

# Volatile Mortgage Rates— A New Fact of Life?

*By Howard L. Roth*

The sharp rise in mortgage interest rates in the spring of 1987 had several adverse effects. Rates on fixed-rate mortgages soared as much as two percentage points between April and June, pricing some prospective buyers out of the housing market. A number of lenders were hurt by mortgage commitments they had made before the rise in rates. Some lenders also suffered losses on their holdings of mortgages and mortgage-backed securities as the rise in rates reduced the market value of these assets. And a few large securities firms suffered large losses on mortgage-backed securities that had not yet been sold.

Beyond underscoring the importance of hedging against swings in interest rates, the increase in mortgage rates illustrated how quickly these rates can react to changes in capital market rates. The quick response of mortgage rates to capital market rates was not limited to last spring. When

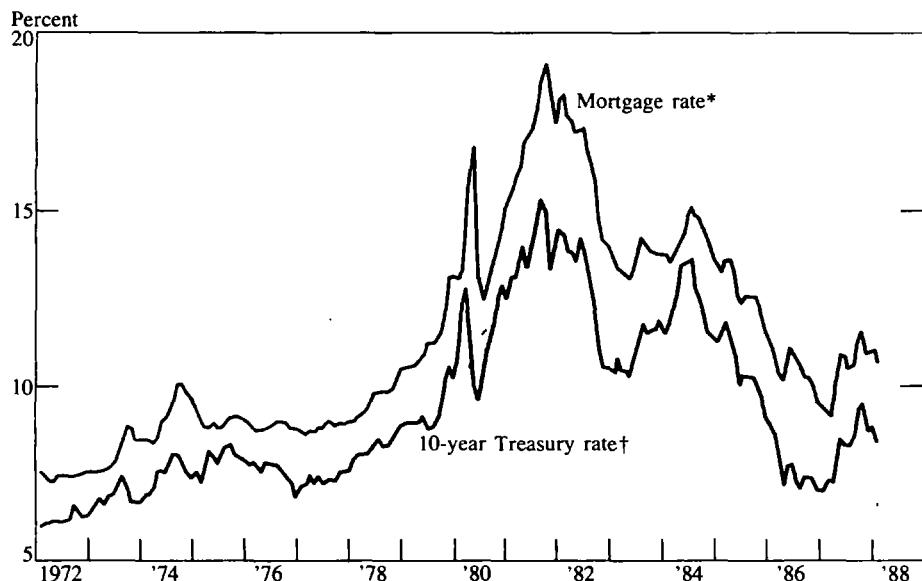
capital market rates rose in the fall of 1987, mortgage rates quickly followed. And when capital market rates fell after the October stock market collapse, mortgage rates again followed closely. The experience last year suggests that mortgage rates may have become more responsive to changes in other capital market rates. If so, what has caused this increased responsiveness?

Growth of the secondary mortgage market has been the main factor causing mortgage rates to move more closely with capital market rates. As a result, the volatility of mortgage rates now is similar to the volatility of capital market rates. The first section of this article puts last spring's increase in mortgage rates in perspective by comparing it with previous changes. The second section discusses developments besides the growth of the secondary mortgage market that might have affected the relationship between mortgage rates and capital market rates. The third section examines why growth of the secondary mortgage market would be expected to affect the relationship. The fourth section documents the closer relationship now of mortgage rates to capital market rates and estimates how much more

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**CHART 1**  
**Mortgage rates and the 10-year Treasury rate**



\*FHLMC survey-based effective rate on new commitment for 30-year, fixed-rate mortgages.

†10-year, constant-maturity Treasury rate.

volatile mortgage rates have been since 1984 because of the closer relationship.

### **Putting last spring's increase in perspective**

Mortgage interest rates changed dramatically twice last year. But even the sharp increase in the spring was not as large as some of the changes in the late 1970s and early 1980s. What was unprecedented was how closely mortgage rates mirrored changes in capital market rates.

The rise in mortgage rates last spring was indeed sharp. One measure of mortgage rates—the Federal Home Loan Mortgage Corporation's (FHLMC's) survey-based measure of rates on 30-year, fixed-rate conventional home mortgages—jumped 79 basis points in April and

another 77 basis points in May.<sup>1</sup> The runup in April was the largest monthly change since October 1982 and was almost three times the average monthly change between January 1983 and March 1987.

But the increase in rates last spring was not as spectacular as some changes in the late 1970s and early 1980s. For example, the FHLMC series rose 119 basis points in November 1979 and 224 basis points in March 1980 before falling 207 basis points in May 1980 and another 155 basis points in June 1980.

