Mortgage Refinancing and the Concentration of Mortgage Coupons

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Because of the concentrated distribution of interest rates on outstanding mortgages, modest interest rate declines in 1997 and 1998 made refinancing a smart choice for a record number of homeowners. In addition, the strong economy and the age of mortgage loans likely contributed to the surge in refinancing activity.

In 1998, interest rates on mortgages dropped to their lowest levels in nearly five years, prompting a record amount of refinancing activity. Refinancings typically rise following a drop in rates as homeowners seek to capture interest savings. The 1998 surge, however, was strikingly large relative to the size of the interest rate declines that triggered it. From mid-1997 to early 1998, thirty-year mortgage rates fell about 1 percentage point, from just over 8 percent to just over 7 percent. During the same period, refinancing applications increased nearly sevenfold. When rates fell modestly again in the second half of 1998, refinancing soared to even higher levels. Indeed, the increases in refinancing activity were so extraordinary that they caught even some experienced mortgage market participants by surprise.[1]

This edition of *Current Issues in Economics and Finance* examines why refinancings responded so dramatically to lower interest rates in 1998. We show that at the end of 1997, a particularly large proportion of outstanding mortgage loans had interest rates slightly above the rates available on new mortgages. When interest rates fell, the gap between the rates on existing and new mortgages widened sufficiently to make the refinancing of these outstanding loans economically advantageous. As a result, an unusually large number of homeowners chose to refinance in 1998.

The high concentration of loans that became cost effective to refinance, however, cannot account for all of the surge in refinancing activity. Favorable economic conditions also appear to have encouraged many homeowners to refinance. In addition, the high proportion of "moderately seasoned" mortgages in 1998—that is, mortgages that are between two and five years old—may have contributed to the increase in refinancing activity.

Broad Effects of Mortgage Refinancing

Mortgage refinancing alters the flow of wealth among households, financial intermediaries, and investors and can have both positive and negative implications for the economy. Homeowners clearly benefit: by refinancing their mortgages at a lower rate, they often realize substantial savings. For example, consider the homeowner who pays a fixed rate of 8 percent on a thirty-year mortgage of $200,000. If market rates on mortgages fall to 7 percent, then this homeowner could reduce his or her monthly mortgage payment from $1,468 to $1,331 by refinancing at the lower rate. While the transaction costs of refinancing partly offset this gain, the household savings over the life of the mortgage could be considerable. In turn, such savings could help boost consumer spending on goods and services.

Offsetting these benefits, however, are the costs to mortgage lenders. When a large number of borrowers refinance, banks and thrifts that own mortgages and investors in mortgage-backed securities such as mutual

funds will see a decline in investment yields. Consequently, these investors may cut back on other financial outlays to compensate for potential losses in the mortgage market.

Surges in mortgage refinancings can also lead to reallocations of income within the financial services industry. Mortgage servicers typically earn fee income based on the size of existing loan pools. When old mortgages are prepaid as part of the refinancing process, loan pools will shrink, causing the service fee income from these loans to decline.[2] By contrast, some participants in the mortgage market—including mortgage bankers and other originators, loan underwriters, and distributors of new mortgage-backed securities—may earn higher fees when refinancing applications rise.

Mortgage Interest Rates and the 1998 Refinancing Surge

Although certain mortgage market participants realize benefits from refinancing, the most important factor driving refinancing activity is the potential interest savings accruing to homeowners. The close connection between market interest rates and refinancing activity is apparent in Chart 1, which plots the average contract rate for new thirty-year fixed rate mortgages against an index of refinancing applications produced by the Mortgage Bankers Association.[3] We see that throughout the 1990s, each decline in rates precipitated a rise in refinancing activity.

For most of the decade, the increases in refinancing applications were commensurate in size with the decline in interest rates that triggered them. In 1998, however, the response of refinancing to rate declines

Chart 1
Mortgage Rates and Refinancings

Sources: Mortgage Bankers Association; Federal Housing Finance Board.

was disproportionately large. After mortgage contract rates dropped 100 basis points—a relatively modest decline of l percentage point—between April 1997 and January 1998, refinancing activity jumped. Refinancings moderated somewhat in the spring of 1998 when rates leveled off, but a further rate decline of about 35 basis points prompted another, sharper spike in refinancing activity during the second half of the year.

