike the other characteristics of ARMs that affect either borrowers or lenders, caps on the periodic change and life-of-loan level of ARM rates affect both borrowers and lenders For instance, while these caps may prevent the return on ARMs from keeping pace with a lender's cost of funds, they also reduce the interest rate risk for a borrower Consequently, even if caps increase ARM rates, borrowers may be willing to pay for these safeguards.

The value of caps depends on the course of future interest rates Thus, an *ex ante* valuation should be based on the yield curve. When the yield curve is steep, indicating that interest rates are likely to rise sharply in the future, caps should be worth more to a borrower. In addition, caps would be more valuable to the extent that they prevent an initial ARM rate reduced by a first-period discount from climbing to the fully indexed level after the first period.[12] At the other extreme, when the yield curve is downward-sloping, a cap on the periodic change in an ARM rate may have negative value to borrowers if it prevents an ARM rate from falling as much as market interest rates

In principle, borrowers and lenders can value caps

[9]The risk of prepayment is an important consideration in the pricing of a mortgage See Henry J Cassidy, "Selection of an Index for Variable Rate Mortgages", *Journal of Retail Banking* (Winter 1982), pages 27-36, Alden L Toevs and Jeffrey H Wernick, "Hedging Interest Rate Risk Inclusive of Prepayment and Credit Risks", *Identification and Control of Risk in the Thrift Industry,* Federal Home Loan Bank of San Francisco, Proceedings of the Ninth Annual Conference (December 1983), pages 97-122

[10]Delinquency rate data were obtained from the U S League of Savings Institutions These data, however, may be biased against FRMs because no adjustment is made for the length of time mortgages are in existence Since the FRMs in this sample were outstanding for more years than ARMs, they, according to market observers, are more prone to default

[11]See Peggy J Crawford and Charles P Harper, "The Effect of the AML Index on the Borrower", *Housing Finance Review* (October 1983), pages 309-320 See also Robert M Buckley and Kevin E Villani, "Problems with the Adjustable Rate Mortgage Regulations", *Housing Finance Review* (July 1983), pages 183-190

[12]The initial period pricing of an ARM is the sum of three parts The first element is an index rate, *e g ,* the one-year Treasury *(p 44)*

Valuation of Caps

To estimate the value of caps, we analyze how ARMs would have behaved with and without caps if they had been available through the 1970s. By determining, *ex post*, how the financing costs would have differed with varying discounts and caps, we hope to capture the current *ex ante* expectations for these ARM modifications

Two horizons for expected home ownership are considered: three and eight years. The eight-year horizon represents the average duration of a mortgage,* while the three-year horizon is applicable to about one-quarter of homebuyers, those who expect to resell quickly † In each case, the fully-indexed ARM rate was assumed to equal 2.8 percentage points above the one-year Treasury rate and to adjust every twelfth month The use of a constant markup and the one-year Treasury rate as a representative index are consistent with recent surveys ‡ Simulations of hypothetical ARMs, with and without caps, were run starting in 1970 for each month for which there was data, *i.e*, ending in 1977 with the eight-year horizon and in 1982 with the three-year

From the simulation results we can find the discounted present values of caps in each month § First, we calculate the present value of the mortgage payments,

*Frederick E Balderston, *op cit*

†John L Goodman, Jr, *op cit*

‡The first survey was taken in November 1984, see *The Primary Mortgage Market*, Federal Home Loan Mortgage Corporation (January 1985) The later survey, taken in February 1985, is unpublished

§Our technique is similar to one developed independently by Patrick H Henderschott and James O Shilling, *Valuing ARM Rate Caps Implications of 1970-84 Interest Rate Behavior*, unpublished paper, Ohio State University

Effective Values of Caps
In percentage points

A: 8-Year Horizon

Group*	Yield curve slope	First-period discount	Effective value of: Lifetime cap 5%	Annual cap 2%	Both caps
Low	<0 5	0 0	0 00	−0 02	0 00
		1 0	0 01	0 04	0 06
		2 0	0 06	0 11	0 16
		3 0	0 17	0 19	0 30
Middle	0 5-1 5	0 0	0 13	0 20	0 29
		1 0	0 24	0 26	0 41
		2 0	0 39	0 34	0 59
		3 0	0 61	0 44	0 88
High	>1 5	0 0	0 68	0 43	0 73
		1 0	0 93	0 49	1 04
		2 0	1 24	0 64	1 36
		3 0	1 59	0 89	1 78

