The Dollar Ahead of FOMC Target Rate Changes[*]

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Abstract

I find that the U.S. dollar appreciates over the two-day period before contractionary monetary policy decisions at scheduled Federal Open Market Committee (FOMC) meetings and depreciates over the two-day period before expansionary monetary policy decisions. The federal funds futures rate forecasts these dollar movements with a 22% R^2. A high federal funds futures spread three days in advance of an FOMC meeting not only predicts the target rate rise, but also predicts a rise in the dollar over the subsequent two-day period. A simple trading strategy, which exploits this predictability, exhibits a 0.93 Sharpe ratio. My findings imply that information about monetary policy changes is reflected first in the fixed income markets, and only later becomes reflected in currency markets.

JEL codes: F31, G12, G17, E52.

Keywords: exchange rates, monetary policy, federal funds futures, predictability.

The foreign exchange (FX) market is the world's largest financial market, with a daily trading volume of more than 5 trillion USD (Bank of International Settlements 2016). Given the size of the market, and the influence exchange rates can have for other prices, it is important to better understand FX movements. A long-standing puzzle in international economics is the difficulty of tying exchange rates to macroeconomic fundamentals, such as money supply, output, and interest rates (Engel and West 2005). Meese and Rogoff (1983) and others have found that in the short run a random walk forecasts exchange rates better than macroeconomic models, suggesting that macro-related variables are not important when forecasting currency prices.[1]

In this paper, I study how FX markets incorporate market participants' expectations of monetary policy changes prior to the scheduled meetings of the Federal Open Market Committee (FOMC). Federal funds ("fed funds") futures and U.S. money market rates rise ahead of time and signal the anticipated monetary policy change with a high accuracy. I document that the same phenomenon occurs in FX markets: the dollar exchange rate (relative to a basket of other currencies) rises in the two days ahead of an FOMC meeting that announces a rate rise, and falls in the two days ahead of a rate cut. Fed funds futures markets move earlier than FX markets. My central finding is that, since 1994, a high federal funds futures spread (over the target) three days in advance of a scheduled FOMC meeting not only predicts a target rate rise, but also predicts a rise in the dollar that will take place in the subsequent two days up until the announcement. The R^2 of the latter predictive relation is 22%. Thus, information about the monetary policy change is captured first by the fed funds futures markets and is reflected only later in currency markets. I show that a currency trader can easily exploit the predictability of the dollar prior to an FOMC announcement. A simple trading strategy that *(1)* goes long the dollar two days prior to the announcement, when the fed funds futures signal a target rate rise, and *(2)* goes short the dollar two days prior to the announcement, when the futures signal a target rate cut, exhibits a 25 bps average excess return, with an annualized Sharpe ratio of 0.93.

My findings pose a puzzle for frictionless models of exchange rate determination that rely on rational expectations. Even though the direction of the movement of the exchange rate in response to monetary policy expectations is in line with the prediction by the standard exchange rate models (e.g., Fleming 1962), the speed at which these movements occur is not aligned across the bond and exchange rate markets: bond markets incorporate information faster than exchange rate markets do. This is surprising given how liquid exchange rate markets are.

This paper contributes to the macroeconomics and finance literature in two ways. First, my findings contrast the exchange rate disconnect and predictability puzzles, as I show that mon-

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[1]Obstfeld and Rogoff (2001) refer to the weak relation between the exchange rate and macroeconomic fundamentals as the "exchange rate disconnect"puzzle.

etary policy expectations signaled by the fed funds futures explain a one-fifth of the variation in currency returns prior to the scheduled FOMC meetings. Second, my results integrate fixed income and currency markets. In particular, I show that these markets absorb information about a monetary policy change at different speeds. This suggests a failure of the efficient-market hypothesis (Fama 1970). I argue that the asynchrony between markets in the days prior to the FOMC announcement is due to limited investor attention and/or a form of market segmentation, as I find that lagged fed funds futures rates forecast currency returns.

According to the interest rate puzzle, over short-term horizons a currency with higher interest rate tends to earn an excess return (e.g., Fama 1984). I show that standard currency risk premiums (e.g., interest rate differentials) *do not* forecast the FX returns prior to the FOMC meetings, when the fed funds futures signal a policy change. Prior to these meetings, the currency predictability arises from the direction of the U.S. monetary policy expectations, signaled by the fed funds futures spreads. There are no monetary policy speeches or interviews by FOMC members (known as a blackout period) in the last days prior to the FOMC announcement. Market participants divine monetary policy actions several weeks prior to an FOMC announcement, as evidenced in the fixed income markets. Changes in the fed funds futures, money market, and Treasury yields are negligibly small in the two days prior to an FOMC meeting. The flow of new information is low in the pre-FOMC window as compared to the time of the announcement or other days. The intraday realised volatility and illiquidity do not rise in the two-day pre-FOMC period. The key challenge for the risk-based explanations of the pre-FOMC dollar returns is this disconnect between the time when the dollar returns are earned and when the news is revealed.

I discuss how limited risk-bearing capacity and market segmentation might partly explain my findings of the predictable dollar changes ahead of the FOMC announcements. Consistent with the theories on limited investor attention and infrequent portfolio rebalancing (e.g. Duffie 2010), currency investors may not pay enough attention to fed funds futures expectations of the Fed's policy change earlier than in the last days prior to the FOMC announcement. A stale (i.e., three-week lagged) fed funds futures spread forecasts the two-day pre-FOMC dollar return almost as well as the fed funds futures spread recorded three days prior to the announcement. At the same time, the number of Fed-related articles in *The Wall Street Journal* and *The Financial Times* rises exactly two days prior to the FOMC announcement. It is possible that investors who are relatively inattentive to the FFF market most of the time become more attentive as a result of this increased salience of the upcoming FOMC meeting. A part of the effect might come from the investor overreaction before an announcement as indicated by the partial reversal in the two days following the announcement. However, the evidence for the reversal is weak, as it is mostly a feature of the crisis.

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I also show that the pre-FOMC dollar return is higher in times when the FX implied volatility is higher. Almost all pre-FOMC announcement effect comes from the meetings, ahead of which it is more risky to enter the currency market, as implied by the volatility of the short-term currency options. Thus, even if all investors are attentive to the market expectations of the Fed's policy change, they may not be willing to trade on this information too far ahead of the FOMC meeting in order to avoid exposure to shocks unrelated to the forthcoming FOMC announcement. When there are only a few days left, the disruptive risks are low enough to start trading the dollar into the direction predicted by the fed funds futures. I find that the pre-FOMC announcement dollar drift mostly comes from times when the implied volatility from currency options is large. While currency investor risk aversion might be a potential explanation of my findings, it would require the presence of market segmentation as I do not find the same effects when I instead use the implied volatility measures from the bond (or stock) markets.

My paper is related to the literature on currency predictability and connection between FX returns and macrofundamentals. Meese and Rogoff (1983) find that a random walk forecasts currencies better than fundamental variables. Evans and Lyons (2005) document that FX order flow forecasts currency movements. Lustig, Roussanov, and Verdelhan (2011) suggest two asset pricing factors to explain currency movements: *RX*, average return of currencies quoted against dollar (dollar index in my paper) and *HML*, a portfolio long high interest currencies and short low interest rate currencies. The *HML* factor does not exhibit directional movements ahead of the FOMC. Lustig, Roussanov, and Verdelhan (2014) show that average forward discounts (interest rate differentials) forecast currency returns.

My paper is also related to recent studies documenting interesting patterns in the returns for different asset classes on the FOMC days and during the hours ahead of an FOMC announcement. Lucca and Moench (2015) document large excess returns on US. equities and other stock markets ahead and on the days of FOMC announcements. They find that about half of the realized excess stock market returns are earned during the 24-hour pre-FOMC window. The authors refer to this pre-FOMC announcement drift as a puzzle because none of risk-based theories they discuss matched empirical evidence. Savor and Wilson (2014) argue that investors demand higher returns to hold higher-beta assets on the days when investors expect to learn important information about the economy. They find that the capital asset pricing model holds on the days when employment, inflation, and FOMC releases are scheduled to be announced. Cieslak, Morse, and Vissing-Jorgensen (2018) document that excess stock returns over Treasury bills follows a bi-weekly pattern over the FOMC meeting cycle. Mueller, Tahbaz-Salehi, and Vedolin (2017) find that FX rates exhibit large *unconditional* excess returns on the days of scheduled FOMC announcements and relates the results to monetary policy uncertainty.

My paper complements the above-mentioned studies as I document that the direction of the pre-FOMC dollar returns depends on the direction of the anticipated target rate change (as signaled by the fed funds futures). My findings imply that prices in one market (fixed income) contain superior information about the forthcoming monetary policy change as they forecast prices in another market (foreign exchange). Relatedly, Neuhierl and Weber (2017) recently document that a slope factor from weekly changes in federal funds futures of different horizons predict stock returns. Dong Lou and Zhang (2013) show that Treasury security prices decrease significantly in the few days before Treasury auctions and recover shortly thereafter. They link these results to dealers' limited risk-bearing capacity and end-investors' imperfect capital mobility.[2]

1. Data

My primary dataset spans the period from January 1994 through December 2015. I use two sources of the FX data: Olsen Associates and WM/Reuters (WMR). Olsen Associates provided five-minute quoted bid and ask prices on four most-traded FX rates (EUR/DEM before 1999, CHF, JPY, GBP) quoted against the U.S. dollar (USD). These four currency pairs cover over almost a half of global foreign exchange market turnover (Bank of International Settlements 2016). WMR provided daily spot and 1-month forward prices on G10 currencies (AUD, CAD, NOK, NZD, and SEK in addition to the four FX rates from Olsen) for the same period. I use WMR to check the robustness of my results and to construct currency excess returns. WMR daily bid and ask prices are recorded at 11:00 EST.

The log spot prices s_t^i are quoted in units of foreign currency i per 1 USD. The simple currency return from $t-j$ to t is the log difference of spot prices, $r_{t-j \to t}^i = s_t^i - s_{t-j}^i$. Positive currency return stands for dollar appreciation. The dollar return, $DOL_{t-j \to t}$, is the simple average return across single currency returns. See more detailed definitions in the Internet Appendix.

The FOMC, the monetary policy body of the Fed, conducts eight scheduled meetings per year. In total, there have been 176 scheduled FOMC meetings from 1994-2015, including 31 contractionary (target rate rises), 23 expansionary (target rate cuts), and 122 neutral (unchanged target rate). The target rate decision is announced between 14:10 and 14:20 GMT, according to *Bloomberg* or *Dow Jones* newswires. The schedule of meetings is announced ahead of time.[3]

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[2]While I do relate my findings to FX dealers' limited risk-bearing capacity, my evidence of this friction is suggestive as my evidence for the post-announcement reversal is weak.

[3]See detailed timing for each FOMC announcement in Lucca and Moench (2015), Table IA.I.

Prior to 1994, market participants inferred FOMC actions based on the size and type of open-market operations, which were announced the day or two days following the scheduled FOMC meetings.

I use daily fed funds futures (fff) from Chicago Mercantile Exchange (CME) as the main measure of market expectations several days prior to the FOMC announcement. I compute the target rate implied by the next-month futures j days ahead of the scheduled FOMC announcement, $E_{t-j}^{fff}[FFR_t] = 100 - fff_{t-j}$, where FFR_t is the fed funds target rate after the FOMC announcement has occurred at t, fff_{t-j} is the price of the next-month Fed funds futures at j days prior the FOMC announcement.[4]

2. Main Results

I first show that the dollar, on average, appreciates during the two-day period prior to an FOMC announcement to raise the target rate and depreciates during the two-day period prior to an FOMC announcement to cut the target rate. I then extract the anticipated policy change from the fed funds futures three days ahead of the scheduled FOMC meetings. I show similar directional pre-FOMC dollar movements ahead of the announcements, when the policy change is ex ante predicted by the fed funds futures. Finally, I document that a high fed funds futures spread over the target three days in advance of a scheduled FOMC meeting predicts a rise in the USD that will take place in the subsequent two days.

2.1 Dollar Around Realized Target Changes

I first provide an event-study graph of the cumulative 5-minute dollar returns around the realized FOMC announcements. *Panel A* of Figure 1 depicts the average 5-minute cumulative dollar returns in a five-day window around 31 target raises and 23 target cuts. This graph uses ex post information on the Fed's actions and I do not take any ex ante market expectations into account.

The event window begins at 00:00 EST two days ahead of the scheduled FOMC meetings and ends at 23:55 EST two days after. *Panel A* of Figure 1 indicates that the USD on average depreciates during the two days ahead of an FOMC announcement to cut the target. The USD's

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[4]The results are similar when I use the adjusted version of the Fed funds futures, which takes into account the exact timing of each FOMC meeting. I use the unadjusted version for the sake of simplicity. My results are robust to accounting for a 2 basis point estimated risk premium in the next-month fff (p. 686 in Piazzesi and Swanson, 2008)

Panel A. Dollar around realized cuts and rises

Panel B. Dollar around realized neutral announcements
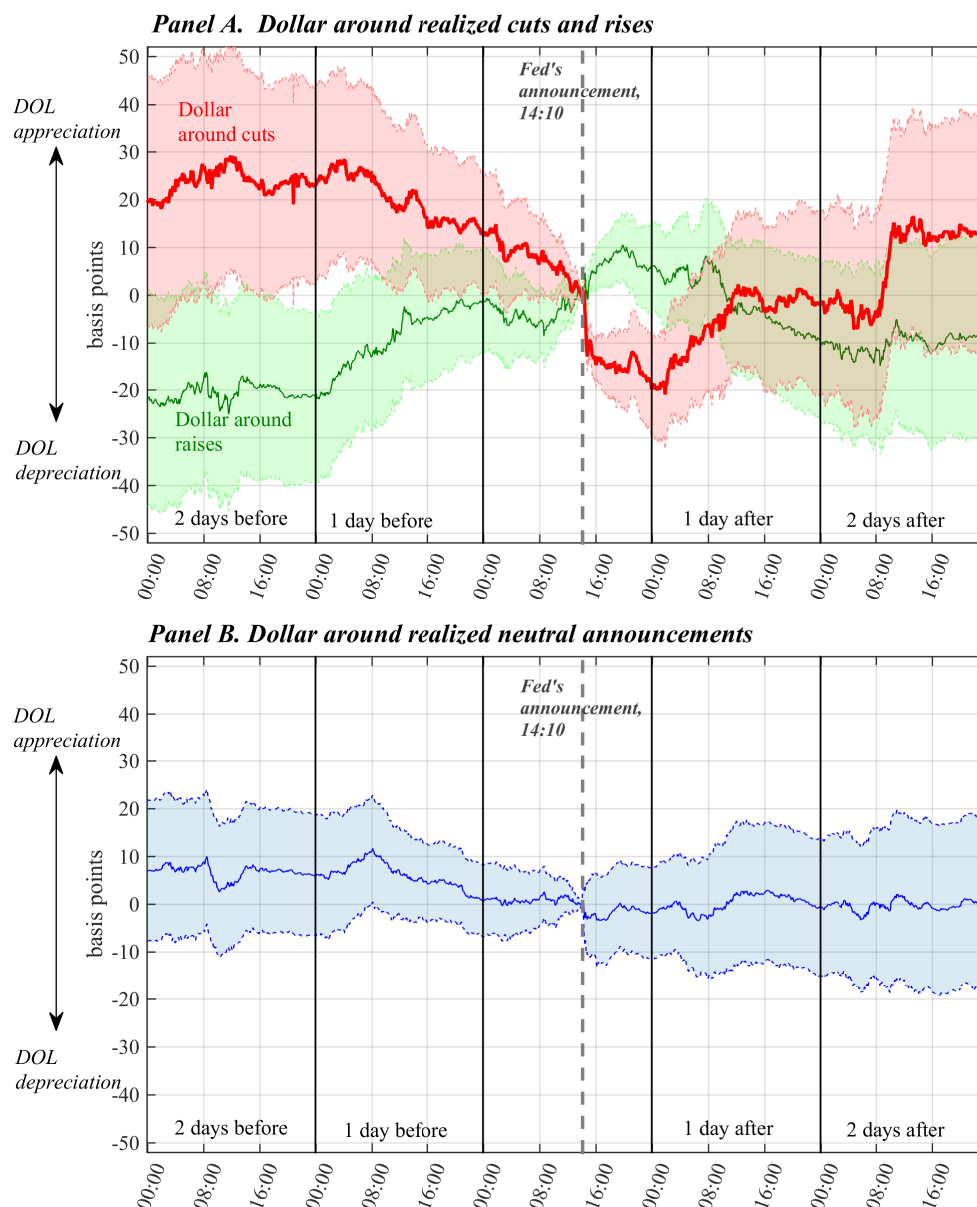
Figure 1: **Dollar around FOMC decisions.** *Panel A* shows average five-minute cumulative dollar returns around 31 target rate rises (bold/green line) and 23 target rate cuts (thin/red line). *Panel B* shows average 5-minute cumulative dollar returns around 122 neutral FOMC decisions. The dotted lines depict pointwise 90% confidence bands around the average cumulative returns returns. I cumulate the average standard error of a pre-FOMC (post-FOMC) 5-minute return and divide it by the square root of the number of considered events to derive the confidence band around cumulative returns before (after) the announcement. I normalize cumulative returns to zero before the announcement. I compute confidence bands around the cumulative returns on the left and on the right starting from the announcement. The dollar returns are equal-weighted five-minute EUR, GBP, CHF, and JPY returns versus the USD.

downward drift begins the morning before the announcement and continues until the announcement occurs. Before 14:00 EST, the USD loses on average 33 bps (18 bps excluding five rate cuts in 2008). The USD drops by 14 bps over the two hours following the announcement. This downward movement in the dollar on impact is largely driven by the negative reaction to the few larger-than-expected rate cuts. A similar, but reversed phenomenon occurs during the two days prior to an FOMC announcement to raise the target rate. Starting in the evening two days prior to the announcement, the USD begins to appreciate, rising by 25 bps by the time of announcement. The difference between the pre-FOMC USD return ahead of target rises and cuts is 58 bps with a *t*-stat=3.5.

