Federal Funds Futures as an Indicator of Future Monetary Policy: A Primer

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Introduction

Monetary policy attracted considerable media attention in 1994. The focus was largely concentrated on the six increases in the federal funds rate objective during the year. The fed funds rate is the interest rate banks pay when they borrow Federal Reserve deposits from other banks, usually overnight. It is closely watched in financial markets because the level of the funds rate can be immediately and purposefully affected by Federal Reserve open market operations.

The Federal Open Market Committee (FOMC), the main policymaking arm of the Federal Reserve System, communicates an objective for the fed funds rate in a directive to the Trading Desk (hereafter Desk) at the Federal Reserve Bank of New York. Actions taken to change an intended level of the fed funds rate are motivated by a desire to accomplish ultimate policy objectives, especially price stability. Permanent changes in the fed funds rate level are thus the consequence of deliberative policy decisions.[1]

Although the Desk does not achieve the intended funds rate on a daily basis, it effectively does so on average. Figure 1 illustrates the effective fed funds rate daily over the past six years relative to the intended rate.[2] The annualized effective yield varies substantially on a daily basis, but the monthly average rate is generally close to the rate specified by the FOMC. Since October 1988, the mean absolute deviation of the monthly average of the fed funds rate from the intended level has been less than six basis points (six one-hundredths of a percent).

Because the average monthly fed funds rate remains close to the intended level (and hence is independent of permanent market influences), it is unique among other short-term rates. Thus, predicting what the average monthly rate will be in the future is tantamount to predicting what the fed funds rate objective will be over the course of the month.

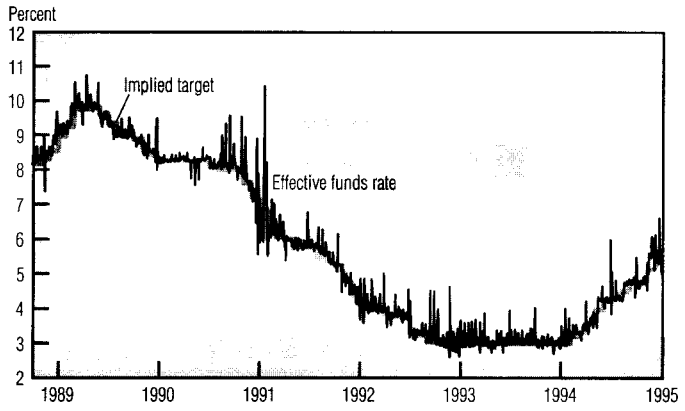
In 1988, the Chicago Board of Trade began trading an interest-rate futures contract based on average monthly fed funds rates. This contract, known as the 30-day fed funds futures

■ **1** Indeed, over most of the post–World War II period, the fed funds rate or its equivalent has been the Fed's policy instrument.

■ **2** The daily effective rate is based on a survey of the transactions arranged through five fed funds brokers.

FIGURE 1

Daily Fed Funds Rate and Intended Level



SOURCE: Chicago Board of Trade.

contract, may be written for any calendar month up to 24 months ahead. The market price of fed funds futures essentially embodies a prediction of the monthly average of the daily fed funds rate. Because markets understand that deviations of the overnight funds rate from its desired level tend to average out over the span of a month, the implied rate is essentially the market's expectation of the intended rate. Thus, the FOMC can assess in fairly precise terms what the markets — at least the fed funds futures market — believe its actions will be.

This paper examines the predictive content of the fed funds futures contract and considers some policy implications. The next section describes the fed funds market and how the funds rate is determined. We examine how closely the average monthly rate matches the monthly average of the intended rate. In section II, we describe the fed funds futures instrument and market. In section III, we examine the predictive accuracy of the implied fed funds futures rates and compare it with alternative forecasts. We offer policy implications and some concluding remarks in sections IV and V.

I. The Fed Funds Market

Participants in any futures market have every incentive to understand the fundamental determinants of the price of the commodity or financial instrument on which the futures contract is drawn. Perhaps the most striking example of this is illustrated by Roll (1984), who examines the market for frozen orange juice futures. The supply of frozen orange juice is highly "concentrated" in the sense that 80 percent of the oranges typically used come from Orange County, Florida. Because frost can destroy a large share of the market, frozen orange juice futures prices are clearly highly sensitive to changes in weather. Indeed, Roll shows that these futures prices can be used to provide weather forecasts for Orange County that are marginally superior to the forecasts of the National Weather Service.[3]

Exogenous factors, such as bad weather, can also affect the daily average funds rate by creating payment delays and hence float, but such effects are transitory and tend to average out on a monthly basis. Moreover, the Desk monitors float closely and stands ready to enter the market to offset any anticipated effects. Nevertheless, unanticipated float and other daily factors can influence monthly average rates and hence lead to marginal deviations from the monthly average funds rate specified by the objective.