The late 1970s and early 1980s was a period of extreme volatility for both mortgage rates and capital market rates. Chart 1 shows the FHLMC

<sup>1</sup> The Freddie Mac survey is restricted to level-payment, first mortgages with 80 percent loan-to-value ratios.

mortgage rate series and the 10-year constant-maturity Treasury rate since 1972.<sup>2</sup> This chart gives the general impression that mortgage rates and the 10-year Treasury rate have varied less in the last two years than they did between 1978 and 1985 but more than they did between 1972 and 1978. To be sure, some of the extreme volatility between 1978 and 1985 was due to the general upward trend in interest rates between 1978 and 1981 and the subsequent downward trend between 1981 and 1985. However, when these trends are removed, as in the empirical investigation of the fourth section, mortgage rates and capital market rates continue to be extremely variable in the early 1980s.<sup>3</sup>

What was most remarkable about the behavior of mortgage rates last year, however, was how closely mortgage rates mirrored changing capital market rates. For example, when concern about the dollar led to sharp increases in Treasury bond yields last spring, mortgage rates responded almost immediately. The adjustment of mortgage rates to the change in capital market rates was essentially complete within a month. In contrast, in the 1970s and early 1980s, mortgage rates generally adjusted to changes in market interest rates with a lag of a month or two. The dramatic changes in the FHLBC rate in 1979 and 1980, for example, lagged changes in Treasury bond yields by about a month.

The quicker adjustment of mortgage rates to changes in capital market rates should make the

volatility of mortgage rates more like the volatility of capital market rates. Suppose, for example, that capital market rates were to rise 100 basis points one month and fall 100 basis points the next. If mortgage rates matched only a fraction of both the rise and fall in capital market rates, the volatility of mortgage rates would be less than the volatility of capital market rates. But if mortgage rates matched the whole rise and fall of capital market rates, mortgage rates would be as volatile as capital market rates. Other examples could be given, but the point is simple. Mortgage rates varied less than capital market rates in the past but recently have come to behave more like capital market rates. Thus, the variability of mortgage rates has increased relative to the variability of capital market rates. Stated another way, mortgage rates have become more variable than they would have been without the closer relationship to capital market rates.

### **Removal of rate ceilings**

Innovation and deregulation fundamentally changed financial markets in the 1970s and 1980s. Two developments that could have affected the relationship between mortgage rates and capital market rates were deposit rate deregulation and the lifting of mortgage usury ceilings. Dissentangling the effects of these developments is difficult. Deposit rate deregulation was an ongoing development that spanned much of the period and overlapped the lifting of mortgage usury ceilings. While deposit rate deregulation should have reduced the responsiveness of mortgage rates to capital market rates, the lifting of mortgage usury ceilings should have increased responsiveness.

#### ***Deposit rate deregulation***

Before the secondary mortgage markets were well developed, the supply of mortgage credit was determined primarily by the supply of deposits

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<sup>2</sup> Rates on 30-year, fixed-rate mortgages are commonly compared with the 10-year Treasury rate. With sales and refinancings, 30-year, fixed-rate mortgages have an average maturity of about ten years.

<sup>3</sup> The effects of trend can be removed by taking first differences of the two interest rate series before computing variances. When this is done, the 1970s continue to be years of relative stability for both interest rate series. And the mid-1980s are years of intermediate variability, less variable than the early 1980s but more variable than the 1970s.

to banks and thrifts. Banks and thrifts obtained funds to increase mortgage lending primarily by attracting additional deposits. As market interest rates rose, banks and thrifts found it necessary to offer higher rates on deposits or otherwise to increase the appeal of deposit accounts. The higher costs of attracting funds were passed on to mortgage borrowers in the form of higher mortgage rates. That is, banks and thrifts were willing to expand mortgage credit only at higher mortgage rates.

The ability of banks and thrifts to expand mortgage credit was limited, however, by regulatory ceilings on deposit rates. When deposit rates rose to the ceilings, little more could be done to attract more deposits. The supply of mortgage credit then became less responsive to changes in market interest rates. Several times in the 1960s and 1970s, deposits grew very slowly when market rates rose above deposit rate ceilings. In some cases, deposits actually declined. Increases in market interest rates not only eroded deposits but also reduced the supply of mortgage credit by making other investments more appealing than mortgages to banks and thrifts. With no change in demand for mortgage credit, the reduced supply would be expected to cause a sharp increase in mortgage interest rates. Thus, deposit rate ceilings contributed to the sensitivity of mortgage rates to changes in market interest rates.

