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Variable Rate Residential Mortgages: The Early Experience from California

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Housing has been one of the most volatile and, over the last ten years, most troubled of industries. The causes of housing's problems are varied and complex, but one of them deserves special mention—the imperfect functioning of the mortgage market. Because most new residential housing acquisition is financed by mortgage debt, conditions in the mortgage market are important to the housing industry. This paper examines one special aspect of the mortgage market, the mortgage instrument. It considers, first, whether the characteristics of the conventional fixed interest rate mortgage (FRM) may have both limited and destabilized the supply of mortgage funds and, second, whether an alternative mortgage plan containing a variable rate may increase and smooth the supply without reducing demand.[1]

In this paper, we analyze the implications of variable rate mortgages (VRMs) for both lenders and borrowers. We pay particular emphasis to the experiences resulting from the use of VRMs by six large savings and loan associations and one large bank in California which have been offering these mortgages since 1975.[2] The California experience is the most widespread use of VRMs in the country, and thus should provide useful insights for other areas. Because many VRM characteristics are stipulated by law, we examine the implications of these constraints and recommend specific changes in those features which appear to reduce the efficiency of the instrument.

FRM and VRM: Theoretical Issues

Most mortgage funds are supplied by private financial institutions. At year-end 1975, savings and loan associations had extended 51 percent of all residential mortgages outstanding, commercial banks 17 percent, mutual savings banks 10 percent, and life insurance companies 4 percent. Government supported agencies extended 13 percent and other private lenders 5 percent. Although they are the largest lenders of mortgage loans, thrift institutions (savings and loan associations and mutual savings banks) and commercial banks have complained of the relative lack of profitability of mortgage lending, and have at times appealed to the Federal government for assistance. In response, the government has introduced a host of mortgage subsidy programs and has limited the costs of depository mortgage-lending institutions by imposing ceilings on the rates they may pay on savings and time deposits. The latter restriction, popularly referred to as Regulation Q, not only limits cost increases for the bulk of the funds available to depository institutions, but also provides thrift institutions with a slight deposit rate edge over commercial banks as a means of encouraging savings flows into the thrifts. Evidence suggests, however, that these restrictions have not improved the operation of the mortgage market. At times market rates of interest have risen sharply above the Q ceilings, and

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funds have been redirected away from institutions not offering competitive rates. This has exacerbated the volatility of mortgage flows. The growing evidence of the unsatisfactory performance of these government programs has stimulated a search for other ways of assisting mortgage lending institutions which would have fewer side effects on the mortgage market.

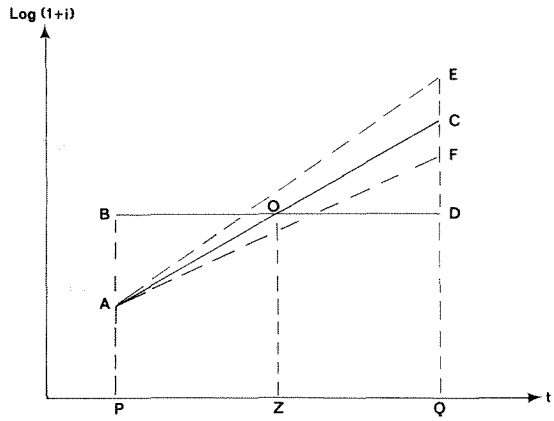
Maturity and interest-rate intermediation

Because residential dwellings are both big-ticket items and long-lived assets, they are financed primarily by long-term mortgage loans collateralized by the dwelling purchased. Many of the institutions extending such loans raise their funds by selling securities in the form of deposits with considerably shorter maturities, so that they engage in maturity intermediation. In addition, to the extent that the mortgages have a fixed rate of interest over their life, while rates on deposits may vary through time, the institutions also engage in interest-rate intermediation. Although these two activities in the past have been identical, they do not necessarily have to be so. In fact, the VRM represents a device for separating the two types of intermediation.

Economic theory tells us that the relationship between a long-term rate and a short-term rate on securities which are similar in all respects but term to maturity is determined largely by the expected course of short-term rates during the remaining life of the longer-term security. If we assume a world of perfect certainty in which the values of all future short-term interest rates are known, the long-term rate is a geometric average of the current short-term rate and future short-term rates on out to the maturity of the long-term security. This implies that, if a depository mortgage-lending institution is to break even, abstracting from costs of operations other than interest rates, the rate it charges on a fixed rate mortgage should be the geometric average of the current deposit rate and the deposit rates it expects to pay until the mortgage matures.