B: 3-Year Horizon

Group*	Yield curve slope	First-period discount	Effective value of: Lifetime cap 5%	Annual cap 2%	Both caps
Low	<0 5	0 0	−0 04	−0 22	−0 22
		1 0	0 00	−0 13	−0 13
		2 0	0 01	−0 05	−0 05
		3 0	0 02	0 02	0 02
Middle	0 5-1 5	0 0	0 00	0 00	0 00
		1 0	0 01	0 04	0 04
		2 0	0 02	0 12	0 12
		3 0	0 06	0 27	0 27
High	>1 5	0 0	0 06	0 27	0 27
		1 0	0 12	0 42	0 42
		2 0	0 21	0 61	0 61
		3 0	0 35	0 81	0 81

*Each group consists of one-third of the simulation results, ranked by the magnitude of the value of both caps

along the lines of option pricing models, which assign probabilities to possible future interest rate paths and then average them.[13] Rather than using this approach, we estimate the value of caps by calculating the extent to which they would have held down the interest costs of ARMs if they had been issued since 1970 (box).

To represent the holding period of a mortgage, we use two horizons. eight and three years The eight-year horizon approximates the average holding period of all mortgages, and as such is representative of the holding period for borrowers in the aggregate.[14] We assume that most ARMs have an annual cap of two percentage points and a lifetime cap of five percentage points. These caps are among the most popular of the recommended configurations proposed by the Federal National Mortgage Association.

According to our calculations, the value of these caps for an eight-year horizon varied between zero and 1.8 percentage points, depending in part on the size of the first-period discount. For example, an ARM issued in 1970 without a discount would not have been affected at all by the presence of our caps. Thus, their value at that time was zero. In contrast, the rate on an ARM issued after 1971 would have been constrained not only by the annual caps but also by the lifetime cap. In these cases, the worth of the caps moved toward the high end of the range.

As we expected, caps would have been less valuable to people with short horizons, *e.g.*, three years, than to those with long horizons. The three-year and eight-year values differ mostly because lifetime caps were never binding over the first three years of an ARM during the 1970s In general, our calculations indicate that borrowers with short horizons face little likelihood that lifetime caps will ever come into play. To be sure, these individuals would value first-period discounts more highly than people with longer horizons since they amortize the discounts over fewer years. Nevertheless, we find that the combined value of caps and discount usually favors borrowers with longer horizons.

Footnote 12, continued
rate The second element is a constant markup The sum of these two is called the fully-indexed rate The third element is the first-period discount, which reduces the fully-indexed rate for the first period of the mortgage only The fully-indexed ARM rate less the first-period discount is called the initial rate

In the second period, the uncapped ARM rate has only two parts It is the sum of the index rate as of the beginning of the period and the same markup as in the first period

[13]See Randall J Pozdena and Ben Iben, "Pricing Mortgages An Options Approach", Federal Reserve Bank of San Francisco *Economic Review* (Spring 1984), pages 39-55

[14]See Frederick E Balderston, *Thrifts in Crisis* (1985)

Valuation of Caps, *continued*

including prepayment of the principal, over the mortgage horizon assuming no caps; we call this the base present value. Second, we recalculate the present value imposing, individually and combined, caps of two percentage points each year and of five percentage points over the life of the mortgage. The differences between these values and the base present value measure the present values of the cost saving resulting from the respective caps. Expressing each difference as a percent of the face value of the loan converts the saving into the equivalent of closing points Then calculating how much these points change the effective yield provides a measure of the effective value of the cap.

For a borrower to accept an uncapped ARM instead of a capped ARM, its markup (over the base rate) would have to be lower by this effective value (Equivalently, a larger first-period discount could be offered.) Since, in our simulations, the cap was tied to the initial rate rather than the fully-indexed rate, the value of a cap increases sharply as the discount increases.

