Global Real Interest Rate Dynamics and Monetary Policy Announcements

Master Thesis Presented to the
Department of Economics at the
Rheinische Friedrich-Wilhelms-Universität Bonn

In Partial Fulfillment of the Requirements for the Degree of
Master of Science (M.Sc.)

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Submitted in September 2024 by:

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Table of Contents

> *By providing long-run guidance, the central bank may influence long-term interest rates.*
>
> — Isabel Schnabel, Member of the Executive Board of the ECB

1 Introduction

The declining trend of interest rates in the past few decades is striking. Although some scholars discussed that the slump in the real interest rates could be traced back for centuries (Rogoff et al., 2022), there has been, at least, more or less a consensus on the secular stagnation of the last few decades since the IMF Conference in 2013. Economists suggested a variety of explanations for the secular decline, including demand-side explanations such as demand shortfall along with aging population (Krugman, 2014), "a lack of investment opportunities" (Summers, 2014), as well as supply-side explanations such as the slump in productivity growth (Gordon, 2017). While these prominent explanations account for the economic forces that are beyond the reach of monetary policy, in a recent and striking study, Hillenbrand (2022) found that 3-day time windows around the Federal Open Market Committee (FOMC) meetings capture the secular decline in 10-year Treasuries in the past few decades, and outside-window yield changes are transitory. By courtesy of this remarkable result, the question naturally arises is the following: In the world of U.S. dollar dominated debt markets, do the monetary policy decisions of central banks other than the Fed have similar explanatory power on the yield change in long-term government bonds, or is Hillenbrand's (2022) result a unique case for the Fed? By extension, can the observed secular decline in the real interest rates across other countries, depicted in the yield change of the long-term government bonds, be attributed to the monetary policy decisions of the Fed, thereby leading to a potential discourse on the Global Financial Cycle?

The results of this paper indicate that although there is a strong heterogeneity between advanced economies, due to the economic variables such as unconventional monetary policy tools, exchange rate interventions and financial frictions, to a certain extent, there is a limited but supporting evidence for a stronger Fed effect than the decisions of other countries' central banks around the narrow time windows over other countries' government bond yields. In this respect, this evidence is in line with Miranda-Agrippino and Rey (2020) that indicating single global factor explains around one-fifth of a common variation of the risky asset prices around the world.

In a nutshell, in this paper, following the descriptive yet stimulating approach of Hillenbrand (2022), I constructed 3-day monetary policy decision windows around the 10-year government bond yields for selected advanced economies, using both the decision dates of the national central bank and the Fed. This approach allowed me to capture yield movements around both central banks' decisions, thus proposing evidence to confirm or reject the Global Financial Cycle hypothesis. Then, the simple empirical approach developed in this study is an OLS method to model the spillovers of bond yields from the 10-year Treasuries to selected countries' 10-year bonds around the 3-day Fed windows. Lastly, financial frictions are incorporated into the model in order to eliminate the omitted variable bias. With an attempt to establish a linkage between the Global Financial Cycle and the secular decline of interest rates, this paper departs from similar studies.

2 Related Literature

The decline in real interest rates in recent decades is noted by Summers (2014), claiming that the lack of investment opportunities along with raised private saving propensities and reduced investment propensities. His approach determines a macroeconomic framework around the Global Financial Crisis and the Eurozone crisis. On the other hand, Rogoff et al. (2022) argues that the decline in the long-term real interest rates is not particular to recent decades. Instead, it is a trend stationary and persistent decline that dates back to the 1300s. This long-term decline, according to Rogoff et al. (2022), reflects the reduced discount factors over time at the global scale and challenges explanations around productivity and demographics.

Shifting the perspective on the decline of real interest rates to financial markets and monetary policy, in their study, Gilchrist et al. (2014) presented that the longer-term interest rates in advanced economies, proxied by 10-year bond yields, were declined in response to both an unanticipated conventional easing and unconventional monetary actions of the Fed. While conventional monetary easing steepens the yield curve in advanced economies through a larger decline in the short-end of the yield curve, unconventional monetary actions narrow the yield spread of nominal foreign interest rates down. Moreover, Hanson and Stein (2015) documented that the changes in monetary policy affect the 10-year forward real rates, utilizing movements during the FOMC announcement days. They offer a "reaching for yield" mechanism such that the yield-oriented investors substitute for longer-term bonds as short-term yields decline if the yield curve is upward-sloping. In turn, increasing demand for longer maturity bonds leads to increasing prices and declining yields. That is, this explanation relies on a "term premium" effect. (Hanson and Stein, 2015)