This relationship is illustrated in Figure 1. Time is measured on the horizontal axis and interest rates on the vertical axis.[3] Consider a loan starting in period P and maturing in period

Figure 1



Q. Assume that there is no prepayment provision, and that the current deposit rate at P is A and that deposit rates are expected to rise steadily through the period C in Q. Again, abstracting from operating costs and a competitive return on capital, the appropriate fixed rate on the loan would be B. At the rate B, the expected total return on the loan would equal the expected total of deposits over the life of the loan, so that the institution would break even on its intermediation operations. The dollar gain in the triangle ABO would be exactly equal to the loss in the triangle OCD.

Although the intermediary breaks even over the life of the mortgage, in any arbitrary shorter period, e.g., one year, it may be incurring either a profit or a loss. In our example, with deposit rates expected to increase, the loan rate will be above the initial deposit rate, so that the intermediary will be generating a profit. Through time, as deposit rates increase, the profit becomes progressively smaller until at Z the deposit rate is equal to the loan rate. Thereafter, the deposit rate rises above the loan rate and the institution experiences progressively larger losses. Thus the appropriate accounting period for evaluating the performance of the intermediary is the life of the loan and not any shorter period.

Under some circumstances the losses may precede the gains, with the loss and gain triangles reversed. In such a case, short-term loans from another financial institution or from

a government agency may be needed to ease the institution's resulting liquidity problem. It should be noted, however, that the problem is one of liquidity and not of solvency.

Our analysis demonstrates that in a world of certainty the return on any successive combination of shorter term investments summing to the maturity of the mortgage loan will be the same as for the mortgage loan itself. This is true because the long-term rate is an average of any combination of composite shorter-term rates and the latter, in turn, are averages of their composite shorter-term rates. Thus, the return on a 10-period loan is equal to that of two comparable five-period loans—and the latter return, in turn, is equal to that of 10 comparable one-period loans. In a world of certainty, long-term maturity and long-term interest-rate intermediation are just as advantageous as similar shorter-term intermediation.

Figure 1 also shows that, if the loan rate changes in synchronization with the deposit rate, the gain and loss periods are eliminated and the institution breaks even at all times. In this instance, the institution engages only in maturity intermediation without interest-rate intermediation.

Effect of uncertainty

We can now remove the assumption of perfect certainty so that future rates are only expected rates. If the intermediary's deposit rate expectations are realized, the analysis is unaltered. The institution breaks even on its fixed rate mortgage lending but experiences subperiods of gains and losses. If expectations are not realized, then it no longer breaks even. If deposit rates rise slower than anticipated, say along line AF in Figure 1, the gain triangle will be enlarged and the loss triangle reduced. The institution earns greater profits than expected. Conversely, if deposit rates rise faster than anticipated, say, along line AE, the loss triangle will be greater than the gain triangle. The institution will generate lasting losses and experience a solvency problem. Because it is lasting,

GLOSSARY

A number of the terms used in this article are subject to different meanings in common usage. To avoid confusion the terms will have the following definitions:

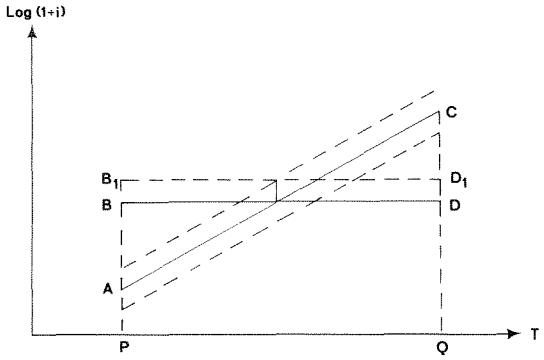
1. A *fixed-rate mortgage* (FRM) is one whose interest rate does not vary over the life of the mortgage. This is the standard form of mortgage in the United States.
2. A *variable-rate mortgage* (VRM) is one whose interest rate varies with movement in short-term interest rates. In California, where VRM's were introduced in 1975, the amount of movement is tied by law to an index of the cost of funds to mortgage lenders.
3. *Maturity intermediation* consists of borrowing at short-term and lending the funds obtained at longer-term.
4. *Rate intermediation* consists of borrowing at short-term *rates* and lending the funds obtained at longer-term *fixed* rates. Thus, the VRM is an attempt to break the link that has existed between maturity and rate intermediation by tying a long-maturity mortgage to a short-term interest rate.
5. The rate on an FRM consists basically of two parts:
   a. The *expectational* portion is the average of expected short-term rates over the life of the mortgage.
   b. The *insurance* portion is a premium which the borrower pays as protection against higher-than-expected future short-term rates. Thus, the VRM is an attempt to share the risk of such higher-than-expected rates between borrower and lender and should carry a lower (or zero) insurance premium. That is, the advantage to the borrower of a VRM should be a lower expected interest cost on a VRM over the life of the mortgage compared with a FRM of the same maturity to offset the increase in risk he must bear with the VRM.

a solvency problem requires a different solution than a short-term liquidity problem.

