CME Group

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CME Group FedWatch Tool - Fed Funds Futures Probability Tree Calculator

Fed Watch Tool's Assumption and Interpretations:

- Probability of a rate hike is calculated by adding the probabilities of all target rate levels above the current target rate.
- Probabilities of possible Fed Funds target rates are based on Fed Fund futures contract prices assuming that the rate hike is 0.25% (25 basis points) and that the Fed Funds Effective Rate (FFER) will react by a like amount.
- FOMC meetings probabilities are determined from the corresponding CME Group Fed Fund futures contracts.

Methodology:

The FedWatch tool calculates unconditional probabilities of Federal Open Market Committee (FOMC) meeting outcomes to generate a binary probability tree. CME Group lists 30-Day Federal Funds Futures (FF) futures, prices of which incorporate market expectations of average daily Federal Funds Effective Rate (FFER) levels during futures contract months. (E.g., the market price of FFU5 reflects the market consensus expectation of the average FFER level during the month of September 2015.) The FFER is published by the Federal Reserve Bank of New York each day, and is calculated as a transaction-volume-weighted average of the previous day's rates on trades arranged by major brokers in the market for overnight unsecured loans between depository institutions.

In the FedWatch tool's probability analysis, the implementation assumes that the size of a rate change is always 25 basis points and that for a given FOMC meeting month, prior or post FF futures contract prices contain information that either is independent of the outcome of that meeting or is solely dependent on that meeting's outcome. Additionally, the FedWatch tool incorporates the assumption that FFER is bounded below by zero. Because the price of each FF futures contract represents the expected average daily FFER for the contract month, if one were in a FOMC meeting month where there was no FOMC meeting in the prior month, then the FF futures price of the previous month contains information independent of the current month's meeting. Likewise, if one were in a FOMC meeting month such that there was no FOMC meeting scheduled for the next following month, then the FF futures price of the following contains only information about the outcome of the current month's meeting. If one assumes that in its current month meeting the FOMC will decide either to raise its daily FFER target or to maintain the status quo, then the probabilities of a rate hike versus no rate hike would be calculated as:

$$P(\text{Hike}) = [\,\text{FFER}(\text{end of month}) - \text{FFER}(\text{start of month})\,] / 25 \text{ basis points}$$

$$P(\text{NoHike}) = 1 - P(\text{Hike})$$

Whether the FOMC sets its target for daily FFER as a level or as a range should not affect either the pricing of FF futures or the calculation of implied probabilities of FOMC meeting outcomes, because calculation is based on a comparison of FFER (end of month) versus FFER (start of month). Provided that changes in the FOMC target levels are of the magnitude of 25 basis points (whether as the change in a given target level or in the location of a target range), the probability of a rate change is relative to the expected End-of-month target versus the expected Start-of-month target.

To calculate unconditional probability of a change in the target at the current month FOMC meeting, the primary consideration is whether there is an FOMC meeting in the month immediately before or in the month immediately after the "current" month. To see this, consider the following examples:

Scenario 1: FOMC meeting in current month where there is no meeting in the month following

N	=	Days in Current Month
M	=	Day(FOMC meeting date) -1
FFER(end)	=	FF contract price for following month (e.g. Meeting in October, V5, FFER(end) = 100 – FFX5)
Implied Rate	=	100 – FF(current month)
FFER(start)	=	(N/M) * [Implied Rate – FFER(end)*((N-M)/N)]

Scenario 2: FOMC meeting in current month where there is no meeting in the month prior

N	=	Days in Month
M	=	Day(FOMC meeting date) -1
FFER(start)	=	FF contract price for previous month (e.g. Meeting in September, U5, FFER(start) = 100 – FFQ5)
Implied Rate	=	100 – FF(meeting month)
FFER(End)	=	(N/(N-M)) * [Implied Rate – (M/N)*FFER(start)]

Example, September 17, 2015 FOMC:

FFQ5	=	99.8675
FFU5	=	99.805
N	=	30
M	=	16
FFER(start)	=	0.1325 (100-99.8675)
ImpliedRate	=	0.195 (100-99.805)
FFER(end)	=	30/14*[0.195 – (16/30)*0.1325] = 0.26643
P(Hike)	=	(0.26643 – 0.1325) / 0.25 = 53.6%
P(NoHike)	=	46.4%

After the FedWatch tool computes the unconditional probability for each known meeting date (as published by the Federal Reserve Board of Governors website), it calculates a binary policy decision tree.

For the first node of the tree, there are probabilities for two outcomes: (1) Maintenance of current target or (2) a change to a different target (25 bps higher or 25 bps lower). In the current example and in subsequent examples, there will only be two outcomes, i.e. hike or no hike, cut or no cut.

* *Based on market commentary and market assumptions the FFER is bounded by zero. As such the scenarios for the second node are as follows: Probability of unchanged FFER at the second meeting, Probability of an increased FFER in the second meeting (or probability of a decrease in the second meeting after an increase in the first), Probability of an increased FFER in the first and second meeting.*

For the second node, assuming that the expectation is for the target rate to be raised or not, then at the second meeting we have the following probabilities: probability of a decreased target rate at the second meeting, probability of an unchanged target rate FFTR at the second meeting, probability of an increased target rate at the second meeting.

The equations are as follows:

P(FFER decreased)	=	Probability(FFER Decrease previous) * (1-Probability of a rate change)
P(FFER unchanged)	=	Probability(FFTR increase previous) * (1-Probablity of a rate change) + (Probability of a FFTR decrease previous) * (Probability of a rate change)
P(FFER increased)	=	(Probability FFTR Increase previous)* (Probability of a rate change)

In the case where the FFER is bounded below by zero:

P(FFER unchanged)	=	Probability(FFER NoHike previous meeting) * (1-Probability of a rate change)
P(FFER first increased on this meeting date, or decreased at second meeting if hike in the first meeting)	=	Probability(FFTR hike previous meeting) * (1-Probablity of a rate change) + (Probability of a FFTR NoHike previous meeting) * (Probability of a rate change)
P(FFER increased this meeting date as well as previous meeting date)	=	(Probability FFTR Increase previous meeting)* (Probability of a rate change)

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