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Special Commentary

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Fed Funds Surprises and Financial Markets: Part 1

Motivation and Executive Summary

With the uncertainty surrounding the first rate hike by the Federal Reserve, the timing and likely impact on financial markets is of the upmost importance to market participants. In this series of reports, we seek to quantify the expected reaction of a fed funds rate shock on several different markets, including Treasury securities, equities and foreign exchange. The effect of unanticipated macroeconomic news on financial markets has been studied extensively in the academic literature.[1] Here, our goal is to replicate the established methodology of prior research and present the current results, although we make our own contributions to the literature as well. We restrict our study to fed funds rate surprises rather than extending to other macroeconomic news in this study because of the importance of the impending liftoff of the federal funds rate from the zero-lower bound.

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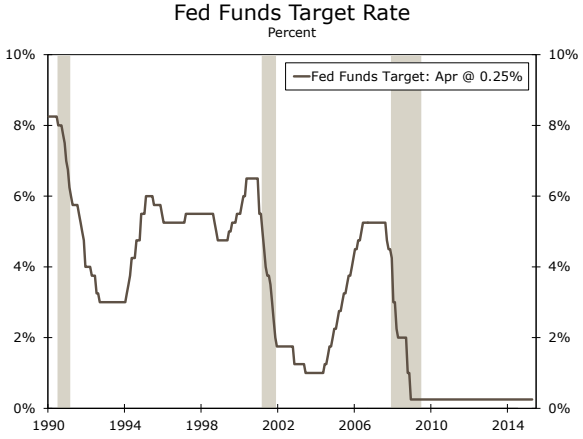
This first installment of the series introduces the concept of a fed funds surprise and develops the theory as to why we employ surprises rather than simply changes to the fed funds target rate. For example, Ben Bernanke's comments in the summer of 2013 caused investors to revise their expectations regarding the path of asset purchases and the fed funds rate, which led to the "taper tantrum." Although our methodology would not capture revisions to the future path of the federal funds rate, the "taper tantrum" still serves as a good example of the role expectations play in asset prices. We also outline the different methods for measuring fed funds surprises, including both survey- and market-based measures. To anticipate our findings, we find the market-based measure is more appropriate for measuring the expected market response to a fed funds surprise. Finally, we end this first report by studying the sensitivity of the dollar exchange rate to fed funds surprises.

Figure 1



Source: Federal Reserve Board and Wells Fargo Securities, LLC

[1] **Barro, Robert. (1981). "Money, Expectations, and Business Cycles."** ***Academic Press.***

Why Use the Surprise Component?

In an efficient financial market, all publicly available information is discounted into prices.[2] This means that market expectations would already be incorporated into prices before any macroeconomic news announcement, and there is substantial literature confirming this claim.[3] In theory, if macroeconomic news were released and perfectly matched market expectations, asset prices would not move because there is no new information. This may not be the case in practice, however, as uncertainty surrounding the event is now resolved and expectations regarding future news releases may be revised, but the literature does offer some support for this claim. Moreover, there still may be trading following a release perfectly matching expectations, as individual market participants may have taken positions differing from consensus expectations. To control for expectations in our analysis, we use the surprise component of the macroeconomic news rather than the actual release value. The surprise component is simply the difference of the actual release from expectations.

Survey- or Market-Based Expectations?

There are two main methods for determining the surprise component of a fed funds rate announcement. The first is to determine market expectations and then calculate the surprise by comparing the actual release relative to expectations. The other method is to look at certain financial assets themselves, which already incorporate expectations regarding the news, and see how their prices change following the announcement. Expectations regarding the fed funds rate are influential in the prices of many financial market instruments, particularly in the money markets. Changes in the prices of these assets immediately following the macroeconomic news announcement reveal the extent to which the news was expected or a surprise, and the surprise component can be calculated from these movements. We believe the market-based measures are more appropriate for our purposes. A third method is to develop a statistical proxy for fed funds expectations. Model selection would be an issue if this method were employed, and we would prefer to measure the surprise using actual data when possible.