The main paper's result that the USD return prior to target rises is statistically different from the USD return ahead to target rate cuts is robust to alternative definitions of the dollar. The difference for the two-day pre-FOMC equal-weighted return, based on G10 FX pairs (daily data from WMR recorded at 11:00 EST) is 53 bps with a *t*-stat=2.9. The result is similar for the currency quotes from Bloomberg, alternative weighting schemes to construct the USD return (i.e., trade-weighted, or volume-weighted), and for excess returns instead of simple returns.[5]

Panel B of Figure 1 indicates a slight 5 to 10 bps downward movement in the dollar during the two days prior to neutral FOMC actions and close to zero returns after the announcement. This result is in line with Mueller, Tahbaz-Salehi, and Vedolin (2017), who relate *unconditional* dollar depreciation prior to an FOMC announcement to monetary policy uncertainty.[6]

Table 1 shows the results of a high-frequency decomposition the dollar returns around the policy moves: (1) *pre-FOMC*, 14:00 two days prior to the announcement to 14:00 on the announcement day, (2) *on impact*, 14:00 to 16:00 on the announcement day, (3) *post-FOMC*, 16:00 on the announcement day to 14:00 on the second day after the announcement

The difference between the pre-FOMC USD return ahead of target rises and cuts reduces from 58 bps to 41 bps after excluding target rate cuts during 2008 financial crisis and target rate raises during a turbulent 1994. The *t*-stat of the difference goes down from 3.4 to 3.0.

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[5]FX returns based on high-frequency quotes from Olsen Associates have over 98% correlation with the FX prices from WM/Reuters or Bloomberg, recorded at the same time. Also, different versions of the dollar return (i.e. based on EUR, GBP, CHF, JPY, vs G10 currencies, trade-weighted vs equal-weighted) have over 85% correlation between each other. The interest rate differential for the two-day period is usually smaller than 2 bps, therefore results for currency excess returns are virtually the same as results for simple returns: both in the magnitude and in the significance. See Internet Appendix for details.

[6]Mueller, Tahbaz-Salehi, and Vedolin (2017) do not split their sample to the actual target rate raises and cuts (which are different from the surprise movements in the fed funds futures on impact). They also do not study the predictive power of fed funds futures for the pre-FOMC dollar returns. In the next subsections, I show that the pre-FOMC dollar returns are *conditional* on the ex-ante monetary expectations, embedded in the fed funds futures.

	Pre-FOMC		On Impact		Post-FOMC	
	$DOL_{t-2,14:00 \to t,14:00}$		$DOL_{t,14:00 \to t,16:00}$		$DOL_{t,16:00 \to t+2,16:00}$	
Panel A. Full sample, 1994 – 2015						
31 Raises	**24.6**	[2.2]	4.6	[0.8]	-16.0	[-1.4]
23 Cuts	**-33.2**	[-2.2]	-13.6	[-1.7]	25.8	[1.6]
Difference	**57.8**	[3.4]	18.2	[1.7]	**-41.7**	[-2.0]
Panel B. Excluding 1994 and 2008						
25 Raises	**23.6**	[2.2]	-0.3	[-0.1]	-8.0	[-0.7]
18 Cuts	**-17.7**	[-2.0]	**-11.1**	[-2.2]	12.1	[0.8]
Difference	**41.3**	[3.0]	10.8	[1.2]	-20.1	[-0.9]

Table 1: **Average Dollar Returns around Realized *FFR* Changes.** This table shows the average USD returns around the Fed's decisions to change the target rate. I decompose average dollar returns around the FOMC into three components: *(1) Pre-FOMC*, from 14:00 two days prior to the announcement to 14:00 on the announcement day (same as $DOL_{t-2 \to t}$), *(2) On impact*, from 14:00 to 16:00 on the announcement day, and *(3) Post-FOMC*, from 16:00 on the announcement day to 14:00 on the second day after the announcement. I compute average dollar returns around 31 raises and 23 cuts at the scheduled meetings between 1994 and 2015. I also compute the difference between these averages for each of three components (see "Difference"). The *t*-statistics for the averages and for a test of difference in averages are reported in brackets. Bold numbers are statistically significant at 5% level. The return numbers are expressed in basis points (simple return multiplied by 10'000).

The USD returns on impact are slightly positive for target rate raises (5 bps with a 0.8 t-stat) and negative for target rate cuts (-14 bps with a -1.7 *t*-stat). The latter number is driven by the fact that there were a few larger-than-expected cuts in the sample. The difference between the returns for raises and cuts on impact is 18 bps with a 1.7 *t*-stat.

The average post-FOMC USD returns are negative (-16 bps) for the rises and positive (26 bps) for the cuts. The post-FOMC returns are driven by a few outliers, occurring in the crisis 2008 and the turbulent 1994. In particular, the spike in the level of average post-FOMC USD return around the target cuts at 10:00 EST on the second day after the FOMC announcement is entirely driven by one data point: a better-than-expected manufacturing report on Feb 1, 2008. (The report stated that Jan 2008 manufacturing activity moved to a reading of 51 versus a 47 expected.) The report came out two days after a 50 bps target rate cut on Jan 30, 2008 and caused an immediate 80 bps jump in the dollar. Excluding 1994 and 2008 reduces the difference between the post-FOMC USD returns for the rises and cuts to -20 bps (-0.9 *t*-stat), which is twice lower than the 41 bps (3.0 *t*-stat) difference between the pre-FOMC USD returns for the rises and cuts. I study the relation between the pre-FOMC and post-FOMC dollar returns in more detail in Subsection 3.1.

The pre-FOMC USD returns account for a sizeable share in the total dollar variation over 1994–2015. Excluding the two-day periods prior to the target rate raises (cuts) from my sample suggests that the USD would have been 6% weaker (10% stronger) by the end of the sample. These two-day pre-FOMC periods cover 114 days and represent less than 2% of the total number of days in my sample (3760).

In sum, Figure 1 and Table 1 illustrate the first finding in my paper: *(1)* the USD on average depreciates (appreciates) during the two days ahead of the realized expansionary (contractionary) announcements, *(2)* the difference between the two pre-FOMC USD movements is over 40 bps and is statistically significant. The dollar extends its movements on impact and partially reverts in the two days following the announcement, but these effects are statistically insignificant as I exclude turbulent periods.

How predictable are the announced policy moves in 1994–2015? A signal extraction about the likelihood of the forthcoming target rate change *three days ahead* of the Fed's scheduled meeting would help to predict the USD appreciation or depreciation before the announcement.

2.2   Dollar Ahead of Target Rate Changes, which are Predicted by Fed Funds Futures

I use the target rate change implied by the next-month fed funds futures j days prior to the FOMC announcement to extract a signal of the Fed's most likely action at the upcoming announcement. I write the fed funds futures spread over the target as the difference between the expected target rate encoded into fff_{t-j} and the fed funds target rate valid at $t-j$:

$$E_{t-j}^{fff}\left[\Delta FFR_t\right] = E_{t-j}^{fff}\left[FFR_t\right] - FFR_{t-j}. \tag{1}$$

This spread signals market expectations of the monetary policy action at the upcoming FOMC announcement. I use a simple rule to extract the predicted action at $t-j$:

- If $E_{t-j}^{fff}\left[\Delta FFR_t\right] \geq 12.5$ bps, fff_{t-j} forecasts a target rate raise,

- If $E_{t-j}^{fff}\left[\Delta FFR_t\right] \leq -12.5$ bps, fff_{t-j} forecasts a target rate cut,

- If $\mid E_{t-j}^{fff}\left[\Delta FFR_t\right] \mid < 12.5$ bps, fff_{t-j} forecasts no target rate change.

I justify a 12.5 bps threshold by the fact that since 1994 the minimum size of the policy change, $\mid \Delta FFR_t \mid$, is 25 bps. If the expected target rate change as measured by $E_{t-j}^{fff}\left[\Delta FFR_t\right]$
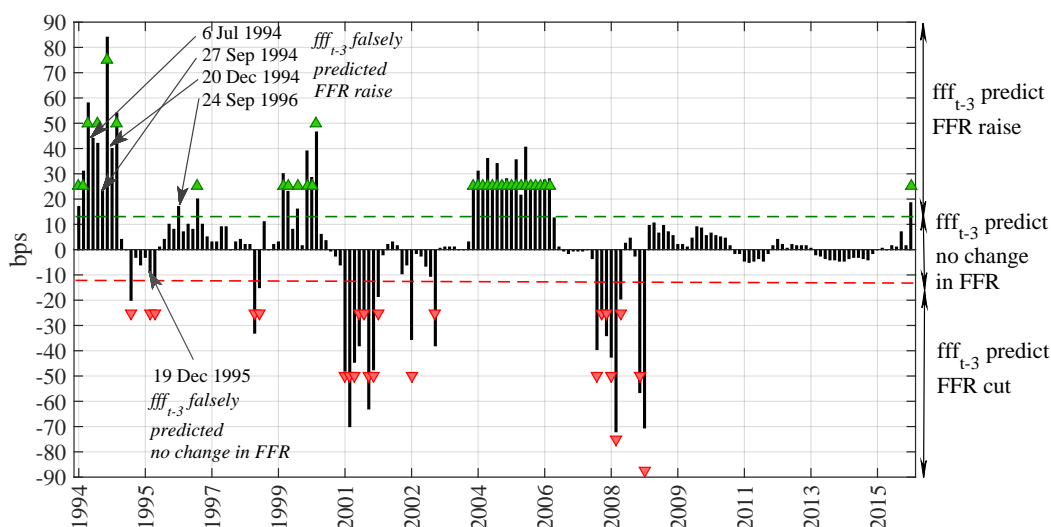
Figure 2: *FFR* **change encoded into the fed funds futures at** $t-3$ **and realized** *FFR* **change.** In the figure, I plot $E_{t-3}^{fff}[\Delta FFR_t]$ (black bars) along with the realized target rate changes at the announcement (raises in green, cuts in red). The target rate change expected by fff_{t-3} is caluclated using equation (1). The sample covers 176 scheduled FOMC announcements over 1994–2015.

is just a few basis points, the likelihood of a policy change at the upcoming FOMC announcement is very low. Similarly, $E_{t-j}^{fff}[\Delta FFR_t]$ being close to 25 bps signals a high likelihood of a target rate increase.[7]

In Figure 2, I plot the size of the expected target change three days in advance of each scheduled FOMC meetings (black bars) along with the realized target change at the scheduled FOMC meeting at t. Fed funds futures are wrong about the future policy move only five times over 1994–2015. All of these occasions happened in the early part of the sample: four false predictions of a target rate increase in 1994–1996 (no change realized) and one false prediction of no target rate change in 1995 (target cut realized).[8] Prior to most policy changes, the fed funds futures spread is well above the 12.5 bps threshold, indicating that accuracy of the predictions based on fff_{t-3} is high. In the Internet Appendix, I show that $E_{t-3}^{fff}[\Delta FFR_t]$ predicts both

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[7]I do not define the likelihood of the target change as $E_{t-j}^{fff}[\Delta FFR_t]$ divided by 25, because the expected target change might exceed 25 bps. This would translate into the probability of the target rate raise in excess of 100%, but in fact might only reflect that futures predict a target change of an amount greater than 25 bps. Note that we do not know the exact size of the realized target rate (25, 50, or 75 bps) change ex ante. Also, increasing or reducing the 12.5 bps threshold by several basis points does not significantly affect my results.

[8]A false target rate increase predictions happened ahead of the following meetings: 6 July 1994 (target stayed at 4.25%), 27 September 1994 (4.75%), 20 December 1994 (5.5%), 24 September 1995 (5.25%). Three days prior to these FOMC meetings, the futures spreads over the target were 43, 23, 41, 16 bps, respectively, well above the 12.5 bps threshold. The Fed unexpectedly cut the target rate on 19 December 1995. Three days ahead of this decision, the futures spread was -10 bps, thus not low enough to signal a cut.
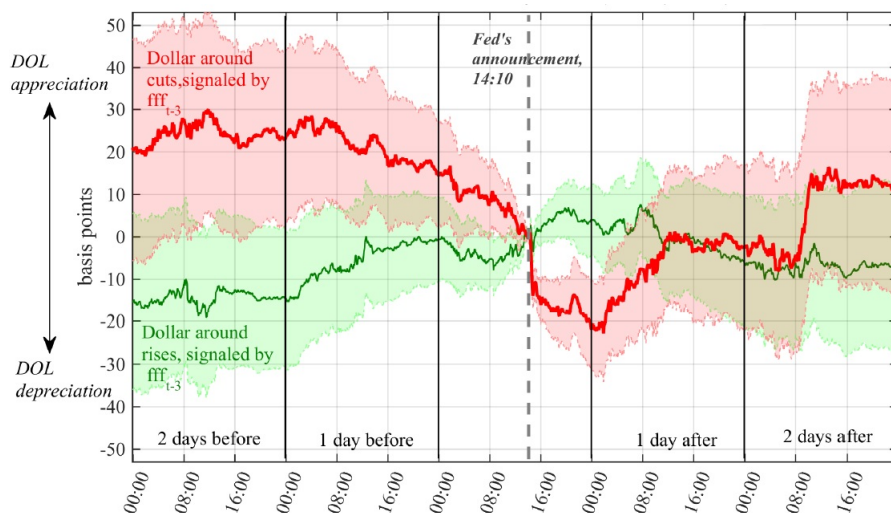
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Figure 3: **Dollar Around FOMC Rate Changes, ex ante Signaled by the Fed Funds Futures.** The figure shows average 5-minute cumulative dollar returns around 35 target rate rises, predicted by the fed funds futures (bold/green line) and 22 target rate cuts, predicted by the fed funds futures (thin/red line). The predictive signal is extracted from the fed funds futures three days prior to an FOMC announcement. See details on the construction of the dollar returns and confidence bands in the caption to Figure 1. The sample is January 1994 – December 2015.

the size and the direction of the realized FFR change with a 74% and 88% R^2, respectively. I also show that 3-, and 6-month fed funds futures are almost as predictive of the target rate as the next month futures, while the spreads of the LIBOR and Treasury yields are less predictive of the policy change.