The deregulation of deposit rate ceilings should have reduced the variability of mortgage rates relative to capital market rates. A transition to relatively lower volatility would be expected as banks and thrifts were increasingly allowed to offer accounts free of rate ceilings. The first significant development along these lines was in June 1978, when banks and thrifts were authorized to offer 6-month money market certificates with a ceiling rate indexed to the 6-month Treasury bill rate.<sup>4</sup> The next significant developments

were the nationwide authorization of NOW accounts in December 1980, the authorization of MMA accounts in December 1982, and the authorization of Super NOW accounts in January 1983. More deregulation followed, but the remaining deposit rate ceilings probably did not significantly constrain banks and thrifts in their efforts to expand deposits. Therefore, by the early 1980s, deposit rate deregulation had likely come to the point where ceiling rates no longer contributed much to the sensitivity of mortgage rates to changes in market interest rates.

### *Removal of usury ceilings*

Unlike the deregulation of deposit rates, removing usury ceilings has probably increased the responsiveness of mortgage interest rates to changes in capital market rates. State usury ceilings limited adjustment of mortgage rates when market interest rates were high. Unable to raise mortgage rates above legal ceilings, lenders were forced to allocate mortgage credit by such non-price terms as lower loan-to-asset ratios, higher origination fees, and additional points.<sup>5</sup>

As recently as April 1, 1980, 39 states had usury ceilings on mortgage rates.<sup>6</sup> Of these, 18 states had floating ceilings tied to a market index. The rest had fixed-rate ceilings. Although floating-rate ceilings could have been raised when

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I. Mahoney, Alice P. White, Paul F. O'Brien, and Mary M. McLaughlin, "Responses to Deregulation: Retail Deposit Pricing from 1983 through 1985," Staff Study No. 151, Board of Governors of the Federal Reserve System, January 1987.

5 Some have argued that banks and thrifts rationed credit even when usury ceilings were not binding. For an analysis of this argument, see William R. Keeton, "Deposit Deregulation, Credit Availability, and Monetary Policy," *Economic Review*, Federal Reserve Bank of Kansas City, June 1986, pp. 26-42.

6 See Donna C. Vandenbrink, "Usury Ceilings and DIDMCA," *Economic Perspectives*, Federal Reserve Bank of Chicago, September/October 1985, pp. 25-30.

<sup>4</sup> For a chronology of new accounts and deregulation, see Patrick

capital market rates rose above the usury ceiling, the adjustment was often so slow that the ceilings remained binding for considerable periods.

The Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA) preempted state ceilings on residential mortgage loans as of April 1, 1980. Strictly speaking, DIDMCA did not abolish mortgage usury ceilings. The law gave states the right to override the federal preemption by acting before April 1, 1983. Although some states exercised this right, it is unlikely that usury ceilings have kept mortgage rates from adjusting to changes in capital market rates since DIDMCA took effect.

In summary, the net effect of these developments is unclear. While the removal of deposit rate ceilings probably reduced the responsiveness of rates on fixed-rate mortgages to capital market rates, the removal of mortgage usury ceilings probably had the opposite effect. The net effect could be determined only empirically. But another, perhaps more important, development may have outweighed all others. That development was the growth of the secondary mortgage market.

### Growth of the secondary mortgage market

Until development of the secondary mortgage market, most mortgage credit was supplied regionally. Mortgage rates reflected the demand for and supply of mortgage credit within regions, and thus did not generally respond fully to changes in capital market rates. Growth of the secondary mortgage market transformed the provision of mortgage credit from a regional to a national activity. Homeowners today collectively compete with business and government for funds in the capital markets. With mortgage markets effectively integrated into the capital markets, mortgage rates more closely reflect capital market rates.

### *Regional markets*

Before the development of the secondary mortgage markets, markets for mortgage credit were primarily regional in nature. And mortgage rates reflected the demand for and supply of mortgage credit in each region. The supply of mortgage credit in a region was determined primarily by the amount of mortgage credit banks and thrifts provided in the region. Demand for mortgage credit depended primarily on the regional demand for housing. With no national market for mortgage credit, mortgage rates in some regions could differ significantly from rates in national capital markets. Mortgage rates differed significantly between regions because of regional variations in demand or supply conditions. For example, regional variation in deposit growth could cause regional variation in the supply and, in turn, the cost of mortgage credit.

