

An Option for Anticipating Fed Action

by John B. Carlson, William R. Melick, and Erkin Y. Sahinoz

Options on CBOT fed funds futures are quite possibly the best means available to express market opinions about what the Fed might or might not do at the upcoming meetings.

—Chicago Board of Trade

Monetary policy meetings attract considerable media attention, especially when the economic outlook is highly uncertain, as it has been in recent months. The Federal Open Market Committee (FOMC)—the Fed’s main monetary policymaking arm—meets every six weeks or so to choose a target for the federal funds rate for the following intermeeting period. The fed funds rate is the interest rate paid on overnight loans made largely between banks. It is commonly viewed as an anchor for all interest rates, especially at shorter maturities. Immediately after a meeting, the FOMC releases a statement explaining its decision. The statement language is analyzed carefully by market analysts for any clue about actions the FOMC might take in the future.

Just prior to an FOMC meeting, the financial press is rife with speculation about the likelihood of possible Fed actions. For example, one might read an account that purports “even odds” of a rate cut of $\frac{1}{4}$ percentage point or 25 basis points—the smallest increment the FOMC typically employs. Odds assessments are sometimes based on an interpretation of fed funds futures prices from contracts around the meeting month. Because such futures effectively entitle holders to borrow at some future date at a specified rate, their prices reflect an opinion about anticipated policy actions. Unanticipated actions and surprises in the policy statement, in turn, induce immediate changes in fed funds futures prices.

The implied rates derived from fed funds futures prices have produced accurate predictions of the actual funds rate over horizons of a few months.

One limitation of using futures as a predictor, however, is that the implied futures rates reveal little or nothing about the distribution of beliefs. For example, suppose the implied future rate is $12\frac{1}{2}$ basis points below the current fed funds rate. Does this suggest even odds of a 25 basis point cut? Or is it possible that a few market participants expect a 50 basis point cut while the majority expect no change? Predictors that do account for such variance in beliefs can be obtained, in principle, from another financial instrument known as an *option*. Options on fed funds futures are very new—in March, the Chicago Board of Trade (CBOT) began to offer them due partly to an increase in the volume of trading in the futures contract.

This *Economic Commentary* describes the new option and develops the intuition behind the notion that information on the distribution of opinion may be derived from options prices. Estimates of the probabilities of alternative July outcomes are reported for the day before and the day after the May and June FOMC meetings. The estimates are consistent with opinion as revealed in the financial press. The reader not familiar with or in need of review of the terminology associated with options or futures is referred to the sidebar on the next page.

■ Fed Funds Futures

Fed funds futures are interest rate futures contracts that are based on the monthly average fed funds rate for each month traded. In simple terms, one can think of the contract as specifying a predetermined average rate for a given month.

Options contracts on federal funds futures, a new financial instrument introduced earlier this year, can be analyzed to gauge public expectations of future Fed actions. The real bonus is that they can detect differences of opinion when markets see more than two possible outcomes for an FOMC meeting as well as the likelihood associated with each.

Thus, a buyer (or seller) can “lock in” a certain interest rate on a borrowed (or loaned) amount—specified to be \$5 million for each contract. In practice the loan is not extended; rather, the difference between the market rate and the settlement rate is settled in cash.

Fed funds futures have a number of characteristics that distinguish them from other futures. These characteristics reflect unique institutional details of the underlying market. For example, unlike interest rates on car loans or mortgages, the fed funds rate is on average aligned with the target federal funds rate, which is chosen as a deliberative act of policymakers. The fed funds market provides a convenient outlet in which banks can buy or sell reserves to offset both the anticipated and unanticipated impact of payments on their reserve positions. The ultimate supplier of reserves is the Federal Reserve, which provides them either through open market operations—performed by the Domestic Trading Desk at the New York Fed—or lending at the discount window.

Open market operations are guided by the objective of supplying the amount of reserves necessary to achieve a target for the federal funds rate. Although the fed

Options, Futures, and Futures Options

Options are financial claims that take one of two basic forms:

- A *call option* is a claim that gives its owner the right to purchase some asset for a specified price—known as an exercise or strike price—on or before a specified *expiration date*.

When an option contract allows for exercise any time on or before the expiration date, it is called an *American option*. Options that allow for exercise only at maturity are known as *European options*. If the market price of the asset is above the strike price, the call option is said to be “in the money.”

With an American option, the owner can immediately “call away” the asset and earn a profit equal to the difference between the market price and the strike price. With a European option, the owner would have to wait until expiration to earn a profit.

- A *put option*, on the other hand, gives its holder the right to sell some asset for a specified price on or before some specified date. An owner of a put will exercise the claim only when the market price is below the exercise price.

It is worth noting that options are created only by an act of buying and selling. Thus, for every owner of an option there must be a seller, called an *option writer*. The seller confers the rights of the option for a payment, the price of the option. Thus, an owner or holder of an option has all the rights and the seller has all the obligations. One might think of the right to exercise as the product the option writer sells.