I extract the policy change expectations from the fed funds futures three days prior to each scheduled FOMC meeting. I then plot the average cumulative USD returns around the predicted target rate rises and cuts. Policy change expectations barely change in the last two days prior to the FOMC announcement. If the efficient-market hypothesis holds, the USD returns should be on average zero as soon as we control for the ex ante expectations of the target rate change. However, Figure 3 illustrates that the dynamics of the USD returns is almost identical to *Panel A* of Figure 1. The USD moves in the direction of an anticipated policy change, even though it has been already priced in the fed funds futures markets.

The dollar goes up on average by 20 bps during the two days prior to the FOMC announcement, when futures signal a target rise. The dollar drops, on average, by 32 bps prior to the announcement when the fed funds futures signal a target rate cut. These numbers are slightly smaller than the dollar returns ahead of the realized target rate rise (25 bps) and cut (33 bps). This is not surprising given that the fed funds futures are inaccurate only five times in signaling
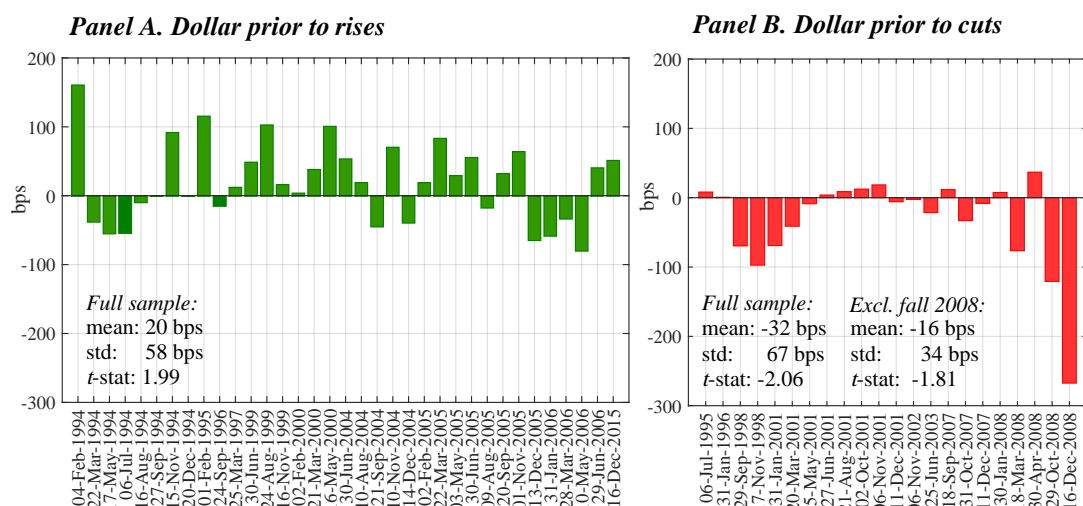
Panel A. Dollar prior to rises

Full sample:
mean: 20 bps
std: 58 bps
t-stat: 1.99

Panel B. Dollar prior to cuts

Full sample:
mean: -32 bps
std: 67 bps
t-stat: -2.06

Excl. fall 2008:
mean: -16 bps
std: 34 bps
t-stat: -1.81

Figure 4: **Dollar Two-day Returns Ahead of the Rate Moves, Signaled by the Fed Funds Futures.** *Panel A* shows $DOL_{t-2 \to t}$ ahead of 35 announcements, when the fff_{t-3} signals a target rate rise ($E_{t-3}^{fff} [\Delta FFR_t] \geq 12.5$ bps). *Panel B* shows $DOLr_{t-2 \to t}$ ahead of 22 announcements, when the fff_{t-3} signals a target rate cut ($E_{t-3}^{fff} [\Delta FFR_t] \leq -12.5$ bps).

the direction of the policy move. The average dollar return for the days outside the pre-FOMC window is 0.5 bps and is statistically insignificant.

How do the pre-FOMC dollar returns, $DOL_{t-2 \to t}$, look across different FOMC announcements? In Figure 4, I plot the time-series of the two-day dollar returns prior to rate raises (*Panel A*) and rate cuts (*Panel B*), which are ex ante signaled by the fed funds futures. The dollar goes up prior to 22 out of 35 (63%) of signaled rises and goes down prior to 13 out of 22 signaled cuts (60%).

There are two obvious outliers in Figure 4. The rate cuts in fall 2008 (by 50 bps on 29 October 2008 and by 87.5 bps on 16 December 2008) were accompanied by a sharp dollar fall in the 48 hours prior to the announcements (by 265 bps and 155 bps). The difference between $DOLr_{t-2 \to t}$ prior to the target rate raises and cuts is 52 bps (*t*-stat=3.1). The difference reduces to 36 bps (*t*-stat=2.7) after I exclude the two outlier cuts in fall 2008. The result, that the pre-FOMC dollar returns prior to target rate rises are statistically different from the dollar returns prior to target rate cuts, is robust to the bootstrap exercises which check sensitivity to outliers and account for small number of observations in the sample (see Internet Appendix for details). The two series of returns on Figure 4 combined effectively represent the long leg (*Panel A*) and minus short leg (*Panel B*) of a tradeable strategy based on the signal encoded into the fed funds futures at $t - 3$.

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2.3 The Pre-FOMC Dollar Strategy

I build an implementable trading strategy based on the fed funds futures three days prior to an FOMC announcement. The strategy goes long the dollar if $E_{t-3}^{fff}[\Delta FFR_t] \geq 12.5$ bps and goes short the dollar if $E_{t-3}^{fff}[\Delta FFR_t] \leq -12.5$.
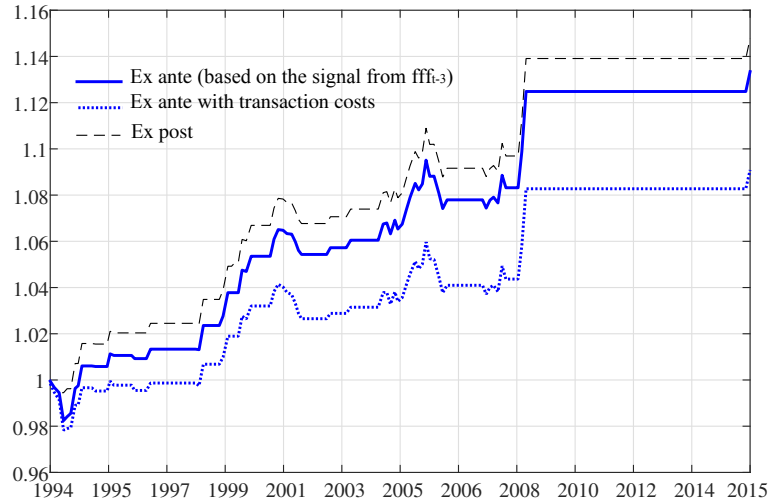

Figure 5: **Cumulative Dollar Returns on the Pre-FOMC Announcement Strategy.** The figure shows the dollar returns from trading the dollar ahead of the scheduled FOMC meetings. Solid (blue) line shows cumulative returns from the implementable strategy from trading 57 times (114 days) ahead of the FOMC meetings, when the target change is signaled with the federal funds futures (i.e., when $| E_{t-3}^{fff}[\Delta FFR_t] | \geq 12.5$ bps). The dashed (blue) line accounts for the transaction costs in this ex ante startegy. The dotted (black) line shows cumulative dollar returns from the unimplementable startegy from trading 54 times (108 days) ahead of (ex post) realized FOMC target changes.

Figure 5 shows the cumulative returns from such a strategy for 1994–2014, see solid line. In the strategy, trading occurs 57 times: 35 times long and 22 times short the dollar during the two days prior to the FOMC announcement, when the fed funds futures signal a target change. Overall, a position is held 114 days or 5 days per year (23 years in my sample). The mean strategy return is 25 bps, and the standard deviation is 61 bps. I calculate the strategy's annualized Sharpe ratio as $SR = Mean \times \sqrt{5}/Std = 25 \times \sqrt{5}/60 = 0.93$. The Sharpe ratio of the pre-FOMC announcement dollar strategy is higher than the Sharpe ratios of the existing strategies on the currency market: carry trade (0.70), dollar carry trade (0.66), momentum (0.52), and value (0.60).[9] The *t*-stat of the strategy is 2.8, well above a 95% confidence level. Excluding two sharp target rate cuts in fall 2008 reduces the pre-FOMC announcement strategy return to

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[9]See the following studies documenting the profitability of the currency strategies: Lustig, Roussanov, and Verdelhan (2011, 2014), Menkhoff, Sarno, Schmeling, and Schrimpf (2012), Asness, Moskowitz, and Pedersen (2013), and Karnaukh (2015).

20 bps (*t*-stat=2.7), while the standard deviation goes down to 50 bps.

Strategy return reduces to 15 bps after accounting for transaction costs (see dashed line). Sharpe ratio of the strategy goes down to 0.57. Transaction costs are sizeable in the first half of the sample: from 1994 to 2002 the average cost of buying/selling the dollar against most liquid currencies was 5–10 bps, consuming almost one-half of the strategy return. FX liquidity improved substantially in early 2000s, when effective cost of USD trading reduced to 1–3 bps.[10] In the second half of the sample, transaction costs constitute less than 20% of the strategy return.

I illustrate how this simple strategy works with a recent target rise on at 14:15 on Wednesday, 16 December 2015. At the market close on Friday, 11 December 2015, the fed funds futures spread was 31 bps, 18.5 bps above the target rate (average between 25 bps upper and 0 bps lower bound). Buying the dollar Monday afternoon and selling it Wednesday afternoon results into 51 bps profit, 48 bps net after transaction costs. Taking into account that even an individual FX investor can take leverage ratios of up to 100 to 1 (or trade on a 1% margin), the potential profits from such trading are huge: an investment of USD \$100 and 100 to 1 leverage ratio implies USD $10'000 \times 1.0051 = 10'051$, a 51% profit on a 2-day investment.

Knowing in advance the outcome of an FOMC announcement, would have improved the strategy returns to 28 bps (see thin dotted line on Figure 5). In other words, those five times, when the fed funds futures signaled an incorrect prediction of the target rate change, reduced the overall profit from the pre-FOMC announcement dollar trade by only 3 bps. The *ex ante* (implementable) and *ex post* (unimplementable) strategies are identical starting from 1997. This reflects the Fed's efforts to provide more forward guidance to the market and, thus, the fed fund futures have an excellent ability to forecast the direction of the policy changes from 1997–2015.

The results for the dollar excess returns are the same both in the magnitude and significance as for the simple dollar returns. This is because the difference in the expectations embedded in the forward discounts or interest rates is on average below 2 bp for the two-day pre-FOMC announcement period. In the Internet Appendix, I document my central finding more formally by running simple regressions of daily (2pm-to-2pm) dollar simple and excess returns with the pre-FOMC dummies.

In summary, I find that *(1)* a fed funds futures spread above 12.5 bps three days in advance of a scheduled FOMC meeting not only signals a target rate rise, but also signals a rise in the dollar that will occur in the subsequent two-day period up until the announcement, *(2)* a fed funds futures spread below 12.5 bps not only signals a target rate cut, and also signals a drop in

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[10] Karnaukh, Ranaldo, and Söderlind (2015) study the time-series and cross-sectional variation in the FX liquidity over 1991–2012.
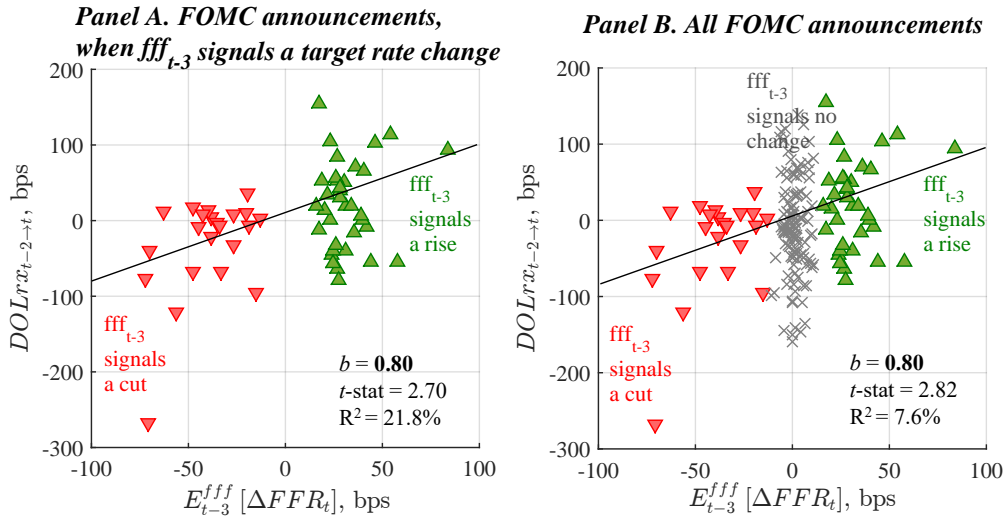
Figure 6: **Fed Funds Futures Predict the Dollar Return.** The figure shows scatter plots of the fed funds futures spread over the target three days prior to the FOMC announcement (*y-axis*) against the subsequent two-day dollar return (*x-axis*). In *Panel A* I run regression (2) for 57 FOMC announcements, for which $\mid E_{t-3}^{fff} [\Delta FFR_t] \mid \geq 12.5$ bps. In *Panel B* I run regression (2) for all 176 scheduled FOMC announcements. The up- and down-pointing and green triangles highlight the observations for the signaled target rate raise and cut.

the dollar that will occur in the subsequent two-day period up until the announcement.

2.4 Predicting the Pre-FOMC Dollar Return: Continuous Version

This far I have used a rigid rule to predict the dollar returns up until the FOMC announcement. Now I test the predictive ability of a continuous version of the fed funds futures spread for the two-day dollar returns, $DOLr_{t-2 \to t}$, prior to the FOMC announcement and in the other days:

$$DOLr_{t-2 \to t} = a + bE_{t-3}^{fff} [\Delta FFR_t] + \varepsilon_{t-2 \to t}. \tag{2}$$

I illustrate my central result, that the fed fund futures predict the pre-FOMC announcement dollar returns, in Figure 6. *Panel A* uses 57 FOMC announcements, when the futures markets expect a policy change. A high fed funds futures spread three days prior to the scheduled FOMC announcement (*y-axis*) forecasts a subsequent rise in the dollar return (*x-axis*) with a *t*-stat=2.7, and R^2=21.8%. A one basis point higher expected change in the policy rate predicts a 0.8 bps rise in the dollar over the following two days up until the announcement. Removing two outliers due to recent financial crisis reduces the R^2 to 12.2% and the slope coefficient to 0.5, while the *t*-stat remains unchanged at 2.7 (unreported).

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Panel B uses all 176 scheduled FOMC announcements during 1994-2015. Since the predictability comes entirely from 57 FOMC meetings, when fed funds futures markets signal a policy change, the regression coefficient and the t-stat remain virtually unchanged ($b = 0.8$, t-stat=2.7). The R^2 reduces to 7.5%, due to additional noise coming from the meetings when fed funds futures signal no policy change. In fact, the fed funds futures spreads have zero predictive R^2 for the dollar prior to the meetings when $\mid E_{t-3}^{fff} [\Delta FFR_t] \mid < 12.5$ bps.

In the Internet Appendix, I study the predictive ability of the fed funds futures spreads for the dollar returns in other days. The predictive power of the fed funds futures outside the pre-FOMC announcement window is close to zero and is statistically insignificant – both for the days when the fed funds futures were signaling a target rate change or no target rate change. I find weak predictive power of the fed funds futures for the dollar prior to the GDP and unemployment announcement (t-stat=1.8 and 1.9), no predictive power prior to inflation announcement.

In this subsection I documented central result of my paper: the expected policy change information contained in the fed funds futures three days prior to the FOMC announcement predicts the subsequent two-day movement in the dollar up until the announcement with a 22% R^2. Thus, information about the monetary policy change is captured first by the fed funds futures markets and is reflected only later in currency markets.