On the other hand, starting from Romer and Romer (2004) and Gürkaynak et al. (2005), there is a growing literature on identifying high-frequency monetary policy shocks. Nakamura and Steinsson (2018) provide a comprehensive analysis of the "Fed information effect" and monetary non-neutrality by examining high-frequency interest rate changes around FOMC meetings, i.e., monetary policy announcements influence not only financial variables but also adjust the beliefs and expectations of private sector participants about economic trajectory. By incorporating the adjustment of private sector expectations, the authors reveal that a considerable portion of the observed responses in real interest rates can be attributed to changes in perceptions of the natural rate of interest, emphasizing the dual role of monetary policy in shaping expectations. Yet, later on, Bauer and Swanson (2023) propesed the "Fed Response to news" hypothesis, challenging the "Fed information effect". Using both high-frequency data around the FOMC meetings and publicly available economic news into their identification strategy, their findings suggest that rather than the Fed retaining superior and market-moving information, along with the market participants, the Fed also react similarly to public economic information.

In a recent study, Hillenbrand (2022) states that previous studies posit structural macroeconomic factors to explain the interest rate decline such as "global savings glut" or "demand shortfall", whereas a narrow time window around the FOMC announcements captures the secular decline in U.S. Treasury yields from the 1980s. Out-of-window yield changes appears to be transitory and "wash out over time" (Hillenbrand, 2022). Consequently, underlining mechanisms like dot-plots, the author proposes "Long-run Fed Guidance", stating that the Fed has a superior information set on the long-run path of interest rates, thus guiding the market expectation of investors.

Heretofore, I discussed the literature on the monetary policy and declining real interest rates, depicted in bond yields. Nevertheless, another line of research that is indispensable for this study, is on the "Global Financial Cycle", which is elaborated in Miranda-Agrippino et al. (2015), Miranda-Agrippino and Rey (2020) and Miranda-Agrippino and Rey (2021). Miranda-Agrippino and Rey (2020) demonstrated that a single global factor explains around one-fifth of a common variation of the risky asset prices around the world. Given that the U.S. dollar is the dominant currency of global banking, one instance of this is that almost %80 of the syndicated loans that have an average amount greater than $5 million are denominated in the U.S. dollar, the monetary policy decisions by the Fed have a direct impact over the Global Financial Cycle. The potential explanations for this phenomenon are the deleveraging of the financial intermediaries around the globe, and relatedly, a decline in global credit and gross capital flows, and a significant rise in aggregate risk aversion. (Miranda-Agrippino and Rey, 2020) In their work on surrender options in life insurance and market interest rates, Kubitza et al. (2023) estimates two-stage least-squares regressing German government bond rates on the U.S. monetary policy shocks, claiming a transmission through the international bond market channel.

3 Data and Institutional Background

This section involves providing background information on the institutional background of the central banks' mechanisms for monetary decision-making for each country in the sample. Later, I elaborate on both yield data and monetary policy decision data, including the number of observations and time intervals.

3.1 Eurozone

In the European Central Bank (ECB), the Governing Council is the principal decision-making entity for conducting monetary policy. The Governing Council consists of twenty-six members—six members of the Executive Board and the Euro-area national central bank governors.[1] While the Governing Council members meet twice a month to evaluate macroeconomic and financial conditions, it decides monetary policy stance every six weeks. The Governing Council conducts monetary policy through three key interest rates: the main refinancing operations rate, the deposit facility rate, and the marginal lending facility

[1] European Central Bank, *Governing Council*, available at ecb.europa.eu/govc

rate. I obtained the dates of monetary policy decisions from the ECB website. My sample contains in total 299 monetary policy decision dates, from March 1999 to March 2024. To remove potential heterogeneity due to credit risk between different European countries, I selected Germany, and collected on-the-run yield data on 10-year German Bunds.

3.2 United Kingdom

In the United Kingdom, the Monetary Policy Committee (MPC) is the key decision-making body of the Bank of England (BoE) to conduct monetary policy. The MPC is made up of nine members, including the Governor, the Deputy Governors for Monetary Policy, Financial Stability, and Markets and Banking, the Chief Economist, and four external members.[2] The main interest rate set by the MPC to drive monetary policy is the 'Bank Rate', which refers to the interest rate BoE pays to commercial banks that hold money with the BoE. The dates of monetary policy decisions are collected from the BoE's voting history database, ranging from June 1997 to March 2024, and the total number of data points is 295. I collected yield data of the UK government bonds, also known as gilts, from 1979 to 2024 from the BoE database. The yield data contains the estimation for zero-coupon continuously-compounded yields, computations are elaborated in Anderson and Sleath (2001).