Since caps only have value when they lower the interest rate on the mortgage, their value depends on the course of future interest rates. Thus, an *ex ante* valuation is based on the steepness of the yield curve. When the yield curve rises sharply, reflecting a market expectation of high future interest rates, caps will be worth more. On the other hand, when the yield curve is downward-sloping, caps may turn into "floors" for borrowers and could have a negative value.

To capture the effect of the market yield curve, we divide the months of the simulations into three equal groups, ranked by value of the caps. (This ranking is similar to one based on the steepness of the yield curve at the time a hypothetical ARM was issued.) Then we average the values in each group For each group we show, in the tables, for different first-period discounts, the effective value of the caps, singly and in combination. In examining the recent *ex ante* valuation, we use the relative steepness of the yield curve to select an appropriate value from the tables. For example, when the difference between the ten-year and one-year Treasury rates exceeds 1 5 percentage points, we use the average of the highest third as the value of the cap or caps The average of the lowest third applies to yield curve differences of less than one-half percentage point. In cases near a boundary, we chose an average value of the two groups.

Using our estimates of the value of caps, we next determine the extent to which the long-term expected ARM financing rate has been below the FRM rate

Financing rate: ARMs versus FRMs

We evaluate the financing rates by comparing the initial period pricing of an ARM and the FRM rate with the corresponding points on the yield curve in the market for Treasury securities Since the Treasury yield curve embodies only expectations of future rates and an interest rate risk premium in longer-term rates, subtracting it from the yield curve implicit in the mortgage market shows the impact of the other factors that distinguish ARMs from FRMs.[15] Consider, for example, an ARM without a discount or caps whose first-period rate is three percentage points above the one-year Treasury rate. If the FRM rate were only, say, two percentage points above a long-term Treasury rate, then the net effect of the distinguishing factors would make the long-term expected financing rate of an FRM lower than that of an ARM by one percentage point (Chart 1) [16]

[15]Shiller, Campbell, and Shoenholtz, *op cit*, show that long-term Treasury rates can be expressed as the sum of an interest rate risk premium and an arithmetic average of weighted expected future short-term rates, where the weights sum to one Expected rates receive less weight the further they are in the future

[16]More precisely, in this case all expected ARM rates in the future are also three percentage points above expected future one-year Treasury rates, since the markup is constant Thus, the expected long-term ARM rate exceeds the expected average one-year Treasury rate by three percentage points This difference can be compared with the spread between the FRM and longer-term Treasury rate, in which the expected future short-term rates and interest rate risk premium are netted out What is left over are the *(p 46)*

Table 2

Value of Discounts and Caps in 1984 and 1985

In percentage points

Quarter	Size of discount*	Yield curve†	Eight-year horizon: Effective value of discount‡	Eight-year horizon: Effective value of caps‡	Three-year horizon: Effective value of discount‡	Three-year horizon: Effective value of caps‡
1984-I	2 0	1 8	0 4	1 4	0 8	0 6
1984-II	2 9	1 7	0 6	1 6	1 2	0 7
1984-III	2 5	1 1	0 5	0 9	1 0	0 3
1984-IV	1 4	1 7	0 3	0 9	0 6	0 4
1985-I	1 4	2 2	0 3	1 2	0 6	0 5
1985-II	0 9	2 3	0 2	0 9	0 4	0 3

*Discount is estimated as the excess of the sum of the one-year Treasury rate and 2 8 percentage points over the initial rate, as reported by the FHLMC

†Difference between the rates on ten-year Treasury notes and one-year Treasury bills

‡The effective values of the discount and caps are the consequential reductions of the effective yield of a mortgage over the stated horizon

Estimated by the authors using data from the Federal Home Loan Mortgage Corporation and the Federal Reserve *Bulletin*

Table 3

Evaluation of the Financing Rate of ARMs in 1984 and 1985

In percentage points

Quarter	Eight-year horizon: Adjusted ARM rate less one-year Treasury rate*	Eight-year horizon: FRM rate less ten-year Treasury rate	Eight-year horizon: Difference	Three-year horizon: Adjusted ARM rate less one-year Treasury rate*	Three-year horizon: FRM rate less three-year Treasury rate	Three-year horizon: Difference
1984-I	1 0	1 4	−0 4	1 4	2 1	−0 7
1984-II	0 6	0 9	−0 3	0 9	1 4	−0 5
1984-III	1 4	1 6	−0 2	1 5	1 8	−0 3
1984-IV	1 6	1 9	−0 3	1 8	2 5	−0 7
1985-I	1 3	1 5	−0 2	1 7	2 4	−0 7
1985-II	.1 7	1 9	−0 2	2 1	3 0	−0 9