2.5 Predicting the Pre-FOMC Dollar Return: Single FX rates

I run regression (2) for single G10 dollar-based FX rates and document that FX rates with higher interest rates have higher loading on the fed funds futures spread. The R^2 for these predictive regressions vary from 7% to 20%, see Internet Appendix for details. Figure 7 plots loadings to the spreads against the currency forward discount ($\approx$ interest rate differentials between their country and the U.S.).[11] The figure shows that typical high interest rate currencies (AUD and NZD) have the largest loadings on the spread (1.2 and 1.5). This implies that these currencies tend to appreciate (depreciate) more than lower interest rate currencies prior to the Fed increases (cuts). The cross-sectional correlation between these slope coefficients and time-series averages of the respective currency forward discounts is 78%.

Currency forward discounts and average forward discount are known to predict FX returns

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[11]The deviations from the covered interest rate parity (CIP) emerged in 2008 financial crisis. During fall 2008, the two rate cuts at the scheduled meetings were accompanied with a 115 and 270 pre-FOMC dollar depreciation, which is slightly larger than the magnitude of the deviations at that period. Over 90% of my sample of FOMC announcements, when the target change was ex-ante anticipated with the fed funds futures, appeared in the period with no significant deviations from the CIP.

Figure 7: **Loading on the fed funds futures spread versus currency forward discount.** This figure plots the times series means of the currency forward discounts against the loadings of the respective pre-FOMC dollar return (vs each G10 currency) on the fed funds futures spread from regression (10).

(e.g., Fama 1984, Lustig, Roussanov, and Verdelhan 2014). I add these two variables into regressions to test whether they explain the predictability of the dollar return in the days leading to the FOMC announcement. I find that the forward discounts have zero predictive power for the pre-FOMC FX returns (see Internet Appendix). Furthermore, the R^2 barely changes as I move from single regressions with the fed funds futures spread to double regressions with forward discounts. This evidence suggests that the standard currency risk premiums do not drive the FX returns in the days leading to the FOMC announcement. A high interest rate differential increases currency sensitivity to the expected target rate change (as embedded into the fed fund futures), but does not help to predict the return itself.

In summary, the evidence in this subsection suggests that *(1)* when the market participants anticipate the target rate cut (increase), they tend to sell (buy) the dollar more against high interest rate currencies and less against low interest rate currencies[12], *(2)* fed funds futures spread predict pre-FOMC currency returns better than own currency forward spreads.

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[12]This finding is consistent with the standard intuition that capital flows from lower-yielding to higher-yielding currencies, exemplified by the following quote from the *The Wall Street Journal* on June 26, 2003, the day after a 25 bps target rate cut: "Prior to the FOMC's announcement of a reduction of 0.25 percentage point in the federal-funds target rate, the dollar had slipped sharply on a flurry of last-minute positioning that sent a slew of currencies to highs for the day against the dollar. Some investors had shifted to higher-yielding currencies such as sterling and the Canadian, Australian and New Zealand dollars to guard against a more aggressive 0.50-percentage-point cut that would have further widened interest-rate differentials and made dollar-denominated assets even less attractive."

3. Interpretations

Standard exchange rate models (Fleming 1962; Mundell 1963; Dornbusch 1976) imply that a country with a relatively higher interest rate has stronger currency. If the Fed raises the target rate while other central banks keep their rates unchanged, then the returns on savings becomes more attractive in the U.S. than in other countries. International investments flow into the U.S. and cause the dollar to appreciate. At first glance, my findings are in line with the standard exchange rate models: I find that the target rate rise of 30 bps is accompanied by a 25 bps dollar appreciation in the two days pre-FOMC announcement period. However, the standard macroeconomic theories do not line up with the following fact. Interest rates and federal funds futures implied rates rise gradually over several weeks leading to the announced target rate change (and stay flat in the last few days prior to an FOMC announcement), while the dollar goes up in the last two days prior to an FOMC announcement. My findings pose a puzzle for exchange rate models that rely on rational expectations. Even though the direction of the movement of the exchange rate in response to monetary policy expectations is in line with the prediction by the standard exchange rate models, the speed at which these movements occur is not aligned across the bond and exchange rate markets: bond markets incorporate information faster than exchange rate markets do.

In this section, I investigate potential interpretations of these findings. I start by looking at how is the pre-FOMC dollar return related to what happens after the FOMC announcement. First, I find that the pre-FOMC dollar return does not carry additional announcement-related information on top of what is already embedded in the ex-ante fed funds futures prices. Second, the immediate dollar change on impact is explained by the new information, released by the FOMC. Third, the part of the pre-FOMC dollar return that is driven by the fed funds futures spread, gets partially reversed following the FOMC announcement. I discuss how limited risk-bearing capacity, market segmentation, infrequent portfolio rebalancing, limited investor attention might explain why the FX market is lagging the fed funds futures markets in reflecting the expectations of the Fed's policy change.

3.1 Pre-FOMC vs Post-FOMC

In the previous Section I show that prior to FOMC announcements the dollar goes into the direction of the forthcoming Fed's policy move. Getting answers on the following questions will help us better understand the dollar behavior around the FOMC announcement. Does the pre-FOMC dollar return carry any information about the forthcoming FOMC announcement on

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top of what is explained by the fed funds futures? What drives the dollar return on impact and in the two days following the announcement?

I first orthogonolize the pre-FOMC dollar return, $DOL_{t-2,14:00 \to t,14:00}$, to the ex-ante fed funds futures spread, $E^{fff}_{t-3}[\Delta FFR_t]$, by taking the residuals from regression (2). Then I regress these residuals on the four variables: (1) dollar return on impact, $DOL_{t,14:00 \to t,16:00}$, (2) post-FOMC dollar return over the following two days, $DOL_{t,16:00 \to t+2,16:00}$, (3) the surprise change in the short-term yield implied with the fed funds futures on impact (see Kuttner 2001), Δfff_t, and (4) the surprise change in 2-year Treasury yield on impact (captures information about the change in longer-term monetary policy expectations), $\Delta Y_{2Y,t}$.

The left part of Table 2 shows that none of the four post-FOMC variables is significantly related to the part of the pre-FOMC dollar return, unexplained by the ex-ante fed funds futures. This suggests that the pre-FOMC dollar return does not carry additional information, that could help to predict the changes in the dollar or interest rates at the announcement.

| | Pre-FOMC$^+$ | | | On Impact | | | Post-FOMC | | |
| | $DOL^+_{t-2,14:00 \to t,14:00}$ | | | $DOL_{t,14:00 \to t,16:00}$ | | | $DOL_{t,16:00 \to t+2,16:00}$ | | |
	b	t-stat	R^2	b	t-stat	R^2	b	t-stat	R^2
(1) $DOL_{t,14:00 \to t,16:00}$	0.3	[0.91]	3.9						
(2) $DOL_{t,16:00 \to t+2,16:00}$	0.1	[1.56]	3.9	0.0	[-0.10]	0.0			
(3) Δfff_t	1.2	[1.15]	2.8	**2.3**	[3.83]	21.0	0.4	[0.22]	0.2
(4) $\Delta Y_{2Y,t}$	0.7	[0.90]	1.5	**1.4**	[3.03]	13.4	1.6	[1.61]	4.8
(5) $E^{fff}_{t-3}[\Delta FFR_t]$				0.3	[1.41]	6.8	**-0.7**	[-2.75]	9.4

Table 2: **Pre- and Post-FOMC Dollar Returns** The table shows results from running regressions of each component of the dollar return around the FOMC on the variables listed in the left column (described in Subsection 3.1). The dollar return around the FOMC is decomposed into three components: *pre-FOMC+*, from 14:00 two days prior to the announcement to 14:00 on the announcement day, orthogonolized to $E^{fff}_{t-3}[\Delta FFR_t]$, *on impact*, from 14:00 to 16:00 on the announcement day, and *post-FOMC*, from 16:00 on the announcement day to 14:00 on the second day after the announcement. *t*-statistics are shown in brackets. Bold numbers are statistically significant at 5% level. The R^2 are in percent. The sample is 57 announcements, for which the target rate change was ex ante signaled with the fed funds futures.

In the remaining parts of Table 2 I run single regressions of the dollar return on impact and the two-day post-FOMC dollar return, on the four variables described above and on the pre-FOMC fed funds futures spread, $E^{fff}_{t-3}[\Delta FFR_t]$. The surprise change in the short-term yield (implied with the fed funds futures) and the two-year Treasury yield partially explain the variation in the dollar return on impact (21% and 13%, respectively). These surprise changes in the yields do not affect the dollar return over the following two days, see the right part of the

table.

The two-day post-FOMC dollar return is negatively related to the pre-FOMC fed funds futures spread, $E_{t-3}^{fff}[\Delta FFR_t]$ (-0.7 coefficient with a -2.8 t-stat). This result suggests that the post-FOMC reversal in the dollar observed in Figure 3 is partially (9% of the variation) explained with the ex-ante monetary policy expectations, embedded into the fed funds futures. However, this predictability diminishes as I exclude turbulent 1994 and crisis 2008 year (-0.3 coefficient with a -1.2 t-stat).[13] This evidence suggests that potential overreaction to the fed funds futures information in the days prior to an FOMC announcement is only a smart part of full effect, as the reversal evidence is weak and is mostly a feature of the crisis.

3.2   Limited Risk-Bearing Capacity

A positive return on the two-day pre-FOMC dollar strategy might reflect the higher risk aversion of currency investors earlier than in the last days prior to the FOMC announcement. Supposedly, all currency traders are aware of the most likely Fed's policy change as signaled by the fed fund futures several weeks in advance of the FOMC announcement. These traders believe that the Fed's target rate increase will cause dollar appreciation and would like to bet on it. However, as there is still long time until the FOMC announcement, these traders decide to wait in order to avoid an exposure to the U.S. and foreign shocks that are unrelated to the Fed's monetary policy change. Such shocks might be a piece of news from the rest of the world, or some other unexpected event that might move the dollar into the direction opposite from the direction predicted by the fed funds futures. As dealers are willing to avoid these risks, they wait until the last days prior to the FOMC announcement. When there are only a few days left, the disruptive risks are low enough to start trading the dollar into the direction predicted by the fed funds futures.[14]

I test the above-described hypothesis by examining whether the two-day pre-FOMC drift in the dollar is larger when the ex-ante level of investor risk aversion is higher. I proxy the investor risk aversion with the level of implied volatility from 1-month currency options. I split the target rate increases and cuts (as signalled by the Fed funds futures) into two groups by

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[13]Specifically, the post-FOMC reversal is highly driven by a one outlier: a better-than-expected manufacturing report on Feb 1, 2008, two days after a 50 bps interest rate cut at the FOMC meeting. This positive manufacturing reports caused an immediate 80 bps jump in the dollar.

[14]The described effect is also exemplified by the following quote by *Dow Jones Insitutional News* several hours prior to the Fed's announcement to raise the target on 16 December 2015: "Market positioning for the dollar may have moved closer to neutral the past few weeks, but many short-euro wagers remained. Now some investors are shedding positions as FOMC-meeting risks have passed."
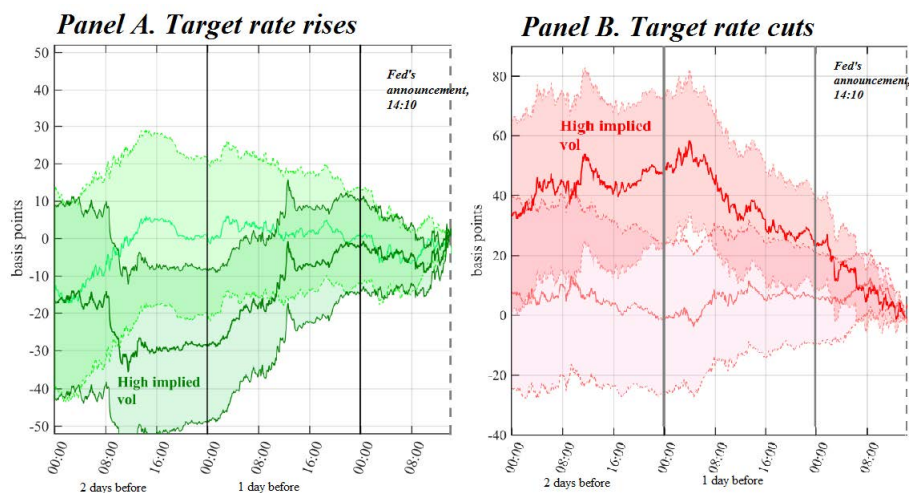
Panel A. Target rate rises

Panel B. Target rate cuts

Figure 8: **Dollar Ahead of FOMC rate changes and FX implied volatility.** The figure shows average 5-minute cumulative dollar returns around target rate rises (*Panel A*) and cuts (*Panel B*) for the different groups of announcements. On each Panel the bold (light) line depicts the average dollar returns for the target rate rises with the high (low) level of FX implied volatility at $t-3$. See details on the construction of the dollar returns and confidence bands in the caption to Figure 1.

the level of FX implied volatility as of three days prior to an FOMC announcement. Figure 8 plots average cumulative dollar returns in the two days prior to the FOMC announcements. The figure shows that both for rate rises and cuts the pre-announcement drift almost entirely comes from the announcements when the level of ex-ante FX implied volatility is high. This evidence is suggestive of the hypothesis that when currency investors are unsure about the future FX movements the most (as reflected in the high levels of FX implied volatility), they tend to wait until the last few days prior to the FOMC announcement. In such cases, the pre-FOMC announcement drift in the dollar reaches 30 bps prior to the rate rises and 45 bps prior to rate cuts. While currency investor risk aversion might be a potential explanation of my findings, it would require the presence of market segmentation as I do not find the same effects when I split the FOMC announcements by the implied volatility measures from other markets: Treasury options (MOVE index) and stock options (VIX index). This empirical evidence is presented in Table A.4 in the Internet Appendix, where in the predictive regressions of the pre-FOMC dollar returns I interact the fed funds futures spreads with the levels of different uncertainty measures – only implied volatility from currency options appears significant (*t*-stat=2.1).[15]

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[15]My findings are unlikely to be driven by monetary policy uncertainty (Mueller, Tahbaz-Salehi, and Vedolin 2017), as the Treasury-option-implied volatility index has zero effect on how large is the *conditional* pre-FOMC announcement return.

3.3 Behavioral Interpretations

Some investors might be slow to adjust their portfolios, perhaps because it is costly to monitor and gather information constantly (Mankiw and Reis 2002; Sims 2003) or because the welfare gain from active currency management is smaller than the corresponding fees (Bacchetta and van Wincoop 2010). Consistent with these theories, some currency investors may not pay enough attention to the predictions of monetary policy moves embedded into the fed funds futures prices earlier than in the few days prior to an FOMC announcement.

Two following pieces of suggestive evidence support this hypothesis. First, stale (i.e., two-week or three-week lagged) fed funds futures spread forecasts the two-day pre-FOMC dollar return almost as well as the fed funds futures spread recorded three days prior to the announcement.[16] Second, the number of Fed-related articles in *The Wall Street Journal* and *The Financial Times* increases exactly two days prior to the FOMC announcement (Lucca and Moench 2015 illustrate this in Figure IA.6 of their Internet Appendix).[17]Thus, the pre-FOMC rise in the dollar may be a delayed response to old information (embedded into the fed funds futures) by some market participants.[18]

In summary, I provide suggestive evidence that the theories relying on limited investor attention, investor risk aversion, and market segmentation could explain the dollar predictability in the last days preceding an announcement as well as its partial reversal in the next two days.

4. Extensions and Robustness

I provide the list of extensions and robustness checks of my main findings, and their outcomes. More details on them are in the Internet Appendix.

- Dollar returns: My central finding, that the fed funds futures spread over the target fore-

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[16]Figure A.3 in the Internet Appendix illustrates this by plotting the R^2 from the regressions of the target rate change and the two-day pre-FOMC dollar return on the fed funds futures spreads recorded on different days during a month prior to the FOMC announcement. The R^2 from using either $E_{t-20}^{fff}[\Delta FFR_t]$ or $E_{t-3}^{fff}[\Delta FFR_t]$ to forecast the two-day pre-FOMC dollar returns are the same.