Developments in national capital markets had only limited effects on mortgage rates. comparatively few depositors considered capital market instruments close substitutes for deposits in their local banks and savings and loans. Few depositors adjusted their balances immediately to changes in the spread between capital market rates and deposit rates. Instead, they waited, at least for a while, to see if the change was short lived. The economic costs of moving funds—including the time required to find out what rates were elsewhere and to fill out the necessary forms to transfer funds—were significant. These costs had to be weighed against the opportunity cost of lower interest income. Also, the psychic costs of moving funds may have been significant, as indicated by the amounts of funds still held in deposits with rates that did not seem competitive. Because of these costs, the effect of a change in capital market rates on a depository institution's supply of deposits, and thus on its supply of mortgage credit, was limited and spread out over time.

Moreover, banks and thrifts did not consider

capital market instruments good substitutes for mortgage loans. For example, some banks and thrifts continued making mortgage loans even when returns on capital market investments rose above those available on mortgages, partly to maintain long-term customer relationships. Moreover, most savings and loans were required to keep a high proportion of their portfolios in mortgages or mortgage-related assets. For these reasons, mortgage rates in local markets adjusted only partially to changes in capital market rates.

Mortgage rates adjusted relatively slowly. Many depository institutions priced mortgages according to average costs. Changes in market interest rates affected the interest costs only on new time deposits. As a result, a change in market interest rates was not fully reflected in an institution's average costs until all its existing time deposits had matured. Thus, average-cost pricing of mortgages slowed the adjustment of mortgage rates to changes in market rates.

#### *Secondary mortgage markets: forging a national market*

The emergence of the secondary mortgage market has helped unify regional mortgage markets into a single national mortgage market. A range of institutions take part in the trading of mortgages and mortgage-related securities in the secondary mortgage markets. Such mortgage originators as savings and loan associations, commercial banks, and mortgage companies sell mortgages to other institutions. The biggest buyers of mortgages are federal credit agencies—the Government National Mortgage Association (GNMA), the Federal National Mortgage Association (FNMA), and Freddie Mac (FHLMC). These agencies buy mortgages, pool them, and either sell shares in the pool or issue debt with the pool as collateral. A variety of institutions purchase these mortgage-backed securities—savings and loans, commercial banks,

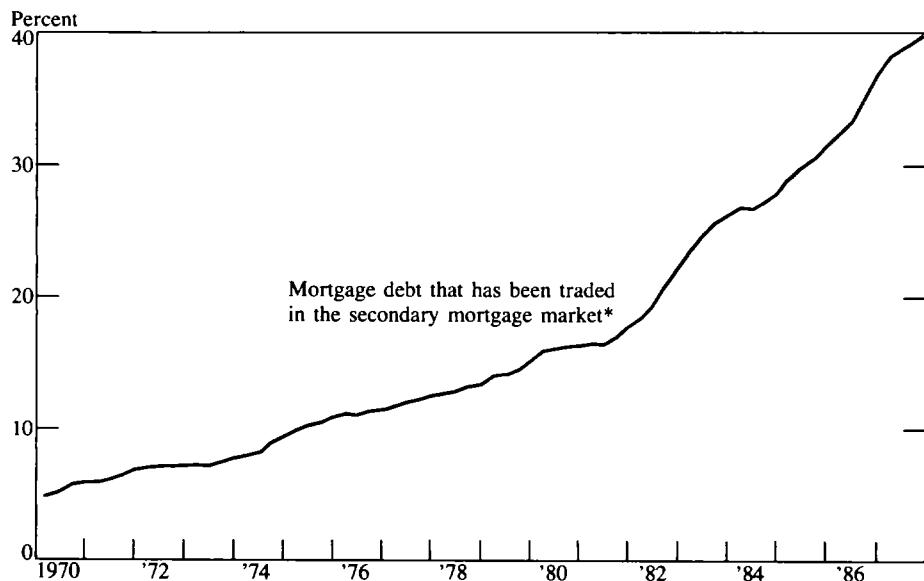
mutual funds, life insurance companies, private pension funds, state and local retirement funds, and state and local credit agencies. The nationwide buying and selling of mortgage securities by financial institutions has led to the separation of mortgage origination, which is still predominantly regional, from mortgage funding, which is now national.

The secondary mortgage market has grown dramatically in recent years. Mortgage debt held by federal credit agencies and in pools sponsored by these agencies has grown as a proportion of mortgage debt outstanding from less than 6 percent in 1970 to more than 38 percent today. As shown in Chart 2, this proportion grew steadily from 1970 to 1981 and then began growing significantly faster.