To appreciate better the unique forces at play in the fed funds market, it is useful to review some critical characteristics of fed funds and the determinants of the fed funds rate.[4] Goodfriend and Whelpley (1993) identify three features that, taken together, distinguish fed funds from other money market instruments. First, they are borrowings of immediately available money — funds that can be transferred between depository institutions in a single day. (About three-quarters of fed funds in 1991 were overnight borrowings.) Second, fed funds can be borrowed only by those depository institutions that are required to hold reserves with Federal Reserve Banks. Third, fed funds borrowings are exempt from reserve requirements and interest-rate ceilings.[5]

The fed funds market serves as an effective device to redistribute reserves in the banking system. For example, some banks, typically large ones with wide access to financial markets, find themselves persistently in need of reserves. Other banks, typically small ones with more limited investment opportunities,

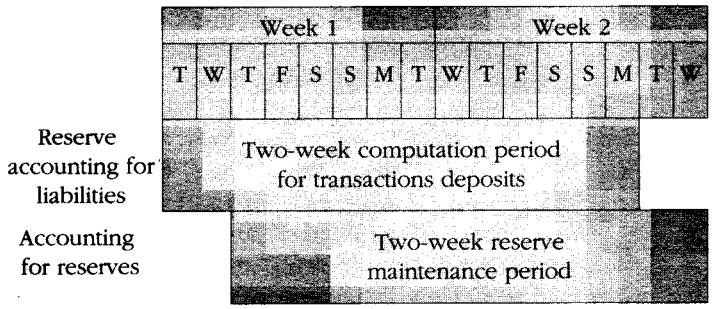
■ **3** Price is a slightly better predictor of the error of the National Weather Service Forecast at 5:00 a.m. than of the forecast made the previous night or that same night (Roll [1984], p. 871).

■ **4** For a more complete description of the fed funds instrument and market, see Goodfriend and Whelpley (1993).

■ **5** *Reserves* refer to bank assets held in the form of vault cash and deposits at Federal Reserve Banks. *Reserve requirements*, on the other hand, are the amount of assets that must be held as reserves against a liability.

FIGURE 2

Timing of Contemporaneous Reserve Accounting System



SOURCE: Authors, adapted from Meulendyke (1989).

have a persistent surplus of reserves. Although banks may lend reserves directly to each other through their correspondent relationships, about 40 percent of total fed funds transactions in 1991 were arranged through brokers, with the remainder purchased directly from counterparties.[6] Moreover, as payments flow through the banking system, individual banks face wide swings both in their reserve balances and in their reservable deposits. The fed funds market thus also provides a convenient outlet in which banks can buy or sell reserves to offset the anticipated and unanticipated impact of payments on their reserve positions.

While the actions of individual banks within the fed funds market may effectively redistribute reserves to where they are most needed in the banking system, they do not affect the aggregate supply of reserves, which is determined by Desk actions and market factors outside the control of individual banks and the Desk. The demand for reserves in the aggregate is critically dependent on the nature of reserve requirements, especially the reserve accounting system, on the public's demand for reservable deposits, and on bank funding decisions.

Required reserves are computed as fractions of daily average deposit levels, as specified in Regulation D.[7] (Since December 1990, only transactions deposits have been reservable.) Under the current reserve accounting system, daily average deposit levels are based on a two-week computation period beginning every other Tuesday (see figure 2).

Although banks may ultimately affect the demand for their transactions accounts (and hence required reserves) by raising or lowering the interest rate paid, depositors typically respond with a lag. In fact, within the span of the reserve computation period, the effect on deposits demanded is negligible; hence, the level of required reserves is largely predetermined.

The time interval over which daily average reserves must equal or exceed computed required reserves — called the reserve maintenance period — is specified as a two-week period beginning two days after the start of the reserve computation period. Total reserves consist of depository institutions' deposits at Federal Reserve Banks net of contractual clearing balances and applied vault cash.[8] It is within the reserve maintenance period, then, in which demand must equal supply (that is, when the market must clear).

The ultimate supplier of reserves is of course the Federal Reserve, which provides reserves through either open market operations or discount window lending. Since the demand for reserves is essentially predetermined over the reserve computation period, the operating problem faced by the Federal Reserve is how much reserves it will supply through open market operations.[9] This decision essentially determines the equilibrium level of the fed funds rate.

The operating procedure is complicated by the fact that the Desk does not know precisely what the levels of required reserves will be nor the demand for reserves in excess of required holdings. It must estimate them daily as new information becomes available. Moreover, because discount window borrowing occurs at the volition of banks, the Desk does not know what the level of borrowing will be. The level of discount window borrowing, however, is related to the spread between the fed funds rate

6 A correspondent relationship is one in which one bank (correspondent) holds the deposits of another (respondent). Large banks often act as correspondent banks for smaller banks because they may have access to a variety of services not directly available to the smaller banks. For example, small banks may choose to hold deposits with the large bank, which in turn provides payment services. Because respondent deposits are reservable, large banks typically find themselves in need of reserves, while small banks typically hold a surplus. Thus, respondent banks may lend their excess reserves directly to their correspondent, but also sell them in the fed funds market.