[17]Market commentators admit the presence of increased investor attention to monetary policy expectations in the last days preceding an FOMC announcement. For example, *Dow Jones Commodities Service* reports on September 19, 2005, a day before the Fed's decision to raise the target rate: "In addition to the support the dollar was getting versus the euro, it has been broadly helped by the wide expectation that Fed policy makers will raise interest rates when they meet Tuesday."

[18]A price reaction to stale information is also found in equity markets. For instance, Tetlock (2011) show that stale firm-specific news predict future returns, indicating that investors trade based on media articles which contain old information.

cast two-day pre-FOMC dollar returns, is robust to alternative specifications of the dollar (excess USD return, trade-weighted, USD vs G10 FX pairs, or ICE USD futures).

- Wider window: I look at the month before and after the FOMC announcements and show that the dollar returns are on average flat outside the two-day pre-FOMC announcement period.

- Pre-FOMC bid-asks and realized volatility: I plot the 5-minute currency bid-ask spreads and 1-hour realized dollar volatility in the days leading to FOMC announcements. Both measures do not go up in the two days or hours prior to the announcement. The level and intraday dynamics of these measures look just as in other days of my sample.

- Unscheduled meetings: There were 7 target rate actions at the unscheduled meetings during 1994–2015. The dollar depreciated during the two days prior to the unscheduled raise. The dollar depreciated prior to five out of six unscheduled cuts.

- Macroannouncements: For 15 FOMC announcements out of 57 (when a target rate change was ex-ante signaled by the fed funds futures) there was a macroannouncement in the two-day pre-FOMC period. When I exclude these 15 announcements and re-run my main predictive regression (2), the coefficient stays the same at 0.8 (t-stat=2.2), the R^2 reduces from 22% to 16%.

- Pre-FOMC fixed income and stock returns: Fed funds futures do not predict their own return or changes in bond or stock prices in the pre-FOMC announcement window.

- Recent change in the fed funds futures: The *change* in the fed funds futures prices over the week or two prior to an FOMC announcement have only a marginal effect on the pre-FOMC dollar return. Over 90% of predictability for the pre-FOMC dollar return comes from the *level* of the fed funds futures spread over the target.

- Predictability in other days: The fed funds futures spread over the target have zero predictive power for the dollar returns in the days outside the pre-FOMC/post-FOMC announcement window.

- Longer-term monetary policy expectations: The level and slope of Treasury yields do not help to predict the pre-FOMC announcement dollar return.

- Pre-1994 period: I study the 1983–1994 period period, when the market participants inferred Fed's actions based on the size and type of open market operations, and the Fed announced only one third of the target rate changes at the scheduled meetings. I

document the ten-day drift in the dollar prior to the fed funds rate increases and cuts at the scheduled meeting. The one-month LIBOR spread over the target predicted these ten-day pre-FOMC returns (2.2 t-stat, 3.6% R^2).

- Monetary policy expectations in other countries: I find that neither foreign monetary policy expectations (proxied by the spreads of 1-month foreign LIBOR rates over the target), nor their difference with the U.S. monetary policy expectations helps to forecast the dollar returns prior the FOMC announcements. Moreover, foreign short-term monetary policy expectations in the European Central Bank, Bank of England, Bank of Japan, Swiss National Bank, Bank of Canada, and Reserve Bank of Australia do not forecast their local FX returns prior to their own pre-scheduled Central Bank meetings. The latter finding suggests the special role of the dollar and the Federal Reserve (see Brusa, Savor, and Wilson 2018 for similar evidence on the pre-FOMC announcement drift in stock market returns).

5. Conclusion

Understanding how different asset markets incorporate information is a key question in finance. I find that prior to the FOMC announcements the fed funds futures market leads the foreign exchange market in reflecting the information about monetary policy change. A high fed funds futures spread several days in advance of a scheduled FOMC meeting not only predicts the target rise, but also predicts the rise in the dollar that will take place in the subsequent days up until the announcement. A simple trading strategy that exploits this predictability exhibits a 0.93 annualized Sharpe ratio, which reduces to 0.57 after accounting for transaction costs. It is hard to reconcile my finding with the standard asset pricing and economic theories.

A key challenge is to explain two facts. First, the speed at which currency prices respond to monetary policy expectations is not aligned across the bond and exchange rate markets: bond markets incorporate information faster then the exchange rate markets do. Second, the dollar excess returns are earned over the pre-FOMC period when various risk variables are not abnormally higher and only little relevant information is expected to come out. These results are surprising given how liquid currency markets are. Limited investor attention, investor risk aversion, and market segmentation might explain my findings. Being able to access intraday FX order flow data of different market participants over the last 20 years would shed more light on my results.

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Internet Appendix

1 Data: Detailed Description

My primary dataset spans the period from January 1994 through December 2015. The following subsections provide a quick overview of the data, including definitions of dollar returns, FOMC meetings, and federal funds futures.

Dollar Returns

I obtain five-minute spot mid prices over the 1994–2015 period from Olsen Associates. This dataset covers four currencies quoted against the U.S. dollar (USD): EUR (DEM before 1999), GBP, CHF, and JPY. These four currencies account for about half of global foreign exchange market turnover (Bank of International Settlements 2016).

I also use daily FX prices and 1-month forward prices of G10 currencies (AUD, CAD, CHF, EUR, JPY, NOK, NZD, SEK, GBP) from WM/Reuters (WMR) for the same period. WMR records mid, bid, and ask prices at 16:00 GMT, which corresponds to 11:00 EST. The correlations between daily WMR returns and daily Olsen returns (based on prices as of 11:00 EST) are 98-99% for EUR, JPY, GBP, and CHF. I use high-frequency data from Olsen to illustrate my main empirical result in Section 2, but use a wider cross-section of currencies for the further results.

The log spot prices s_t^i are quoted in units of foreign currency i per 1 USD. Thus, positive currency return stands for dollar appreciation. I write the simple currency return from $t - j$ to t as the log difference of spot prices,

$$r_{t-j \to t}^i = s_t^i - s_{t-j}^i. \tag{3}$$

I denote the forward discount as $f_{t-j}^i - s_{t-j}^i$, where f_{t-j}^i is the currency log forward price at $t - j$. The forward discount indicates by how much do market participants anticipate the spot price to change from $t - j$ to t. I write the currency excess returns from $t - j$ to t as the difference between the spot return and the forward discount rate,

$$rx_{t-j \to t}^i = (s_t^i - s_{t-j}^i) - (f_{t-j}^i - s_{t-j}^i) = s_t^i - f_{t-j}^i. \tag{4}$$

My outputs are five-minute simple (spot) returns on the USD against the EUR, GBP, CHF, and JPY and daily 11am-to-11am simple and excess returns on the USD against G10 currencies.

I compute dollar returns from $t - j$ to t by taking a simple average across currencies:

$$DOLr_{t-j \to t} = \bar{r}^i_{t-j \to t}, \tag{5}$$

The correlation between the daily dollar returns, equal-weighted across EUR, GBP, CHF, and JPY, and the daily dollar returns, equal-weighted across G10 currencies is 87%. The results in my paper are robust to using these two alternative versions of the dollar as well as to using alternative weighting schemes for the currencies in the dollar basket: bilateral trade-weighted or currency turnover-weighted.

I compute dollar excess returns from $t - j$ to t as the difference between the dollar simple returns and the average forward discount for the period from $t - j$ to t:[19]

$$DOLrx_{t-j \to t} = \bar{rx}^i_{t-j \to t} = \bar{r}^i_{t-j \to t} - \overline{(f^i_{t-j} - s^i_{t-j})}. \tag{6}$$

FOMC Meetings

The FOMC is the monetary-policy body of the Fed. The FOMC conducts eight scheduled meetings per year, one approximately every six weeks. The schedule of meetings for a particular year is announced ahead of time. Scheduled meetings are the focus of my paper, since I am interested in characterizing and predicting the dollar returns over the days prior to these meetings.

Starting in February 1994, the FOMC began to announce its target rate decisions after the scheduled meetings, around 14:15 GMT. Specifically, during 1994–2015 target rate announcements occurred between 14:10 and 14:20 EST, according to *Bloomberg* or *Dow Jones* newswires. See detailed timing for each FOMC announcement in Lucca and Moench (2015), Table IA.I. In total, there have been 176 scheduled FOMC announcements from 1994–2015, including 31 contractionary (target rate rises), 23 expansionary (target rate cuts), and 122 neutral (unchanged target rate). Over the sample period, only seven target changes took place at the unscheduled FOMC meetings: one target raise on 18 April 1994 (25 bps) and six target cuts on 15 October 1998 (-25 bps), 3 January 2001 (-50 bps), 18 April 2001 (-50 bps), 17 September 2001 (-50 bps), 22 January 2008 (-75 bps), and 8 October 2008 (-50 bps). The black line on Figure A.1 depicts the Fed funds target rate (taken from the FRED), while the green and red triangles represent the Fed's decisions to raise and cut (respectively) the target rate at the scheduled FOMC meetings. Starting from 2009, I use the average of the upper and lower bounds. Prior

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[19]Lustig, Roussanov, and Verdelhan (2011) suggest two asset pricing factors to explain currency movements: *RX*, average return of currencies quoted against dollar and *HML*, a portfolio long high interest currencies and short low interest rate currencies. Their *RX* factor is equivalent to $DOLrx$ in my paper.
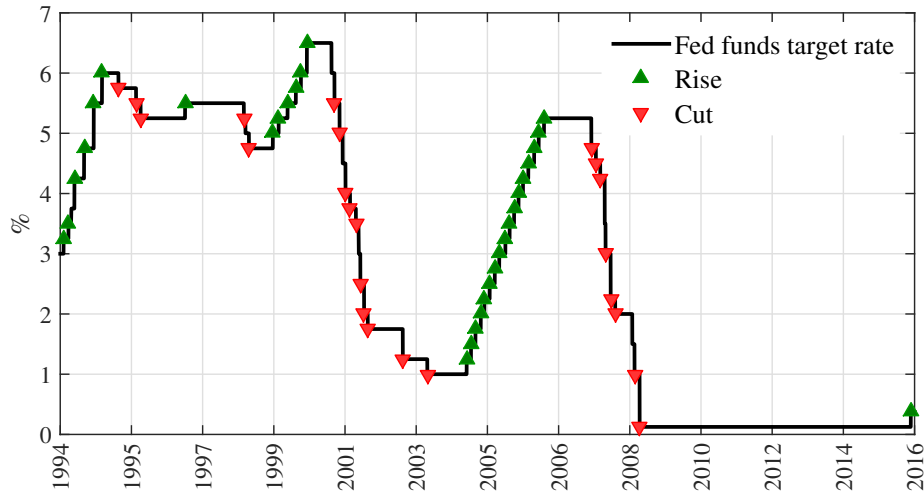
Figure A.1: **Fed funds target rate and FOMC decisions.** The figure shows the Fed funds rate and Fed's decisions to raise the target rate (up-pointing triangle) or cut the target rate (down-pointing triangle) at the scheduled meetings. The sample covers 176 scheduled (31 rises, 23 cuts, 122 neutral) and 7 unscheduled announcements, from January 1994 to December 2015.

to 1994, market participants inferred FOMC actions based on the size and type of open-market operations, which were announced the day following the scheduled FOMC meeting.

Federal Funds Futures

I use daily fed funds futures (fff) from Chicago Mercantile Exchange (CME) as the main measure of market expectations several days prior to the FOMC announcement. Fed funds futures started trading on the Chicago Board of Trade in October 1988. These contracts have a face value of USD 5 million. Prices are quoted as 100 minus the daily average fed funds rate that is realized during the contract month.

I compute the target rate implied by the next-month futures j days ahead of the scheduled FOMC announcement as follows:

$$E_{t-j}^{fff}\left[FFR_t\right] = 100 - fff_{t-j}, \tag{7}$$

where FFR_t is the fed funds target rate after the FOMC announcement has occurred at t, fff_{t-j} is the price of the next-month Fed funds futures at j days prior the FOMC announcement. The results are similar when I use the adjusted version of the Fed funds futures, which takes into account the exact timing of each FOMC meeting. I use the unadjusted version for the sake of simplicity. My results are also robust to accounting for a 2 basis point estimated risk premium in the next-month fff (p. 686 in Piazzesi and Swanson, 2008).

2 Dummy Regressions and Excess Returns

I document my central finding (described in Figure 3) more formally by running simple regressions of daily (2pm-to-2pm) dollar simple and excess returns with the pre-FOMC dummies.

$$DOLr_t = \alpha + \beta D_t + \varepsilon_t \tag{8}$$

$$DOLrx_t = \alpha + \beta D_t + \varepsilon_t \tag{9}$$

where D_t is a pre-FOMC dummy variable, which takes D_{rise}^{fff} (equal to one on the two days ahead of 35 announcements, when the fff_{t-3} signals a target rate rise, and is zero otherwise), D_{cut}^{fff} (equal to one on the two days ahead of 22 announcements, when the fff_{t-3} signals a target rate cut, and is zero otherwise), or $D_{rise}^{fff} - D_{cut}^{fff}$. To construct daily excess returns, I use daily one-week forward discounts divided by 5.

Table A.1 reports the results from running these dummy regressions. Firstly, the coefficients in front of D_{rise}^{fff} and D_{cut}^{fff} are half of those reported for the means of two-day returns in Figure 4. The dollar goes up by 10 bps per day during the two days prior to the announcement when fff_{t-3} signals a target rate rise. The dollar goes down by 16 bps per day during the two days prior to the announcement when fff_{t-3} signals a target rate cut. The difference between the two dummies, 12 bps, effectively represents daily returns from being long the dollar ahead of rises and short the dollar ahead of the cuts, when both are signaled with fff_{t-3}.

	D_{rise}^{fff}		D_{cut}^{fff}		$D_{rise}^{fff} - D_{cut}^{fff}$	
$DOLr_t$	**10.1**	[2.03]	**-16.2**	[-2.08]	**12.4**	[2.88]
$DOLrx_t$	**10.3**	[2.08]	**-16.3**	[-2.09]	**12.5**	[2.92]

Table A.1: **Dollar Returns with the pre-FOMC Dummies.** The regressions are $DOLr_t = \alpha + \beta D_t + \varepsilon_t$ and $DOLrx_t = \alpha + \beta D_t + \varepsilon_t$, where where D_t is a pre-FOMC dummy variable, which takes D_{rise}^{fff} (equal to one on the two days ahead of 35 announcements, when the fff_{t-3} signals a target rate rise, and is zero otherwise), D_{cut}^{fff} (equal to one on the two days ahead of 22 announcements, when the fff_{t-3} signals a target rate cut, and is zero otherwise), or $D_{rise}^{fff} - D_{cut}^{fff}$. t-statistics are shown in brackets. They are based on the standard errors, robust to conditional heteroscedasticity and serial correlation up to two lags as in Newey and West (1987). Bold numbers are statistically significant at 5% level. The full sample covers 5760 days.

Second, the results for the dollar excess returns in Table A.1 are almost identical to the results for the simple returns, reflecting that only a tiny part of the excess return comes from the interest rate differentials. On average, the daily expectation of currency depreciation or appreciation as encoded into the currency forward discounts (interest rate differentials between the

U.S. and foreign countries) are negligibly small in their magnitude to account for the observed pre-FOMC announcement dollar return. Specifically, these expectations are on average below 1 bps for the two-day pre-FOMC announcement period.

Third, the average return on the other days as indicated by the constant (unreported) is 0.5 bps and is statistically insignificant. The standard deviation of the daily dollar returns in the pre-FOMC days is 60 bps (53 bps excluding the recent financial crisis), only slightly larger than their standard deviation in all other days, 51 bps.