When an intermediary extends a long-term loan at a fixed interest rate, it accepts the risk that the underlying expected short-term interest rates may not be realized. Although this may result in gains or losses, many market participants are risk averse and assign greater weight to an extra dollar loss than to an extra dollar gain. A fixed rate mortgage contains two components for the borrower: (1) a long-term financing commitment and (2) insurance against loss from higher than expected short-term interest rates. Like any insurance seller, the lender will charge a premium for the interest rate insurance. The premium would be related to the expected loss, or the probability of losses from greater than expected interest rate increases multiplied by the magnitude of the associated loss. This premium is added to the long-term rate obtained by averaging the relevant expected short-term rates. If this is done and deposit rates are realized, the gain triangle will exceed the loss triangle. In Figure 2 the solid line AC is now the *expected* path of short-term rates, and the dotted lines above and below AC represent the degree of uncertainty about that path. The rate BB_1 is purely *expectational,* based on expected future short-term rates. This is the standard explanation of the mortgage interest rate without risk. BD is the *insurance premium* payable by the borrower and is proportional to the amount of risk. With the total market interest rate at PB_1 there is neither a profit to the intermediary nor a net loss to the fixed rate mortgage borrower, because the cost of providing insurance for the former and the cost of purchasing insurance for the latter are the same. If short rates turned out below expectations, long rates would fall and the borrower would wish to refinance. With no prepayment penalty an underpriced premium would imply that realized losses exceeded expected losses, and the intermediary would incur net losses on its lending.

The analysis also indicates that the profitability of fixed rate mortgage lending is dependent only upon whether expected future interest

Figure 2



rate changes are realized, and not on the shape of the yield curve. Financial intermediaries can operate as profitably under descending or flat, as under "normal" ascending yield curves. Thrift institutions, in fact, expanded as rapidly as commercial banks between 1905 and 1930, though the yield curve was downward sloping throughout almost all of that period. Except where the yield curve is flat, realization of expected interest rates shifts the yield curve, and consequently, the level of profitability reflects the extent to which changes in the yield curve are greater or less than those consistent with the realization of expected rates. Fixed rate mortgage lending can be profitable to intermediaries even if short-term rates rise more than long-term rates, provided that the increases do not exceed expectations.

Implications of VRM

Variable rate mortgages are long-term mortgage contracts in which the interest rate changes at prearranged periods, in sympathy with changes in some designated market interest rate that is referred to as the standard index.[4] Unlike a series of consecutive short-term loans, a VRM avoids the transactions costs that accompany a new mortgage note. As Figure 1 indicates, a VRM would simplify the operations of the intermediary by eliminating or greatly reducing interest rate intermediation. Under the assumptions that VRM interest rates 1) change concurrently with deposit rates and 2) are translated into changes in the dollar amount (rather than in the number) of monthly payments, the institution's interest receipts and payments are

perfectly synchronized and no interest rate risk arises.

What happens to the interest rate risk? If there are no constraints on VRM interest rate changes, all the risk is shifted to the borrower. The latter knows the amount of the first monthly payment and the length of the mortgage, but not the amount of the subsequent payments or of the total payments. In contrast, on a fixed rate mortgage he would know the amount of all payments and the length of the payments. If interest rates over the life of the mortgage changed in line with market expectations, the borrower would pay the same average rate on the VRM as on the FRM (less the FRM interest rate insurance premium), although the time pattern of the payments would be different. If short-term interest rates increased more than expected, the VRM would be costlier to the borrower than the FRM, while if short-term interest rates increased less than expected, the VRM would be cheaper.

A compromise between an FRM and a full VRM would involve a risk-sharing arrangement between the lender and borrower.[5] This could be accomplished by placing a symmetrical maximum interest rate band on either side of the rate on a new mortgage. Within the band, the borrower assumes the risk; outside the band, the lender assumes the risk. The wider the band, the greater the risk assumed by the borrower. The two polar cases are represented by an infinitely wide band, which is a pure VRM, and an infinitesimally narrow band, which is a pure FRM.

The California Experience

Six large state chartered savings and loan associations in California began offering VRMs in early or mid-1975. Five of these associations rank in the top ten in the country. (Their example was followed at year end by the Wells Fargo National Bank, the eleventh largest commercial bank in the nation.) These six savings and loan associations together extended some $1.7 million of VRMs between April and December 1975—about two-thirds of the total mortgages they made in this period. Although this experience is too brief to develop meaningful conclusions, some tentative impressions can be expressed. On the whole, the VRM is a much more complex instrument than either lenders or regulators generally realize. As a result, regulations and pricing practices could limit the value of the instrument to both lenders and borrowers. In addition, difficulties could arise under seven different headings, as described below.