*Calculated as the constant ARM markup of 2 8 percentage points less the sum of the effective values of caps and discounts, shown in Table 2

Evaluating the expected long-term ARM financing rate involves several steps To take account of caps and the first-period discount, we add the present value of each to the face value of a mortgage and calculate the reduction of the effective yield over the holding period We call this reduction the "effective value" of the caps and first-period discount By subtracting this effective value from the fully-indexed ARM rate in the first period, the net result, the "adjusted" ARM rate, can be compared with the one-year Treasury rate as previously discussed

We apply this approach beginning in 1984, which is the first year for which rates on a fairly homogeneous sample of ARMs are available These data, compiled by the Federal Home Loan Mortgage Corporation (FHLMC), show the initial ARM rate The difference between this rate and the one-year Treasury rate equals the markup less the first-period discount To disentangle the first-period discount, we rely on two FHLMC surveys, taken at different times, indicating that the markup over the one-year Treasury rate for a typical ARM has been constant at 2 8 percentage points.[17] On the basis of these survey results, we assume that all the variation in the initial ARM/one-year Treasury spread represents changes in the first-period discount. Since January 1984 this discount has varied between 0.9 and 2 9 percentage points, which, for an eight-year horizon, translates into a range of effective values between 0 2 and 0 6 percentage point (Table 2)

Effective values of caps depend on the expectations of and the risks associated with future rates—both of which are embodied in the yield curve—and the discount. Thus, we apply our estimated values to 1984 according to the slope of the yield curve and the size of the discount in each month, as described in the box Caps were worth the most for ARMs issued in 1984-II and the least in the second half of 1984 and 1985-II

Using the Treasury yield curve and our estimated values of the discount and caps, we now determine how attractive ARM pricing has been for the average holding period For each quarter since the beginning of 1984 we calculate the adjusted ARM rate, as described above, and subtract from it the one-year Treasury rate We then compare this difference with the spread between the FRM rate and ten-year Treasury rate [18] Table 3 shows that the two spreads were similar in every quarter, implying that the long-term expected financing rates of ARMs and FRMs were about the same In other words, to the extent that individuals had the same expectations as the market, the average of expected ARM rates over the length of home ownership was close to the FRM rate This has been the case when FRM rates were low, as in early 1984 and 1985, as well as when they were temporarily high, as in mid-1984

Even if ARMs do not appear to have been priced much below FRMs for the typical individual, ARMs might be favored by people with short horizons, *e g* , an expected length of home ownership of three years, to avoid paying a long-term rate on a short-term loan

To evaluate the expected financing rate of an ARM for these borrowers, we compare the spread between the adjusted ARM rate and the one-year Treasury rate with the spread between the FRM rate and the three-year Treasury rate In this comparison, the adjusted ARM/one-year Treasury difference has varied between 0.3 percentage point and 0 9 percentage point less than the FRM/three-year Treasury rate difference since January 1984 While the differences may have been large enough to significantly affect these individuals' demand

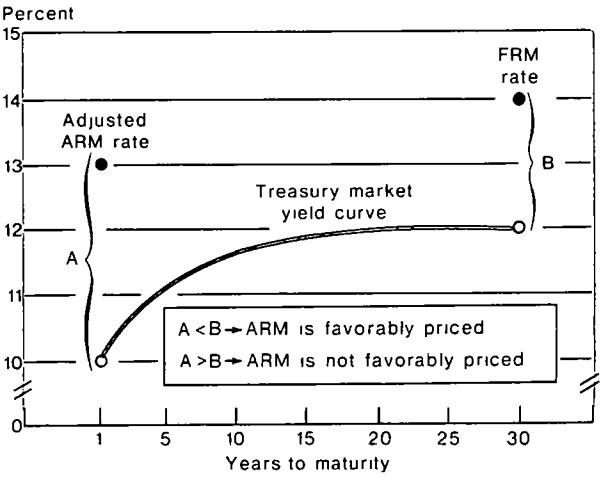
Footnote 16, continued
effects of the distinguishing characteristics of FRMs from ARMs The long-term expected financing rate of an FRM would differ from that of an ARM by these effects as well as the interest rate risk premium