3   Bootstrap Exercises

I do several bootstrap exercises to account for the small number of observations in my sample and to check the sensitivity of my results to the outliers. First, I draw with replacement a return series of length corresponding to the number of signaled target rate rises (35) from the observed distribution of the dollar returns prior to signaled target rate rises in the full 1994–2015 sample, and a series of length 5,646 from the observed distribution of non-FOMC returns. Then I reestimate my dummy regression (9) and find that the bootstrapped coefficients and their standard errors (unreported) are similar to my regression results in Table A.1. Second, I draw with replacement from the distribution of non-FOMC announcement returns a time series of length equal to the number of signaled target rises (35). I find that the probability of observing a mean greater than 10 bps is close to zero. The results for the signaled target rate cuts are similar.

	Federal funds futures [1]–[3]			Money market rates [4]–[7]				Treasury yields [8]–[13]						Eff rate	Com paper
	NextM	3M	6M	1W	1M	3M	6M	3M	6M	1Y	2Y	5Y	10Y	ON	1M
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Panel A. $Direction_{\Delta i_t} = \alpha + \beta \bar{y}_{t-3} + \varepsilon_t$, 1994–2015 (N=176)															
b	**2.2**	**1.6**	**1.0**	**1.9**	0.5	0.4	0.3	**1.3**	**1.2**	**0.8**	**0.5**	**0.2**	**0.1**	**1.8**	**1.0**
t	[11.6]	[11.3]	[9.6]	[4.3]	[1.3]	[1.3]	[1.7]	[9.9]	[11.1]	[9.3]	[8.0]	[3.8]	[2.0]	[4.8]	[2.1]
R^2,%	74	73	66	31	7	7	11	58	64	49	34	10	3	14	18
Panel B. $\Delta i_t = \alpha + \beta \bar{y}_{t-3} + \varepsilon_t$, 1994–2015, N=176															
b	**0.9**	**0.6**	**0.4**	**0.8**	0.2	0.1	0.1	**0.5**	**0.5**	**0.3**	**0.2**	**0.1**	**0.0**	**0.8**	**0.4**
t	[24.3]	[16.4]	[11.8]	[4.9]	[1.0]	[0.9]	[1.2]	[10.4]	[14.4]	[11.5]	[8.1]	[4.1]	[2.4]	[6.0]	[2.1]
R^2,%	88	82	69	37	6	5	8	66	70	55	39	13	4	21	24
Panel C. $Direction_{\Delta i_t} = \alpha + \beta \bar{y}_{t-3} + \varepsilon_t$, 1994–2007, N=122															
b	**2.4**	**1.7**	**0.9**	**3.2**	**1.6**	**1.6**	**1.3**	**1.6**	**1.2**	**0.8**	**0.5**	**0.2**	**0.1**	**2.5**	**1.9**
t	[10.1]	[9.9]	[8.7]	[11.6]	[3.8]	[8.2]	[8.8]	[11.1]	[9.7]	[7.9]	[7.0]	[3.9]	[2.6]	[3.4]	[5.6]
R^2,%	75	73	65	57	36	52	60	62	65	49	34	13	6	14	38
Panel D. $\Delta i_t = \alpha + \beta \bar{y}_{t-3} + \varepsilon_t$, 1994–2007, N=122															
b	**0.9**	**0.6**	**0.3**	**1.1**	**0.6**	**0.6**	**0.5**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**	**0.8**	**0.8**
t	[23.8]	[16.9]	[12.3]	[12.9]	[4.1]	[9.9]	[14.2]	[9.2]	[13.4]	[11.2]	[7.9]	[4.1]	[2.7]	[3.0]	[6.0]
R^2,%	87	81	71	59	43	61	68	65	71	57	40	16	8	12	48

Table A.2: **Predicting the direction and size of the target rate change.** The dependent variable in *Panel A and C* is the direction of target change, $\{1, -1, 0\}$ for up/down/neutral decision. The dependent variable in *Panel B and D* is the target rate change itself. The independent variables are the spreads of various money market expectations measures (federal funds futures rate, money market rates, treasury yields, effective rate, and commercial paper rate) over the target three days ahead of the scheduled FOMC meeting. *Panel A and B* run the regressions for the full sample, 1994–2015, 176 scheduled announcements. *Panel C and D* run the regressions for 1994–2007, 122 scheduled announcements. Full sample is 176 scheduled meetings, January 1994 – December 2015. *t*-statistics are in brackets. They are based on the standard errors, robust to conditional heteroscedasticity and serial correlation up to one lag as in Newey and West (1987). Bold numbers are statistically significant at the 5% level.

5 Predicting the Dollar Return with the Fed Funds Futures: Other Days

	$E_{t-3}^{fff}[\Delta FFR_t]$	t-stat	R^2	N days
Panel A. Prior to the FOMC announcements				
All FOMC ann.	**0.80**	[2.82]	7.6	176
fff_{t-3} signal a target rate change	**0.80**	[2.70]	21.8	57
fff_{t-3} signal no target rate change	0.16	[0.11]	0.0	118
Panel B. Prior to other days				
GDP announcement	1.15	[1.79]	5.8	74
PPI announcement	0.45	[0.90]	1.1	192
Unemployment announcement	0.55	[1.89]	2.1	192
All other days	0.13	[1.15]	0.1	2879

Table A.3: **Predicting Dollar Returns with Fed Fund Futures Spread Ahead of Different Days.** The table shows results from running $DOLrx_{t-2\to t} = \alpha + \beta E_{t-3}^{fff}[\Delta FFR_t] + \varepsilon_{t-2\to t}$. Each time I predict the dollar returns ahead of the events. The dollar returns in *Panel A* are from 14:00 EST two days prior to the FOMC ann. to 14:00 EST on the day of announcement. The dollar returns in *Panel B* are from 8:00 two days prior to macroannouncements to 8:00 EST on the day of announcement. All macroannouncement. are released at 08:30 EST. The sample for the FOMC announcements runs from 1994–2015. The sample for macroannouncement runs from 1997 to 2015. The number of events used in each regression are in the last column. t-statistics are shown in brackets. They are based on the standard errors, robust to conditional heteroscedasticity and serial correlation up to two lags as in Newey and West (1987). Bold numbers are statistically significant at the 5% level. The R^2 are in percent.

6 Predicting the Pre-FOMC Dollar Return: Implied Volatility

right-hand var.	β		γ		δ		R^2
FX realized vol	**0.42**	[2.07]	-7.44	[-1.55]	0.12	[0.96]	15.1
FX implied vol	**0.42**	[2.05]	-0.59	[-0.08]	**0.33**	[2.06]	17.0
Treasuries implied vol	**0.52**	[2.34]	-2.12	[-0.21]	-0.07	[-0.31]	13.0
Stock implied vol	**0.59**	[2.40]	9.36	[0.91]	0.23	[1.14]	16.3
FX illiquidity	**0.50**	[2.76]	-0.47	[-0.07]	0.14	[0.77]	13.5

Table A.4: **Pre-FOMC Dollar Return and Levels of Volatility and Illiquidity.**
I run the following regressions of the pre-FOMC dollar return: $DOLr_{t-2\to t} = \alpha + \beta E_{t-3}^{fff} [\Delta FFR_t] + \gamma F_{t-3} + \delta E_{t-3}^{fff} [\Delta FFR_t] \times F_{t-3} + \varepsilon_{t-2\to t}$. All right-hand side variables are standardized to have zero mean and unit standard deviation. Bold numbers are statistically significant at the 5% level. The R^2 are in percent. The sample consists of FOMC announcements, when the target change is *ex ante* encode with the federal funds futures (i.e. when $| E_{t-3}^{fff} [\Delta FFR_t] | \geq 12.5$ bps) and excludes two outlier target cuts in fall 2008 (29 Oct 2008 and 16 Dec 2008). Number of such announcements is 55.

7 Predicting Single Currency Returns

Throughout the paper I focus on the predictability of the equal-weighted dollar returns. In this subsection, I assess the predictability of the excess returns of single exchange rates, $rx^i_{t-2\to t}$, prior the FOMC announcements. A positive $rx^i_{t-2\to t}$ indicates the dollar appreciation versus the foreign currency. I run the regressions of G10 currency excess returns on the U.S. fed funds futures spread and average currency forward discount:

$$rx^i_{t-2\to t} = \alpha + \beta E^{fff}_{t-3}\left[\Delta FFR_t\right] + \varepsilon_{t-2\to t} \tag{10}$$

$$rx^i_{t-2\to t} = \alpha + \beta E^{fff}_{t-3}\left[\Delta FFR_t\right] + \gamma \overline{(f^i_{t-3} - s^i_{t-3})} + \varepsilon_{t-2\to t} \tag{11}$$

	Panel A			*Panel B*				
	$E^{fff}_{t-3}\left[\Delta FFR_t\right]$		R^2	$E^{fff}_{t-3}\left[\Delta FFR_t\right]$		$\overline{(f^i_{t-3} - s^i_{t-3})}$		R^2
AUD	1.21	[1.75]	10.7	1.24	[1.82]	0.12	[0.53]	10.8
CAD	0.66	[1.69]	9.3	0.66	[1.74]	0.02	[0.10]	9.3
CHF	**0.79**	[2.08]	14.1	0.66	[1.62]	-0.51	[-1.41]	17.3
EUR	**0.94**	[2.30]	19.4	**0.85**	[2.00]	-0.34	[-0.93]	20.7
JPY	0.30	[0.94]	1.6	0.27	[0.84]	-0.08	[-0.25]	1.7
NOK	0.59	[1.89]	6.9	0.60	[1.76]	0.03	[0.09]	6.9
NZD	**1.48**	[2.21]	17.8	**1.46**	[2.20]	-0.07	[-0.23]	17.8
SEK	0.64	[1.76]	7.1	0.60	[1.67]	-0.12	[-0.46]	7.2
GBP	**1.01**	[2.06]	15.9	**1.00**	[2.01]	-0.05	[-0.19]	16.0

Table A.5: **Predicting Individual Currency Returns.** *Panel A:* $rx^i_{t-2\to t} = \alpha + \beta E^{fff}_{t-3}\left[\Delta FFR_t\right] + \varepsilon_{t-2\to t}$. *Panel B:* $rx^i_{t-2\to t} = \alpha + \beta E^{fff}_{t-3}\left[\Delta FFR_t\right] + \gamma \overline{(f^i_{t-3} - s^i_{t-3})} + \varepsilon_{t-2\to t}$. I run the regressions for the periods prior to the FOMC announcements, for which the futures spread signal a policy change (i.e., when $\mid E^{fff}_{t-3}\left[\Delta FFR_t\right] \mid > 12.5$ bps). The number of these announcements is 57. The returns are versus the USD. Positive returns indicates the USD appreciation versus the foreign currency. *t*-statistics are shown in brackets. Bold numbers are statistically significant at the 5% level. The R^2 are in percent.

Table A.5 reports the results from these predictive regressions. *Panel A* shows that a high fed funds futures spread significantly (at the 5% confidence level) forecasts the dollar appreciation for four out of nine FX pairs. For three other FX pairs, the *t*-stats indicate 10% significance, and only JPY has an insignificant coefficient. The R^2s vary from 7% to 20%, when excluding JPY. Typical high interest rate currencies (AUD and NZD) have the largest loadings on the fed funds futures spread (1.2 and 1.48). This implies that these currencies tend to appreciate (depreciate) more than lower interest rate currencies prior to the Fed cuts (increases). The cross-sectional

correlation between these slope coefficients and time-series averages of the respective currency interest rate differentials is 78%.

I add own average forward discount to each regression and report the results in *Panel B* of Table A.5. I find that none of the increases in the R^2 as compared with *Panel A* are marginally small (0-3%). The results for own currency-specific forward discounts, $f^i_{t-3} - s^i_{t-3}$, are similar and reported in Table A.6. In summary, the predictive power for the two-day pre-FOMC dollar returns comes from the fed funds futures spreads, not from the interest rate differentials as proxied with the forward spreads.

	$E^{fff}_{t-3}[\Delta FFR_t]$	*t*-stat	$(f^i_{t-3} - s^i_{t-3})$	*t*-stat	R^2
AUD	1.10	[1.80]	-2.02	[-1.35]	12.1
CAD	0.70	[1.69]	0.91	[0.60]	9.6
CHF	0.71	[1.88]	**-1.40**	[-2.32]	19.0
EUR	**0.82**	[2.04]	-1.43	[-1.70]	23.3
JPY	0.29	[0.93]	-0.53	[-0.85]	2.3
NOK	0.76	[1.59]	0.98	[0.67]	8.0
NZD	**1.40**	[2.34]	-1.46	[-0.90]	18.8
SEK	0.61	[1.71]	-0.40	[-0.70]	7.3
GBP	**0.99**	[2.02]	-0.38	[-0.56]	16.0

Table A.6: **Predicting Individual Currency Returns with Single Forward Discounts.** $rx^i_{t-2 \to t} = \alpha + \beta E^{fff}_{t-3}[\Delta FFR_t] + \gamma(f^i_{t-3} - s^i_{t-3}) + \varepsilon_{t-2 \to t}$. I run the regressions for the periods prior to the FOMC announcements, for which the futures spread signal a policy change (i.e., when $| E^{fff}_{t-3}[\Delta FFR_t] | > 12.5$ bps). The number of these announcements is 57. The returns are versus the USD. Positive returns indicates the USD appreciation versus the foreign currency. *t*-statistics are shown in brackets. Bold numbers are statistically significant at the 5% level. The R^2 are in percent.

I also run regressions (10) for the set of 38 currencies, using a sample of daily exchange rates from Lustig, Roussanov, and Verdelhan (2011). The cross-sectional correlation between the fed funds futures slope coefficient and average forward discount is lower than for G10 currencies: it is 27%, significant at 10% level. Figure A.2 illustrates this cross-sectional relationship.[20] In summary, the evidence in this subsection suggest that *(1)* fed funds futures spread predict pre-FOMC currency returns better than own currency forward spreads, *(2)* when the market participants anticipate the target rate cut (increase), they tend to sell (buy) the dollar more against high interest rate currencies and less against low interest rate currencies.

I do not have daily or intraday FX order flow data to examine whether investors indeed

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[20]The fed funds futures spread does not have the predictive power for the *HML* factor (difference between the currency returns of high and low interest rate currencies) from Lustig, Roussanov, and Verdelhan (2011).

quit the dollar and buy higher interest rate currencies in the last two days prior to the Fed cuts. However, this is consistent with the standard intuition that capital flows from lower-yielding to higher-yielding currencies, exemplified by the following quote from the *The Wall Street Journal* on June 26, 2003, the day after a 25 bps target rate cut: "Prior to the Federal Open Market Committee's announcement of a reduction of 0.25 percentage point in the federal-funds target rate, the dollar had slipped sharply on a flurry of last-minute positioning that sent a slew of currencies to highs for the day against the dollar. Some investors had shifted to higher-yielding currencies such as sterling and the Canadian, Australian and New Zealand dollars to guard against a more aggressive 0.50-percentage-point cut that would have further widened interest-rate differentials and made dollar-denominated assets even less attractive."
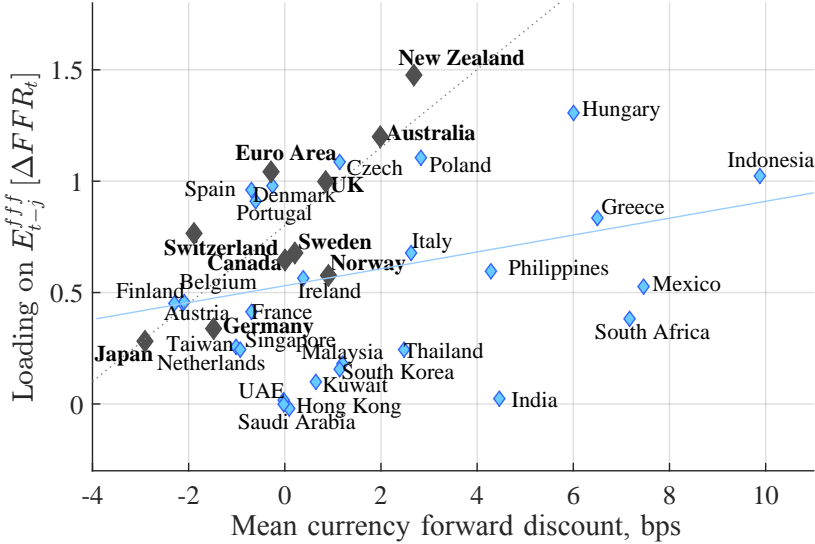

Figure A.2: **38 currencies: Loading on the fed funds futures spread versus currency forward discount.** This figure plots the times series means of the currency forward discounts against the loadings of the respective pre-FOMC dollar return on the fed funds futures spread from regression (10). A solid line shows a linear cross-sectoonal fit for 38 currencies, a dashed line shows a linear cross-sectional fit for G10 currencies.

