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Did U.S. Conventional Monetary Policy affect Foreign Exchange Rates in a Conventional Way during the Pandemic?

By

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Abstract

Monetary policy has traditionally served as a critical signal influencing various market behaviors. However, the effectiveness of traditional monetary policy in the context of financial markets during times of crisis has been called into question. This study seeks to investigate this issue by analyzing exchange rate ETF data and federal funds futures data from 2020 to 2023. Specifically, it examines the association between US conventional monetary policy surprises and exchange rate movements during the COVID-19 pandemic. The results indicate that a 1% increase in the tightening policy rate shock correlates with a 0.0365% appreciation of the US dollar during the event window. This finding suggests that even amidst the economic uncertainties brought on by the COVID-19 pandemic, traditional monetary policy actions, such as interest rate changes, continue to play a significant role in influencing exchange rate dynamics. This has important implications for policymakers and market participants, as it underscores the persistent relevance of monetary policy in guiding market expectations and behaviors during periods of crisis.

1 Introduction

Monetary policy has played a crucial role in managing inflation, fostering growth and employment, impacting asset prices, ensuring financial stability, and altering investors's future expectations through interest rate adjustments. In an era marked by unprecedented financial turbulence and global economic crises, the relationship between monetary policy and asset prices has come under increased scrutiny. Understanding the connection between central bank announcements and asset prices is vital for monetary policymakers. It allows them to gauge the impact on the real economy through financial markets, assess market reactions, and make informed decisions that foster financial stability and economic growth. Likewise, participants are interested in estimating the response of asset prices to changes in monetary policy because investigating this effect enables them to detect market shifts promptly, gain confidence in economic prospects, and optimize returns while mitigating potential losses.

Much research has built on the investigation of the effectiveness of monetary policy on asset prices, and there is a rich body of literature on the transmission of monetary policy to financial markets, based on event-study methodology. This literature review embarks on an evolution of the research method and a comprehensive exploration of the evolving dynamics between monetary policy and asset prices, consolidating the research question on the ongoing effect of the U.S. conventional monetary policy surprise on the financial markets, particularly on the exchange rate behavior during the covid pandemic.

Cook and Hahn (1989) pioneered the analysis of market reactions to monetary policy actions by studying the one-day response of bond rates to changes in the target Fed funds rate through regression analysis. However, instead of conditioning on the changes in the policy rate itself, Kuttner (2001) innovatively utilized changes in Fed funds futures to gauge the impact of surprise factors in monetary policy on market response, distinguishing between expected and unexpected policy actions. This approach revealed that the market's reaction to unexpected policy changes is notably stronger than to anticipated changes embedded in the policy rate itself, as the futures market captures market expectations and surprises effectively. This method has since been widely adopted for estimating the effects of policy surprises on financial markets and event study analyses. The evolution of research is that later application of event studies has adjusted the ordinary least square regression used under such a method to include more aspects of the monetary policy announcement, besides the surprise change in federal funds rates, to capture the surprise element of the market. Instead of measuring policy surprise alone in the OLS regression, Gürkaynak et al. (2005) divided the policy surprises into two factors as the "current federal funds rate target" factor and the "future path of policy" factor, and thus estimated the effects of the change in each of these two dimensions of monetary policy announcements on asset prices. They propose that the second factor, in particular, is linked to the statements from the FOMC and, as a result, impacts the market by altering market anticipations regarding future policy measures. In addition, he used intra-day data rather than daily data for his estimation. By narrowing down the time frame, he eliminated the influence of employment reports and other news events that coincide with monetary policy announcements. Consequently, the relationship between monetary policy actions and asset prices becomes more apparent than when working with daily data. This approach captures the market's anticipation element by emphasizing the second factor related to FOMC statements. By adopting intra-day data, a more nuanced understanding of the relationship between monetary policy actions and equity prices has emerged. Moreover, by employing more comprehensive regression models to specify policy surprises into distinct factors, this paper also paves the way for future monetary policy event-study literature.

As the 2008 financial crisis unfolded, extensive research has delved into the true efficacy of monetary policy on financial markets, giving rise to controversial viewpoints regarding its effectiveness. For example, Mishkin (2009) argues that implementing aggressive monetary policy measures during financial crises, including preemptive interest rate cuts and unconventional policy tools near the zero lower bound, is highly effective in mitigating economic damage. These actions could alleviate the adverse cycle of economic downturn, thereby preventing further job losses, increasing consumer spending and business revenues, and mitigating the uncertainty in asset values. While much literature suggests that monetary policy has had limited and insignificant effectiveness on stock and bond markets reaction during financial crises (Kontonikas et al. (2013); Connolly and Doh (2013), multiple studies indicate that monetary policy actions significantly influence exchange rates market, with a more pronounced impact observed during financial crises compared to other periods. For example, employing event study analysis and daily frequency futures, Jiang and Wang (2017) find that exchange rates in developed countries were significantly influenced by unexpected monetary policy shocks from the Fed, with foreign exchange rates showing heightened sensitivity during crisis periods compared to ordinary periods. In addition, Ben Omrane and Savaşer (2017) discovered that employing the two-state logistic smooth transition regression (LSTR) model revealed a stronger reaction of currency markets to Fed funds rate news during the crisis period. While the effectiveness of monetary policy on stock and bond markets during financial crises may be debated, the evidence from multiple studies underscores its significant impact on exchange rates, particularly heightened during periods of economic turmoil.

