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Technical Report

Timing a Home Mortgage

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Summary

Anticipating future interest rate trends is valuable in making mortgage financing decisions. A reliable strategy to forecast interest rate trends would help in choosing between an adjustable-rate mortgage and fixed-rate mortgage or in deciding when to refinance an existing mortgage. This study examines whether such a strategy exists and reports an empirical experiment that tests various strategies. Results indicate that because timing strategies are not reliable over the long term, their value is not sufficient to outweigh other factors associated with these decisions.

Homeowners considering mortgage refinancing and buyers choosing between fixed-rate mortgages (FRMs) and adjustable-rate mortgages (ARMs) often wonder how to time their decision. Ideally, a borrower refinances when interest rates are low to lock in that rate. The ARM borrower wants assurance that rates will not rise, thereby negating the savings of a low initial rate.

Because interest rates are not predictable, no one knows with certainty whether a current rate is at a low or high point in its cycle. Nevertheless, an effective strategy for choosing the best time to lock in a rate has appeal, even if it is fallible.

Observable economic indicators that tend to lead mortgage interest rates consistently over time are essential. For example, some capital markets respond to market fluctuation more rapidly than do mortgage markets. If mortgage interest rates change as a result of the ripple effect, those other markets may provide a method for anticipating rate trends. State economic variables associated with the economic cycle also may be indicators. In this case, it is conjectured that mortgage interest rates behave consistently during various phases of economic cycles, as well as consistently lagging change in those cycles. If such relationships exist, then one could note the stage of the cycle and anticipate interest rate changes accordingly.

This report explores these ideas and tests their validity. Strategies are developed from the literature on interest rate dynamics and evaluated based on market performance during the past 25 years, focusing on more recent years. Results indicate that some strategies work well some of the time, but few inspire confidence as a long-term guide. Moreover, the benefits of timing are found to be less important than other considerations impinging on the decision to refinance.

Can Mortgage Interest Rates Be Predicted?

Future behavior of interest rates fundamentally affects the performance of most investment assets. In fact, interest rates represent the yields on bonds and bondlike securities. Furthermore, interest rates in different security markets tend to move along similar paths because of arbitrage and debt conversions. If interest rate trends could be consistently anticipated, excess returns could be enjoyed when those trends run against market expectations.

Despite extensive research, no consistently reliable predictive model of interest rates has been developed. Nevertheless, investors are forced to act upon anticipated interest rate trends. These expectations have a common basis, but from them have emerged several competing interpretations of market history. After all, difference of opinion about the future makes a market.

Most practitioner strategies rely on interest rates' behavior or relationship to the economic cycle. Of special importance is the *yield curve,* the relationship at any one time of securities' average yields to their respective terms. Ordinarily, the curve slopes slightly upward, reflecting relatively higher yields on securities of longer maturity. However, the curve may become steeper as the spread between long- and short-term securities increases. The curve may become inverted when short-term rates exceed long-term.

Many investors believe that a steepening yield curve signals impending declines in long-term interest rates. The rationale is that short-term rates are more volatile and respond to changing economic conditions sooner than long-term rates. Thus, conditions leading to lower interest rates are initially reflected in short-term yields. The yield curve steepens until long-term rates catch up. Additional support for this notion derives from the observation that falling short-term yields encourage

investors to shift funds into longer term investments, thereby driving down long-term yields.[1] Finally, declining short-term interest rates may result from efforts by the Federal Reserve to counteract the effects of a slowing economy, and long-term rates usually fall in a recession.[2]

Some followers of this view also believe that interest rates will climb once the economy begins recovery. Demand for credit by expanding businesses pushes up rates and, as excess capacity in the economy is absorbed, inflation heats up.[3] On the other hand, interest rates commonly fall during the rapid growth phase of a recovery.[4] John Markese, research director for the American Association of Individual Investors, finds little evidence of a systematic cyclical relationship but thinks noting seasonal trends may be useful (i.e., rates tend to be lower in the fourth quarter of the year).[5]

Moreover, some reject, out of principle, the idea of any reliable method for anticipating rate trends. Murphy devotes an entire treatise to refuting the belief that interest rates have a predictable pattern.[6] He maintains that rates behave only randomly, that no normal state exists for the yield curve and that the current rate spread has no relationship to the trend in long-term rates.