The increased growth of the secondary mortgage market coincided with the initiation of new mortgage pass-through programs by FHLMC and FNMA in the early 1980s. Pass-through securities, the most common mortgage-backed securities, represent interests in a pool of mortgages. The issuer of pass-through securities receives the principal and interest payments on the mortgages in the pool and passes those payments through to holders of the securities. Growth of pass-throughs since 1981 has been phenomenal. Issuance of pass-through securities by FHLMC, FNMA, and GNMA grew from less than \$25 billion in 1981 to more than \$250 billion in 1986. The dollar amount of pass-through and other mortgage-backed securities issued in 1986 was almost twice the amount of corporate bonds issued.

The development of the secondary mortgage market has reduced the variation in mortgage rates across regions. Mortgage originators that sell their mortgages in the secondary mortgage market are present in every major mortgage market. Their presence makes it difficult for other mortgage originators to offer mortgages at rates other than those determined by the secondary mortgage

**CHART 2**  
**Growth of the secondary mortgage market**



Source: *Federal Reserve Bulletin*, various issues.

\*Mortgage debt held by federal credit agencies and in pools sponsored by these agencies as a percent of total 1- to 4-family mortgage debt outstanding.

markets. An originator that offered mortgage credit at an interest rate higher than the rate determined nationally would see demand for its mortgages dry up. And an originator that offered credit at a rate lower than the rate determined nationally would be giving up profits needlessly.

Since mortgage rates are now determined in the secondary mortgage market, the cost structures of mortgage originators in a regional market have little bearing on regional mortgage rates. Banks and thrifts no longer rely on depositors in their area to fund mortgages. So it is unnecessary to increase deposit rates to increase the supply of mortgage credit. Supplying mortgage credit according to the average cost of mortgage credit instead of the marginal cost does not impede close adjustment of local mortgage rates to changes in capital market rates. Nor does hesitancy by depositors in transferring funds in response to

changes in spreads between deposit rates and capital market rates. These factors also have no bearing on the total amount of mortgage credit extended in the market. The amount of mortgage credit extended in the market is determined by the demand for mortgage credit at the mortgage rate determined in the secondary mortgage market.

### **Estimates of the effect of secondary mortgage markets**

To see whether mortgage rates have come to move more closely with capital market rates and, if so, whether the development of the secondary mortgage market has been instrumental in this change, a model of mortgage rates was estimated. The estimates confirm the suspected closer adjustment of mortgage rates to capital market rates and

**TABLE 1**  
**Correlation between mortgage rates  
 and capital market rates**

<b>Year</b>	<b>Correlation*</b>
1972	-0.22
1973	0.19
1974	0.46
1975	-0.18
1976	0.16
1977	-0.49
1978	0.42
1979	0.34
1980	0.33
1981	0.42
1982	0.80†
1983	0.81†
1984	0.65†
1985	0.76†
1986	0.58†
1987	0.91†

\*Correlations are between month-to-month changes in the FHLBC mortgage rate and the 10-year Treasury rate.

†Significantly different from zero at a 5-percent confidence level.

point to the development of the secondary mortgage markets as the primary cause of the closer relationship. The estimates also show how much more variable mortgage rates have become because of their closer relationship to capital market rates.

#### *A model of mortgage rates*

The impression that mortgage rates have become more closely tied to capital market rates is supported by the closer correlation between mortgage rates and capital market rates. Table 1 shows simple correlations between monthly

changes in the 10-year Treasury rate and in the FHLBC mortgage rate. From 1972 through 1981, the correlation was generally small and statistically insignificant, perhaps reflecting variability in the timing and magnitude of the response of mortgage rates to changes in capital market rates. In contrast, the correlation since 1981 has increased and become statistically significant, suggesting a closer relationship between mortgage rates and capital market rates.

To explore the relationship more closely, a general model of mortgage rates was estimated by regression techniques. The model is based on the assumption that the weekly changes in the FHLBC mortgage rate depend on the difference between the 10-year Treasury rate and the mortgage rate the previous week. Empirical estimates of the model were used in determining how closely mortgage rates adjusted to changes in the 10-year Treasury rate over the estimation period.<sup>7</sup>

The model was first estimated over two periods—the first ending when mortgage usury ceilings were preempted by DODMCA on April 1, 1980, and the second period beginning then. Results of these regressions are shown in the first two columns of Table 2. The results confirm that mortgage rates have become more responsive to capital market rates in the 1980s. The value of b, which measures this responsiveness, more than tripled in the more recent period. This result is consistent with the view that the secondary mortgage market has increased the responsiveness of mortgage rates to capital market rates. But because most of the growth of the secondary mortgage market has taken place since 1980, the results are also consistent with the view that the elimination of mortgage usury ceilings was responsible for the increased responsiveness. The results are not, however, consistent with the

<sup>7</sup> More detail on the model is given in the box on page 25.