Chart 1 shows that during the first half of the 1990s, rate declines comparable in size to those in 1997 and 1998 touched off smaller bursts of refinancing activity. The break with this earlier pattern raises an important question: If the interest rate savings available to homeowners in 1998 were not exceptional, why was mortgage refinancing activity so vigorous? The answer requires an understanding of the important role played by the distribution of rates on outstanding mortgages.
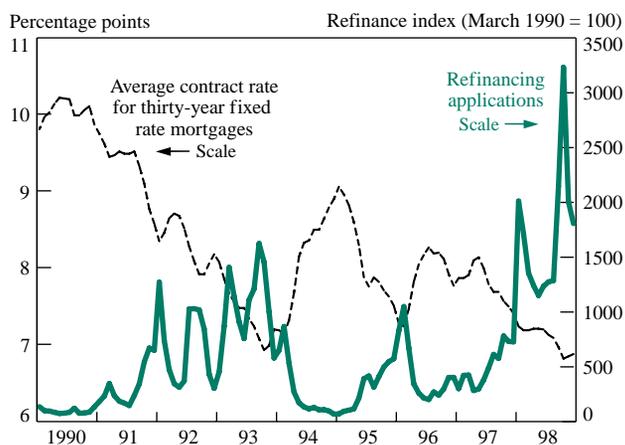
The Changing Distribution of Existing Mortgage Rates

Homeowners typically refinance a fixed rate mortgage if the rate they pay exceeds the rate available on new mortgages by 50 to 200 basis points—that is, by ½ to 2 percentage points.[4] Mortgages that meet this refinancing threshold, or a more narrowly defined threshold, can be called "in-the-money." Thus, in aggregate, how much refinancing activity follows a given rate drop depends largely on the proportion of homeowners whose loans are in-the-money after the interest rate adjustment.

The distribution of rates on outstanding mortgage loans changes substantially over time (Chart 2). At the end of 1991, most mortgage loans held rates of about 10 percent, the prevailing interest rate at the time that these loans were originated in the 1980s.[5] As mortgage rates fell over most of the next two years, a series of refinancing waves followed, peaking in the fall of 1993. The concentration of loans in the 10 percent neighborhood was largely eliminated by the 1992-93 refinancings, and the distribution of existing coupons was much flatter by the end of that year.