3.3 Japan

In Japan, the key decision-making body for conducting monetary policy is the Policy Board of the Bank of Japan (BoJ). Similar to the MPC of the BoE, the Policy Board of BoJ also consists of nine members—the Governor, two Deputy Governors, and six other members. The Bank of Japan uses the Policy-Rate Balance to conduct monetary policy as its main tool, which refers to the interest rate for the policy-rate balances that financial institutions hold at the central bank.[3] In the dataset on monetary policy decision dates by the BoJ, there are 515 data points, ranging from December 1981 to March 2024. The interest rates on government bonds are collected from the database of Japanese Ministry of Finance, and computed using on-the-run securities.

[2] Bank of England, *Monetary Policy Committee*, available at bankofengland.co.uk/mpc
[3] Bank of Japan, *Outline of Monetary Policy*, available at boj.or.jp/mopo

3.4 Canada

In Canada, the Governing Council of the Bank of Canada is the decision-making body for conducting monetary policy and promoting a more resilient financial system. The Governing Council comprises six members: the Governor, the Senior Deputy Governor, and four Deputy Governors. The Council uses the policy interest rate as a main tool for conducting monetary policy, and the rate is typically set on eight predetermined announcement dates annually, with decisions reached by consensus rather than through individual votes. Within the sample, there are 175 monetary policy decision dates spanning from January 1999 to April 2024, and for the yield data, I consulted the Bank of Canada's own data sources, from which Bolder et al. (2004) constructed the historical zero-coupon yield curve data.

3.5 Switzerland

The Governing Board, the Swiss National Bank's (SNB) executive body for monetary policy decisions, comprises three members appointed for six-year terms by the Federal Council upon the recommendation of the Bank Council.[4] The Governing Board holds the primary responsibility for formulating monetary policy. The SNB conducts -monetary policy through setting the policy rate, aiming the alignment of short-term Swiss franc money market rates with the policy rate, indicating a different policy mandate than previous central banks in sample. The data on the monetary policy decision dates spans from January 2000 to March 2024, with a total number of 109 meetings. Yield data, referred to as the spot interest rates, represent the yields on zero-coupon bonds computed by the extended Nelson-Siegel procedure by the SNB.

3.6 Australia

The Reserve Bank of Australia (RBA) conducts monetary policy through its key executive body, the Reserve Bank Board. Again, similar to the executive bodies of the BoE and BoJ, the Reserve Bank Board comprises nine members—the Governor, the Deputy Governor, the Secretary to the Treasury, and six other members.[5] The Board holds meetings eight times a year for decision-making of the monetary policy. The primary monetary policy instrument utilized by the RBA is the "cash rate target", which is the interest rate on

[4] Swiss National Bank, *Supervisory and Management Boards*, available at snb.ch/supervisory-boards

[5] Reserve Bank of Australia, *RBA Board*, available at rba.gov.au/rba-board

overnight loans in the money market, and this rate influences a range of interest rates across the economy. For my analysis, I collected the dates of monetary policy decisions from the RBA, spanning from August 1992 to March 2024, which includes a total of 215 meetings. Additionally, I collected yield data of Australian government bonds from January 1995 to May 2024 from the Reserve Bank of Australia's database. The yields are computed and interpolated by the RBA.

4 The Decline in Interest Rates and Monetary Policy

In the selected sample of advanced economies, the results imply heterogeneous effects of the national monetary policy and the U.S. monetary policy. Furthermore, unconventional monetary policy interventions, e.g., quantitative easing programs, yield varying results in different countries. Therefore, I examine the yield movements around the monetary policy decision dates by country.

4.1 German Bund Yields

In Figure 1 and 2, the cumulative yield change of the 10-year German bunds with respect to both ECB and FOMC announcements is depicted for complete sampled interval and post-crisis period. Figure 1 implies that in the post-crisis period, the monetary policy announcements by the ECB appear to be white noise for 10-year German bunds. In contrast, in the pre-crisis period, the yield movements around the ECB monetary policy announcements co-move with the trend. This finding provokes a question of what phenomenon exactly causes this kind of structural break. More specifically, the cumulative yield change and ECB's within-window yield change have almost opposite directions around 2009-2012. Therefore, the effect of the unconventional monetary policy tool of the ECB, namely the Securities Market Programme of 2010-2012, and the effect of the quantitative easing by the Fed are potential causes. Nevertheless, the fragile relationship between the cumulative yield change and ECB's within-window yield and the yield movement is obvious.