**TABLE 2**  
**Estimated mortgage rate equations**

	<u>Jan. 5, 1972 to Mar. 26, 1980</u>	<u>Apr. 2, 1980 to Aug. 5, 1987</u>	<u>Apr. 2, 1980 to Dec. 28, 1983</u>	<u>Jan. 4, 1984 to Aug. 5, 1987</u>
<b>Estimated Parameters</b>				
b	0.048 (3.109)	0.156 (10.744)	0.160 (8.933)	0.465 (13.445)
c	2.020 (8.274)	2.640 (5.197)	3.012 (26.066)	2.292 (14.857)
<b>Summary Statistics</b>				
R <sup>2</sup>	0.02	0.23	0.29	0.50
Standard error (percentage points)	0.142	0.119	0.129	0.092
Note: t-statistics in parentheses				

view that the deregulation of deposit rate ceilings was an important development. This development should have reduced the responsiveness of mortgage rates to capital market rates.

So finding an increased responsiveness of mortgage rates to capital market rates indicates that growth of the secondary mortgage market and removal of mortgage usury ceilings jointly had a greater impact on mortgage rates than did the deregulation of deposit rates. These results shed no light on whether the development of the secondary mortgage market or the removal of mortgage usury ceilings was the predominant influence.

An indication of the importance of the growth of the secondary mortgage markets can be obtained, however, by examining the behavior

of mortgage rates in the post-usury ceiling period. The secondary mortgage markets grew rapidly in the 1980s. The principal difference between the mid-1980s and the early 1980s is that the secondary mortgage market has become much more significant in the mid-1980s. If mortgage rates moved more closely with capital market rates in the last four years than in the previous four years, growth of the secondary mortgage markets must have been an important factor. To determine whether this was the case, the model was estimated over two subperiods in the 1980s—the period from the preemption of usury ceilings in April 1980 through the end of 1983 and the period from the beginning of 1984 through August 5, 1987. These results are shown in the

## Model

A partial adjustment model was used to relate the FHLMC measure of mortgage rates to the 10-year constant-maturity Treasury rate. In this model, the mortgage rate adjusts to changes in the spread between the 10-year Treasury rate and the mortgage rate. The model is given as follows:

$$r_t^m - r_{t-1}^m = b \cdot (r_t^{b10} - r_{t-1}^m + c) + u_t$$

$$0 \leq b \leq 1$$

where  $r^m$  is the FHLMC mortgage rate,  $r^{b10}$  is the 10-year Treasury rate, and  $u_t$  is an error term. The parameter  $c$  is the equilibrium spread between the mortgage rate and the 10-year Treasury rate. As the equation is written,  $c$  is expected to be greater than zero. That is, in equilibrium, the mortgage rate is expected to be higher than the 10-year Treasury rate.

The parameter  $b$  determines how closely the mortgage rate moves with the 10-year Treasury rate when the mortgage rate is out of equilibrium. The closer  $b$  is to 1, the more closely the mort-

gage rate moves with the 10-year Treasury rate. A value of  $b$  equal to 1 would indicate that the mortgage rate moves perfectly with the 10-year Treasury rate; that is, the spread between the two rates is constant. At the other extreme, a value of  $b$  equal to 0 would indicate that the mortgage rate is unrelated to the 10-year Treasury rate.

The form in which the equation was estimated is obtained by expanding the right-hand side of the equation above.

$$r_t^m - r_{t-1}^m = b \cdot c + b(r_t^{b10} - r_{t-1}^m) + u_t$$

That is, week-to-week changes in the FHLMC mortgage rate were regressed on the difference between the current 10-year Treasury rate and the previous week's mortgage rate.

A maximum likelihood procedure that corrects for the first-order serial correlation in the errors was used in estimating the model. The estimated coefficients and other regression results are shown in Table 2.