7 See, for example, *Federal Reserve Bulletin*, vol. 81, no. 1 (January 1995), table 1.15, p. A9.

8 Applied vault cash equals average vault cash over a two-week period beginning 30 days before the end of the reserve maintenance period. Thus, applied vault cash is determined before required reserves are known.

9 Total reserve demand equals required reserves over the computation period plus the demand for reserves in excess of required reserves (which are also largely predetermined).

TABLE 1

Deviation of Monthly Average Fed Funds Rate from Intended Level (percent)

	Mean Deviation	Mean Absolute Deviation
1988–1994	0.04	0.06
1992–1994	0.03	0.05

SOURCES: Chicago Board of Trade; and authors' calculations.

BOX 1

Fed Funds Futures Market Terminology

Open interest	Total number of contracts outstanding on a given day.
Volume	Daily volume in number of contracts traded.
Settlement price	Official price set by the exchange at the end of the day to determine daily gains and losses and margin requirements.
Derivative	Security whose value depends on the value of underlying simpler securities.
Futures contract	Agreement between two parties to buy or sell an asset at a future date at a specified price.
Fed funds market	Collective interbank borrowing and lending activities designed to maintain required reserve ratios.
Fed funds effective rate	Average daily rate on overnight fed funds as reported by the Federal Reserve Bank of New York.
Trading unit	$5 million overnight fed funds held for a minimum of 30 days.
Price bias	Settlement price calculated as 100 minus the monthly average overnight fed funds rate.
Hedging	Taking a position that is equal and opposite to the risk exposure relative to a market position in an attempt to offset any losses incurred by the underlying position by gains in the future position.

and the discount rate, so initial estimates are obtained for the desired spread.

At the beginning of a maintenance period, the Desk projects reserve needs based on estimates of required reserves, excess reserves, and discount window borrowing. It formulates a program to add or absorb reserves smoothly over the course of the two-week period. It also estimates the effect of market factors on the level of nonborrowed reserves. As the period unfolds, the Desk continually monitors the appropriateness of its estimates and revises its program for reserves provision accordingly. Over the course of the maintenance period, it is also guided by the behavior of the fed funds rate. For example, if the rate is persistently above its desired level, the Desk may choose to supply more reserves than the program calls for.

Although the fed funds rate may swing widely from day to day, the Desk's actions are generally successful in achieving its objective on average. Table 1 presents the monthly average and the mean absolute deviation of the daily fed funds rate from its intended level since October 1988. The funds rate over this period tended to be only three basis points above, and the mean absolute deviation only about six basis points above, its target level. Thus, the Desk achieves its objective rather closely on a monthly average basis. Over the same period, the daily funds rate ranged between 10 percent and 3 percent. The key determining factor in this movement is the deliberative policy choice of the FOMC.

II. The Fed Funds Futures Contract

The fed funds contract, also known as 30-day fed funds futures, calls for delivery of interest paid on a principal amount of $5 million in overnight fed funds (see box 1).[10] In practice, the total interest is not really paid, but is cash-settled daily. This means that payments are made whenever the futures contract settlement price changes. The futures settlement price is calculated as 100 minus the monthly arithmetic average of the daily effective fed funds rate that the Desk reports for each day of the contract month.

To illustrate, consider the situation in which a bank sold 10 December contracts at 94.42 just before the market's close on October 4, 1994. This was the contract's price around market closing as reported in *The Wall Street Journal* the following day (see the fourth ["settle"] column in table 2). It embeds a market expectation of a December fed funds rate of 5.58 percent (that is, [100 – 5.58] = 94.42). For deferred-month contracts, such as the December contract, each basis-point (0.01 percent) change causes the price of the contract to move by one tick, or $41.67 (that is, 0.01 percent times [30 days/360 days] times $5

■ **10** See Chicago Board of Trade (1992).

TABLE 2

Interest Rate[a]

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
10/94	94.98	94.99	94.96	94.96	0.02	95.63	94.63	4,392
11/94	94.78	94.78	94.78	94.76	0.02	95.52	94.50	3,779
12/94	94.44	94.44	94.41	94.42	0.03	96.00	94.41	1,082
1/95	94.28	94.28	94.27	94.27	0.02	94.66	94.24	162

a. 30-day federal funds (Chicago Board of Trade) – $5 million; pts. of 100 percent.
SOURCE: *Wall Street Journal*, October 5, 1994.

million).[11] Thus, if the December settle price rises to 94.45 on October 5, the seller of the contract owes the contract holder $1,250.10 ($41.67 times three ticks times 10 contracts). Payments are made through margin accounts that sellers and holders have with their brokers. At the end of the trading day, sellers' and holders' accounts are debited or credited to facilitate payments.