Standard index

Regulations of the California Savings and Loan Commissioner tie the rate on VRMs to a standard index, defined as the last published weighted average cost of savings, borrowings, and Federal Home Loan Bank advances to California member associations of the Federal Home Loan Bank of San Francisco. Commercial banks offering VRMs also use this S&L cost of funds index. However, the index presents three problems, two economic and one political.

First, when individual lenders are forced to use an all-lender index, those institutions in capital-short areas may be discouraged from bidding more aggressively for deposits by offering higher interest rates, knowing as they do that the rates on their outstanding mortgages will not be increased correspondingly. Because a lender's decisions on the deposit rates it pays will not greatly affect the index value, some individual institutions could bid less aggressively for funds by offering lower rates and still benefit from higher mortgage rates. This reduces competition among individual lenders.

Secondly, the index is published semi-annually with a lag of two to eight months, and thus does not reflect current market rates. If market dates decline in any period, the drop will not be reflected in the index until later. Yet to be competitive with FRM lenders, VRM lenders must lower their rates in the current period. In the absence of a decline in the standard index, they can remain competitive only by reducing the differential between the market rate and the standard index. This spread, which remains constant over the life of the mortgage, is designed to compensate the intermediary for the

costs and risks of operations, which remain unchanged. A lower spread than necessary to cover the costs would, of course, lead to unprofitable operations over the life of the mortgage. It would appear at first that lower than required spreads when the standard index lags a decline in market rates would be offset by higher than required spreads when the index lags an increase in market rates. But because of the combined impact of prepayment provisions and limits on maximum interest rate changes, borrowers are encouraged to switch from higher spread mortgages to lower spread mortgages, reducing the profitability of lending institutions. A more appropriate solution would be the use of an up-to-date index, such as a two-month moving average of the cost of funds for individual institutions.

Lastly, a political problem arises because the cost of funds index is greatly affected by Regulation Q. Major increases have occurred in the cost of funds index in past periods when Regulation Q ceilings were increased. Because increases in Reg Q ceilings would lead to increases in rates on all outstanding VRM mortgages, and not only on new mortgages, it is reasonable to predict that all homeowners would exert significant political pressure to maintain—or even reduce—Reg Q ceilings as market rates rose. If financial intermediaries could not offer competitive deposit rates, depositors would transfer their funds away from these institutions into private capital markets, depriving the mortgage market of funds.

Maximum interest rate limit

A limit on the maximum VRM interest rate change causes the risk of unexpected interest rate changes to be shared between lender and borrower. Two difficulties exist with the current California regulations regarding this limit. First, they make possible asymmetrical rate changes for the affected savings and loan associations. The rate cannot be increased more than 2½ percentage points above the initial rate, but there is no limit on the amount it can decline as the standard index falls below the initial rate. This regulation places a greater share of the risk on the lender, increasing the rate that he is likely to charge on each new loan. Also, because borrowers are allowed to prepay without penalty within 90 days of any announced increase in loan rates, they have an incentive to shift into new VRMs during any later period of declining market rates in order to take advantage of lower maximum VRM rates.

Secondly, the maximum limit is based upon the initial VRM rate rather than upon the rate on a comparable FRM extended at the same time. This feature benefits VRM borrowers who obtain their mortgages when deposit or short-term rates are high, because they can not only ride the rates down, but can also convert to new VRMs with lower maximum interest rate limits. On the other hand, lenders are unable to recoup these losses from those borrowers who obtain their mortgages when rates are low and assume only limited upside risk. As a result, lenders must charge a higher interest rate in order to be compensated for the added risk.

Limits on the maximum interest rate change also cause new VRMs to differ from comparable outstanding VRMs, either in the loan rate or in the maximum permissible loan rate. These differences, in turn, may encourage lenders and borrowers to shift from old to new mortgages, and thereby encourage the use of prepayment and assumption restrictions to compensate either party for potential losses from such transfers.

Prepayment fees

Prepayment fees on mortgages have frequently been a problem for lenders. If the prepayment penalty fees are nonexistent or too low, in periods of low interest rates the lender will experience losses from expected income and become reluctant to engage in additional lending under the same conditions. Casual inspection suggests that prepayment penalties generally have not been very severe on fixed rate mortgages, so that borrowers have been able to refinance into lower rate mortgages in periods of declining rates. On the other hand, borrowers were locked into lower rates during periods of rising market rates. This situation has helped

make FRMs unfavorable instruments for lenders.