There is large literature delving into exchange rate reactions to monetary policy, expanding upon Gürkaynak et al. (2005) methodology by examining the impact of two policy surprise components—target surprise and path surprise—on exchange rates. Hausman and Wongswan (2011), utilizing Gürkaynak's methodology, investigated monetary policy surprises using two proxies: the surprise change in the target federal funds rate (target surprise) and the revision in the expected path of future monetary policy (path surprise) defined as the change in one-year-ahead eurodollar interest rate futures in a 30-min window around the announcement. They found that exchange rates mainly respond to the path surprise, capturing news about revisions in the future policy path. Specifically, a 25-basis-point downward revision in the expected policy path correlates with approximately a 0.5% decline in the dollar's exchange value against foreign currencies. Additionally, their analysis reveals significant variations in asset price responses to Federal Open Market Committee (FOMC) announcements across countries, with these variations linked to a country's exchange rate regime. Rosa (2011) expanded upon Gurkaynak's method, in which he identify by second path factor by summarizing FOMC meeting statements' tone about future monetary policy directions and approximating unexpected components from its path communications through regressions. He discovered that both the surprise in policy decisions and statement tone significantly impact stock prices and dollar exchange rates, with the surprise component of statements driving most of monetary policy's effect on asset returns. Gürkaynak et al. (2021) further pointed out that since different currencies may react differently to the same monetary policy surprises due to informational assumptions, no single economic model can fully capture and explain the diverse response of exchange rates. Due to the heterogenity, they argued that the lack of uniformity implies multiple factors influence exchange rates movements to monetary policy changes, suggesting the need for further research and modeling efforts to reconcile the event study methodology. All these studies demonstrate that exchange rates respond to both target and statement surprises, with a stronger reaction observed towards statement surprises because they convey more information about future policy directions and market sentiment. However, due to time constraints, my research will build upon Gürkaynak et al. (2005) work but will specifically focus on the impact of monetary policy announcements (target surprise) on exchange rates, which remains effective albeit to a lesser extent than the statement effect.

The studies whose period is most pertinent to this research are those that assess the impact of monetary policy on financial markets amid the COVID-19 pandemic period. Wei and Han (2021) conducted an event study and used daily data to analyze how the pandemic affected monetary policy transmission in 37 severely impacted countries. They found that the pandemic significantly weakened this policy transmission to financial markets, regardless of the severity of the pandemic, and both conventional and unconventional monetary policies did not have significant effects on government bonds, stocks, exchange rates, or CDS markets during the COVID-19 period. The lack of significant policy transmission to financial markets during COVID may be attributed to the short investigation period, which only extended until April 30, 2020, and given that the pandemic continues until May 11, 2023, subsequent data collection could reveal more information on monetary policy effects. Moreover, the period from February to April 2020 was characterized by noisy fluctuations due to COVID-related developments, policies, lockdowns, and volatile public expectations, leading to a V-shaped trajectory in the stock market Cox et al. (2020). Given that April was a turbulent month in the context of COVID-related policies, their event-study estimation using daily data can be misled by the confounding policies. Thus, this volatility from Feburary to April may render conventional policy measures ineffective in influencing the stock market in the earily stage of pandemic, and a similar trend may have been observed in the exchange rates market. Baek and Lee (2022) study the link between monetary policy, mortality rates, vaccination efforts, and stock market volatility during the pandemic using quarter-fixed effects, benefiting from a longer timeframe spanning January 2020 to January 2022. Their extended dataset provides a more accurate assessment of how monetary policy affects the stock market during COVID, revealing that interest rate cuts initially cause market instability but lead to stabilization in the intermediate term (8-16 weeks). Their comprehensive analysis across all firms and industries strengthens the conclusion that monetary policy has a greater impact on the stock market than vaccination efforts, suggesting a shift in market focus towards Federal Reserve announcements during the pandemic. However, as highlighted previously, the initial phases of COVID-19 incorporated a multitude of shocks, including news shocks and various macroeconomic disturbances due to the volatile expectations surrounding the pandemic. When these diverse shocks, including monetary policy shocks, coincide within the same week, relying on quarter-fixed effects may be inadequate in controlling for non-monetary policy shocks. Given the possibility of multiple types of shocks occurring concurrently, the quarter-fixed effect might fail to isolate shocks related to monetary policy from other shocks. Consequently, its efficacy in capturing the impact of monetary policy shocks on stock market performance may be less persuasive. In contrast, utilizing intraday data is more compelling as it allows for a narrower window of analysis, effectively excluding unrelated shocks and enhancing the precision of capturing the specific influence of monetary policy on the financial market.