[17]The first survey was taken in November 1984, see Federal Home Loan Mortgage Corporation, *The Primary Mortgage Market* (January 1985) The later survey, taken in February 1985, is unpublished The one-year Treasury rate has gained in popularity as the index rate for ARMs over cost-of-fund indexes and by 1984 was used by about 90 percent of lenders surveyed

[18]The ten-year Treasury rate most closely matches the average holding period of a mortgage Because the yield curve in the past several years has been essentially flat past a maturity of seven years, choosing other long-term rates does not significantly alter our results

Chart 1

ARM Pricing and the Treasury Market Yield Curve: An Illustration*



* Constructed by the authors

Table 4

Spread Between the FRM and Ten-year Treasury Rates

In percentage points

1970-78 average	1 3
1979	1 8
1980	2 3
1981	2 7
1982	3 1
1983	2 1
1984	1 4

Federal Home Loan Mortgage Corporation and Board of Governors of the Federal Reserve System

for housing, this group includes somewhat less than a quarter of all homebuyers at a given time.[19] Thus, any resulting boost to aggregate housing demand is likely to have been relatively small.

In sum, our estimates indicate that ARMs have generally not been priced significantly below FRMs. Inasmuch as our calculations are based on several approximations, however, the precise estimates should not be taken literally Nevertheless, the pricing of an ARM most likely has to be substantially more favorable than an FRM to persuade someone to purchase a house on the basis of the more risky financing rate. In this light, our results suggest that even if some of our approximations are not entirely correct, the alternatives are unlikely to be so different as to change the basic conclusion. ARMs do not seem to have been priced attractively enough to raise housing demand in the aggregate by a large amount.

ARMs and the FRM rate

ARMs may have still provided an indirect boost to housing by putting downward pressure on the FRM rate Two arguments have been advanced along this line. First, to the extent that the FRM rate in the past contained a premium to cover the risk associated with the imbalanced portfolios of thrifts, the ARM-induced reduction of this risk might cut the premium.[20] Second, with ARMs having captured a growing share of new mortgages, the supply of FRMs in the secondary mortgage market may not have kept up with demand, especially after demand was bolstered by the development of collateralized mortgage obligations in 1984.[21] As a result, the price of FRMs may have been bid up, which reduced the FRM rate.

Unfortunately, experience with ARMs has been too brief to distinguish their effect on the FRM rate from other influences. In fact, the FRM rate fell relative to other long-term rates over the past two years (Table 4). However, in 1982 the spread between them had widened to an unprecedented extent, most likely reflecting to some degree a jump in the FRM's prepayment risk premium that ocurred when interest rates climbed to exceptionally high levels. The FRM rate subsequently declined relative to other rates at least in part because this risk premium fell along with the overall level of rates.

The share of ARMs in newly issued mortgages

Even though our calculations point to little impact of ARMs on housing demand, small differences in the perceived financing costs of ARMs and FRMs could still have a large effect on how people choose to finance a home. Because these two types of mortgages are so closely substitutable, the differences may greatly influence the choice between an ARM or an FRM once an individual has decided to purchase a home. Although it is very difficult to know at this point all the determinants of the share of ARMs in new mortgages, we investigate in this section two systematic factors that might tilt the financing choice the distribution of risks surrounding the market's expectations of future rates and the pattern of mortgage payments over time.

In deciding whether to finance a home purchase with an ARM or an FRM, individuals presumably consider the risks surrounding market expectations of future rates. When interest rates look as if they will be rising, *i.e.*, the yield curve slopes upward sufficiently, FRMs may be viewed as a better hedge than ARMs. Conversely, when rates look as if they will be falling, *i.e.*, the yield curve is downward sloping, ARMs might be considered a good risk. From this perspective, then, the slope of the yield curve may indicate the predominant financing choice.