If there were no limits on changes in VRM rates, old VRMs would yield the same rate as new VRMs of the same credit quality—and thus there would be no advantage to borrowers to refinance at lower rates, no loss to lenders, and no need for prepayment fees. However, rates are generally not free to fluctuate without limit. If the maximum interest rate limits are either asymmetrical or centered around the initial VRM rate rather than the comparable FRM rate, it may be advantageous for the borrower to refinance into a new VRM when interest rates decline sufficiently. This, of course, would be disadvantageous to the lender, so that he would be likely, if permitted by law, to impose prepayment penalties on VRMs when market rates fell below initial rates. At other times, there would be no loss to the lender, so that he would be likely to permit prepayment without charge.

The California code permits prepayment of VRMs without penalty anytime within 90 days of an announced increase in loan rates. Thus, if rates had been falling for a period, borrowers would be able to refinance into new, lower rate VRMs after the first announcement of an increase. This provision should be changed to permit prepayment without charge at any time the loan rate is at or above the initial rate. At other times, when the loan rate is below the initial rate, prepayment penalties should be permitted.

Loan assumptions

Most conventional FRMs have "due on sale" clauses, which permit the lender to demand repayment of the outstanding balance (plus prepayment fees) at the time the mortgaged property is sold. This feature permits the lender to extend a new mortgage at a higher loan rate if market rates have risen since the initial mortgage contract. Restrictions on the assumption of an existing mortgage by the property buyer are analogous to unrestricted prepayment, with two differences: the option to terminate the loan rests with the lender rather than the borrower, and the injured party is the borrower when interest rates are above the initial rate (rather than the lender when interest rates are below the initial rate).

Because of these general similarities, loan assumption provisions may be analyzed best relative to prepayment provisions. If there are no prepayment penalties to compensate the lender when interest rates decline, equity suggests that assumption should be restricted so as not to compensate the borrower when interest rates increase. (Although the burden of higher rates falls directly on the buyer, the new mortgage rate affects the price at which property can be sold and thus indirectly affects the seller.) On the other hand, if sufficient prepayment penalties are permitted to compensate the lender for any loss he may experience, restrictions on assumption would not appear to be warranted.

Unlike prepayment penalties, only part of the assumption penalties—the part made up of the higher rate on the new mortgage—accrues to the lender. The remainder is absorbed in the process of obtaining a new promissory note, in the form of search loss, title insurance costs, recording costs, and legal costs. Thus, the effective assumption costs to the borrower are greater than the benefits to the lender.

As in the case of prepayment provisions, if there were no restrictions on VRM maximum interest rate changes, there would be no need for assumption restrictions. The rate on a new mortgage would be the same as on the old mortgage. However, as already noted, restrictions on interest rate changes may at times not make the two mortgages equivalent, so that either the borrower or the lender can find some advantage at such times in choosing between a new and an old mortgage. As a result, some VRM lenders have imposed assumption restrictions similar to those on FRMs, even though unrestricted assumption has often been cited as an advantage of VRMs.

Because only part of the benefit from restricted assumption goes to the lender, it would help both sides if these restrictions were modified. One alternative is to reset the maximum interest rate band each time the property were sold. (This could be done without having to

write a new promissory note.) The band on the existing mortgage would then be equivalent to that on a comparable new VRM. The necessary legal changes could be achieved with only a minor change in the California code.

Implementation of rate changes

Changes in loan rates may be implemented either as changes in the dollar amount of monthly payments or as changes in the number of unchanged monthly payments. Because deposit rate changes are reflected only in changes in the amount of interest payments, discrepancies between the time of inflows and outflows are reduced if loan rate changes are implemented in the same fashion, making interest receipts match interest payments. However, VRM loan rates can increase sharply, increasing monthly payments sharply, while most borrowers' incomes increase only slowly. As a result, borrowers may occasionally experience payments difficulties.

To ease the burden of such rate changes, lenders frequently permit increases in loan rates to be implemented, at the option of the borrower, as increases in the number of monthly payments rather than in the dollar amount. This eliminates interest rate risk, but because cash inflows and outflows are not snychronized, liquidity problems may still arise. The lender may need to meet deposit rate payments before receiving his loan rate payments. Thus, whenever a lender increases the length of a mortgage in response to loan rate increases, he should reserve the right to shorten the length again to the original maturity in the event rates decline.

California regulations permit VRM rate increases to be translated into increases in the number of monthly payments, provided that the remaining life of the mortgage does not exceed 40 years. Although this is reasonable for a mortgage with 20 or more years left to maturity, it appears to be an unnecessarily long extension for shorter mortgages. If rates increased over time, some mortgages might never be completely repaid. A change in the regulations, permitting mortgage maturities to be lengthened by no more than, say, 10 years in response to loan rate increases, could help lenders without creating any undue problems for borrowers.