Fed funds futures are a convenient tool for hedging against future interest-rate changes. To illustrate, consider a regional bank that consistently buys $100 million in fed funds. Suppose the bank's analysts believe that economic data to be released in the upcoming week will induce the FOMC to increase the objective of the fed funds rate by 50 basis points at its next meeting. If the contract settle price (for the meeting month) implies no change from the current rate, the bank may choose to lock in its current cost by selling 20 contracts (or taking a short position) and holding the position to expiration. Conversely, suppose that a net lender of funds expects a policy action to lower the fed funds rate. It can protect its return by buying futures contracts (or taking a long position).

Participants in the fed funds futures market need not be banks that borrow in the fed funds markets. Anyone who can satisfy margin requirements may participate. Thus, traders who make their living as "Fedwatchers" may speculate with fed funds futures. This would suggest that to the extent Fed policy is predictable, speculators would drive futures prices to embody expectations of future policy actions. Since the level of the fed funds rate is essentially determined by deliberative policy decisions, the fed funds futures rate should have predictive value for the size and timing of future policy actions. Moreover, given that the Desk may face systematic problems that hinder its ability to achieve its objective, the consequences for the funds rate may be predictable. Speculators who anticipate such effects may find it profitable to buy or sell current contracts.

Figure 3 illustrates the monthly average of both the number of outstanding contracts (open-interest) and the volume for each of the six contracts studied. Although it reveals that the market has grown appreciably in a relatively short time, this growth has not been shared equally among contracts of various durations. For example, open interest has trended upward for contracts of less than four-months' duration, while it peaked in late 1992 and then receded for the four- and five-month contracts.

Current-month and one-month contracts are most heavily traded throughout the period.[12] Two-month and three-month contracts have also enjoyed active trading; however, when the length of the contract extends beyond this point, trading activity diminishes. Indeed, the monthly average volume in the five-month market has rarely exceeded 100 contracts. The market for four- and five-month-ahead contracts peaked in 1993 after the fed funds rate had plateaued at its cyclical low. Contracts over five months long do exist, but their appearance is sporadic.

III. Predictive Accuracy

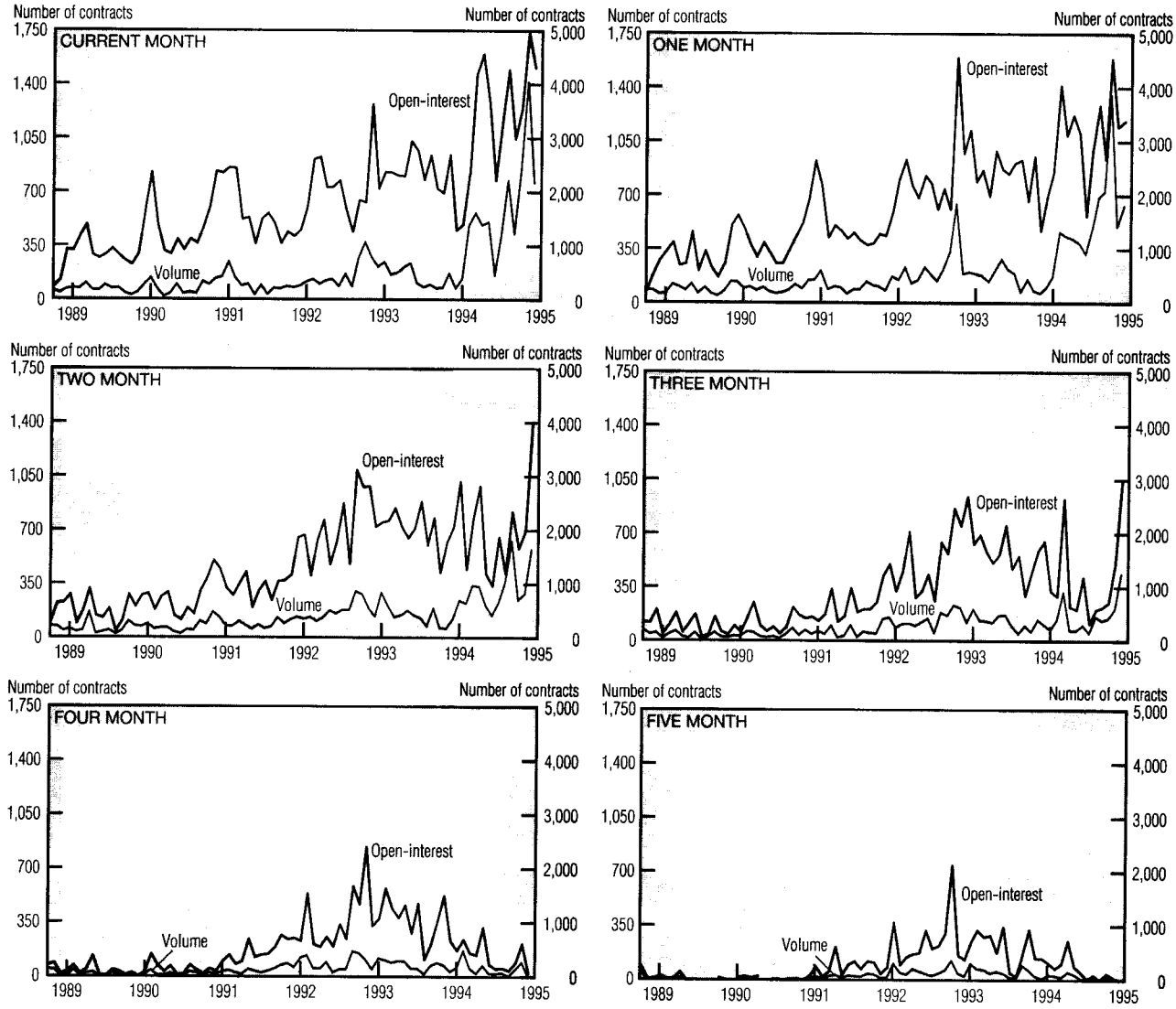
Figure 4 illustrates monthly average futures rates and the corresponding forecast errors since October 1988 (when contracts were first traded) for each of the contract horizons. Not surprisingly, predictive accuracy diminishes as the contract horizon is extended. Also, errors tend to be relatively large when the funds rate changes direction or when it changes rapidly over a short period. Neither the 1989 peak in