There has been limited research on the impact of US conventional monetary policy on exchange rate markets during COVID using event study methodology, with existing studies focusing on only a portion of the pandemic period. However, the absence of significant findings regarding conventional monetary policy's effect during the early stages of COVID does not diminish its potential relevance throughout the entire pandemic period. The purpose of this paper is to assess the relationship between US Fed monetary policy and the US exchange rate. This paper contributes to the literature in two aspects: by extending the traditional analysis to a longer timeframe, encompassing the entire COVID period up to May 2023, and using high-frequency ETF exchange rates data for six currencies (the US dollar exchange rate versus the euro, the Canadian dollar, the British pound, the Swiss franc, the Japanese yen, and the Australian dollar) to mitigate the influence of confounding factors like COVID-related news. By focusing on the effect of target surprise in US conventional monetary policy on exchange rate markets, this study aims to determine whether conventional monetary policy remains influential in the financial market landscape, particularly in shaping exchange rate dynamics and contributing to market stability during periods of economic uncertainty such as the COVID-19 pandemic. In addition, using high-frequency data in event studies around FOMC allows for a narrower window of analysis, effectively excluding confounding factors such as unrelated shocks and delayed reactions that might reflect more fundamental changes in expectations, adjustments in investment strategies, or shifts in economic conditions that unfold over days. With low-frequency or daily data, market movements might be influenced by events that occurred earlier or later in the day, whereas high-frequency data provides a clearer picture of how markets respond exactly at the time of the policy announcement. This focused analysis reduces ambiguity and noise, allowing for a more accurate identification of the causal impact of policy decisions on financial markets.

The rest of the paper is structured as follows: section 2 presents the data and some of the characteristics; section 3 provides the methodology of this study; section 4 shows the result of event study and several robustness checks; section 5 concludes and discuss the limitation of this study.

2 Data Description

2.1 Exchange Rate Data

Due to data limitation, I used exchange-traded funds: FXB, FXE, FXY, and FXF, FXC, FXA as a proxy of exchange rates. These are the US dollar exchange rate versus the British pound, the Euro, the Japanese yen, the Swiss franc, the Canadian dollar, and the Australian dollar. The ETFs prices were downloaded from NYSE Trade and Quote (TAQ) from Wharton Research Data Services (WRDS) dataset, covering the years of 2020 to 2023. Then I calculated the five-minutes log return of each etf, from 10 min before and 60 min after the monetary policy announcement (both statements and minutes release from 2020/04/29 to 2023/05/24. Throughout this paper, I adhered to Rosa (2011) definition for measuring exchange rates in US dollars needed to buy one unit of the foreign currency. In this context, a negative change signifies an appreciation of the US dollar.

3 Method

3.1 Measuring Monetary Policy Shocks

Following the standard practice in the literature Kuttner (2001), I utilized Fed funds futures data and applied Rosa (2011) equation and methodology to measure the surprise component of monetary policy decisions using 30-day fed funds futures sourced from Barchart.com. as detailed below:

$$MPS_t = \Delta f_t \left(\frac{m}{m-t} \right)$$

Where the fed funds futures rates

$$f_t$$

are calculated by 100 minus the fed funds futures prices,

$$\Delta f_t$$

is the change in the current month federal funds futures rates 10 min before and 20 min after the FOMC announcements at 2:00 p.m. (both statements and minutes announcement), t is the day of the month of the meeting, and m is the total number of days in that month. If there is no fed funds prices around this 30 minutes window, I observed and used the prices that are closest to this window. The fed funds futures 30 minutes window and the etf window follow the procedure used by Carlo Rosa. The reason why etf window is longer than futures window may be because these currency efts are more liquid, requiring more time to react. In addition, if the policy announcement dates take place during the last five days of the month, monetary policy shocks (MPSt) will be the unscaled change in the next-month federal funds futures contract:

$$MPS_t = \Delta f_t$$

On Federal Reserve website, I obtained the FOMC announcement dates by looking at the statement and minutes released days, in which the policy rate changes were announced. For this analysis, I will exclude dates of unscheduled monetary policy meetings, primarily happening during the COVID outbreak in early 2020, to avoid potential noises in the data that may arise from extraordinary circumstances during that period.

3.2 Plotting ETF's Return to Policy Shocks

By plotting the ETF log returns reaction to FOMC announcement for positive and negative policy shocks, the data shows trends that are compatible with the monetary policy behavior during the COVID period. Figure 1 illustrates the response of each cumulative exchange rate ETF's log return to FOMC announcements, spanning from 2 hours before to 2 hours after the policy announcement, for average positive and negative shocks. Following the 2:00 p.m. policy announcements, the cumulative log returns exhibit an upward trajectory, indicating dollar depreciation. These trends align with the investigation period, particularly during the COVID era, when conventional monetary policy primarily focused on rate reductions. Consequently, both positive and negative shocks predominantly stemmed from rate cuts. The positive and negative signs simply denote whether the rate cut exceeded or fell short of expectations, both resulting in an uptrend in log ETF returns and USD depreciation. Figure 2 presents a detailed view of the response of each cumulative exchange rate ETF's log return to FOMC announcements, ranging from 2 hours before to 2 hours after the announcement, for average positive and negative shocks in separate graphs. This focused analysis complements Figure 1, highlighting a distinct and consistent trend of foreign currency appreciation and USD depreciation following the policy announcement, except for the Swiss franc. The observed consistent trend, while informative, does not inherently signify statistical significance; thus, the subsequent section will delve into assessing the significance of monetary policy effects on log ETF returns through event study regression analysis results.