Complexity of mortgage contract

Because a VRM is a complex instrument, the VRM contract or promissory note is also complex—much more so than an FRM contract. Like the FRM note, the VRM note must specify the initial interest rate, the amount of the monthly payments, and the length of the mortgage. But in addition, the VRM note must also stipulate the conditions under which the interest rate can change, the methods by which an interest rate change may be implemented, the options available to either side for implementing rate changes, the maximum and minimum limits on interest rate changes, the frequency of possible rate changes, and the maximum limits on the total interest rate change over the life of the mortgage. VRM prepayment provisions are also more complicated, since they can shift with the relationship of the current market rate with the initial rate. Lastly, the legal provisions applicable to VRMs are numerous, complex, and subject to frequent changes.

As a result, it is easy for errors to appear in the promissory note. An analysis of the notes used by the seven major users of VRMs in mid-January, 1976, revealed that many contained errors of nonconformity with the state laws and regulations then in effect. The largest number of errors pertained to the alternative procedures by which loan rate changes could be implemented. Such errors are not binding on the borrower, but they do reduce the amount of information provided and thereby lower the borrower's ability to evaluate the contract.

In addition, almost all of the promissory notes omitted information that was materially relevant to the ability of the borrower to understand the provisions and the value of the standard index at the time the loan was originated. Because of the complexities of the instrument, lenders and borrowers alike should benefit from the development of a model VRM contract. This would be of considerable use to lenders in preparing their own promissory notes and to borrowers in becoming knowledgable about the information that is material to them.

Consumer protection

The intrinsic complexity of the VRM makes it more important to protect borrowers against errors resulting from incorrect or omitted material information. One source of error unique to VRMs arises from the computation of the change in monthly payments resulting from changing loan rates.

Interest rates on almost all new residential mortgages of any type are denominated in multiples of 0.25 percent, e.g. 9¼ percent. Borrowers can check the monthly payments that are consistent with this rate and the loan maturity by using a standard mortgage payments table. (Computations of these amounts without the assistance of a calculator or computer is not recommended.) However, as interest rates change, the loan rate on outstanding VRMs can be in multiples smaller than 0.25 percent. Interest rate fractions in these smaller multiples are not included in standard mortgage tables. Thus there is no easy way for a borrower to check the monthly payment stipulated by the lender and obtained through the use of a computer. To remove doubts about the accuracy of such figures, all VRM lenders should make available at their offices a monthly mortgage payments table, perhaps in computer printout form, for all interest rate fractions and maturities in which their mortgages are outstanding.

California law requires lenders to provide borrowers with at least 30 days' written notice before the effective date of a change in VRM loan rates. When the economy is stable, with only small changes in market interest rates, there may be no changes in VRM loan rates for extended periods of time. But some borrowers may forget that these rates can actually change, and be both surprised and upset when an increase in monthly payments finally occurs. Lenders would be well advised to send borrowers a brief notice on every mortgage anniversary, possibly describing interest rate developments in the mortgage market since the last notice and reminding them that their loan rates could change if market rates change sufficiently. At least one smaller California savings and loan association, which has used VRMs for some years, has found such a program successful in defusing borrower animosity to rate increases.

Evaluation of VRM

The mortgage industry has developed the VRM as an alternative and/or supplement to the FRM in order to reduce the financial pressures on mortgage-lending financial intermediaries, to increase the flow of funds through the mortgage market, and to stimulate the purchase of additional housing. Hence, the usefulness of the VRM as a mortgage instrument can be evaluated by examining its actual and potential impacts on the mortgage and housing markets. This, in turn, requires a determination of the advantages and disadvantages of VRMs, relative to FRMs, for mortgage borrowers and lenders. These advantages and disadvantages can be set forth in tabular form, based in part on theoretical considerations, and in part on our observation of California's limited experience with this instrument.

Mortgage Borrowers

Advantages

1. Possible gain from lower than currently expected interest rates over the life of the mortgage.
2. Possible gain from lower prepayment fees.[6]
3. Possible gain from more liberal assumption provisions.[6]
4. Greater availability in periods of great interest rate uncertainty.

Disadvantages

1. Possible loss from higher than expected short-term interest rates and need to predict interest rates.
2. Possible risk of financial strain if mortgage rate increases sharply but family income remains unchanged.
3. Greater complexity of mortgage contract.
4. Difficulty of ascertaining accuracy of changes in monthly payments as a result of changes in standard index.

Mortgage Lenders

Advantages

1. Reduced solvency problem from risk of

higher than expected cost of funds through shifting of part or all of risk to borrower.
2. Reduced liquidity problem through increased synchronization of interest payments and receipts, whenever changes in loan rates are translated into corresponding changes in dollar amount of monthly payments.