While investors may subscribe to a strategy if they think it is helping them make money, research economists are subject to the rigors of statistical verification. Much research on interest rate behavior has attempted to verify the *expectations hypothesis*. The first part of the hypothesis states that the term structure of interest rates (another way to describe the yield curve, in this case, the idea that interest rates include a specific premium depending on the length of the security's term) includes information about market expectations of interest rate trends.

The second part of the hypothesis holds that these expectations predict actual interest rate behavior, either because the market correctly anticipates rate movements or such expectations become self-fulfilling prophecies.[7] Linking expectations to actual performance generally has not withstood statistical scrutiny. Nevertheless, the concept inspires repeated attempts to verify and to improve term structure models. Better results are reported when spot rates are used instead of security yields,[8] when a time-varying term premium is assumed[9] and when specification improvements are made.[10] One study suggests that the model is better at long-term predictions than short-term.[11] One research group studies stock market prices for expectations of inflation and interest rates.[12]

Despite improved methods, the models' predictive power is marginal. Furthermore, as capital markets become more efficient (certainly more integrated and coordinated), information is more rapidly incorporated into yields, thereby reducing the value of expectations in determining future rates. Additional research suggests that long-term rates tend to underreact to expectations, possibly because of more efficient, responsive markets.[13]

Short-term rates, because of their timely response to economic change, may be predictors of long-term rates. The same could be said for the securities markets. Early research uncovered a consistent one-year lag in interest rates on mortgage loans compared to bond yields.[14] Using more recent data and improved techniques, later investigation indicated a lag of only a few weeks and, more importantly, a general convergence in the timing of the two markets.[15] Extensive involvement of mortgage conduits in mortgage markets has more completely integrated the capital markets.

Have markets become too efficient and interrelated for predictive strategies? The next two sections report the kinds of strategies tested and how each performed based on actual data.

Forecasting Strategies

Although literature review provides little encouragement in finding an interest rate forecasting tool, it does suggest several avenues. For loan refinancing, a forecast need merely indicate the *direction* of the trend in the near future. A statistically significant correlation is not necessary, nor is a constant time lag. An indicator that tended to signal the onset of an extended downward or upward trend would be valuable.

This study's method was to: construct strategies from indicators suggested in the literature; apply those strategies to hypothetical refinancing decisions using data from the past 25 years; evaluate how consistently the strategies provided the "right" answer. The strategies involve an objective indicator used to interpret its value. The specific variables used as operators for these strategies appear in Table 1.

Table 1. Variables Used in Rate Strategies

Symbol	Definition
SPREAD	TBOND minus TBILL.
dSP500	Annual percentage change in Standard & Poor's index of 500 common stock prices.
TBOND	Unweighted average rate on all outstanding Treasury bonds neither due nor callable in less than ten years.
TBILL	Average auction yield on three-month Treasury bills.
dM2	Annual percentage change in the broadly based measure of the money supply (M2).
dGNP	Annual percentage change in Gross National Product (GNP) in constant 1967 dollars.
LEAD	Composite index of 12 leading indicators of the economy.
MORT	Average effective interest rate for conventional mortgage loans closed on existing single-family homes.

Term Structure Strategy

Interest rates are a combination of premiums reflecting credit suppliers' concerns. The inflation premium compensates for the reduced value of money obtained in the future. Inflation premiums vary according to market expectations of inflation. The premium is more crucial to long-term interest rates because real return is more vulnerable to inflation fluctuations. Therefore, it may be possible to isolate the inflation premium by comparing long- and short-term rates (the spread that indicates the slope of the yield curve). With this strategy, an increasing SPREAD value would indicate expectations of increasing inflation and higher interest rates.

Stock Market Strategy

Titman and Warga found that common stock prices include information on inflation expectations. Stock prices tend to fall (as do bond prices) when the market expects rising inflation rates. Applying this strategy, higher interest rates are expected when stock prices (SP500), in general, are falling.

Arbitrage Strategy

Historically, mortgage rates have been less volatile than other capital market yields. A more efficient market may lead similar change in mortgage rates, given significant lag between the two markets. In the past, yields on ten-year Treasury bonds, for example, have preceded mortgage rates by as much as one year. However, lags may have been reduced and even destroyed by market integration during the past ten years (see figure). Nevertheless, this strategy holds that the trend in long-term Treasury bond yields (TBOND) foretells trends in mortgage rates. In addition, an alternative strategy uses short-term Treasury bill yields (TBILL) in the same way, as ARMs may be priced according to such short-term rates.