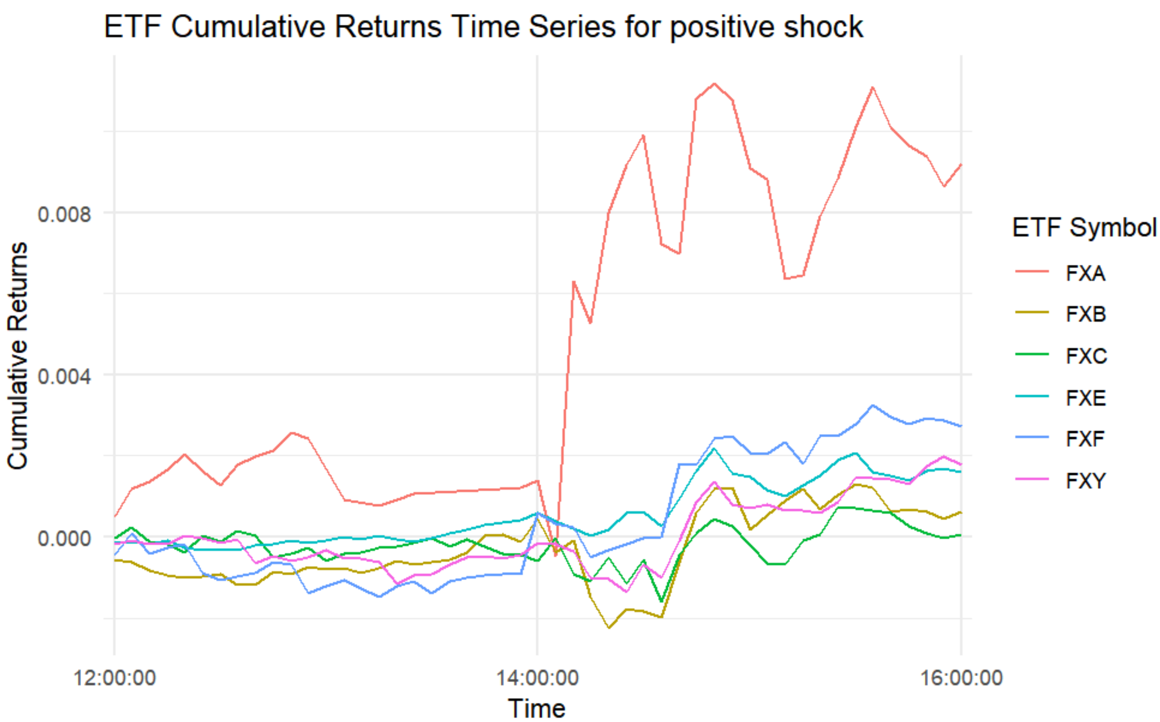

Figure 1: ETFs Cumulative Returns Time Series for Positive Shocks

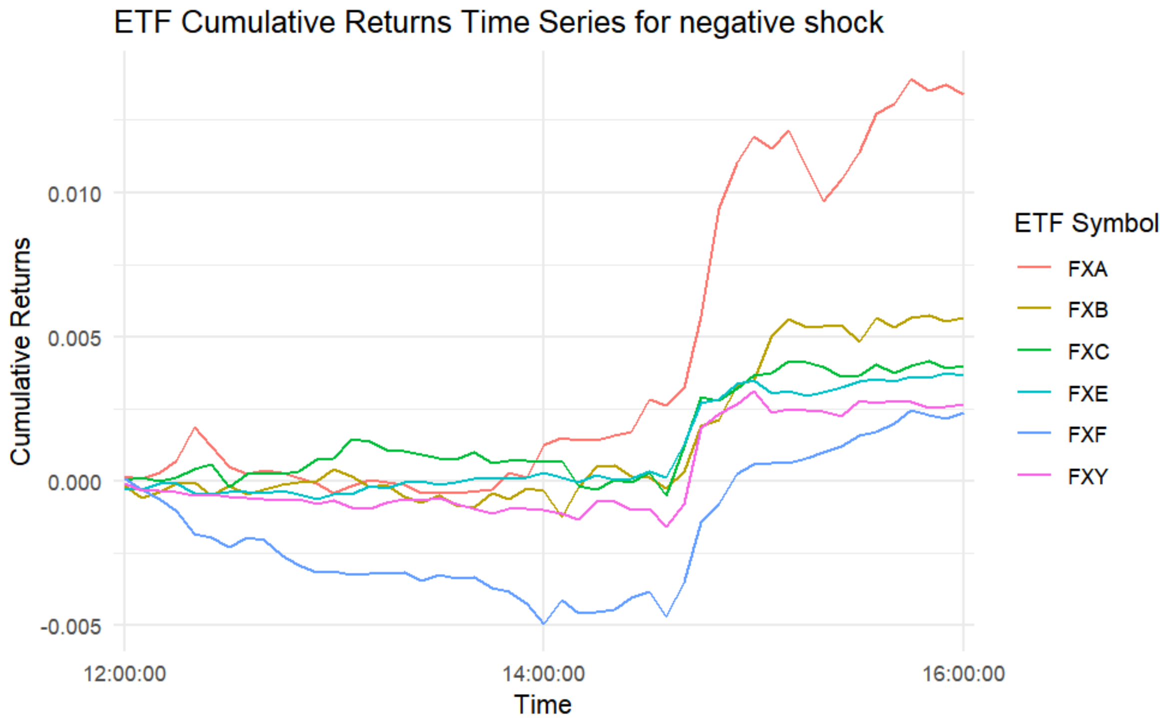

Figure 2: ETFs Cumulative Returns Time Series for Negative Shocks

4 Result

4.1 Simple Regressions for each ETF

The methodology follows the standard event study literature. $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$ The analysis focuses on the percentage change in the US dollar bilateral exchange rate, specifically from 10 minutes before an event to 60 minutes after. The variable

$$MPS_t$$

denotes the surprise components in the Fed's policy action, measured within the tight (30-minute) window surrounding the corresponding the FOMC announcement. The intercept represents the expected percentage change in the US dollar bilateral exchange rate from 10 minutes before an event to 60 minutes after when the surprise components in the Fed's policy action

$$MPS_t$$

are zero. The error term accounts for all other factors that influence the change in the exchange rate but are not explicitly included in the model. For regression 1 through regression 3, I estimate the effect of policy shocks on each ETF log return then estimate the effect of policy shocks on all six ETF log returns combined.

4.1.1 Regression 1

I first regress each log ETF return on US monetary policy shocks (regardless of whether it is on statements or minutes release days), without any controls.$log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$ According to Table 1, the sign of their betas suggests that 1% of the tightening policy rate shock is associated with a decrease in ETF log return. The p-values of each ETF are insignificant, suggesting that we don't have enough evidence to show a significant effect of US monetary policy shocks on each ETF return.

ETF	α	β	se$_\alpha$	se$_\beta$	t_α	t_β	p_α	p_β
FXA	0.0008	-0.0694	0.0006	0.0495	1.1986	-1.4013	0.2366	0.1676
FXB	0.0003	-0.0280	0.0004	0.0295	0.8523	-0.9465	0.3983	0.3486
FXC	0.0003	-0.0299	0.0003	0.0257	0.8172	-1.1605	0.4179	0.2516
FXE	0.0006	-0.0410	0.0004	0.0308	1.5944	-1.3326	0.1174	0.1890