An *option on a future* or a *futures option* is one that takes a futures contract as the underlying asset. A futures contract calls for delivery of an asset or some derived cash value at a specified delivery date for an agreed-upon price—a *futures price*—to be paid at a specified date. Most options on futures are cash settled, meaning that the option writer must provide the cash equivalent of the difference between the futures price and the strike price to the option buyer.

funds rate may vary day to day in response to uncontrollable market factors, Desk actions are generally successful in achieving the target on average. The monthly mean deviation from the target is zero over the past five years with a standard deviation of 5 basis points. Thus, the monthly average funds rate is effectively determined by the deliberative act of the FOMC through its choice for the funds rate target.

Fed funds futures contracts are listed on the CBOT for the current month and for each of the 24 months that follow. The futures settlement price is calculated as 100 minus the monthly average of the overnight fed funds rates. For example, the July contract settlement price on May 7 of 98.905 implies a futures rate of 1.095 percent.

The correspondence between the rate implied by the futures price and the expected fed funds target rate is straightforward since there is no evidence of bias when the two-months-ahead futures

price is used to forecast the actual fed funds effective rate. Thus, the May 7 settlement price for July was factoring in some probability of a rate cut from the then-current target rate of 1.25 percent.

Now assume for the moment that in May, market participants expected the choice at the June 25 FOMC meeting to be limited to either no change or a cut of 25 basis points and no other change before August. Under this assumption, one might draw the conclusion that the July settlement price implied that a cut was more likely than no change since the expected rate was below an even-odds expected rate of halfway between 1.25 and 1.00, that is, 1.125 percent. As long as one assumes only two outcomes, one can calculate odds from a single futures price. Because with only two choices, the probability of no change must equal one minus the probability of a 25 basis-point cut; only one piece of information is necessary to pin down the odds.

Reports in the financial press, however, suggested that market expectations were not limited to only two possible policy outcomes. The *New York Times* business section, for example, reported on May 9 that some investment banks were expecting a rate cut of 50 basis points. Thus, it is more reasonable to assume that in May market participants were expecting at least three possible outcomes for the June meeting. In this case, one needs information from at least two independent sources. The newly traded options on fed funds futures provide a potential source of such information.

■ Fed Funds Futures Options

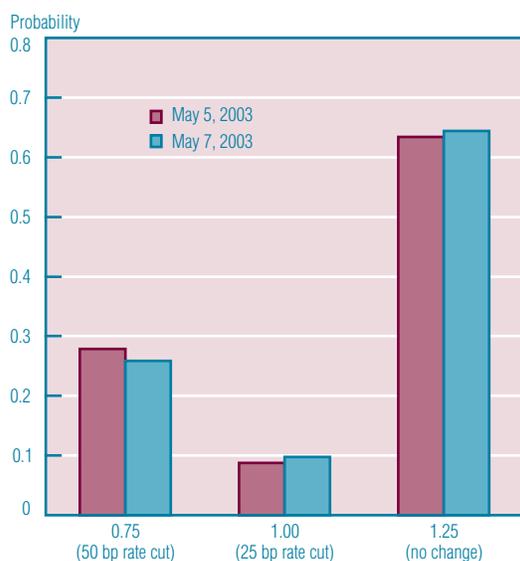
As described more completely in the sidebar at left, an option is a contract that allows one to buy (call) or sell (put) some asset at a preset price on or before some specified expiration date. The preset price is known as an *exercise* or *strike price*. The new option on fed funds futures is an option to buy (in the case of a call) or sell (in the case of a put) one fed funds contract with strike price intervals of $6\frac{1}{4}$ basis points. It is an American option, meaning that it may be exercised any time on or before its expiration date.

In both goods and asset markets, prices may experience periods of high variability and relative stability. For example, crude oil prices are enormously volatile during periods of geopolitical uncertainty but can also exhibit long periods with little change in prices. If underlying prices become more volatile, this increases the chance of a large payoff for the options owner, but it does not increase the chance of a large loss since the owner can always choose not to exercise the option. Hence, the option's price will increase with increases in the underlying asset's volatility. Thus, an option's price will be related to market views about future volatility in the price of the underlying good or asset. However, even more detailed information can be extracted if options are being traded at several different strike prices.

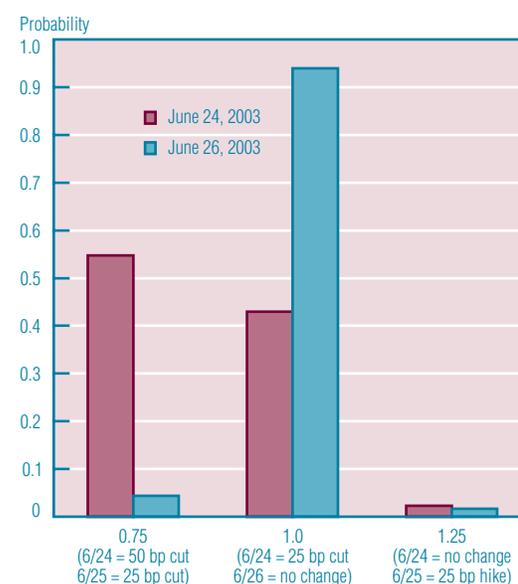
Options prices typically differ across alternative strike prices, a difference that reflects the distribution of underlying opinion. For example, consider two call options, one with a high strike price and one with a low strike price. The option with the low strike price will always be at least as valuable and almost always more valuable than the option with the high strike price because it is more likely that the underlying price will