On the other hand, the yield movements of 10-year German bunds around the FOMC announcements have stronger co-movement with the trend in the whole sample. However, it is important to note that there was a jump around 2012 in this co-movement but the

Figure 1: ΔYield in 3-days Around the ECB and FOMC Announcements (2008-2024)

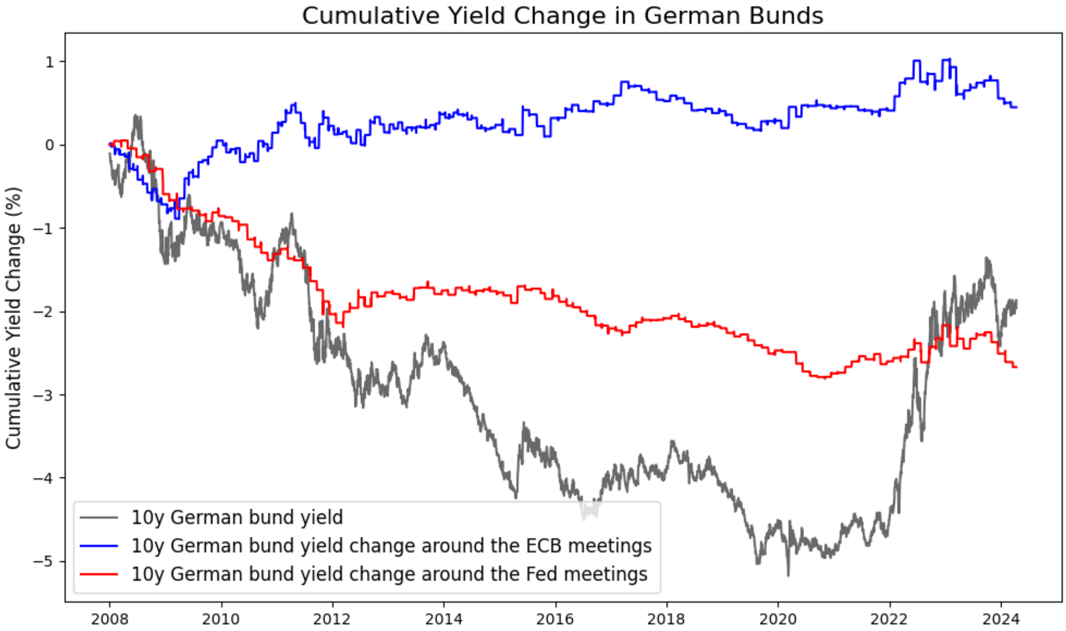
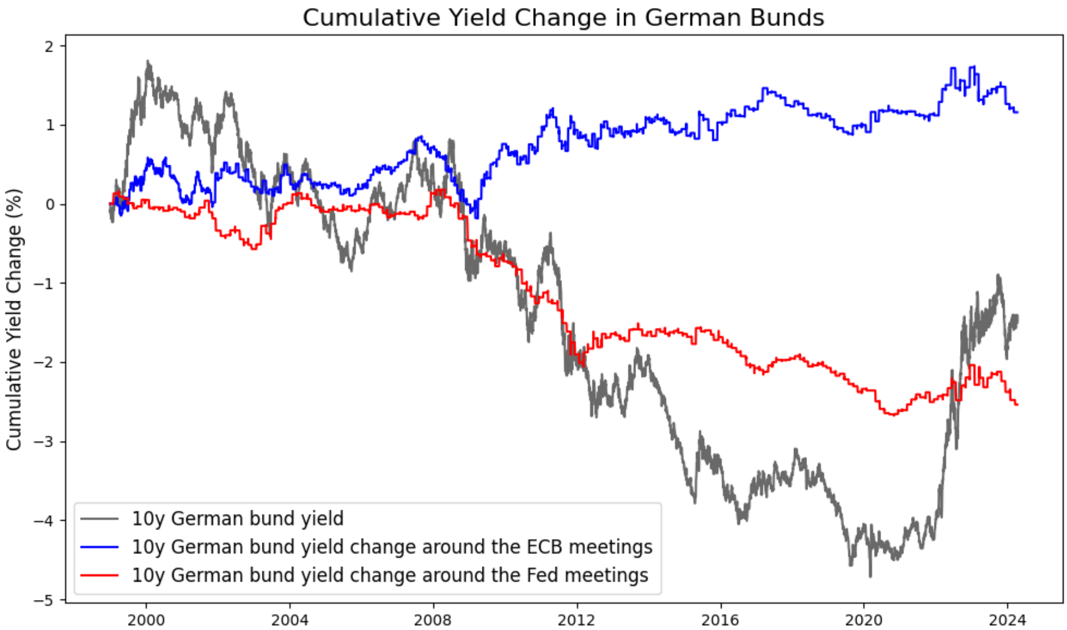