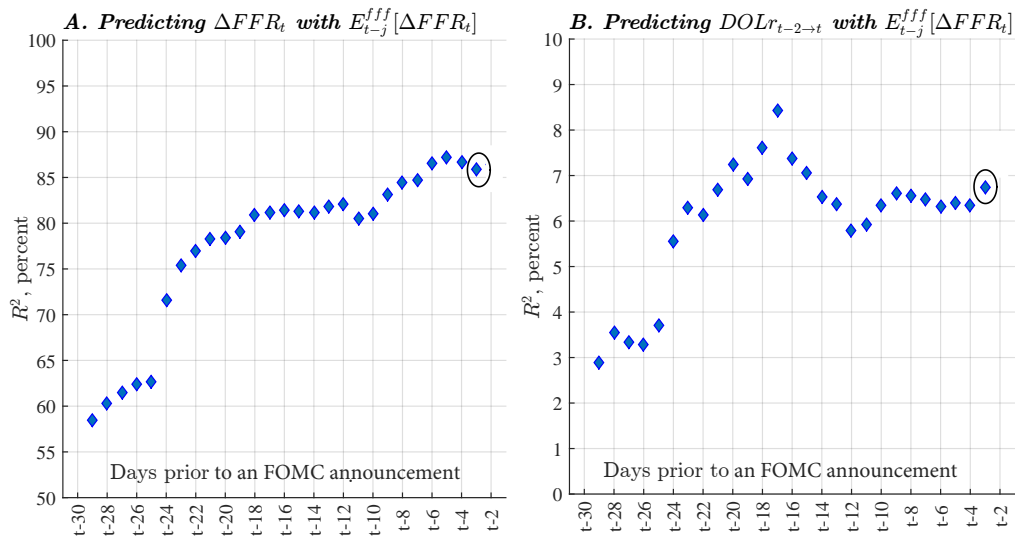# 8 Predicting pre-FOMC Dollar Returns with Lagged Fed Funds Futures

Figure A.3: **Predicting with stale fed funds futures spreads.** The figure depicts the R^2 from predicting the target rate change (*Panel A*) and the two-day pre-FOMC dollar return (*Panel B*) with the fed funds futures spreads recorded on different days during a month prior to the FOMC announcement (see *x*-axis). The diamond point in the circle in *Panel A* (*Panel B*) is the R^2 from the regression of ΔFFR_t ($DOLr_{t-2 \to t}$) on $E_{t-3}^{fff}[\Delta FFR_t]$. The sample is 176 scheduled FOMC announcements from 1994–2015.

9 Currency Realized Volatility and Bid-Asks around FOMC Announcements

I examine the realized volatility and bid-ask spreads on the dollar returns around FOMC announcements. Since these measures are proportional to the information flow in the large set of models (e.g., Ross 1989), a spike in either volatility or illiquidity prior to the FOMC announcement would indicate a rise in the flow of information, for example, due to commentaries in the media. Figure A.4 plots the rolling one-hour realized dollar volatility (computed from five-minute returns) around target rate raises and cuts. Figure A.5 depicts five-minute bid-ask spreads surrounding target rate rises and cuts. Both realized volatility and illiquidity are not abnormally higher in the two days prior to the announcement – they are just as in other days of my sample. (FX illiquidity tends to increase in the afternoon EST as European markets close. FX illiquidity is the lowest in the mornings, when both U.S. and European markets are open.) Both measures jump right after the announcement, reflecting increased trading on the FOMC news.
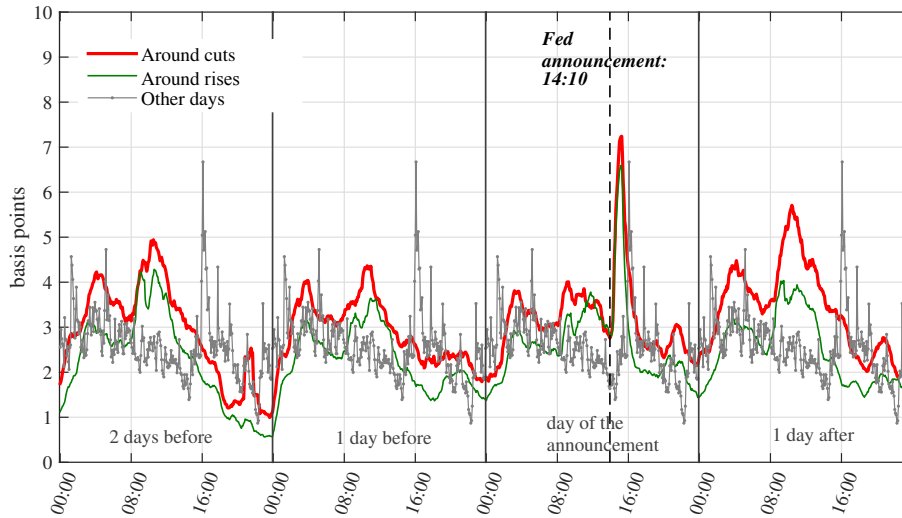
Figure A.4: **Realized volatility around target rate cuts and rises and in the other days.** The figure depicts five-minute FX realized volatility, computed as a one-hour rolling average of absolute five-minute dollar returns. I show the average volatility around 35 target rate rises, 22 target rate cuts (as predicted by the fed funds futures) and in the other days. The realized volatility is averaged across the EUR, GBP, CHF, JPY rates vs USD.
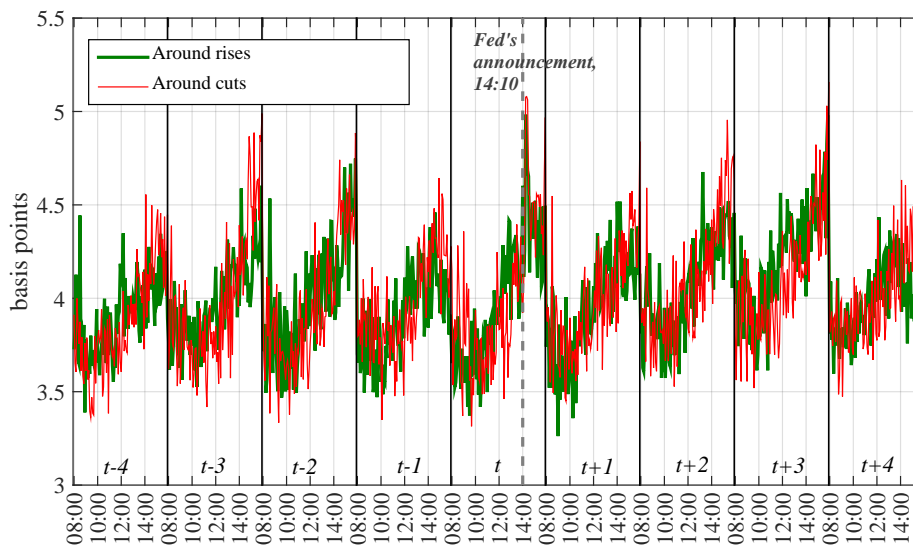

Figure A.5: **Dollar illiquidity around target rate cuts and rises and in the other days.** The figure depicts average standardized five-minute bid-ask spreads around 35 target rate rises and 22 target rate cuts, predicted by the fed funds futures. The bid-ask spreads are averaged across the EUR, AUD, GBP, and CAD rates vs USD.

10 Unscheduled Meetings

What happen with the dollar prior to unscheduled FOMC meetings? Over 1994–2015, seven target rate changes took place at the unscheduled FOMC meetings: one increase in 1994, one cut in 1998, three cuts in 2001, and two cuts in 2008. The dollar depreciated during the two days prior to the unscheduled raise. The dollar also depreciated prior to five out of six unscheduled cuts. The sample size is too small to draw any conclusions.

11 Macroannouncements as a Source of Risk Premium

Another source of information might come from the macroannouncements which are released in the two-day pre-FOMC window. A positive GDP or unemployment report can make market participants more certain about the Fed's most likely policy move and thus boost the pre-FOMC dollar return. I use Bloomberg to collect key macroannouncements (GDP, industrial production, CPI, PPI, unemployment) in the two-day pre-FOMC window. For 15 FOMC announcements out of 57 (when a target rate change was ex-ante signaled by the fed funds futures) there was a macroannouncement in the two-day pre-FOMC period.

First, I exclude these 15 announcements and re-run my main predictive regression (2). The coefficient stays the same at 0.8 (t-stat=2.2), the R^2 reduces from 22% to 16%. I then re-run the same regression for only 15 announcements, when the fed funds futures predict a target rate and there is a macroannouncement scheduled in the two-day pre-FOMC announcement period. The slope coefficient is 1.8 (t-stat=3.6), the R^2 is 55%. These results suggest that the presence of macroannouncements might explain a part of the pre-FOMC dollar risk premium, but not all of it as the predictive power from the fed funds futures spreads for the dollar returns remains after I exclude the overlapping events from the sample.

12 Wider Window Around the FOMC Announcement

What is the dynamics of the fed funds futures spread and the dollar earlier than in the last two days prior to an FOMC announcement? In Figure A.6, I plot the average (across the FOMC announcements) fed funds futures spreads around the realized target rate raises (*Panel A*) and cuts (*Panel B*), see dotted lines. The solid bold line indicates the cumulative five-minute dollar returns, standardized to zero at the day of announcement. The figure covers the month (22 trading days) surrounding the FOMC announcement.

First, fed funds futures spreads move in the direction of the realized policy move during

a month prior to the FOMC meetings. In other words, fixed income markets become more certain about the Fed's most likely action. This evidence is suggestive of a presence of risk premium during the weeks prior to the announcement. In fact, fff_{t-15} or fff_{t-10} do predict their own returns and government bonds returns over the next three or two weeks up until the announcement. The macroannouncements, policy speeches and other world shocks which (might) come out during this time are the most likely source of this risk premium.

Figure A.6 also shows that the dynamics of fed fund futures spread does not line up with the dynamics of the dollar earlier than in the two days preceding the FOMC announcement. The dollar returns are not statistically different from zero over a month prior to the announcement and a t-stat=-0.7 for the difference between $DOLr_{t-22\to t-2}$ prior to the target rate rises and cuts. The correlations between $DOLr_{t-j\to t-3}$ and changes in futures spreads $E^{fff}_{t-j\to t-3}[\Delta FFR_t]$ (for $j = 22, 12, 7$ days) are close to zero.

Figure A.6 also shows that on average the futures spread is already 25 bps three weeks prior to the target rate raise, well above a 12.5 bps threshold. Similarly, the futures spread is -20 bps three weeks prior to the target rate cut, well below a 12.5 bps threshold. This illustrates that the futures market has already figured out the most likely Fed's decision well ahead of time, not just three days prior to the FOMC announcement. Finally, the figure suggests that the pre-FOMC announcement dollar drift is short-lived as on average the dollar does not keep going into the direction of the announced target rate change after the announcement.
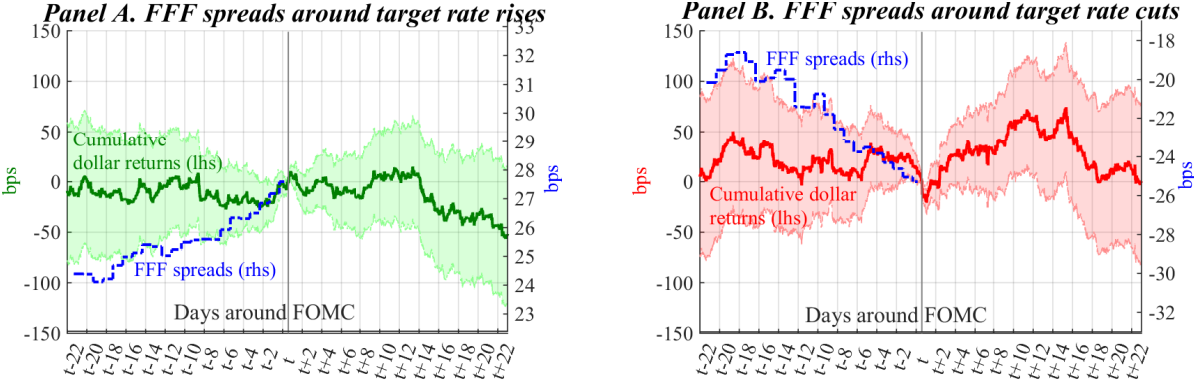

Figure A.6: **FFF Spreads and Dollar.** The solid line depics average cumulative dollar returns during a month before and after the FOMC announcement (day t). I standardize the fed funds futures spread (dotted line) by the size of the realized policy change (25/50/75 bps) before computing the average spread across the announcements. See the notes to Figure 1 for the details on the standard errors around average cumulative returns.

13 Pre-FOMC Fixed Income Returns

Do fed funds futures spreads predict their own return or the changes in other interest rates in the pre-FOMC window? If so, this would suggest a presence of the risk premia. I run the regressions $ret_{t-3 \to t-1} = \alpha + \beta E_{t-3}^{fff} [\Delta FFR_t] + \varepsilon_{t-3 \to t-1}$, where $ret_{t-3 \to t-1}$ is the return on the fed funds futures contracts, T-bills and Treasury bonds. I use *CRSP* to extract the price data on the on-the-run 3-month and 6-month T-bills prior to the announcement.[21]. As for the bonds, I use the continuous series of one year through ten year yields from the *FRED* and transform them to the returns. I do not have high-frequency data on these yields, so I use their returns from three days prior to the FOMC announcement to 1 day prior to the announcement, both of which are captured at 16:00 EST. Table A.7 shows that neither of these fixed income pre-FOMC returns is predicted by the futures spread. The only exception is a 1-year bond with a -0.05 coefficient significant at 10% level.[22]

		$E_{t-3}^{fff} [\Delta FFR_t]$	t-stat	R^2
1	Next-month fff	0.03	[0.95]	4.6
2	3M fff	0.42	[0.10]	0.0
3	3m T-bill	-0.20	[-0.23]	0.1
4	6m T-bill	-0.48	[-0.40]	0.4
5	1Y bond	-0.05	[-1.91]	9.4
6	2Y bond	-0.03	[-0.43]	0.5
7	3Y bond	-0.02	[-0.20]	0.1
8	5Y bond	0.06	[0.32]	0.2
9	10Y bond	0.76	[1.34]	3.1

Table A.7: **Predicting pre-FOMC Fixed Income Returns with the Fed Fund Futures Spread.** The table shows results from running $ret_{t-3 \to t-1} = \alpha + \beta E_{t-3}^{fff} [\Delta FFR_t] + \varepsilon_{t-3 \to t-1}$, where $ret_{t-3 \to t-1}$ stands for a return of each fixed income instrument from three days prior to the announcement to one day prior to the announcement. t-statistics are shown in brackets. Bold numbers are statistically significant at 5% level. The R^2 are in percent.

Fixed income instruments are the most sensitive assets to the monetary policy news. The evidence that the fed funds futures do not predict their own returns and returns of other fixed income instruments is suggestive that there is no monetary policy risk premia in these assets in the two-day pre FOMC period. It is hard to reconcile this evidence with a potential presence of risk premia in the FX market.

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[21]This avoids technical rises in the yield due to rolling maturity, if I were to use the interpolated continuous series.

[22]Currency forward spreads also do not predict the fixed income pre-FOMC returns (unreported).