FXF	0.0008	-0.0158	0.0004	0.0341	1.6987	-0.4628	0.0958	0.6456
FXY	0.0006	-0.0349	0.0004	0.0301	1.6382	-1.1614	0.1079	0.2512

Table 1: Simple Regression Results for each ETF

4.1.2 Regression 2

For the second regression, I estimate the effect of the monetary policy announcement surprise on FOMC statements released days on each of the six ETF log returns. $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$ According to Table 2, their betas suggest that 1% of the tightening policy rate shock is not associated with a change in ETF log return. The p-values of each ETF are insignificant, suggesting that the small decreases estimated may be due to chance and not changes in policy.

ETF	α	β	se$_\alpha$	se$_\beta$	t_α	t_β	p_α	p_β
FXA	0.0018	-0.0607	0.0012	0.0664	1.5033	-0.9145	0.1464	0.3699
FXB	0.0008	-0.0190	0.0007	0.0399	1.1965	-0.4774	0.2437	0.6376
FXC	0.0009	-0.0237	0.0006	0.0326	1.4949	-0.7258	0.1485	0.4753
FXE	0.0014	-0.0342	0.0007	0.0417	1.9651	-0.8181	0.0616	0.4217
FXF	0.0015	-0.0118	0.0008	0.0475	1.7335	-0.2486	0.0964	0.8059
FXY	0.0011	-0.0344	0.0007	0.0418	1.5548	-0.8226	0.1337	0.4192

Table 2: Simple Regression Results for each ETF on Statement Days

4.1.3 Regression 3

For the third regression, I estimate the effect of monetary policy announcement shocks on both statement and minutes released days on log ETF return. $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$ According to Table 3, the results are insignificant again. The lack of significance for the above-mentioned regressions could be attributed to data scarcity: each ETF only comprises 50 observations within the investigated period from April 2020 to May 2023. This limited dataset inherently reduces the reliability and power of the statistical analysis. The small number of observations restricts the ability to detect meaningful patterns or relationships, particularly when conducting separate regressions for each ETF. Such a constrained dataset may not capture the full variability and complexity of market dynamics, leading to results that lack statistical significance.