Monetary Policy Strategy

The inflation premium links expectations of inflation rates and interest rates. Monetarist economists believe that inflation rates are determined by government monetary policy. The quantity theory of money states that, given a stable velocity of money, increases in the money supply that exceed the demand for liquidity in the economy inevitably produce inflation. While rapid growth in the money supply depresses short-term interest rates, the inflation produced increases future rates. Therefore, money supply growth (dM2) may provide a forecast of higher interest rates. Tested here are one strategy that compares money growth to a fixed standard and another that compares it to the growth in real GNP (dGNP).

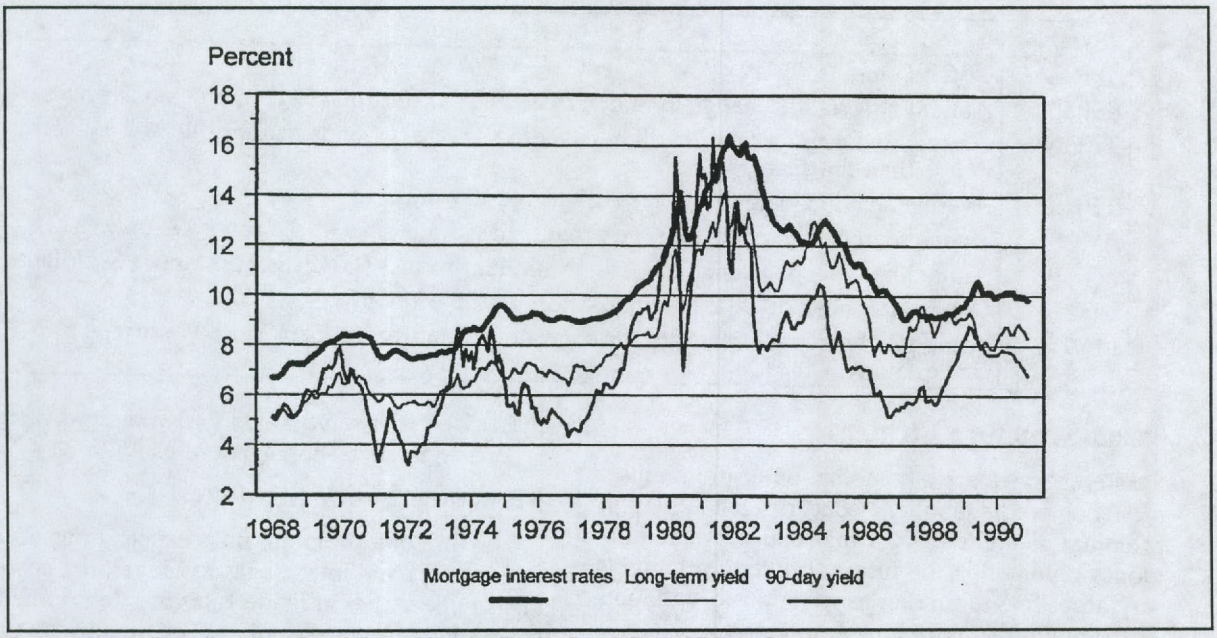
Business Cycle Strategy

Interest rates tend to rise during a mature growth phase in the economy, often continuing into a recession. Rates tend to fall in the early stages of a recovery. By observing the business cycle's current state (not as easy as it sounds), one may be able to anticipate interest rate trends. This approach suggests two strategies. Since dGNP is a basic indicator of economic growth, recovery's high growth rates may indicate falling rates, while low and negative growth rates may signal rate increases. A second strategy relies on a predictor of GNP growth, the index of leading indicators (LEAD), to signal a change in cycle phase.

Rate Trend Strategy

Mortgage rate series (MORT) patterns may offer clues. If part of the rate change carries over to the next period, past trends may indicate future movement. Two strategies based on observing past trends are included in the study.

Mortgage Interest Rates and Treasury Yields, 1968-90



Sources: Federal Home Loan Bank Board; Federal Housing Finance Board; Federal Reserve System

Tests

The strategies just discussed use current indicators to predict interest rate trends. To be useful, these strategies must be converted into a technique to guide refinancing decisions. Thus, a borrower might prefer an ARM if rates are expected to fall but lock into an FRM if they are expected to rise. Similarly, a homeowner would refinance an existing mortgage immediately if rising rates are anticipated but wait for a better rate if they are expected to fall further. The strategies can be adapted to provide indicators for these situations.