Disadvantages

1. Difficulty in pricing of new VRMs and potential inability to compete for new mortgages in periods of declining rates because of standard index lagging behind market rate changes.
2. Reduction in potential gains from lower than expected cost of funds.
3. Elimination of potential profit from sale of "interest rate insurance."
4. Lack of synchronization of monthly payments and receipts, and possible liquidity problems, whenever changes in standard index are translated into changes in number of monthly payments.
5. Necessity of educating borrowers in complexities of mortgage contract, and possible borrower animosity whenever rates are raised on outstanding mortgages.
6. Difficulty in designing features of mortgage contract and simple promissory note.

Mortgage Market

Advantages

1. Possible increase in supply of funds from lenders.
2. Possible smoother supply of funds over the cycle.
3. Protection of solvency of thrift institutions, provided that new contracts are priced correctly.

Disadvantages

1. Possible decrease in demand for funds by borrowers because of greater risk.
2. Possible pressure on government from mortgagors to prevent increases in standard index, particularly through use of Regulation Q to hold down cost of funds and thus level of index.

Housing Market

Advantages

1. Possible greater demand for new and improved housing from greater availability of mortgage funds.
2. Possible smoother demand for new and improved housing over cycle from smoother flow of mortgage funds.
3. Possible greater demand for new and improved housing from increased ability of home owners to sell, as a result of more liberal prepayment and assumption provisions.

Disadvantages

1. Possible reduced housing demand from reduced demand for mortgages.
2. Possible reduced housing demand from (a) increased disintermediation if free movement of standard index is restricted; and (b) mispricing of mortgage if standard index is not sufficiently current.

Conclusion

The VRM is a complex instrument, much more complex than first analysis would suggest, and there is good evidence that it is not yet fully understood by any of the parties concerned—borrowers, lenders, or regulators. The potential success or harm of the VRM is heavily dependent upon the regulations and practices defining its characteristics. The California experience highlights a number of requirements that must be met for the VRM to operate successfully:

1) the need to select an appropriate standard index;
2) the need for thrift institutions to understand fully the complexities of maturity and term structure intermediation;
3) the need to offset political pressures for greater government interference with interest rates;
4) the need to determine loan rate changes in the light of the desired degree of risk sharing and the implications for prepayment and assumption provisions;
5) the need to "educate" borrowers;

6) the need to design the promissory note to provide complete, accurate, and understandable disclosure of all material information;
7) the need to provide proper protection to borrowers; and
8) the need for careful marketing of both the initial contract and subsequent changes in interest rates.

Inappropriate decisions in any of these areas could greatly reduce the potential contribution of VRMs. The California experience to date suggests that it may not be easy to realize the full potential of this mortgage instrument.

APPENDIX

How a VRM Works

The VRM is a long term mortgage contract in which the loan rate may change periodically, concurrently with changes in some predetermined market rate of interest, referred to as the standard index. The provisions governing the relationship between the loan rate and the standard index are stipulated in the promissory note and, in part, are established by state statute or regulation. These provisions generally include the fixed differential between the standard index and the loan rate, the frequency at which the loan rate may be changed, the amount by which the loan rate may be changed (at any single time and over the life of the note), and the method by which changes in the loan rate are translated into changes in the monthly payments (and at whose option). In California, many of these provisions are stipulated either in the State Civil Code or regulations of the Savings and Loan Commissioner.

The operation of a VRM may be illustrated with a hypothetical example developed in Table A-1. The standard index is the actual current value of the average cost of funds of insured savings and loan associations in the San Francisco Federal Home Loan Bank District.[1] The loan rate is assumed to be 1½ percentage points (150 basis points) above the standard index, to compensate the lender for all costs of operation and provide him with a competitive return. Changes in the loan rate are subject to the following restrictions:

1. Limit per change:
   maximum = 25 basis points
   minimum = 10 basis points
2. Carryover: changes in the standard index greater than 25 basis points or less than 10 basis points are carried over to the next and, if necessary, subsequent periods and added to the change in the index at that time.
3. Number of changes: no more than one per six month period.
4. Overall limit: 250 basis points from the rate on a comparable fixed rate mortgage extended on the same date.