ETF	α	β	Type	Interaction	se_α	se_β	se_{Type}	se_{Int}	p_α
FXA	-0.0002	-0.0644	0.0020	0.0037	0.0009	0.1819	0.0013	0.1891	0.8247
FXB	-0.0001	-0.0808	0.0010	0.0618	0.0005	0.1088	0.0008	0.1131	0.7969
FXC	-0.0003	-0.0396	0.0012	0.0160	0.0005	0.0937	0.0007	0.0974	0.5309
FXE	-0.0002	-0.0331	0.0016	-0.0011	0.0006	0.1108	0.0008	0.1152	0.7693
FXF	0.0000	0.0154	0.0014	-0.0272	0.0006	0.1249	0.0009	0.1299	0.9437
FXY	0.0001	0.0180	0.0010	-0.0524	0.0006	0.1108	0.0008	0.1152	0.8523

Table 3: Simple Regression Results for each ETF on Both Statements and Minutes Days

4.2 Simple Regression for all ETFs

For the fourth regression, I estimate the effect of monetary policy shocks on all six log ETF returns, regardless of the currencies and other control variables. $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$ The intuition is change in FXR = change in the value of the foreign currency - change in the value of USD. Since this is a US monetary policy shock, we can assume that foreign currency values do not change in the short event windows around US monetary policy announcements. Therefore, a change in foreign exchange rate = - change in value of USD. This regression directly shows the effect of US conventional monetary policy shocks on US dollar value.

According to Table 4, the outcome is significant at the 1% level, indicating that a 1% increase in the tightening policy rate shock correlates with a 0.0364943% appreciation of the US dollar. These estimated coefficients align closely with those from previous studies focused solely on the FOMC's decisions regarding the current federal funds rate target. Earlier research suggests that a surprise tightening of 1% in the federal funds rate typically leads to a 1% to 2% appreciation of the US dollar within an hour following the event Rosa (2011). This observation may indicate that monetary policy is particularly impactful during the pandemic period, possibly due to unique economic conditions or market responses during this time. Specifically, the exceptional circumstances brought about by the pandemic, such as increased market volatility, shifts in investor sentiment, and heightened sensitivity to policy changes, could have amplified the impact of monetary policy announcements on currency markets.

Table 4: Simple Regression Results for all ETFs

	Estimate	Std. Error	t value	Pr(> $\|t\|$)
(Intercept)	0.0005653	0.0001784	3.168	0.00169 **
MPS	-0.0364943	0.0137756	-2.649	0.00850 **

	Residual Std. Error	Multiple R-squared	Adjusted R-squared
Value	0.003083	0.02301	0.01973

	F-statistic	p-value
Value	7.018	0.008499

4.3 Robustness check

To assess the robustness of the basic regression model examining all ETFs' log returns (regression 4) concerning the significance of the surprise element in central bank announcements, I perform supplementary regression analyses incorporating additional variables. These variables include economic projections, interaction terms, the types of the announcement (statements or minutes), and ANOVA tests.

4.3.1 Simple Regression with Economic Projections on all log ETF returns

For this regression, I estimate the effect of monetary policy shocks and whether the shock is along with economic projections on all the log ETF returns. $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \beta_2 Projections + \beta_3 MPS_t * Projections + \epsilon_t$

According to Table 5 the results enhance the robustness of the analysis by exploring the interplay between MPS, economic projections, and their combined impact on currency market responses. The MPS p-value of 0.015409 indicates that the effect of MPS on log ETF returns is statistically significant at the 5% level, controlling the presence of economic projections. This reaffirms the importance and reliability of the relationship between MPS and ETF returns observed in the basic regression. Based on the above result, on average, without economic projections, 1% of the tightening policy rate shock is associated with a 0.0538951% appreciation of the US dollar. With economic projections, 1% of the tightening policy rate shock is associated with a 0.0186676% appreciation of the US dollar. (b1+b3).

Regarding the interaction term, the statistical insignificance of the interaction implies that we do not have sufficient evidence that economic projections will affect the dollar value response to MPS. However, the interaction term effect is economically significant: dollar value is only 34.6% (0.0186676/0.0538951) responsive to MPS with economic projection presented. This observation might be explained by economic projections containing additional information that influences market expectations beyond just policy rate shocks. As a result, market participants may be less responsive to MPS when economic projections are considered. Additionally, not distinguishing between positive and negative economic projections could also contribute to the statistical insignificance of this interaction term. The P-value (0.061139) of economic projections suggests that the effect of economic projections on log ETF returns is marginally significant. When there are economic projections, log ETF return will tend to decrease by 0.06760% on average, holding MPS constant. This adds nuance to the analysis by suggesting that economic projections may have a modest influence on market behavior, albeit not as pronounced as MPS alone.