After 1993, new loans were originated for several years in the 7 to 9 percent range, eventually resulting in a denser concentration of coupon rates. By the end of 1997, an estimated 83 percent of mortgage loans fell in the 7.25 to 8.75 percent range, and 53 percent carried rates between 7.50 and 8.25 percent. As market rates on new thirty-year fixed rate loans dropped toward 7 percent in January 1998, the spread between the market rates and rates on most outstanding mortgages entered the 50-to-200-basis-point range that normally triggers refinancing. As a result, refinancings rose to record highs.
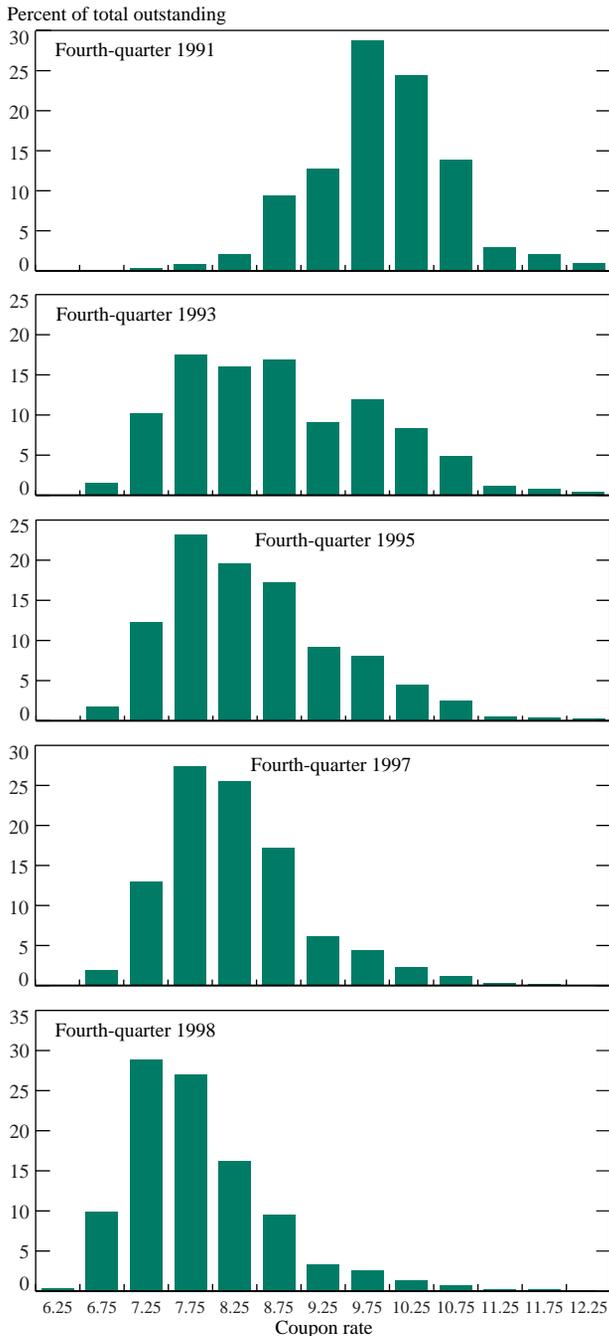
To illustrate the link between the distribution of mortgage rates and the number of refinancings, we plot existing mortgages that are in-the-money alongside aggregate refinancing activity (Chart 3). For simplicity, we measure in-the-money mortgages as the percentage of outstanding thirty-year loans with rates exceeding the current market rate by at least 100 basis points, or 1 percentage point.[6] Once again, our measure of refinancing is the Mortgage Bankers Association index of refinancing applications. As the chart shows, the two series track each other's movements very closely, suggesting that a strong relationship exists between the distribution of existing mortgages that are cost effective to refinance and aggregate refinancing activity.
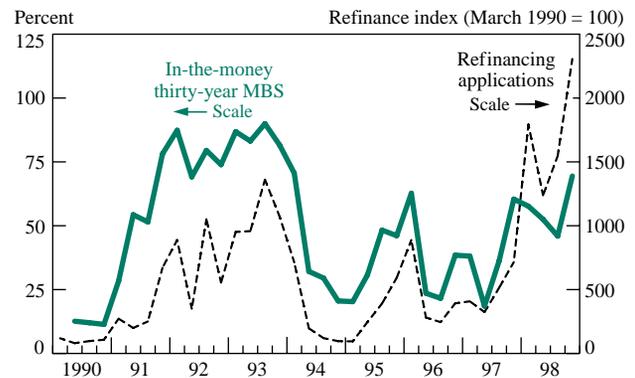
Statistical Models of Aggregate Refinancing

To assess the relationship between refinancings and the distribution of mortgage rates more precisely, we estimate a series of statistical models of aggregate refinancing activity from 1990 to 1998 (see table).[7] The models allow us to measure the degree to which the interest rate spread, the distribution of existing mortgage coupons, and other factors can explain refinancing activity.[8]

Because changes in interest rates motivate most homeowner decisions to refinance, we first estimate a simple model (Model 1) relating refinancing activity to an interest rate spread, measured as the average thirty-year contract rate offered in the primary market less the median interest rate on outstanding thirty-year fixed rate mortgages.[9] The model estimates confirm that this mortgage spread is a key determinant of refinancing, explaining about 72 percent of this activity in the 1990-98 period.

We then include the distribution of existing mortgage interest rates as measured by two variables—the

Chart 2
Distribution of Outstanding Thirty-Year Fixed Mortgage Rates, 1991-98

Source: Bloomberg L.P.