There are numerous survey-based methods to gauge financial market participants' expectations for the fed funds rate. Economists at the Federal Reserve Bank of New York outlined several of these, including the Survey of Primary Dealers and the Pilot Survey of Market Participants.[4] In addition, economists' consensus estimates can easily be retrieved from various news outlets and data providers. The surveys are relatively infrequent compared to market-based measures, meaning that additional news between the survey date and the actual announcement date could add noise to the data. In addition, regardless of the survey, some market participants would be excluded, thus the survey results may not accurately reflect expectations of the market as a whole.

We prefer market based measures as they represent a probability weighted average of the possible paths of the funds rate.

Finally, and most importantly, survey-based measures of expectations generally present the modal, or most likely, estimate of the funds rate. We prefer market-based measures as they typically represent a probability weighted average of the possible paths of the funds rate, which can differ from the modal estimate. It is this probability-weighted average that should be discounted into financial assets, since their prices should discount the entire distribution of possible outcomes, not just the most likely.

In addition, the modal estimate does not allow for "partial" surprises, as evident when comparing Figure 2 to Figure 3. As is readily apparent, the survey-based surprises typically have a magnitude of 25 basis points (bps) or 50 bps. Market-based measures, however, can capture more uncertainty around a release and the average surprise has a magnitude of 6 bps. Even if consensus estimates are correct, markets may still react as they priced in a possibility for fed action, and market-based measures of surprises should better account for this reality. This limits

[2] French, E. F. (1969). "Efficient Capital Markets: A Review of Theory and Empirical Work." *The Journal of Finance*, 383-417. This characterizaton is technically the semi-strong form of the Efficient Market Hypothesis proposed by Fama.

[3] Kim, S., McKenzie, M. D., & Faff, R. W. (2004). "Macroeconomic News Announcements and the Role of Expectations: Evidence for US Bond, Stock and Foreign Exchange Markets." *Journal of Multinational Financial Management*, 217-232.

[4] Crump, R., Moench, E., O'Boyle, W., Raskin, M., Rosa, C., & Stowe, L. (2014). "Survey Measures of Expectations for the Policy Rate." *Liberty Street Economics, Federal Reserve Bank of New York*.

the number of surprises and is not as indicative of reality. In addition, money market data are readily available from a number of sources and have a relatively long time horizon.

Figure 2

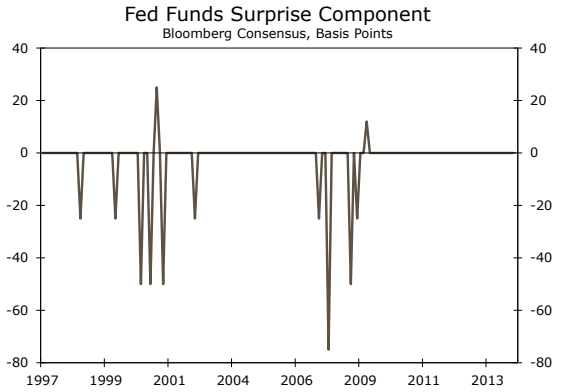
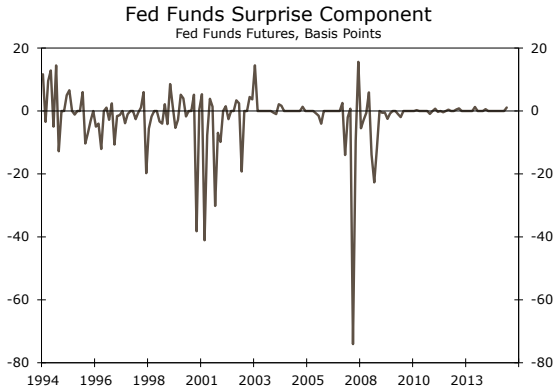