11 Although December has 31 days, a 30-day-month standard is used to define a constant tick size. Also, the structure of current-month pricing is different from deferred-month pricing in that the price of the current contract reflects a day-weighted average of the rate experience to date and the implied term rate to the end of the month. Contracts are listed on the Chicago Board of Trade exchange for the current month and for each of the 24 months that follow.

12 However, on a daily basis, current-month volume often drops below one-month volume given the dramatic decline in the number of contracts generally associated with trading during the final days of the month. At the same time, there is an opportunity for arbitrage as trading forces the convergence of the futures price with the spot price as the contract approaches maturity. As the closing price becomes a virtual certainty, the incentive to place a bet on the settlement price declines as speculative profits are reduced to zero.

FIGURE 3

Size of Market



SOURCE: Chicago Board of Trade.

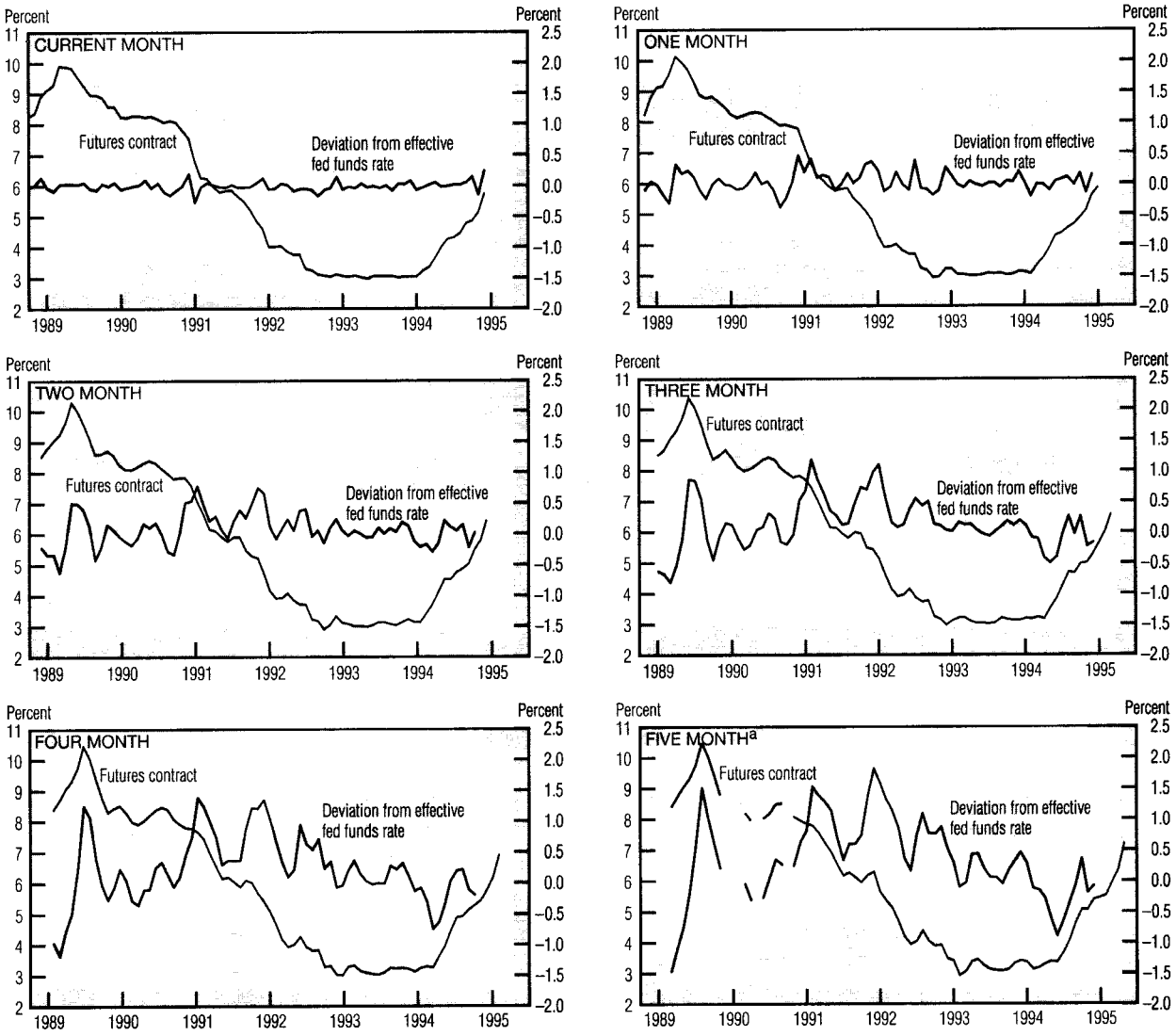
the funds rate nor the policy turnaround in February 1994 was anticipated at any contract horizon. Nor did the market adequately foresee the sequence of funds-rate reductions initiated in mid-1990 and again in 1991.