Table 5: Simple Regression Results on all ETFs with Economic Projections

	Estimate	Std. Error	t value	$Pr(>\|t\|)$
(Intercept)	0.0008564	0.0002526	3.390	0.000793 ***
MPS	-0.0538951	0.0221177	-2.437	0.015409 *
Econ_Proj	-0.0006760	0.0003597	-1.880	0.061139 .
MPS:Econ_Proj	0.0352275	0.0283541	1.242	0.215067

	Residual Std. Error	Multiple R-squared
Value	0.003064	0.04113

	F-statistic	p-value
Value	4.232	0.005986

4.3.2 Simple Regression Given both Statements and Minutes Days

For the this robustness check, I estimate the effect of monetary policy announcement shocks on both statements and minutes released days on log ETF returns: $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \beta_2 Statement + \beta_3 MPS_t * Statement + \epsilon_t$

According to Table 6, the coefficient of MPS (-0.0307463) indicates the estimated change in log ETF return for a one-unit change in MPS, holding Type constant. However, its p-value of 0.536356 indicates that the effect of MPS is not statistically significant at 5%. This means that the effect of MPS on log ETF returns is not reliably different from zero, holding everything else constant. Despite the insignificance of the p-value, the similarity in magnitude to the coefficient (-0.0364943) observed in the fifth regression implies a consistent range of influence on log ETF returns attributed to MPS. This suggests that while the statistical significance may be lacking, there is still a measurable and consistent impact of MPS on log ETF returns, although within a range that may not be statistically distinguishable from zero. However, this statistical insignificance can also be possibly attributed to model complexity or multicollinearity. To further ensure the robustness of the analysis and address these potential issues, additional models and analyses are needed.

The coefficient of TypeStatement (0.0013591) indicates the estimated change in log ETF return during the event windows on days when there is a FOMC statement release, holding MPS constant. The positive coefficient suggests that policy statement release are associated with an increase of 0.0013591 in log ETF return on average compared to minutes release, controlling for MPS. The p-value of 0.000133 indicates that the effect of TypeStatement is statistically significant at a high level of confidence. This means that besides current MPS, the policy statement itself delivers other surprise components through its communications and news about the expected path of future policy rates, which then significantly impact log ETF returns. It is consistent with the argument of other papers that variation in exchange rate returns in response to the Fed's monetary policy is mainly due to unanticipated statements rather than to unexpected changes in the federal funds rate target. The unanticipated information stemming from the Fed's statements is helpful to explain changes in exchange rates and can matter more for the determination of exchange rates than news about actual monetary policy decisions during the pandemic.

The statistical insignificance of the interaction term MPS: TypeStatement suggests that the source of the shock, whether the shock is observed in event windows of statement release days or minutes release days, does not significantly impact the dollar value response to MPS. In other words, regardless of whether the monetary policy announcement shock originates from statements or minutes, its impact on the market is consistent. This is further supported by the similarity between beta1 and beta3 coefficients. Expanding on these findings, we observe that on minutes-released days, a 1% tightening policy rate shock is associated with a decrease of 0.0307463% on log ETF returns, while on statements-released days, the corresponding decrease is slightly lower at 0.0306296%. Although these differences are minor, they underscore the stability and consistency of the shock's impact across different announcement sources.

Furthermore, the lack of statistical significance in the interaction coefficient indicates that a simpler model is enough to explain the effect of target rate announcement shocks on exchange rates. This suggests that the source or context of the shock, whether observed in statement or minutes release days, does not significantly alter its impact on market responses. Therefore, a straightforward approach that focuses on the core relationship between monetary policy rate shocks and ETF returns could be more effective in capturing the essential dynamics of the system.

4.3.3 Simple Regression with Interactions of Currency Symbols

For this robustness check, I estimate the effect of monetary policy announcement shocks on ETF log returns while considering the potential interaction effects with different currency symbols: $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \beta_2 FXB + \beta_3 FXC + \beta_4 FXE + \beta_5 FXF + \beta_6 FXY + \beta_7 MPS * FXB + \beta_8 MPS * FXC + \beta_9 MPS * FXE + \beta_{10} MPS * FXF + \beta_{11} MPS * FXY + \epsilon_t$

Given Table 7, the coefficient of MPS is statistically significant (p = 0.0431), indicating that one unit change in MPS is associated with a decrease of 0.06943 in log ETF returns at 5% significance level, holding other variables constant. The coefficients for the dummy

Table 6: Simple Regression Results on all ETFs given Statement and Minutes Days

	Estimate	Std. Error	t value	Pr(> $\|t\|$)
(Intercept)	-0.0001088	0.0002477	-0.439	0.660763
MPS	-0.0307463	0.0496665	-0.619	0.536356
TypeStatement	0.0013591	0.0003510	3.873	0.000133 ***
MPS:TypeStatement	0.0001167	0.0516305	0.002	0.998198

	Residual Std. Error	Multiple R-squared
Value	0.003018	0.07021

	Adjusted R-squared	F-statistic	p-value
Value	0.06079	7.451	7.959e-05

variables (-4.433e-04, -4.969e-04, -1.338e-04, -1.879e-05, -1.312e-04) represent the estimated change in log ETF return associated with each ETF compared to the reference ETF, FXA. None of these dummy coefficients are statistically significant, as their p-values are all above 0.05. There is no sufficient evidence showing different log returns for different ETFs in this model, holding MPS constant. This reinforces the idea under regression 5 that the primary focus is on the value of the US dollar itself, rather than intricate variations among different foreign currencies. However, the sign of their coefficient corresponds to the sign of the fifth regression above, suggesting a general negative relationship between MPS and log ETF return.