Figure 3



Source: Bloomberg LP and Wells Fargo Securities, LLC

Fed Funds Futures and Expectations

Now that we have decided on a market-based measure, we must decide what instrument is most appropriate for determining expectations regarding a Federal Open Market Committee (FOMC) policy announcement. Gurkaynak, et. al. (2002) studied several different money market instruments—including term fed funds rates, fed funds futures, Eurodollar rates, Eurodollar futures, Treasury Bills and commercial paper—to determine which is best for measuring monetary policy expectations.[5] They find that fed funds futures contracts are superior at predicting the fed funds rate for the short time horizons we are studying. Several other studies similar to ours also utilize fed funds futures contracts and the methodology for extracting the surprise component is more or less standard in the literature and is illustrated in the appendix.[6]

Studies similar to ours also utilize fed funds futures contracts and the methodology for extracting the surprise component is more or less standard in the literature.

We plot the surprise component extracted from the futures contracts above in Figure 3 for the time period 1994 to 2014. At the December 2008 meeting, the FOMC reduced the fed funds rate 75 bps to the current 0-25 bps range. Since this meeting, the FOMC has undertaken numerous unconventional monetary policy measures to meet its objectives, and market participants are only now beginning to anticipate liftoff from the zero lower bound on the horizon. For this reason, we suspect that the small surprise readings seen following this meeting were mostly noise associated with the futures data and decided to truncate our dataset at the end of 2008. Note that there were "shocks" to market expectations for the funds rate during this period, most notably the "Taper Tantrum" in 2013. As we mentioned earlier, however, this only caused agents to revise expectations for the funds rate further out into the future, and thus would not be captured in this study. We will study the "Taper Tantrum" more specifically in the future.

We partition our dataset to study how fed funds rate surprises affect different markets before and during the crisis. Our definition for the beginning of the crisis is the first time the FOMC reduced interest rates for the cycle, which was at the September 2007 meeting.

Table 1

Fed Funds Surprises Summary Statistics		
	Count	Mean Surprise
All Surprises	84	(3.4)
Positive Surprises	34	5.1
Negative Surprises	50	(9.1)

Source: Bloomberg, LP and Wells Fargo Securities, LLC

[5] Gurkaynak, R. S., Sack, B., & Swanson, E. (2002). "Market-Based Measures of Monetary Policy Expectations." *Federal Reserve Board of Governors*.

[6] We used announcement dates provided in the paper "Monetary Policy Tick-by-Tick" by Fleming & Piazzesi (2005) from 1994-2004. From 2004 on, the meeting dates were obtained from Bloomberg, LP.

Fed Funds Surprises and the Dollar

To conclude this introductory review, we study the sensitivity of the trade-weighted dollar to surprises in the fed funds rate. The interest rate differential between two countries is a large driver of the exchange rate. Thus, we suspect that unexpected moves in the federal funds rate would also drive moves in the dollar around these announcements. We hypothesize that an unexpected positive shock in the fed funds rate would, on average, be associated with a strengthening of the dollar, as dollar-denominated assets are relatively more attractive to investors. Of course this works well in theory, but further investigation is required to see if this is what happens in reality surrounding fed funds surprises.

To investigate the response of the dollar to fed funds shocks, we use an event-study approach. We regress the percent change in the dollar index around fed funds surprises on the unexpected component of announcements in the federal funds target rate. This analysis was similar to that conducted by Charles Evans of the Chicago Fed.[7] The Chicago Fed study found that the dollar/mark and dollar/yen exchange rates were affected by the unexpected component of a fed funds rate announcement, although this effect was not evident until a large amount of time had passed. Our analysis would not capture this delayed effect, since we are looking at daily returns around the event.

Table 2

Full-Sample Results		
	Intercept	Sensitivity
Trade-Weighted Dollar	(4.6)	18.2
Major Currency Index	(5.4)	61.0

Source: Federal Reserve Board and Wells Fargo Securities, LLC

Clearly the relationship is more complicated than we initially thought.