Finally, I find that the correlation between the contemporaneous change in the fed funds futures, $E_{t-3\to t-1}^{fff}[\Delta FFR_t]$ and the pre-FOMC dollar return (across the announcements for which the futures encode the target rate change) is 18% and is statistically significant. While indicating that a positive dollar return is associated with market participants becoming more hawkish prior to the announcement, it is not clear why rises in the futures spreads earlier than three days prior to the FOMC are not associated with the dollar appreciation (recall *Panel A* of Figure A.6). Also, the level of the fed fund futures spread, $E_{t-3}^{fff}[\Delta FFR_t]$, drives out $E_{t-3\to t-1}^{fff}[\Delta FFR_t]$ in the regression of the pre-FOMC dollar return.

14 Recent Change in the Fed Funds Futures

I next investigate whether a recent change in monetary policy expectations, $E_{t-k\to t-3}^{fff}[\Delta FFR_t]$ (I run *k* from 10 to 4), can help to predict the pre-FOMC announcement dollar return. It might be that the dollar pre-FOMC return is a delayed reaction to a recent *change* in the expectations, rather than a reaction to the *level* of expectations formed by market participants prior to the announcement. I find that $E_{t-k\to t-3}^{fff}[\Delta FFR_t]$ provides explanatory power for up to 10% of variation in the pre-FOMC dollar returns for some *k*, but only marginally contribute to the R^2 as soon as I include $E_{t-3}^{fff}[\Delta FFR_t]$ in the regression (2). The maximum improvement in the R^2 from my baseline 22% result comes from adding the most recent change in the expectations, $E_{t-4\to t-3}^{fff}[\Delta FFR_t]$, which enters the regression with a 1.7 *t*-stat and increases the R^2 by two percentage points.

15 Longer-term Monetary Policy Expectations

I next test whether long-term market expectations of future Fed policy, measured with the level and slope of Treasury yields can predict the pre-FOMC dollar return. I extract the first two principal components from the cross-section of daily one through ten year Treasury yields from the *FRED* to construct the level and slope factors. I find that neither of these two factors has predictive power for the pre-FOMC announcement dollar return (unreported for brevity).

16   Pre-1994 Period

Did the dollar returns exhibit the directional pre-FOMC announcement drift before 1994? In short, yes it did, but the drift started earlier than two days prior to the target rate change.

Prior to 1994, market participants inferred Fed's actions based on the size and type of open-market operations, which were announced the day following the scheduled FOMC meeting. I collect historical dates of scheduled FOMC meetings from the Fed's web-site[23] and match them with the target rate from the FRED. If I observe a target rate change on the day or during three days following the day with a scheduled meeting, I assume that the Fed adopted a policy change at that meeting.

Between 1982 and 1993, the Fed announced only one-third (31) of the target rate changes at the scheduled meetings, while two-thirds (64) of target rate changes were made during inter-meeting periods, i.e., outside the pre-specified schedule of FOMC meetings. Among 31 policy changes at the scheduled meetings, there are 16 rate increases and 15 cuts. Among the 64 intermeeting policy changes, there are 27 rate increases and 37 cuts. The pre-1994 period is interesting not only because I can check whether my results hold out-of-sample (even though under a different policy regime), but it also offers an opportunity to compare the dynamics of the dollar between the target rate changes at the scheduled and unscheduled FOMC meetings.

In Figure A.7, I plot average daily cumulative dollar returns for the 20 days before and the 20 days after the target rate raises and cuts at the scheduled meetings (*Panels A* and *B*) and at the unscheduled meetings (*Panels C* and *D*). The figure has four messages. First, prior to 1994, the dollar tends to go up during the several days prior to the target rate increases (*Panel A*) and goes down prior to the target rate cuts (*Panel B*). The two-day pre-FOMC announcement dollar return is 24 bps (1.7 *t*-stat) prior to the increases and -37 bps (-2.8 *t*-stat) prior to the cuts. The difference between the two averages is statistically significant and the magnitudes are very similar to those observed in 1994–2015. Second, the pre-FOMC announcement drift in the dollar is longer-lasting: on average the dollar goes up by 84 bps (2.7 *t*-stat) during the two weeks preceding the target rate increases and by 114 bps (-7.1 *t*-stat) during two weeks preceding the target rate cuts. Third, the dollar does not revert after the scheduled announcements. The dollar keeps appreciating after the increases and depreciating after the cuts. Finally, the dollar is on average flat around the unscheduled announcements where the Fed increased the target rate. The dollar goes down by 27 bps (-1.9 *t*-stat) during the two days preceding the the unscheduled announcements of target rate cut.

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[23]https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm
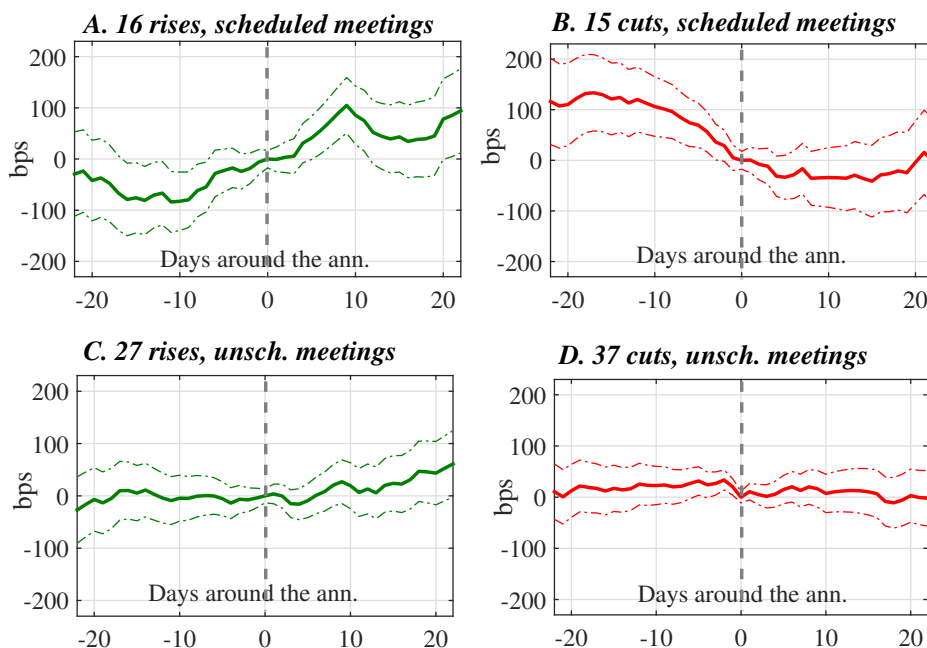
Figure A.7: **Pre-1994: Dollar Cumulative Returns Around Target Rate Changes.** The dashed lines are 90% confidence bands around average cumulative returns. The sample covers 31 target changes at the scheduled meetings and 64 target rate changes at during intermeeting periods, September 1982–December 1993.

How predictable are these movements in the dollar prior to 1994? Since the fed funds futures started being traded in 1988, I use one-month LIBOR spread over the target as a proxy for monetary policy expectations. I regress the two-day pre-FOMC announcement return on the L spread recorded three days prior to the scheduled FOMC meetings. I run this regression for all 90 scheduled meetings for 1982–1993. The slope coefficient is positive and statistically significant at 10% level (1.7 t-stat), the R^2 is 2.4%. This R^2 is three times smaller than 7.6% in the predictive regression with the fed funds spread for all 176 scheduled meetings from 1994–2014 (see Table A.3). The LIBOR spread has more predictive power for the 10-day pre-FOMC return (t-stat=2.2, R^2=3.6%) .

The weaker predictability of the dollar in the pre-1994 period might be due to poor predictability of the Fed's policy changes in this period. I regress the target rate changes at the scheduled meetings on the LIBOR spread recorded three days prior to the FOMC announcement and find an 18% R^2 (the slope coefficient has 2.6 t-stat). This R^2 is much lower than a 80% R^2 observed in the 1994–2014 period.

In summary, I observe a similar pattern prior to the scheduled meetings for the 1982–1993 period as for the 1994–2015 period: the dollar appreciates during the several days preceding

a tightening policy move and depreciates during the several days preceding an expansionary policy move. Money market rate spreads have lower predictability for the pre-FOMC dollar return, supposedly because the target rate changes are less predictable during this period.

17 Monetary Policy Expectations in Other Countries

It might be that monetary policy expectations in other countries or their difference with the U.S. monetary policy expectations matter for the dollar returns prior to an FOMC announcement. For instance, if the Fed is adopting monetary policy tightening, the pre-FOMC dollar return might depend on whether other Central Banks are also planning to raise rates in the nearest future, i.e. how hawkish are other Central Banks as compared to the Fed.

Since not all G10 countries have futures markets for their target rates, I collect their 1-month LIBOR interest rates and target rates (TR) from Bloomberg.[24] I proxy the foreign monetary policy expectations with the average money market spreads, $\overline{E_{t-3}^{LIBOR}\left[\Delta TR_t^i\right]}$, i.e., the average difference between the LIBOR and target rate across the G10 currencies. I exclude fall 2008 due to the presence of huge credit risk premium in the money market rates.

I run predictive regressions of the pre-FOMC announcement dollar returns with $\overline{E_{t-3}^{LIBOR}\left[\Delta TR_t^i\right]}$ and the difference between $\overline{E_{t-3}^{LIBOR}\left[\Delta TR_t^i\right]}$ and $E_{t-3}^{fff}\left[\Delta FFR_t\right]$ and find that neither foreign monetary policy expectations, nor their difference with the U.S. monetary policy expectations helps to forecast the pre-FOMC announcement dollar returns. The result for average monetary policy expectations across EUR, GBP, CHF, and JPY is similar.

18 Target Rate Changes by other Central Banks

I investigate whether currency returns of other countries can be predicted prior to the target rate changes made by their Central Banks. I collect the exact dates of policy actions for G10 countries from *Bloomberg*. For each country, I use the spread of 1-month rate over the target rate, $E_{t-3}^{LIBOR}\left[\Delta TR_t\right]$, to measure the policy expectations three days prior to the announcements by Central Banks. Then I run predictive regressions of the two-day currency pre-announcement returns on $E_{t-3}^{LIBOR}\left[\Delta TR_t\right]$. I find close to zero R^2 and insignificant t-stats, suggesting that other countries' monetary policy expectations (encoded into the LIBOR rates) do not predict their home currency returns prior to the target rate changes.

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[24]In the case of the U.S., 1-month LIBOR interest rate spreads predict the target change almost as well as the fed funds futures spread for the period prior to the financial crisis, when money market yields had a large credit risk component.

19 Interest Rates in the US and in G10 countries

Panel A. Target rate
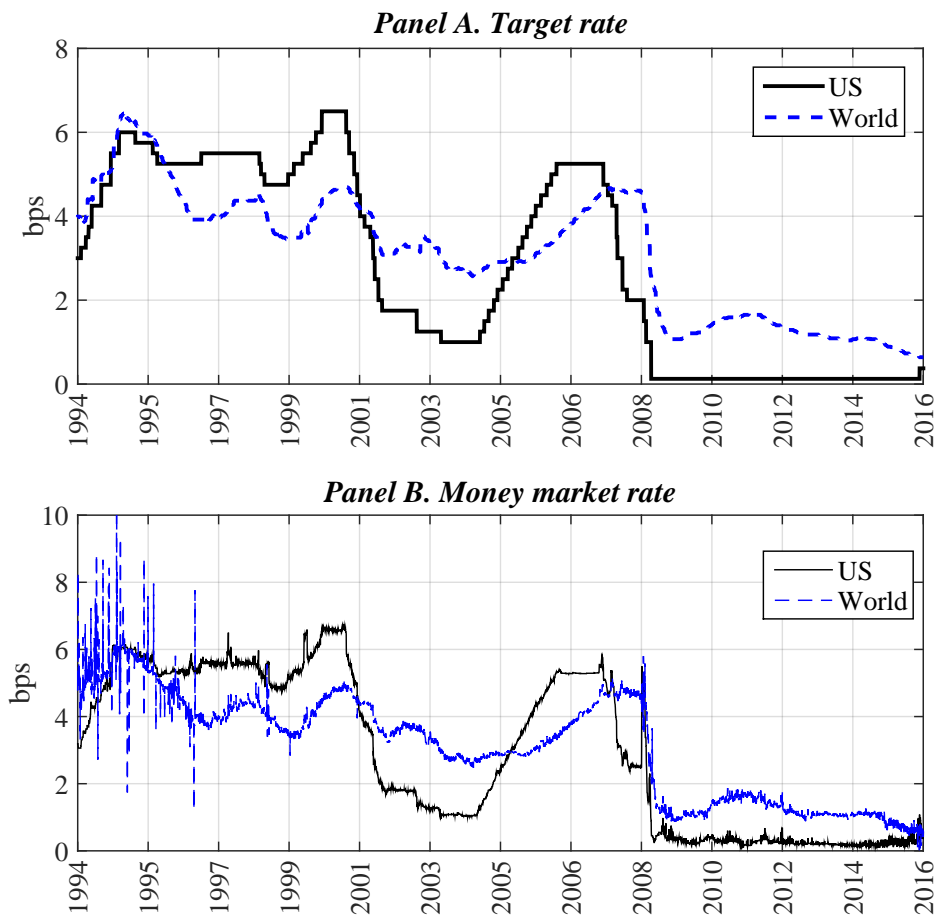

Panel B. Money market rate

Figure A.8: **Interest Rates in the US and in G10 countries.** The world interest rate is the average across the G10 countries interest rates (excluding the U.S.).

20 Media Interpretations of the Pre-FOMC Drift in the Dollar

The Wall Street Journal, 27 June 2003, second day after 25 bps target rate cut on 25 June 2003: "The dollar rocketed higher to finish the day around its session peaks as the lingering effects of the Federal Open Market Committee's interest-rate decision fueled gains at the expense of the euro and other rivals. Even the so-called high-yielding currencies, such as the New Zealand, Canadian and Australian dollars, lost ground to the U.S. dollar in the wake of the Fed Reserve's smaller-than-expected interest-rate cut and more-upbeat accompanying statement."

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Dow Jones Commodities Service, 19 Sep 2005, day before the FOMC announcement to raise the target: "In addition to the support the dollar was getting versus the euro, it has been broadly helped by the wide expectation that Fed policy makers will raise interest rates when they meet Tuesday."

Dow Jones Commodities Service, 19 Sep 2005, day before the FOMC announcement to raise the target: "Volatilities implied by dollar/yen currency options fell slightly around the short-end of the curve in Asia Tuesday as demand for downside protection weakened amid expectations that the U.S. Federal Reserve will raise interest rates later in the day."

Dow Jones Chinese Financial Wire, 1 November 2005, right after the FOMC announcement to raise the target: "The dollar was little changed Tuesday, failing to gain much support from a widely expected Fed decision to hike interest rates. The dollar was unable to extend earlier gains after FOMC voted unanimously to raise its benchmark interest rate 25 basis points to 4.0%. The Fed fully met market expectations by hiking interests rates and at the same time offered a clear signal that no end is yet in sight for its ongoing tightening campaign."

Dow Jones Commodities Service, 28 June 2006, day before a 25 target rise: "The dollar is sharply higher versus its European rivals late Wednesday morning in New York, as the euro and other currencies grind through stops ahead of the Federal Reserve interest rate decision on Thursday. After trading within narrow bands overnight and earlier in the session, the dollar began to advance, with the single currency dropping about a third of a cent in less than half an hour and the pound declining about half a cent in the same time frame. Analysts attributed the movement mostly to pre-Fed meeting jitters and technical trading, noting that moves through key levels triggered automated orders that sent the European currencies lower."

The Wall Street Journal, 29 June 2006, on the day on 25 bps target rate rise: "The dollar gained in jittery trading against the euro, yen and most other currencies as foreign-exchange markets braced for today's U.S. interest-rate announcement. Investors bought dollars ahead of the Federal Open Market Committee's decision, to guard against a larger-than-anticipated rate increase or strong signals of further rate increases in the statement that accompanies the FOMC announcement, analysts said. The prevailing opinion is that at least a 0.25-percentage-point increase is all but guaranteed, while more-speculative types believe there is an outside chance of a 0.50-percentage-point rate increase. Higher U.S. rates support the dollar because they make dollar-denominated assets more attractive to investors from abroad."