FIGURE 1 IMPLIED PROBABILITIES FOR ALTERNATIVE JULY TARGET FEDERAL FUNDS RATES

Panel A: May 5 and 7, 2003



Panel B: June 24 and 26, 2003



SOURCE: Probabilities are calculated by the authors using prices from options on July 2003 federal funds futures that trade on the Chicago Board of Trade.

exceed the lower strike price. The bigger the difference between the low and high option prices, relative to the difference in the strike prices, the higher the probability market participants assign to the price of the underlying asset settling above the low strike price but below the high strike price. If, on the other hand, the difference between the low and high options prices is not significantly different from the difference in the strike prices, then market participants see only a small chance of the underlying asset price settling between the two strike prices. Thus, in principle, options written on several strike prices reveal a greater amount of information about market opinion than the single underlying futures price.

Because their underlying prices are based on a deliberative choice, fed funds futures prices will reflect opinion on probabilities of a limited set of outcomes, whereas changes in competitive market prices typically arise from a distribution resembling a bell curve. For example, in early May, market analysts might have conceivably expected three outcomes for the meeting in late June: no change, a 25 basis point cut, or a 50 basis point cut. For each possible outcome there is, in principle, a corresponding probability.

■ Estimating the Probabilities of Policy Outcomes

Panel A of figure 1 reveals estimates of the probabilities for each of these three possible outcomes as reflected in options prices for the July fed funds futures contract on May 5 and May 7, the days prior to and after the FOMC meeting. Given the rarity of intermeeting policy actions, it is reasonable to assume no further action will be taken between the June 25 and the August 12 meetings. Hence, the three outcomes would correspond to average fed funds yields for July of 0.75 percent, 1 percent, and 1.25 percent. Our example, therefore, embodies an assessment in early May of the probabilities for each of the considered outcomes for the forthcoming June meeting.

Interestingly, the implications of our results contrast with the opinion one might draw from a simple assessment based on just the fed funds futures price. For example, because the fed funds futures price on that day was more than halfway between no change and a 25 basis point cut, one might interpret the odds of a cut being greater than 50/50.

Our estimates of the probabilities of a change by July are less than 50/50 in the days around the May meeting. They suggest that the probability of no change in the target rate is about 0.6. The probability of a change is thus 0.4, but if a

change occurs, the market expects a 50 basis point cut to be more likely than a 25 basis point cut. Given that the estimates did not vary substantially between the two days, the statement released at the end of the May 6 FOMC meeting appears to have had no measurable effect on the distribution of opinion about July.

As the June FOMC meeting approached, however, the odds shifted in favor of a rate cut. Panel B of figure 1 shows that our estimates based on options prices the day before the meeting place the highest odds on a 50 basis point cut, with very small probability of no change. After the 25 basis point cut was announced, market participants saw little chance of an intermeeting move that would further change the target rate in July. The odds of remaining at a target of 1.0 percent were greater than 9 out of 10.

The calculations behind figure 1 are subject to some limitations. First, the probabilities shown are recovered under the assumption that market participants are risk neutral or indifferent to risk. That is, the calculations assume that market participants would be indifferent between receiving \$1 in the future and a 50/50 chance of receiving \$0 or \$2 in the future. This may not be problematic if large institutions that are relatively indifferent to risk dominate trading in this market. Second, to simplify the calculations, we assumed that the

options are European when they are actually American. This assumption will have no material impact on the recovered probabilities because, according to options pricing theory, the options used in the calculations were not likely to be exercised early. Finally, and most importantly, the trading volumes for these new option contracts are still relatively small. Trading may not be sufficiently deep to reflect broad market opinion. If the market for these options develops, we could have much more confidence in the probabilities that are recovered.

■ A Promising New Predictor?

The CBOT's new option on fed funds futures has been advertised as quite possibly the best means available to express market opinions about what the Fed might or might not do at the upcoming meetings. Whether the new instrument lives up to such a billing remains to be seen. Nevertheless, options do contain potential information not revealed in futures prices alone. Indeed, under some reasonable assumptions, one may estimate the distribution of opinion on expected policy actions at

upcoming meetings. We offer one such estimate. Though very preliminary, our results suggest that the new option shows promise in revealing a deeper assessment of market opinion.

■ Recommended Reading

Kenneth Kuttner, 2001, "Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market." *Journal of Monetary Economics*, vol. 47, no. 3, pp. 523–44.

Ed Nosal, 2001, "How Well Does the Federal Funds Futures Rate Predict the Future Federal Funds Rate?" Federal Reserve Bank of Cleveland, *Economic Commentary*, October 1.

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Daniel Altman, 2003, "Fed Is Starting to Fret over Falling Prices." *New York Times*, Business Section (Section C), May 9.

Chicago Board of Trade,
<<http://www.cbot.com/>>.

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The views expressed here are those of the authors and not necessarily those of the Federal Reserve Bank of Cleveland, the Board of Governors of the Federal Reserve System, or its staff.

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