Our findings, shown above, support Evans' result immediately following the event, which was that fed funds surprises have an insignificant effect on the dollar initially. This was at odds with our initial hypothesis, which suggested that the dollar would strengthen immediately following a positive fed funds surprise. An alternative explanation could be the signaling effect that is contained in the unexpected component of a fed funds rate announcement cancels out, on average, the effect caused by interest rate differentials. It is plausible that news contained in a federal funds surprise could cause investors to revise their expectations regarding the domestic economy. Because of the size of the U.S. economy, this may have large implications on the global economy, which could change investors' risk preferences. For example, an unexpected rate cut could signal the economy is weaker than many thought, which could ignite fears regarding the global economy and cause a flight to safety to the dollar. Clearly the relationship is more complicated than we initially thought, and the insignificant sensitivity of the dollar to fed funds surprises confirms this. Investigating the subsamples before and during the crisis also yielded similar insignificant results. In addition, we checked for asymmetric responses to see if the dollar responded differently to positive versus negative surprises. We found that the sensitivity of the dollar was still insignificant.

Sensitivity of Financial Markets

In the remaining reports of the series, we will study the effect that fed funds rate surprises have had on various other financial assets. The purpose of this paper was to explain our measure of federal funds surprises and introduce the methodology through a study of the sensitivity of the dollar to fed fund surprises. In future reports we will investigate the sensitivity of Treasury securities and broad equity indices to the unexpected component of a fed funds rate announcement. This should give us insight to the behavior of these financial markets surrounding the impending rate hike and we attempt to quantify their reaction to surprises, both positive and negative.

[7] **Evans, Charles L. (1994). "The Dollar and the Federal Funds Rate"** ***Chicago Fed Letter*****.**

Appendix: Calculating the Surprise

Following the literature, Kuttner (2001) and Bernanke & Kuttner (2004), we utilize the fed funds futures market to calibrate the surprise component of changes in the fed funds rate.[8] Because the contracts represent the expected fed funds rate during the month, for a given event on day d of month m, the surprise component can be calculated as the change in the fed funds futures.[9] Recall, however, that the contract represents the average fed funds rate, thus, the change in the futures must be multiplied by a scaling factor, including the number of days left until settlement. To summarize, the unexpected change in the target rate, following Bernanke and Kuttner (2004) can be calculated as follows:

$$\Delta i^u = \frac{D}{D-d}\left(f^0_{m,d} - f^0_{m,d-1}\right)$$

where Δi^u is the surprise component of the fed funds target rate change, $f^0_{m,d}$ is the current-month futures rate on day d, and D is the number of trading days in the month.[10] An additional complication is that the fed funds futures are based off the effective fed funds rate while we study expectations regarding the target rate. Kuttner (2001) and Bernanke & Kuttner (2004) both point out this is generally not an issue except around the end of the month because of the increased scaling factor and the magnified effect any noise may have. For this reason, the unscaled one-month ahead futures rate is utilized to determine the surprise when the change is in the last three days of the month. In addition, if the announcement is on the first day of the month, we correct for the fact that the one-month ahead futures rate is now the current futures rate (substitute $f^1_{m,d-1}$, the one-month ahead futures contract, for $f^0_{m,d-1}$ in the above equation).

[8] Bernanke, B. S., & Kuttner, K. N. (2004). What Explains the Stock Market's Reaction to Federal Reserve Policy? *Federal Reserve Bank of New York Staff Reports no. 174*.

[9] We use the 30-day fed funds futures offered by the CME Group. Our analysis is restricted to the time period 1994-2014. The futures are quoted as 100 minus the average daily effective fed funds rate. The last trading day for the active contract is the last business day of the month. Contracts are cash settled on the first business day following the last trading day. We used the generic first future data series from Bloomberg.

[10] Bernanke & Kuttner (2004).

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