The indicators derived from the strategies and their interpretation for the two financing situations are shown in Table 2. In many cases, moving averages are used to provide a trend line so that, when an observation breaks with the trend, it can be detected readily.[16] When necessary, several formulations of the indicator were tested, with the best performing indicator retained for reporting.

According to the strategies, a borrower considering an ARM or FRM should take the ARM if the indicator's sign is the same as in Table 2. For example, if dSP500 is positive at decision time, the borrower should take an ARM. If it is negative, the borrower should take an FRM. Likewise, the refinancing homeowner should refinance immediately if dSP500 is negative and wait for a lower rate if it is positive.

The test was conducted as follows. Each indicator was monitored with monthly data for the period 1968-90 (for MORT, which used a 24-month moving average, the period started in 1969). A financing decision was made each month according to the rule convention shown in Table 2. The results were evaluated according to the following criteria.

The homebuyer's decision is to take either an ARM or an FRM. For each option, monthly principal and interest (P&I) payments were projected for a five-year period (for years later than 1985, the period was shortened to correspond to available data). To project the P&I for the ARM, it was assumed the loan was originated at an interest rate equal to MORT minus SPREAD and was adjusted annually according to an index equal to TBILL. No interest rate limitations or capitalization rates (caps) were applied. The P&I for each loan option was discounted to present value using MORT as the discount rate. If the strategy selected the option with a lower or equal present value, the decision was deemed correct. The cost of an incorrect choice was the additional present value of debt service incurred as a percentage of the present value of the correct choice.[17]

In the study, the homeowner's refinancing decision was whether to refinance immediately or wait for a lower rate. The homeowner's current loan was assumed to have an interest rate 200 basis

Table 2. Interpretation of Indicators

Strategy: Indicator	Take ARM if:	Refinance now if:
Term structure: (1) SPREAD—6-month moving average of SPREAD	+	-
Stock market: (2) dSP500	+	-
Arbitrage: (3) TBOND—12-month moving average of TBOND	-	+
(4) TBILL—12-month moving average of TBILL	-	+
Monetary policy: (5) dM2—dGNP (used 6-month moving average)	-	+
(6) dM2—5% (used 6-month moving average)	-	+
Business cycle: (7) dGNP—3%	-	+
(8) dGNP—dLEAD	+	-
(9) dLEAD—3 consecutive months same sign	-	+
Rate trend: (10) MORT—24-month moving average of MORT	+	-
(11) MORT—3 consecutive months same direction	decline	rise

points (2 percentage points) above the currently available rate (MORT). If the homeowner waited, the loan would be refinanced at the next lower monthly MORT. The decision time limit was three years. If MORT never fell below its level at decision time, the loan never was refinanced.

The criterion for evaluation is the present value of P&I savings during the three years. P&I savings equals the difference between P&I with no refinancing and actual P&I. Thus, if the loan is not refinanced, savings equals zero. If the decision is to wait, no savings accrue during the waiting period and the time during which savings are achieved is shortened and delayed. The correct decision maximizes total savings. An incorrect decision costs savings lost as a percentage of the amount of savings possible with the correct decision.

To evaluate a strategy's effectiveness, the percentage of months having correct decisions was tabulated and the average cost of incorrect decisions was calculated. An effective strategy should provide a high percentage (greater than 50 percent) of correct answers and incorrect decisions should not be costly. Evaluations were made for the entire period (1968-90) as well as for split periods (1968-79, 1980-90). Because some of the fundamental relationships between the indicators and the mortgage interest rate series changed during the period, performance in the most recent period is especially significant. An indicator that became less reliable in recent years would have limited value in the future. Rather, it might be evidence that the underlying factors supporting the strategy no longer exist.

Testing the Strategies

The performance of each strategy in the test for the entire period and for the split periods in terms of total number of errors, percentage error rate and average cost of errors is shown in the tables in Appendix A. The best performing strategies for each period are ranked in Tables 3 and 4. **No strategy proved highly reliable for the entire period. While some strategies were reasonably reliable for the refinancing decision, none was as reliable as simply choosing to refinance immediately each month without regard to an indicator (this strategy provided a 24 percent error rate with an average cost of 1.1 percent.)**

Table 3. Best-Performing Timing Strategies for ARM/FRM Decision

Period	Reference Number*	Name	Error %	Average Cost %
Entire	7	GNP growth	31	16
Period	4	T-bill yields	34	13
1968-90	1	Yield spread	36	13
	3	T-bond yields	44	14
	10	Mortgage yield	46	18
Early	7	GNP growth	13	3
Period	4	T-bill yields	27	6
1968-79	6	M2 growth	31	6
	1	Yield spread	31	8
	10	Mortgage yield	32	10
Later	1	Yield spread	42	18
Period	4	T-bill yields	42	18
1980-90	3	T-bond yields	46	22
	7	GNP growth	50	20
	9	Leading indicators	50	22

*See Table 2 for reference numbers.