Notes: Coupon rates on the horizontal axis are adjusted to correspond to the contract mortgage rates actually paid by households on thirty-year Fannie Mae, Ginnie Mae, and Freddie Mac loans. Each bar sums two consecutive quarter-point coupon levels, with only the higher coupon listed.

Chart 3
In-the-Money Mortgages and Refinancings

Note: In-the-money thirty-year MBS is the percentage of existing thirty-year mortgage-backed securities issued by government agencies (Fannie Mae, Ginnie Mae, and Freddie Mac) that have interest rates at least 100 basis points above the current thirty-year contract rate.

percentage of in-the-money mortgages and the percentage of newly in-the-money mortgages (Model 2).[10] The latter variable, calculated as the change in the percentage of in-the-money mortgages from the preceding quarter, is designed to capture the surge in refinancing that occurs when an especially large number of mortgages have just become economical to refinance and many homeowners take action immediately. Both concentration variables have a positive and statistically significant effect on refinancing, and together they improve our model predictions about 5 percent. Moreover, the two concentration variables claim some of the explanatory power attributed to the spread variable in the simple model.[11] Overall, the interest rate spread and the distribution of rates together appear to explain about 77 percent of the refinancing activity.

In Model 3, we introduce the unemployment rate as an indicator of the state of the economy. Our hypothesis is that refinancings may have responded so strongly to interest rate incentives because the overall economy was strong. Solid employment prospects could help boost home prices, borrower creditworthiness, and lender confidence, leading previously cautious borrowers to refinance. Our results confirm the link between favorable economic conditions and refinancing: adding the unemployment rate raises the model's explanatory power another 7 percent.[12]

Finally, we examine the role of mortgage seasoning in the 1998 refinancing wave. Seasoning is defined as the amount of time since a loan was originated. Other factors equal, unseasoned loans (loans two years or less from origination) and seasoned loans (loans more than five years from origination) are less likely to be refinanced than moderately seasoned loans.[13] Thus,

the existence of a high proportion of moderately seasoned mortgages could help fuel refinancing activity following an interest rate drop.

Evidence of the importance of seasoning can be found by comparing mortgage market developments in 1995 with those in 1998 (Chart 1). One reason that refinancing activity may have remained so mild in 1995 is that a heavy bout of refinancing had just occurred two years earlier. Given the heavy wave of lending in 1993, many outstanding loans in 1995 would have been fairly new and thus less likely to be refinanced. By late 1997, however, these same loans would have become moderately seasoned and may have contributed to the high level of 1998 refinancing activity.

In Model 4, we test the effect of seasoning by separating the mortgage loans in our sample into two categories—those that are seasoned and those that are new or moderately seasoned. (Unfortunately, our data do not permit us to distinguish new from moderately seasoned loans.) We then calculate in-the-money mortgages and newly in-the-money mortgages for each of the two categories. We estimate our full model, which includes the interest rate spread, the unemployment rate, and separate measures of in-the-money and newly in-the-money mortgages for both seasoned mortgages and new and moderately seasoned mortgages.

Our results support the conclusion that the level of refinancing activity is affected by the seasoning of mortgage loans. For new and moderately seasoned loans, the concentration variables have a significant effect on refinancing, while for seasoned loans, these variables show no significant effects. Thus, it appears that the rate distribution for new and moderately

Refinancing Models

|	Spread	Measures of Mortgage Coupon Concentration				Unemployment Rate	Adjusted R^2
		In-the-Money Mortgages		Newly in-the-Money Mortgages			
Model 1	-1.326*** (0.120)	—		—		—	0.72
Model 2	-0.6981*** (0.2152)	0.0187** (0.0081)		0.0163** (0.0065)		—	0.77
Model 3	-0.4259* (0.2400)	0.0401*** (0.0096)		0.0118** (0.0060)		-0.8423*** (0.2033)	0.84
		N&M	Seasoned	N&M	Seasoned		
Model 4	-0.6209** (0.2286)	0.0390*** (0.0072)	-0.0103 (0.0071)	0.0136** (0.0059)	-0.0071 (0.0080)	-0.8219*** (0.1293)	0.86

Notes: All regressions were run using quarterly data from third-quarter 1990 to third-quarter 1998. N&M—new and moderately seasoned mortgages—consist of mortgages that are five years or less from origination. Seasoned mortgages are those that are more than five years from origination. Newey-West standard errors appear in parentheses. Standard tests suggested no significant serial correlation in the error terms.
  *Statistically significant at the 10 percent level.
  **Statistically significant at the 5 percent level.
  ***Statistically significant at the 1 percent level.