4.3.4 Anova Test

ANOVA test is a statistical technique used to assess the model fit. In the context of regression analysis, ANOVA can serve as a robustness check by evaluating whether the variations

Table 7: Regression Results with Interaction Effects of Currencies

	Estimate	Std. Error	t value	Pr(> $\|t\|$)
(Intercept)	7.693×10^{-4}	4.426×10^{-4}	1.738	0.0832 .
MPS	-0.06943	0.03417	-2.032	0.0431 *
SYMBOLFXB	-0.0004433	0.0006259	-0.708	0.4794
SYMBOLFXC	-0.0004969	0.0006259	-0.794	0.4279
SYMBOLFXE	-0.0001338	0.0006259	-0.214	0.8308
SYMBOLFXF	-0.00001879	0.0006259	-0.030	0.9761
SYMBOLFXY	-0.0001312	0.0006259	-0.210	0.8340
MPS:SYMBOLFXB	0.04148	0.04832	0.858	0.3914
MPS:SYMBOLFXC	0.03957	0.04832	0.819	0.4135
MPS:SYMBOLFXE	0.02843	0.04832	0.588	0.5567
MPS:SYMBOLFXF	0.05365	0.04832	1.110	0.2678
MPS:SYMBOLFXY	0.03451	0.04832	0.714	0.4757

	Value
Residual standard error	0.003121 on 288 degrees of freedom
Multiple R-squared	0.03197
Adjusted R-squared	-0.005001
F-statistic	0.8647 on 11 and 288 DF
p-value	0.5755

observed between different groups are statistically significant. This evaluation helps validate the results obtained from regression models and select the most appropriate model for the data. Therefore, I will perform ANOVA tests to assess the significance of these variations and ensure the reliability of the regression analysis findings.

I ran the the first ANOVA test to compare the models where the sum of returns is regressed solely on MPS (Model 1, mirroring regression 4) versus the model where sum of returns is regressed on MPS and the interaction of MPS with SYMBOL (Model 2, mirroring regression 7). According to Table 8, the high p-value suggests that there isn't a significant difference between the two models. In simpler terms, adding the interaction term (MPS * SYMBOL) to the model doesn't significantly enhance its ability to explain the variability in the sum of returns compared to a model without this interaction term. Therefore, choosing the simpler model is more appropriate. Regression 5 adequately explains the impact of US conventional monetary policy announcement surprises on log ETF returns at a 1% significance level: $log(e_{t+60m}/e_{t-10m}) = \beta_0 + \beta_1 MPS_t + \epsilon_t$

Table 8: ANOVA Test Results for MPS with Currency Value

	Res.Df	RSS	Df	Sum of Sq	F	$\Pr(> F)$
Model 1: Sum_returns ~ MPS	298	0.0028				
Model 2: Sum_returns ~ MPS * SYMBOL	288	0.0028	10	0.0000	0.2667	0.9878

I ran the second ANOVA test to compare the models where sum of returns is regressed solely on MPS (Model 1, mirroring regression 4) versus the model where sum of returns is regressed on MPS and the interaction of MPS with economic projections (Model 2, mirroring regression 5). In this case, Table e̊ftab:anova2 suggests that the p-value of 0.06265 is greater than 0.05, which means that the difference between Model 1 and Model 2 is not statistically significant at the 0.05 significance level. Therefore, regression (4) is again enough to explain the effect of US conventional monetary policy announcement surprise on the log ETF return at 1% significance level.

Table 9: ANOVA Test Results for MPS with Economic Projections

	Res.Df	RSS	Df	Sum of Sq	F	$Pr(> F)$
Model 1: Sum_returns ∼ MPS	298	0.0028				
Model 2: Sum_returns ∼ MPS * Econ_Proj	296	0.0028	2	0.0001	2.7963	0.0627

5 Conclusion

This paper delves into the relationship between monetary policy decisions and the response of the US dollar exchange rate during the COVID-19 period from April 29, 2020 to May 23, 2023. It specifically investigates whether conventional US monetary policy remains significant in the exchange rate market through its surprise policy actions during the pandemic. Even though many studies suggest that shocks stemming from Fed's statements can always matter more for the reactions of exchange rates and other financial assets than shocks about actual policy rate adjustments, this research, employing traditional event study analysis and regression on all ETFs together, demonstrates that pure policy rate announcement surprises still exert notable effects on exchange rates. My findings indicate that an unanticipated 1 percent increase in the tightening policy rate shock corresponds to a 0.0364943% appreciation of the US dollar at a 1% significance level. Notably, this work extends beyond the shorter time frames examined in prior studies, which often ended in April 2020, a turbulent period marked by market volatility at the onset of the COVID-19 pandemic. By excluding these noisy months and covering the entire COVID-19 period, my study suggests that US conventional monetary policy remains effective on exchange rates, contrary to previous conclusions of insignificance during the pandemic's earlier stages. Although the Fed continually introduces new methods to ease financial difficulties by employing other strategies such as unconventional policy adjustments, one should not ignore the effect of conventional monetary policy on the financial market. However, questions remain regarding the scope of influence of conventional monetary policy on other financial assets besides exchange rates, and whether this policy can still be effective during the next crisis. Additionally, further research could delve into how global economic dynamics and geopolitical factors may interact with US monetary policy to shape international financial markets in future crises.

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