Figure 2: ΔYield in 3-days Around the ECB and FOMC Announcements (1999-2024)



co-movement remained persistent even after that jump. As in the case of the ECB announcements, the question arises as to what caused that jump with potential explanations of the unconventional monetary policy tools. Using a straightforward OLS approach to measure the cross-border monetary policy spillovers from the FOMC announcements to German bunds, I regress the yield change of 10-year German bunds on the yield change of 10-year Treasuries around the 3-day FOMC announcements:

$$\Delta 10yr_{t-1,t,DE} = \beta_0 + \beta_1 \, \Delta 10yr_{t-1,t,US} + \varepsilon_t$$

The results of the spillover regression is depicted in Table 1 and Figure 13. The estimation to assess the magnitude of cross-border spillovers from 10-year Treasury yields to 10-year German bunds indicates that a one standard deviation change in U.S. Treasury yields corresponds to a 0.44 standard deviation change in German bund yields, highlighting the significant influence of FOMC announcements on German bond markets.

4.2 UK Gilt Yields

Figure 3 depicts the yield change of the 10-year government bonds of the United Kingdom, gilts namely, with respect to both BoE and FOMC announcements for both sample intervals, i.e., post-1999 and post-crisis. The simple descriptive evidence suggests a divergence between the German bunds and the UK gilts. That is, neither in pre-crisis nor post-crisis periods, the effect of the BoE's rate announcements became white noise. Instead, regardless of the selected time interval, the yield movements around the BoE and FOMC announcements accounts for the yield movement itself. To see this strong relationship, the yield changes around both meetings are combined in Figure 4.

Moreover, in contrast to other countries in the sample, the fact that the decline in bond yields could be explained by the decline in the 3-day windows around the BoE's decisions may indicate that the BoE, unlike other central banks in the sample, enjoys relatively stronger monetary authority and a certain degree of autonomy in the face of the Global Financial Cycle. While the UK's divergence from other countries requires a more in-depth macroeconomic analysis, the fact that the 3-day windows around the BoE and FOMC announcements explain the decline in long-term bond yields confirms that, contrary to conventional thinking, monetary policy is likely to explain the decline in long-term interest rates. Lastly, the result of regressions yield change of 10-year UK gilts on the yield change of 10-year Treasuries around the 3-day FOMC windows indicate that for one standard deviation decline in the 10-year Treasuries is associated with 0.49 standard deviation decline in the 10-year UK gilts, confirming the cross-border monetary spillovers.

Figure 3: ΔYield in 3-days Around the BoE and FOMC Announcements (1999-2024)