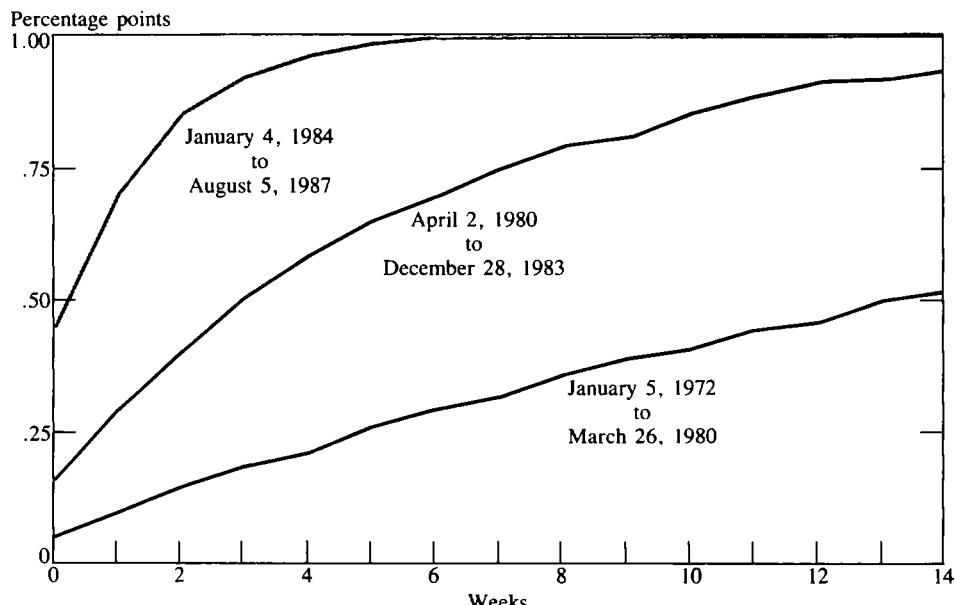
third and fourth columns of Table 2.

Regression results from these two periods confirm that the development of the secondary mortgage market has been important in affecting the relationship between mortgage rates and capital market rates. The mortgage rate moved significantly more closely with the 10-year Treasury rate in the mid-1980s regression than in the early 1980s regression, as demonstrated by the increase in the estimated value of  $b$  from 0.160 in the early 1980s to 0.465 in the mid-1980s. Moreover, the statistical significance of  $b$  (as measured by the t-statistics) increased in the more recent period, as did the percentage of variation in mortgage rates explained by changes in capital market rates (as measured by the  $R^2$ ).

One way to measure the effects of closer adjustment of mortgage rates to capital market rates is to simulate the model estimated over the usury ceiling period and the two post-usury ceiling periods for a one-percentage-point increase in the 10-year Treasury rate. The results of this experiment are shown in Chart 3. As is clear from Chart 3, the estimated model suggests that mortgage rates in the most recent period adjusted almost completely to the change in the Treasury rate within four weeks. In contrast, the model estimated with data from earlier periods suggests that adjustment was much slower before the growth of the secondary mortgage market.

Another way of comparing how closely mortgage rates adjust to changes in capital market rates

**CHART 3**  
**Quicker adjustment of mortgage rates to capital market rates**



Note: The chart shows how much the FHLMC mortgage rate is predicted to change in the weeks following a one-percentage-point change in the 10-year Treasury rate.

is to see how long it takes mortgage rates to complete their adjustment to the change in the Treasury rate. According to the regression estimates for the most recent period, the adjustment would now be nearly complete in eight weeks.<sup>8</sup> In contrast, the regression results from earlier periods suggest that complete adjustment took about 27 weeks in the early 1980s and about 94 weeks in the 1970s.

#### *Effect on volatility*

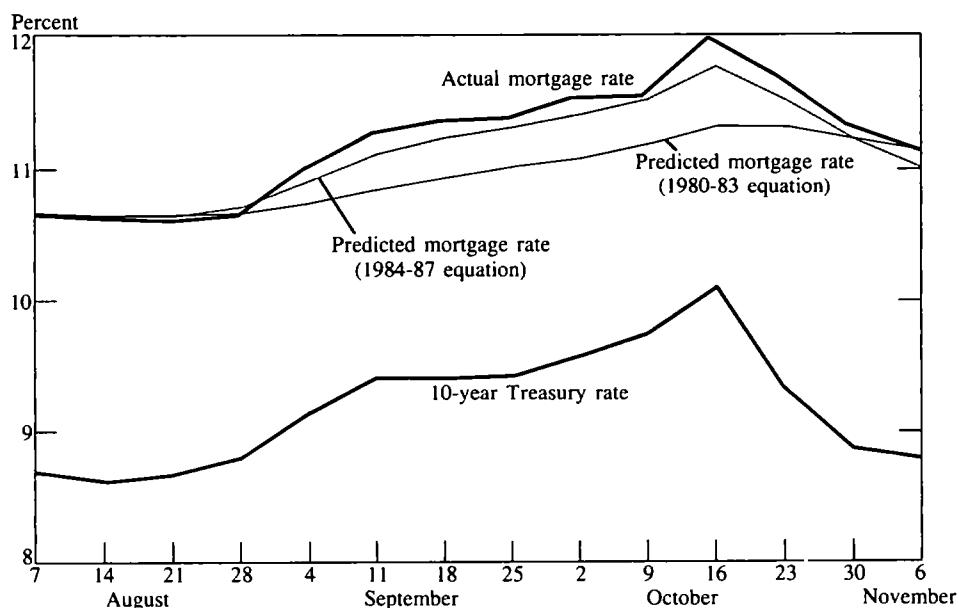
The two regressions from the post-usury ceiling period also were used to show how much the growth of the secondary mortgage market has