The carryover (or cumulative) provision requires the computation of two numbers:

$$\text{Total loan rate carryover (TC)} = UC_{-1} + \Delta SI$$

$$\text{Unused loan rate carryover (UC)} = UC_{-1} + \Delta SI - P\Delta = TC - P\Delta$$

where:

SI = change in standard index

$P\Delta$ = permissible change in loan rate

UC_{-1} = unused carryover in previous period

A $20,000, 30-year VRM is assumed to be extended on January 1, 1967, at 6.85 percent, based on a standard index of 5.35 percent. (A comparable FRM is assumed to cost 7 percent.) In the second semiannual period, the standard index declines by 32 basis points. As a result, the loan rate is reduced by the maximum 25 basis points to 6.60 percent. The remaining 7 basis points are included in the unused carryover and are applied to the change in the next period. By the end of the first half of 1975, the standard index had climbed to 6.41 percent, or 106 basis points over its initial value. The loan rate had increased by 105 basis points to 7.90 percent. In the 16 semiannual periods following the origination of the mortgage, the standard index had declined five times and increased 11 times, while the loan rate had declined twice and increased seven times.

The monthly payments, as the table shows, are $131.06 in the first six months when the interest rate is at the initial 6.85 percent level. The payments then decline to $127.77 in the next six month period when the loan rate declines to 6.60 percent. (This assumes that all changes in the loan rate are translated into changes in the dollar amount of monthly payments.) In the first six months of 1975, the last semiannual period shown, the monthly mortgage payments have increased to $143.24.

[1]This rate is not published until some months after the close of the respective semiannual period. Nevertheless, we assume here that it is available at the beginning of the period, in order to have a current index that permits lenders to price their new mortgages at the current market loan rate without changing the rate differential.

The unpaid balance at the end of this period is $17,754.10.

In contrast, a FRM extended on January 1, 1967 at a 7-percent fixed rate would call for constant monthly payments of $133.20. At the end of the period, the unpaid balance would be $17,703.20, only $50 less than on the VRM. Of course, if interest rates had increased faster, the difference would have been greater, but the initial rate on the FRM may also have been higher.

FOOTNOTES

1. For a discussion of alternative changes in mortgage plans, see D. Lessard and F. Modigliani, **New Mortgage Designs for Stable Housing in an Inflationary Environment** (Boston: Federal Reserve Bank of Boston, 1975).
2. Another large commercial bank began offering VRMs after the conclusion of the study.
3. The interest rate on the vertical axis is scaled in terms of the logarithm of 1 plus the interest rate, to reflect reinvestment of the interest on both the mortgage and the deposit, as is required by the definition of compound interest.
4. The operation of a typical VRM is shown in Appendix (A).
5. The risk could also be shared or assumed totally by the Federal government as a third party. For such suggestions see George G. Kaufman, "The Case for Mortgage Rate Insurance," **Journal of Money, Credit, and Banking,** November 1975, and James L. Pierce, "A Program to Protect Mortgage Lenders Against Rate Increases," in **Financial Institutions and the Nation's Economy (FINE),** Committee on Banking and Currency, U.S. House of Representatives, November 1975.
6. Prepayment and assumption provisions depend on the magnitude of the maximum interest rate band and degree of risk sharing. The larger the spread, the more liberal the provisions are.

TABLE A-1

Monthly Payments and Unpaid Balance Variable and Fixed Rate Mortgages†

1967-1975

Period (Semi-Annual)	Variable Rate Mortgage* Standard Index	Loan Rate	Monthly Payments (dollars)	Unpaid Balance @	Fixed Rate Mortgage‡ Monthly Payments (dollars)	Unpaid Balance @
1/1/67				20,000.		20,000.
1967.1	5.35	6.85	131.06	19,897.	133.20	19,899.
1967.2	5.03	6.60	127.77	19,785.	133.20	19,794.
1968.1	5.08	6.60	127.77	19,670.	133.20	19,686.
1968.2	5.10	6.60	127.77	19,551.	133.20	19,575.
1969.1	5.17	6.60	127.77	19,428.	133.20	19,459.
1969.2	5.27	6.75	129.65	19,304.	133.20	19,339.
1970.1	5.58	7.00	132.78	19,181.	133.20	19,215.
1970.2	5.67	7.15	134.65	19,057.	133.20	19,086.
1971.1	5.64	7.15	134.65	18,928.	133.20	18,953.
1971.2	5.57	7.15	134.65	18,795.	133.20	18,815.
1972.1	5.55	7.05	133.45	18,655.	133.20	18,672.
1972.2	5.56	7.05	133.45	18,510.	133.20	18,524.
1973.1	5.60	7.05	133.45	18,359.	133.20	18,371.
1973.2	5.83	7.30	136.35	18,209.	133.20	18,213.
1974.1	6.14	7.55	139.23	18,059.	133.20	18,049.
1974.2	6.44	7.80	142.10	17,908.	133.20	17,879.
1975.1	6.41	7.90	143.24	17,754.	133.20	17,703.

†$20,000, 30-year mortgage extended January 1, 1967.
*Initial loan rate = 6.85 percent.
‡Loan rate = 7 percent.
@At end of semi-annual period.