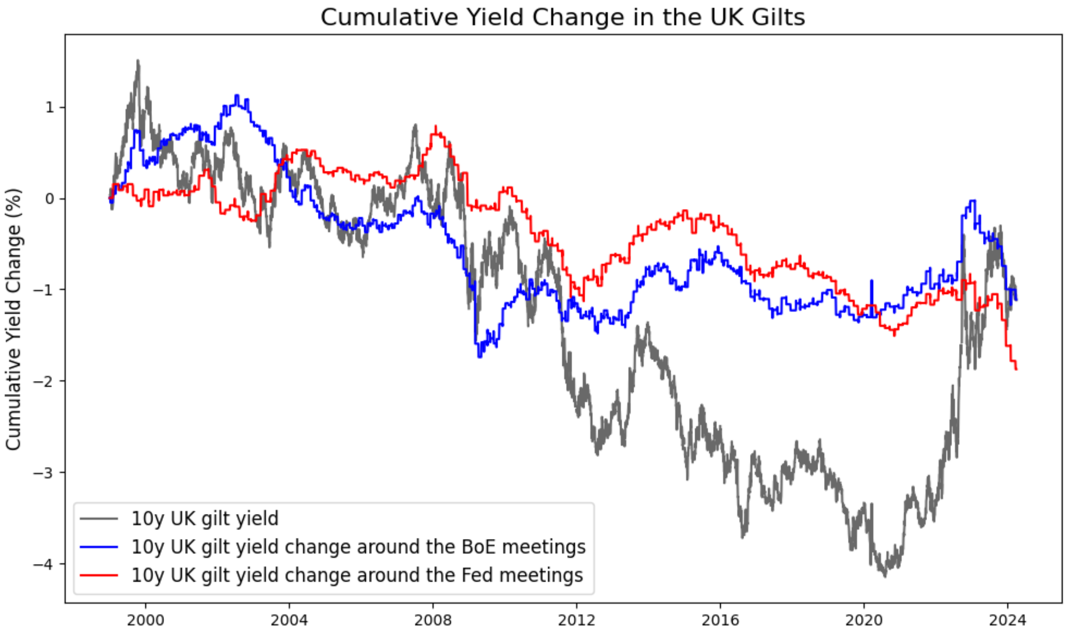
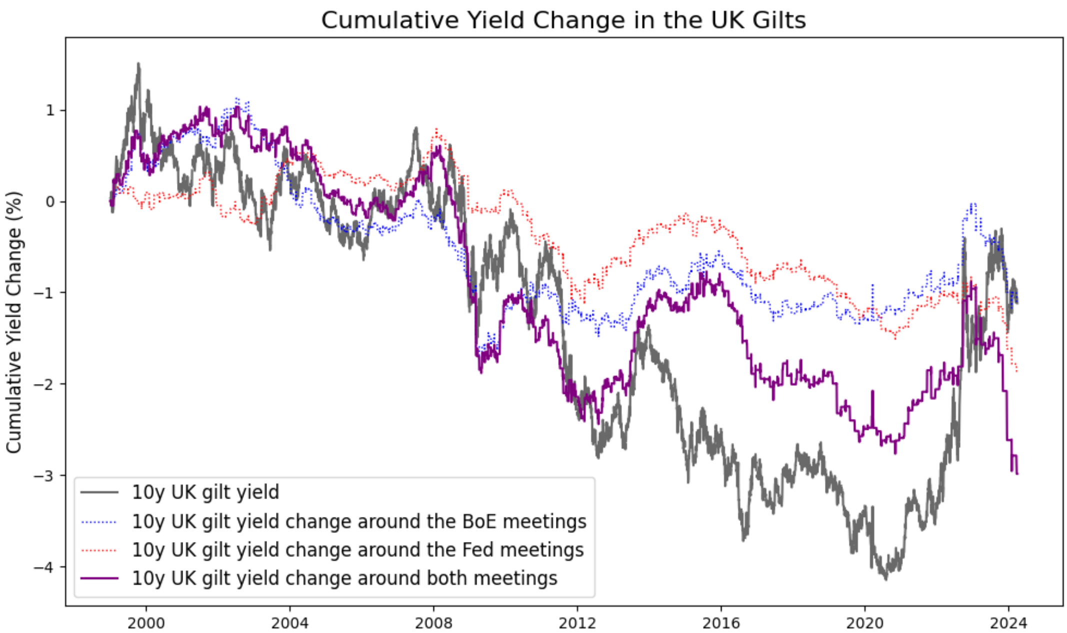


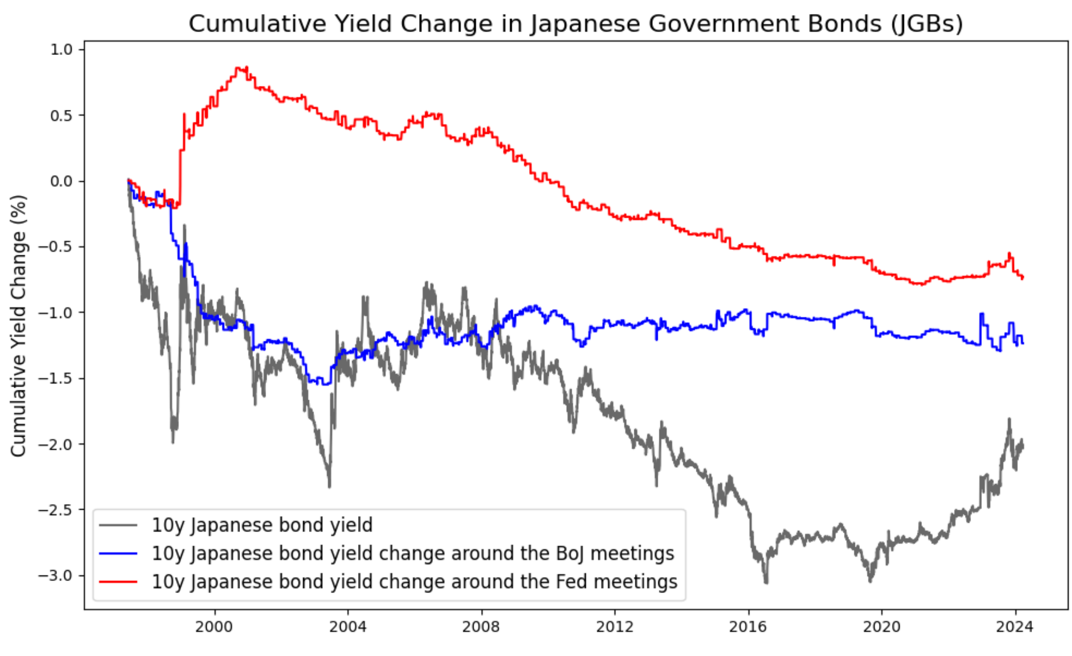
Figure 4: ΔYield in 3-days Around the Both CBs' Announcements (1999-2024)