That the fed funds futures market failed to anticipate these episodes may not be all that damning. Because such decisions are often based on information that surprises both forecasters and policymakers alike, there may be no way to predict the timing of such events. Moreover, the market may be dominated by hedgers, who seek to reduce risk rather than to speculate on a projected change. The uncertainty surrounding the response of policy may be too great for some speculators to act on the projection. That is, the expected rate of return may not be sufficient to compensate for the level of risk to which the position is exposed.

One might expect that the current month's futures rate would be a good predictor of the month's fed funds rate. After all, by the middle of the month, the market already knows half of the daily rates used in the monthly average calculation. Moreover, as time moves on, more information relevant to policy decisions becomes available, which in turn should enhance the predictive performance of a given contract. For example, one

FIGURE 4

Fed Funds Futures Rate as a Predictor of the Effective Fed Funds Rate



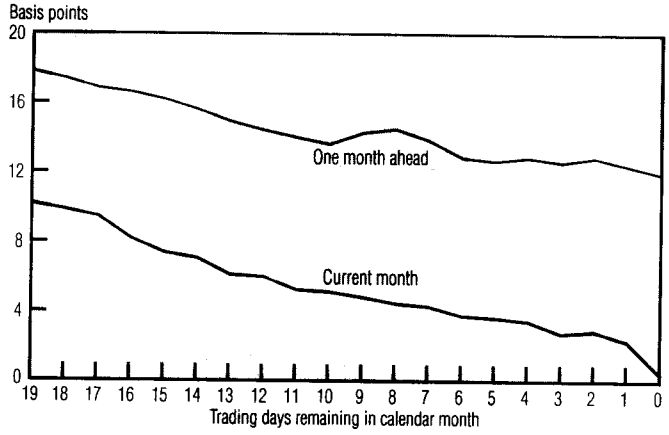
a. Line breaks reflect periods during which no contracts were traded.
SOURCES: Chicago Board of Trade; and Board of Governors of the Federal Reserve System.

would expect the probability of an unanticipated shift in Fed policy to diminish as the expiration date of a contract approaches.

To examine how readily the futures market incorporates available information into its pricing decisions, we estimate the mean absolute deviation between the daily rate and the contract standard for each of the trading days leading up to the expiration date. In principle, if the market is efficient, the mean absolute deviation should diminish. Figure 5 illustrates that the deviation declines steadily as the expiration date approaches. Indeed, the mean absolute deviation is virtually zero by the last trading day. Moreover, the mean absolute deviation averaged over the month is less than six basis points, about the same as the mean absolute deviation of the fed funds rate from its monthly average intended rate. This suggests that all systematic variation in the fed funds rate is anticipated by the market and incorporated into the future's price. If the fed funds futures market were not incorporating all the information about future fed funds yields, one might expect

FIGURE 5

Mean Absolute Deviation of Future from Effective Funds Rate



SOURCES: Chicago Board of Trade; and authors' calculations.