Table 4. Best-Performing Timing Strategies for Refinancing Decision

Period	Reference Number*	Name	Error %	Average Cost %
Entire	11	Mortgage trend	25	3
Period	3	T-bond yields	25	4
1968-90	4	T-bill yields	29	4
	9	Leading indicators	30	5
	5	M2-GNP growth	31	2
Early	11	Mortgage trend	13	6
Period	6	M2 growth	18	4
1968-79	3	T-bond yields	26	5
	9	Leading indicators	26	7
	7	GNP growth	31	5
Later	4	T-bill yields	23	4
Period	3	T-bond yields	24	4
1980-90	9	Leading indicators	34	3
	7	GNP growth	34	5
	1	Yield spread	35	3

*See Table 2 for reference numbers.

Generally, strategies performed better in the early period than in the later period. However, the mix of best strategies changed from one period to the next, indicating that a strategy often works reasonably well for only a limited time.

The strategy based on term structure of interest rates was more sensitive to impending rate declines than to increases. That is why it performed relatively well in the later period, a time when interest rates primarily were falling. Because interest rate series are a mean reverting process,[18] a narrow or negative spread inevitably is followed by a decline in short-term interest rates to reinstate the normal spread. Declines in short-term rates are followed by a gradual decline in long-term rates, including mortgage interest rates. Still, the strategy was correct only 65 percent of the time in the later period.

The stock market strategy proved of little value. Apparently, the stock market, as a component of the leading economic indicators index, predicts economic cycles better than inflation and interest rates.

Arbitrage indicators using Treasury yields performed relatively well. Although these strategies were less reliable in the later period than in the earlier, their performance shifted as much as the others. Undoubtedly, this change was caused by increased efficiency of capital markets over time and the greater integration of mortgage and bond markets. Still, in choosing among strategies, monitoring bond yields would be a good selection.

The money supply strategies worked well in the early period but were highly unreliable in later years. The Federal Reserve modified its monetary policy procedures in 1979 to focus more on price stability instead of managing interest rates. Markets became more sensitive to changes in monetary policy, thereby reducing the lag between actions by the Fed and their impact on interest rates. Without the lag between M2 and interest rates, little forecasting power remains.

Strategies based on changes in real GNP worked well in the early period but became unreliable in the later period. This may be tied to lack of cyclical variation in the 1980s national economy. While the period began and ended in recession, most years were characterized by comparatively steady growth. This strategy might be worthwhile when the economy is relatively volatile (such as the 1970s) but is not a long-term guide.

Finally, attempting to locate mortgage interest rate peaks and troughs by monitoring short-term trends is possible only when rates are relatively volatile. The strategy based on mortgage interest rate trends worked reasonably well in the early period. In the 1980s, when rates trended downward during long periods, the strategy was not successful.

Market Timing for Borrowers

The experiments reported here offer little promise of a consistent strategy to predict interest rate trends for financing decisions. Some of the strategies tested were useful for limited periods. However, that knowledge provides little reassurance for making a decision today.

Moreover, other factors should be considered. Given the spotty record of the timing strategies tested, the financing decision probably should involve considerations other than near-term interest rate forecasts. For example, when comparing an ARM and an FRM, the more important considerations are the comparatively favorable ARM terms, the projected holding period of the property and the availability of safeguards against abrupt rate increases (such as adjustment caps). Similarly, loan refinancing decisions should rest most heavily on projected savings compared to refinancing costs. **For the period studied, it was almost always advantageous to refinance immediately rather than wait for a lower future interest rate. Even in those few instances when it paid to wait, the benefits were marginal.**

Notes

[1]Investors' reading of yield curves is explained in Constance Mitchell, "What's the Yield Curve Message?" *Wall Street Journal* (June 3, 1991), pp. C1, C15.