Another factor that may influence the mode of home finance is the pattern of mortgage payments over time. One way to represent the different payment patterns of ARMs and FRMs is to use the difference between the FRM and the first-period ARM rates. The larger this spread, the lower the near-term payments of ARMs relative to those of FRMs and, thus, the more attractive ARMs may appear.

Experience to date seems to support the roles played by these two factors. Since mid-1981 there have been two periods in which the share of ARMs in new mortgages has risen sharply—the first half of 1982 and the second half of 1983 through the first half of 1984

[19] John L Goodman, *op cit*

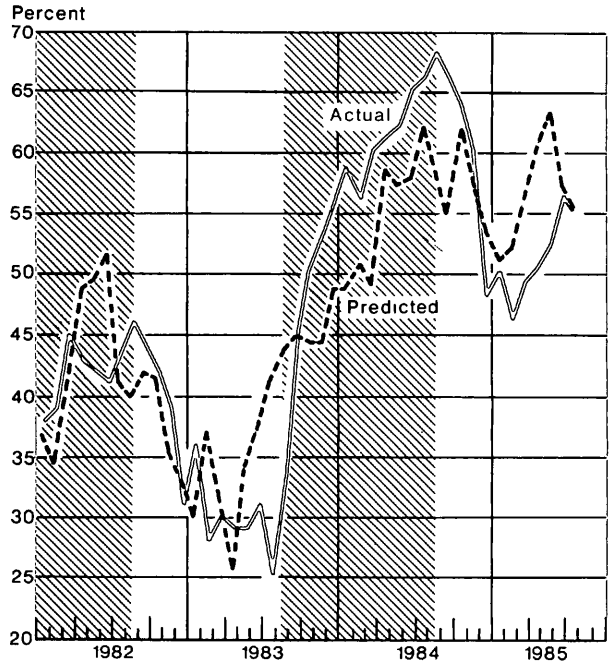
[20] Robert Van Order, *op cit*

[21] See Joseph Hu and Judy Hustick, "Major Developments in Housing and Mortgage Finance", *Bond Market Research*, Salomon Brothers Inc (January 1985)

Chart 2

Share of ARMs in Mortgages Closed

Shading shows periods of increasing ARM popularity



The predicted values are from the estimated equation
(t-statistics are shown in parentheses)

$$YT_t = -2.333 + 1.130\ INITGAP_t - 0.366\ SLOPE_{t-2} + 0.142\ RFRM_{t-1}$$
$$(-1.78)\quad (8.17)\qquad (-3.40)\qquad (1.68)$$

Sample period January 1982 - July 1985 $\bar{R}2 = 0.65$, D-W = 0.822

YT = $\log_e(JARM) - \log_e(1-JARM)$

JARM = Share of ARMs in new single-family home mortgages closed

INITGAP = Interest rate on FRMs less the initial interest rate on ARMs

SLOPE = Yield on 20-year Treasury bills less the yield on one-year Treasury bills (constant maturity)

RFRM = Interest rate on FRMs for new single-family homes

The transformation of the predicted values of YT into the share is given by

$$\hat{JARM}_t = (1+e^{\hat{YT}_t})^{-1}$$

The dependent variable is so transformed to restrict its range to the interval [0, 1]

Sources Federal Home Loan Bank Board and Board of Governors of the Federal Reserve System

(Chart 2). During the first episode, the share peaked at 46 percent, and during the second period it reached 68 percent. Outside of these episodes—from the end of 1982 to the summer of 1983, and in late 1984 and early 1985—ARMs lost some of their popularity.

In the first episode, the primary reason for the increased use of ARMs may have been related to the risks surrounding the yield curve Over the first year or so since widespread use of ARMs was permitted in April 1981, the yield curve was downward sloping or fairly flat (Chart 3). People may have taken advantage of ARMs in the belief that the potential for future declines in interest rates made this form of financing a good risk. In contrast, the timing of ARM payments was probably not important since the initial ARM rate was not much different from the FRM rate during this period.