4.3 Japanese Government Bond (JGB) Yields

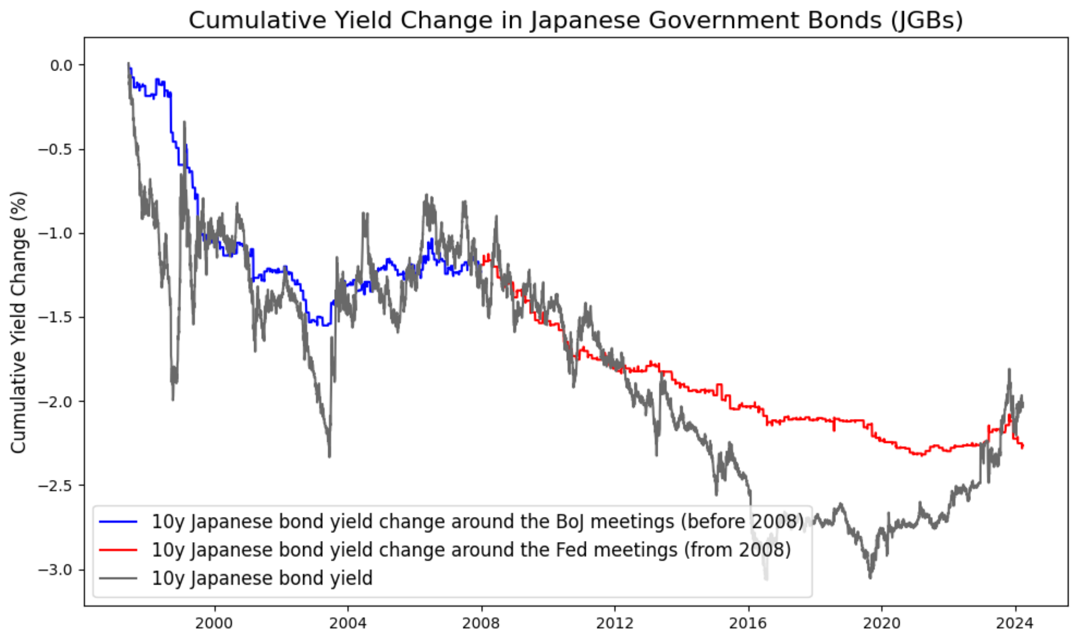
Figure 5 illustrate the yield movements of 10-year Japanese Government Bonds (JGBs) including 3-day time window change with respect to the FOMC and BoJ announcements, for both post-1997 and post-crisis intervals. In line with the findings in the Germany case, it is evident that there was a striking structural break around the Global Financial Crisis. A more thorough analysis shows that the break occurred approximately between 2006 and 2008. From 1997 until the Global Financial Crisis, the 3-day yield windows built around the BoJ announcements captured the change in bond yields to a large degree and in tandem with the trend, whereas in the post-crisis period, the change in bond yields became insensitive to BoJ announcements. On the other hand, as shown in Figure 5, the 3-day windows around the FOMC announcements in the post-crisis period largely account for the change in bond yields. To observe this pattern more precisely, see Figure 6, which depicts the time windows around the BoJ announcements in the pre-crisis period and the time windows around the FOMC in the post-crisis period. Additionally, the coefficient for the cross-border monetary spillover regression, presented in Table 1 and Figure 13, illustrates that at the 0.05 significance level, the decline in the U.S. Treasuries spills over the Japanese long-term government bonds. In terms of economic significance, for one standard deviation decline in the U.S. Treasuries lead 0.1 standard deviation decline in Japanese bonds.