[2]For a description of theories explaining the linkage between monetary policy, interest rates and the business cycle, see Bryon Higgins, "Monetary Growth and Business Cycles," *Issues in Monetary Policy* (Kansas City: Federal Reserve Bank of Kansas City, 1980), pp. 98-117.

[3]James Stark, editor of *InvesTech* newsletter, quoted in Jane Baird, "Potential Refinancers Still Uncertain Rates Have Hit Rock-bottom," *The Houston Post* (November 26, 1991), p. C1.

[4]"History shows that the inflation rate typically drops in the early stages of an economic recovery. The dollar's surge in foreign-exchange markets and the Federal Reserve's anti-inflation stance also are encouraging more investors to expect lower interest rates and to buy bonds." Tom Herman, "Still-Weak Economy Leads Many to Predict Lower Interest Rates," *Wall Street Journal* (April 29, 1991), p. C1.

[5]Cited in Baird, op. cit.

[6]Joseph P. Murphy, *The Random Character of Interest Rates* (Chicago: Probus Publishing Company, 1990).

[7]Gikas A. Hardouvelis, "The Predictive Power of the Term Structure during Recent Monetary Regimes," *The Journal of Finance* 43 (June 1988), pp. 339-52.

[8]David F. Babbel, "Interest Rate Dynamics and the Term Structure," *Journal of Banking and Finance* 12 (1988), pp. 401-17.

[9]Bong-Soo Lee, "A Nonlinear Expectations Model of the Term Structure of Interest Rates with Time-Varying Risk Premia," *Journal of Money, Credit and Banking* 21 (August 1989), pp. 348-66.

[10]John L. Kling and David A. Bessler, "Calibration-based Predictive Distributions: An Application of Prequential Analysis to Interest Rates, Money, Prices and Output," *Journal of Business* 62 (1989), pp. 477-98.

[11]Eugene F. Fama and Robert R. Bliss, "The Information in Long-Maturity Forward Rates," *American Economic Review* 77 (September 1987), pp. 680-91.

[12]Sheridan Titman and Arthur Warga, "Stock Returns as Predictors of Interest Rates and Inflation," *Journal of Financial and Quantitative Analysis* 24 (March 1989), pp. 47-58.

[13]Kenneth A. Froot, "New Hope for the Expectations Hypothesis of the Term Structure of Interest Rates," *The Journal of Finance* 44 (June 1989), pp. 283-304.

[14]Saul B. Klaman, *The Postwar Residential Mortgage Market* (Princeton, N.J.: Princeton University Press, 1961), p. 78. Klaman's observations were based on interest rates during 1947-56.

[15]Jimmy E. Hilliard and Richard L. Haney, "The Evolutionary Relationship Between Bond Markets and Mortgage Markets: A Cross-Spectral Analysis," *Housing Finance Review* 1 (July 1982), pp. 279-98.

[16]A moving average is the mean (average) of observations within a defined time span. For example, a three-month moving average series represents the mean of three-month intervals moving through a series of monthly data. Market technical analysts often use moving averages to indicate a trend line and to spot departures from the trend.

[17]Examples of the method for calculating test criteria are presented in Appendix B.

[18]Fama and Bliss, op. cit., attribute their findings of predictable long-term interest rate changes to slow decay in the autocorrelations within the interest rate series. See page 689.

Appendix A

Strategy Performance

The following tables show the results to the tests described in the text. The column headed "Number of Errors" indicates the total number of months in which a strategy led to an incorrect decision. "Error Rate" is the percentage of total months in which an incorrect decision was indicated. "Average Cost" is the average percentage increase in present value from each erroneous choice.

Table A-1. ARM/FRM Decision

Strategy	1968-90			1968-79			1980-90		
	Number of Errors	Error Rate %	Average Cost %	Error	Error Rate %	Average Cost %	Error	Error Rate %	Average Cost %
T-bond yields	121	43.8	13.9	61	42.4	5.9	60	45.5	22.0
T-bill yields	95	34.4	13.2	39	27.1	5.8	56	42.4	18.3
Yield spread	100	36.2	13.4	44	30.6	7.5	56	42.4	17.9
Stock prices	138	50.0	17.4	48	33.3	9.1	90	68.2	21.9
M2/GNP growth	173	62.7	17.7	56	38.9	5.8	117	88.6	23.4
M2 growth	150	54.3	19.2	44	30.6	5.6	106	80.3	24.9
GNP growth	85	30.8	15.8	19	13.2	2.5	66	50.0	19.6
GNP/leading indicator	131	47.5	15.3	65	45.1	8.6	66	50.0	21.9
Leading indicator	158	57.2	5.2	49	34.0	5.6	109	82.6	19.6
Mortgage trend	126	45.7	18.3	46	31.9	9.9	80	60.6	23.1