The second surge in ARM popularity that began in the fall of 1983 may have been related to a widening spread between the FRM and initial ARM rates. In the spring of that year, first-period discounts became widely available and were more and more prevalent through the first half of 1984 These heavily advertised discounts may have reinforced people's perceptions of the different payment streams associated with ARMs and FRMs. The yield curve was fairly steep during this period and, thus, was unlikely to be behind the growing share of ARMs in newly issued mortgages. However, the yield curve flattened substantially in the summer of last year and may have helped extend the popularity of ARMs through most of the remainder of 1984, despite a narrowing in the FRM/ARM spread.

Finally, in almost all the periods when most people turned to FRM financing, neither the yield curve nor the FRM/ARM spread would have encouraged the widespread use of ARMs; the yield curve was steep and the FRM/ARM rate difference small. Individuals with short horizons, however, would have chosen ARMs on the basis of the steep yield curve

Since the beginning of 1985, though, the FRM/ARM spread has begun to widen at the same time that the yield curve has remained very steep So far, the share of ARMs has stayed around 50 percent, well below its previous peak. One factor that may be bolstering FRMs is that since the end of 1984 their rates have been close to their lowest level of this expansion. The long-term financing rate of a mortgage, thus, is perceived to be about as low as can be expected, thereby encouraging borrowers to lock in the FRM long-term financing rate [22]

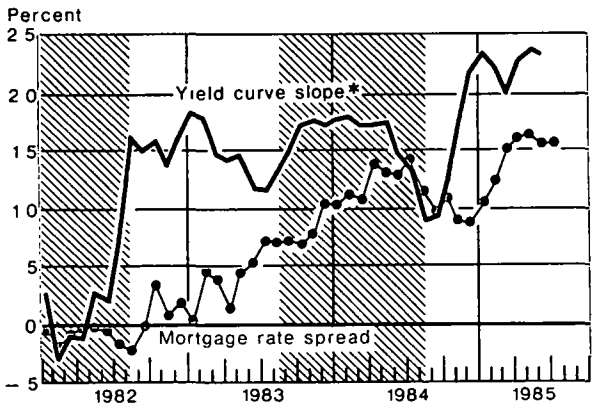
For confirmation that these systematic factors play a role in determining the mode of mortgage, we estimated

[22]See *Freddie Mac Reports*, Federal Home Loan Mortgage Corporation (May 1985), for a similar analysis

Chart 3

Slope of the Treasury Market Yield Curve and Spread Between the FRM and Initial ARM Rates

Shading shows periods of increasing ARM popularity



*Difference between ten-year and one-year Treasury rates

Sources Federal Home Loan Bank Board and Board of Governors of the Federal Reserve System

several simple equations relating the share of ARMs to the yield curve, the FRM/ARM spread, and the level of the FRM rate. In the best of these equations, the explanatory variables, for the most part, were statistically significant and explained much of the variation in the share of ARMs (Chart 2).

Conclusion

Our analysis suggests that ARMs have not had a major effect on the demand for housing. We have shown that for most people the pricing of ARMs has been such that their expected long-term financing rate may not have differed much from the FRM rate, assuming individuals have the same expectations of future rates as the market For people who hold mortgages only a short time, the effects could be important, but this group tends to be less than one-quarter of all homebuyers at a given time. Nonetheless, small differences between ARMs and FRMs may have produced large swings in the mode of home finance, once the decision to purchase a house was made. We believe that this dual approach goes a long way in resolving the apparent paradox of the recent econometric findings that indicate little impact of ARMs on housing and the observed popularity of ARMs

Our results, to be sure, are based on short and limited experience with ARMs. The economy has not yet gone through a period of sharply rising interest rates while ARMs were widely available and familiar to most people The impact of ARMs on housing demand might then be more pronounced than under recent financial market conditions.

Judging from recent experience, however, our analysis also implies that ARMs have not significantly influenced the dynamics of the business cycle by altering the interest responsiveness of housing demand. Of course, ARMs may have other effects on the business cycle by making spendable income after mortgage payments, and thus consumption, more sensitive to interest rate changes Nevertheless, since the long-term expected financing rate of ARMs seems to move broadly in line with the FRM rate, the aggregate demand for housing should continue to respond to interest rate movements as it has in the past

Carl J Palash and Robert B Stoddard