BOX 2

Alternative Forecasting Models

Naive Model (random walk)

$$r_t = r_{t-1} + \varepsilon_t$$

where r_t is the effective fed funds rate and ε_t is a random disturbance.

Univariate Model (estimated)

$$\Delta r_t = 0.011 + 0.367\,\Delta r_{t-1} + \varepsilon_t$$
$$(0.046)\quad (7.912)$$

where Δr_t is the first difference of the effective fed funds rate and ε_t is an independent, identically distributed (i.i.d.) random disturbance. The equation is estimated from September 1954 to September 1988.

that the mean absolute deviation of the futures rate would materially exceed that of the fed funds rate from its intended level.[13]

Market participants are clearly able to improve their estimates of the current month's average as the month progresses. What's more impressive is that the predictive accuracy of the one-month-ahead futures rate also improves over the period leading up to the end of the prior month. The mean absolute error on the last day of the previous month is about one-third lower than the mean absolute error 20 days earlier. The only exception to this trend occurs for a few days in the middle of a calendar month. Nevertheless, the predictive performance is not significantly diminished.

To the extent that the fed funds futures market is efficient, contract rates should predict fed funds rates at least as well as alternative forecasting models. As a preliminary investigation of market efficiency, we compare the prediction errors of fed funds futures with those of a naive model and an estimated univariate model (first-order autoregressive model of the change in the fed funds rate).[14] The naive model simply assumes that the best forecast of the future fed funds rate is the current rate (see box 2). This model is sometimes called a random walk because it implicitly assumes that changes to the fed funds rate are random and permanent. The univariate model also assumes that changes to the level of the fed funds rate are permanent, but it allows for some persistence of the change. That is, if a change occurs in one period, it can occur again (at least partially) in the subsequent period.

Table 3 presents the mean prediction error (MPE) and the mean square error (MSE) for each of six forecast horizons and for each of the alternative forecasting approaches.[15] The prediction error is defined as the forecast less the actual (monthly average effective fed funds rate). All three approaches tended to overpredict over the whole period. The bias was uniformly larger for predictions based on fed funds futures rates, the only exception being for the five-month-ahead horizon. This suggests that fed funds futures pricing may be dominated by consistent borrowers of overnight funds who are willing to pay a premium to hedge against the risk of interest-rate increases.[16] Given the limited sample, however, it may be too early to draw such a conclusion.[17]

13 Both measures of variability are small.

14 This model, an ARIMA (1,1,0), was identified using a method proposed by Box and Jenkins (1970).

15 The *i*-month-ahead prediction errors for the futures contract are simply the difference between the futures rate on the *i*-month-ahead contract and the average of the fed funds rate for the same month. All contract rates are averaged over the month that they are recorded.

16 One might ask why this premium exists. It is possible that transactions costs may preclude any profitable strategy to exploit the premium.

17 Indeed, Spence Hilton at the Trading Desk of the Federal Reserve Bank of New York believes that the prediction bias may be a quirk of the sample period. He notes that over most of the sample period, the market (as well as the FOMC) was surprised by the lack of strength in the economy. The FOMC often responded to evidence of economic weakness by lowering the fed funds rate immediately. He believes that this experience could dominate the average prediction error given the limited sample.

TABLE 3

Relative Predictive Accuracy of Fed Funds Futures

Panel A. Whole Forecast Period (October 1988–December 1994)

	Federal Funds Futures		Naive Model		Univariate Model	
Forecast Horizon	MPE[a]	MSE[b]	MPE	MSE	MPE	MSE
Current	0.01	0.00	—	—	—	—
One month ahead	0.06	0.03	0.04	0.05	0.03	0.04
Two months ahead	0.10	0.09	0.08	0.17	0.08	0.13
Three months ahead	0.17	0.20	0.14	0.33	0.15	0.27
Four months ahead	0.25	0.36	0.20	0.54	0.22	0.48
Five months ahead	0.26	1.62	0.27	0.77	0.30	0.72

Panel B. Second Half of Forecast Period (after 1991)

	Federal Funds Futures		Naive Model		Univariate Model	
Forecast Horizon	MPE[a]	MSE[b]	MPE	MSE	MPE	MSE
Current	0.01	0.01	—	—	—	—
One month ahead	0.06	0.03	−0.04	0.04	−0.01	0.03
Two months ahead	0.10	0.06	−0.07	0.12	−0.02	0.09
Three months ahead	0.13	0.11	−0.06	0.22	−0.00	0.16
Four months ahead	0.18	0.18	−0.05	0.38	0.03	0.31
Five months ahead	0.23	0.29	−0.22	0.75	0.08	0.49

a. Mean prediction error.
b. Mean square error.
SOURCE: Authors' calculations.