Table A-2. Refinancing Timing Decision

Strategy	1968-89			1968-79			1980-89		
	Number of Errors	Error Rate %	Average Cost %	Error	Error Rate %	Average Cost %	Error	Error Rate %	Average Cost %
T-bond yields	66	25.0	4.1	37	25.7	4.6	29	24.2	3.5
T-bill yields	76	28.8	3.9	47	32.6	4.0	27	22.5	4.1
Yield spread	86	32.6	4.4	44	30.6	5.7	42	35.0	3.0
Stock prices	138	52.3	7.3	84	58.3	10.3	54	45.0	5.8
M2/GNP growth	83	31.4	2.4	27	18.8	4.9	56	46.7	1.2
M2 growth	89	33.7	2.8	26	18.1	3.9	63	52.5	2.3
GNP growth	85	32.2	4.9	44	30.6	4.9	41	34.2	4.9
GNP/leading indicator	132	50.0	7.9	66	45.8	11.3	66	55.0	4.6
Leading indicator	79	29.9	4.9	38	26.4	6.7	41	34.2	3.3
Mortgage trend	65	24.6	2.6	19	13.2	6.0	46	38.3	1.6

Appendix B

Example Calculations of Test Criteria

1. ARM/FRM Decision

For each month of the data series, a hypothetical homebuyer has the choice of an FRM at the national average interest rate on mortgage loans and an ARM at an interest rate equal to the FRM rate minus the spread between long-term and short-term treasury securities. For example, in January 1971, the average mortgage rate is set at 8.08 percent. The ARM rate then is calculated:

Average mortgage rate		8.08 percent
T-bond rate	5.92	
T-bill rate	-4.49	
Spread		-1.43
ARM rate		6.65 percent

Next, the monthly payments on the two loans are calculated for a five-year period. Each loan has a principal of $1,000 and a 30-year term. The ARM interest rate is adjusted by an amount equal to the change in T-bill rates for the same period. For the example, the five-year schedule is as follows:

Year	T-Bill %	ARM %	ARM P&I $	FRM P&I $
1	4.49	6.65	$6.42	$7.39
2	3.40	5.56	5.73	7.39
3	5.31	7.47	6.93	7.39
4	7.76	9.92	8.57	7.39
5	6.49	8.65	7.72	7.39

Monthly payments are discounted to present value using the initial mortgage interest rate as the discount rate. The resulting figure is the present value of the first 60 payments of each loan:

Present value of FRM: $363.78

Present value of ARM: $345.87

In this example, the ARM is the better choice because the present value of its required payments is lower. The cost of erroneously choosing the FRM in that month is calculated as the percentage increase in present value of the payments incurred relative to those required for the correct choice:

Cost of error: (363.78 - 345.87) ÷ 345.87 = 5%

2. Refinancing Decision

The borrower has the opportunity to refinance an existing mortgage loan with an interest rate exactly 2 percentage points above the current rate available. This figure is chosen because this is the minimum spread required to make refinancing a mortgage feasible. The borrower has the option of refinancing immediately at the average interest rate on current mortgage loans or waiting for a lower rate. Under the convention chosen for this test, if the borrower chose to wait, the loan was refinanced at the next lower rate in the time series. A limit of three years was established for this waiting period. In other words, if a rate lower than the current rate never occurred during the consequent three-year period, the loan was not refinanced.

For the example, the rate available in January 1971 was 8.08 percent. For the test, the borrower's existing loan has a rate of 10.08 percent. The next lower interest rate available is 7.8 percent, which occurs the following month.

If the borrower refinances immediately, the new loan will require payments of $7.39 per month (again with a 30-year term and $1,000 principal). The present value of these payments during the next three years, discounted at the rate of 8.08 percent, is $235.55. If the borrower waits, the existing loan carries over for the first month, requiring a payment of $8.83. The new loan has a payment schedule of $7.20. The present value of the combination of existing loan for one month and new loan for 35 additional months is $230.37. In this case, the better choice would be to wait for the lower rate. The cost of refinancing immediately, instead of waiting, is:

$(235.55 - 230.37) \div 230.37 = 2\%$

Reprint Policy

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