Chart 4
Comparison of Model Performances

Refinance index (March 1990 = 100)
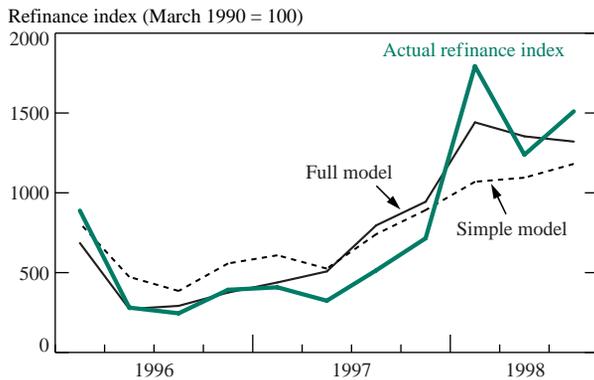
Notes: The chart compares the actual values of the Mortgage Bankers Association Refinance Index with the values predicted by the statistical models described in the text. The simple model (Model 1) includes the interest rate spread, a time trend, and a constant. The full model (Model 4) includes the concentration variables adjusted for seasoning, the unemployment rate, a time trend, and a constant.

seasoned mortgages accounts for all of the significance attributed to concentration in the earlier regressions.

Chart 4 illustrates the gain in explanatory power that comes with the full model and confirms the importance of rate concentration and a buoyant economy in explaining the dramatic 1998 rise in mortgage refinancing. The simple model, relying exclusively on the rate spread, predicts a substantially smaller increase in refinancing in 1998 than actually occurred. But with the addition of the two measures of concentration and the unemployment rate, the model tracks the course of last year's refinancing activity more closely.[14] The full model captures most of the surge in the first quarter of the year, when the large concentration of loans clustered in the 7.50 to 8.25 percent rate range became cost effective to refinance. It also captures the drop-off in refinancing in the second quarter, after the most responsive households had acted. Finally, it does a better job than the simple model in predicting the high level of refinancing activity in the third quarter of the year. While a modest decline in interest rates during this quarter boosted refinancings, the effects of concentration and a persistently low unemployment rate helped to keep refinancing activity robust.

Conclusion

What accounts for the unexpected strength of mortgage refinancing activity in 1998? At the end of 1997, a very large proportion of existing mortgages—many of which had been originated within the past five years—had rates slightly above market rates. As interest rates fell in 1997 and 1998, the spread between the rates on these existing mortgages and the rates available on new mortgages widened to the point where refinancing became

economically advantageous. Combined with the effects of a strong economy, the high concentration of outstanding loans—particularly moderately seasoned loans—that suddenly met this threshold explains why refinancings rose so quickly and persisted at such high levels in 1998.

Notes

1. For instance, see "A Market That Quivers as Refinancings Rise," *New York Times*, February 8, 1998, late edition; LEX Comment, *Financial Times*, February 5, 1998; "Unlike `93, Current Wave of Refinancings Hasn't Rocked MBS Market—Yet," *Investor Dealers' Digest*, January 26, 1998; and "Refinancing Boom Is Year Long Affair," *National Mortgage News*, October 12, 1998.

2. Consider, for example, the losses associated with early 1998 refinancings, discussed in *National Mortgage News* (1998). Servicing rights agreements entitle servicers to a payment equal to a set percent (for example, 0.5 percent) of an outstanding mortgage pool (not unlike interest). The value of these rights declines as mortgage prepayments rise. Similarly, investors in interest-only components of collateralized mortgage obligations suffer losses when a pool of loans prepays rapidly because the anticipated interest to be paid over the life of the pool decreases.