Although alternative models may provide less-biased predictions than the fed funds futures, investment strategies based on the models would be more risky. This is evident when comparing the MSEs of alternative forecasts. The MSE provides a measure of the dispersion of forecast errors and hence of the uncertainty associated with the prediction. In all but one case, the MSE of the fed funds futures prediction is less than the alternatives.[18] Thus, although the average gain could be greater for alternative predictions, the potential for losses is also higher.

Because the fed funds futures market is young and the volume of trades is small relative to some other comparable instruments (for example, Eurodollar futures), one might question whether the market is "deep" enough to accommodate large trades. If the market is deep, large trades should not appreciably affect market rates unless they reflect the incorporation of new information in futures prices. To assess the potential relevance of this issue, we examine whether the increased volume of the market has led to better predictions. The second panel in table 3 presents the MPE and MSE statistics for the period since 1991. These results reveal that the dispersion of forecast errors declines sharply for horizons of three months or more. However, the improved predictive performance over the latter period may reflect the fact that the fed funds rate was relatively more stable over this period.

In sum, the preliminary evidence presented above suggests that fed funds futures are useful for predicting future fed funds rate changes (and hence policy moves), especially over the shorter forecast horizons. Prediction error is shown to diminish almost daily leading up to a contract's expiration date. The fact that the MSEs of fed funds futures predictions are relatively small provides some evidence that fed funds futures markets efficiently incorporate information into pricing decisions.

■ **18** The only exception is for the five-month-ahead futures contract, which was not actively traded over the first three years of the market.

IV. Some Policy Implications

The fed funds futures rate, by virtue of being a market-determined expectation about future deliberative actions, provides potentially useful information for Fed policymakers. For example, the FOMC may find the futures rate helpful in assessing the credibility of alternative policy choices. To illustrate, consider a situation in which financial markets clearly perceive increasing inflationary pressures and expect the FOMC to counter with a fed funds rate increase.

A key market concern may be that the FOMC must demonstrate sufficient resolve to ensure that short-term objectives—such as interest-rate smoothing—do not interfere with the achievement of longer-term price stability. Under these circumstances, the absence of an anticipated action could induce expectations of rising inflation and in turn become embedded in longer-term interest rates as increased inflation premia. Thus, if the market expects an anti-inflationary move, the FOMC may feel compelled to act even if it believes inflationary pressure will ebb so as to prevent a flare-up of inflationary expectations.

To what extent should the FOMC react to fed funds futures as a signal of expectations regarding future changes? In principle, participants in the fed funds futures market will base their trading decisions on expectations of the fed funds rate path they believe the FOMC will choose over time. If the FOMC were to base its decision solely on the market's expectation, it is not clear what would ultimately determine the fed funds rate path. That is, the equilibrium outcome of such a policy may be indeterminate. This problem is described by Keynes (1936, p. 156) in an analogy with newspaper competitions:

> ... the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of other competitors, all of whom are looking at the problem from the same point of view. It is not the case of choosing those which, to the best of one's judgment, are really the prettiest, nor even those which average opinion genuinely thinks is the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects average opinion to be. And there are some, I believe, who practise the fourth, fifth and higher degrees.

One cannot know at which degree participants choose to make their decision; hence the indeterminacy.

The FOMC, of course, does not base its decision solely on what the market expects it to do, as clearly evidenced by the failure of the fed funds futures market to anticipate turning points in fed funds rates. Rather, the FOMC looks at many things, and bases its decision on the majority's assessment of the fed funds rate level needed to accomplish ultimate objectives. In this context, however, the Committee may find knowledge of market expectations useful in assessing the financial-market consequences of alternative actions. For example, the estimated impact of any given action may differ depending on whether the policy change is anticipated by the market. Thus, fed funds futures rates are helpful as part of an array of indicators considered by the FOMC in its policy deliberations.

V. Concluding Remarks

Futures contracts are typically drawn on commodities or financial instruments whose price or yield is determined in competitive markets. In the case of fed funds, however, the rate is essentially determined by a deliberative decision of the FOMC, the main policymaking arm of the Federal Reserve System. Hence, the fed funds futures market must anticipate actions taken by the FOMC. In short, through the fed funds futures market, one can place a bet on what future monetary policy will be. The Committee then can get a clear reading of what these market participants expect them to do, which may at times be helpful for FOMC members who place great weight on knowing if a policy choice would surprise the market.

If they are to be instructive for policymakers, fed funds futures rates should have some predictive content. The predictive accuracy of futures rates clearly improves over the two-month period leading up to the contract's expiration, providing some evidence that the market is efficient in incorporating new information into its pricing. The largest prediction errors occur around policy turning points. Nevertheless, the evidence above suggests that the fed funds futures markets are efficient processors of information concerning the future path of the fed funds rate.

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