increased the volatility of mortgage rates. The equations were used to predict the reaction of mortgage rates to changes in capital market rates last summer and fall and the subsequent easing of capital market rates after the October stock market collapse. The results are shown in Chart 4, which compares the mortgage rate predicted by the equations estimated with data from the 1980-83 period and the 1984-87 period with the actual mortgage rate. The mortgage rate predicted by the equation estimated with the more recent data adjusts more quickly to the rise in the 10-year Treasury rate in late August and early September. As a result, this equation tracks the increase in mortgage rates better than the equation estimated with the earlier data. Furthermore, mortgage rates predicted by the equation estimated with the more recent data more quickly reflects the easing of rates in mid-October.

<sup>8</sup> "Almost complete" is defined as 99-percent-complete. The number of weeks necessary for 99-percent-complete adjustment is given by the smallest integer that is greater than  $\ln(0.01)/\ln(1-b)$ .

CHART 4

## Predicted response of mortgage rates to changes in capital market rates, 1987



As shown in Chart 4, the closer adjustment of mortgage rates to changes in capital market rates has increased the volatility of mortgage rates. The variance of week-to-week changes in mortgage rates over the period shown in Chart 4 is more than twice as high for the equation estimated with the more recent data than for the equation estimated with the earlier data. Thus, the closer adjustment of mortgage rates to capital market rates appears to have contributed to the volatility of mortgage rates last summer and fall.<sup>9</sup>

Another estimate of how much more volatile mortgage rates have become as a result of their

more rapid adjustment to changes in capital market rates was obtained directly from the estimated parameters of the model. This estimate was made by comparing the predicted volatility of mortgage rates over the 1984-87 period, using the parameter estimates from the 1980-83 period, with the predicted volatility of mortgage rates over the 1984-87 period, using the parameter estimates from the 1984-87 period.<sup>10</sup> These calculations show that the more rapid adjustment of mortgage rates has led to about a 25-percent increase in mortgage rate volatility.

In summary, the regression results, like the simple correlations reported in Table 1, confirm

<sup>9</sup> To claim that mortgage rates are twice as variable because of their closer adjustment with capital market rates would be to overstate the case. This claim would hold only if mortgage rates had no residual variance—that is, if all the variability of mortgage rates stemmed from variability in capital market rates. Such is clearly not the case, as is shown in the regression results in Table 2.

<sup>10</sup> In this analysis, the 10-year Treasury rate is assumed to follow a random walk with the variance of week-to-week changes in the 10-year Treasury rate set equal to its variance in the 1980-83 estimation period. With this assumption, the variance of week-to-week changes in the mortgage rate is obtained directly from the equation given in the box on page 25.

a closer relationship between mortgage rates and capital market rates. The regressions from the post-usury period indicate that growth of the secondary mortgage market has helped tie the rates closer together. Furthermore, these regressions indicate that mortgage rates have been as much as 25 percent more variable since 1984 than they would have been if the secondary mortgage market had not become increasingly important in financing housing.

## **Conclusions**

The closer tie between mortgage rates and capital market rates is due partly to the growth of the secondary mortgage market. Because of the closer tie, mortgage rates have been more volatile than they otherwise would have been. And mortgage rates are likely to continue reflecting the volatility of capital market rates more closely.

The sudden increase in mortgage rates last spring brought considerable losses at some financial institutions and frustrated many prospective homebuyers. The lesson to be learned from that experience is that the nation's mortgage markets are now more closely tied to the overall capital system. In effect, mortgage markets have been integrated into the capital markets, and developments affecting capital markets will increasingly affect mortgage markets.

Have volatile mortgage rates become a fact of life? More than in the past, the answer depends on the volatility of capital markets. One of the drawbacks to financial innovation and deregulation is that they have created the means for disturbances in one market to ripple through other markets. But few would dispute that the secondary mortgage market has been instrumental in achieving important social objectives, including a way for market participants to protect themselves from unexpected changes in interest rates.