3. The seasonally adjusted Mortgage Bankers Association Refinance Index is constructed from a weekly survey of applications to refinance existing mortgages. Conducted since 1990, the survey covers about 40 percent of the residential real estate market in the United States; respondents include mortgage bankers, commercial bankers, and thrifts. A complete description of the index is available in "Weekly Mortgage Application Survey, Description, Indexes and Interest Rates," March 22, 1995, Mortgage Bankers Association, Washington, D.C.

4. See Follain, Scott, and Yang (1992) for a simulation model analysis of the optimal rate gap for refinancing. Bennett, Peach, and Peristiani (1998b) present a statistical analysis of the size of the rate gap that prompted refinancing in the 1984-94 period, conditional on credit, home equity, market volatility, and other variables.

5. The data in Chart 2 measure the size of pass-through mortgage-backed securities of the three large government-related mortgage agencies—Fannie Mae, Ginnie Mae, and Freddie Mac. These securities pass homeowner payments of interest and principal—net a servicing charge of about 50 basis points—through to investors. A large portion of, but not all, home loans qualify for inclusion in agency pools. Nevertheless, common interest rate swings affect *all* borrowers; thus, the shape of the distribution of existing agency security rates should be reasonably representative of the distribution of outstanding rates paid by all borrowers on thirty-year fixed rate loans.

6. This estimate is consistent with recent work on incentives to refinance. For example, see Follain, Scott, and Yang (1992) and Bennett, Peach, and Peristiani (1998b).

7. In all of the regression models reported in the table, the dependent variable is the ratio of the Mortgage Bankers Association index of refinancing applications to the number of owner-occupied homes with outstanding residential mortgages. The data on the number of

outstanding residential mortgages are from the U.S. Census Bureau's American Housing Survey. Because this survey is conducted biannually, we created quarterly observations on the stock of mortgages by interpolating data using a cubic spine technique.

8. Each model listed in the table also includes a constant term and a time trend. The time trend variable, which captures the general increase in the propensity to refinance existing mortgages over time, is statistically significant in most regressions. Previous studies, such as Bennett, Peach, and Peristiani (1998a), suggest that this increased propensity may reflect lower transaction costs and increased competitiveness among mortgage-lending institutions.

In addition to estimating the four models reported in the table, we experimented with models that incorporated interest rate volatility and home price appreciation—two variables that previous studies, such as Caplin, Freeman, and Tracy (1997) and Peristiani et al. (1997), have shown to affect refinancings. These models are not reported because in our aggregate-level equations neither variable is statistically significant and their exclusion did not significantly affect the coefficients on the other explanatory variables.

9. The median rate is the rate in the middle of the distribution of existing thirty-year fixed rate mortgages in Fannie Mae, Ginnie Mae, and Freddie Mac mortgage pools. For skewed distributions—such as the distribution of outstanding mortgage coupons shown in Chart 2—the median, rather than the average, may be a better measure of the "center" of the distribution.

10. We define in-the-money mortgages as loans exceeding the market rate by at least 100 basis points. In our regressions, we tried several alternative thresholds ranging from 50 to 200 basis points. Assuming a 150-basis-point threshold produced results very similar to those reported in the table. Using 50- and 200-basis-point thresholds produced results that differed somewhat from the results reported in Table 1 but that had the expected sign and were statistically significant.

11. This conclusion is based on a comparison of the coefficients and standard errors on the spread variable in the two models. The addition of the concentration variables in Model 2 reduces, but does not eliminate, both the economic and the statistical importance of the spread variable.

12. Adding the unemployment rate to our model does, however, make the time trend variable statistically insignificant. Because the

unemployment rate was generally declining during the 1990s, it appears to be picking up both the effects of improved economic conditions on refinancings as well as the general increase in refinancing activity.

13. For a discussion of the effect of seasoning on refinancing, see Richard and Roll (1989) or Fabozzi and Modigliani (1992, p. 208).

14. The model also successfully predicts the 1992-93 surge in refinancing activity, although this episode is not shown in the chart.

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