Figure 5: ΔYield in 3-days Around the BoJ and FOMC Announcements (1997-2024)



While on the one hand, the patterns of this change brought about by the Global Financial Crisis are evident and raise the question of the amplification of the Global Financial Cycle, on the other hand, questions remain about the impact of unconventional monetary policy tools on this outcome. As in the case of Germany, the ECB's Securities Market Program of 2010-2012 is being discussed, whether the Japanese QE program, which ended in 2006, had an impact on this structural break remains a noteworthy research agenda.

Figure 6: ΔYield Around the Altered BoJ-FOMC Announcements (1997-2024)



4.4 Canadian Bond Yields

Due to spatial proximity and entangled economic and financial relationships, Canada has a particular status in the sample. Employing a global VAR model, Beaton and Desroches (2011) emphasizes the significance of financial variables in transmission of shocks from the U.S. to Canada, including both disturbances to real economic activity and to financial conditions. Financial linkage, combined with robust trade relations and geographical proximity, would be likely spillovers from the U.S. monetary policy decisions to Canadian economy and to Canadian bond yields in particular. Indeed, in both the post-1999 and post-crisis sample, depicted in Figures 7 and 8, it is obvious that Canadian bond yield movements in the 3-day time windows of the FOMC announcements account for the overall trend in Canadian bond yields. As deep-rooted economic entanglements might suggest, there is no evident structural break per se around the Global Financial Crisis that intensified the evidence for the Global Financial Cycle.

Figure 7: ΔYield in 3-days Around the BoC and FOMC Announcements (2008-2024)

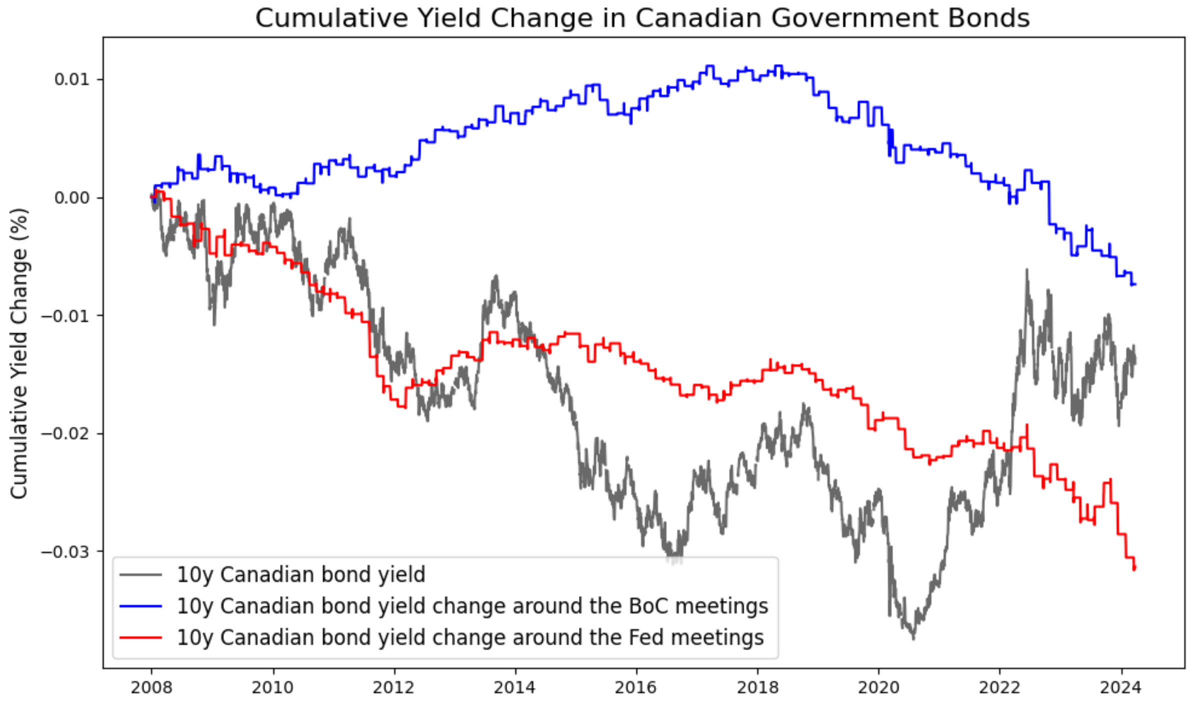
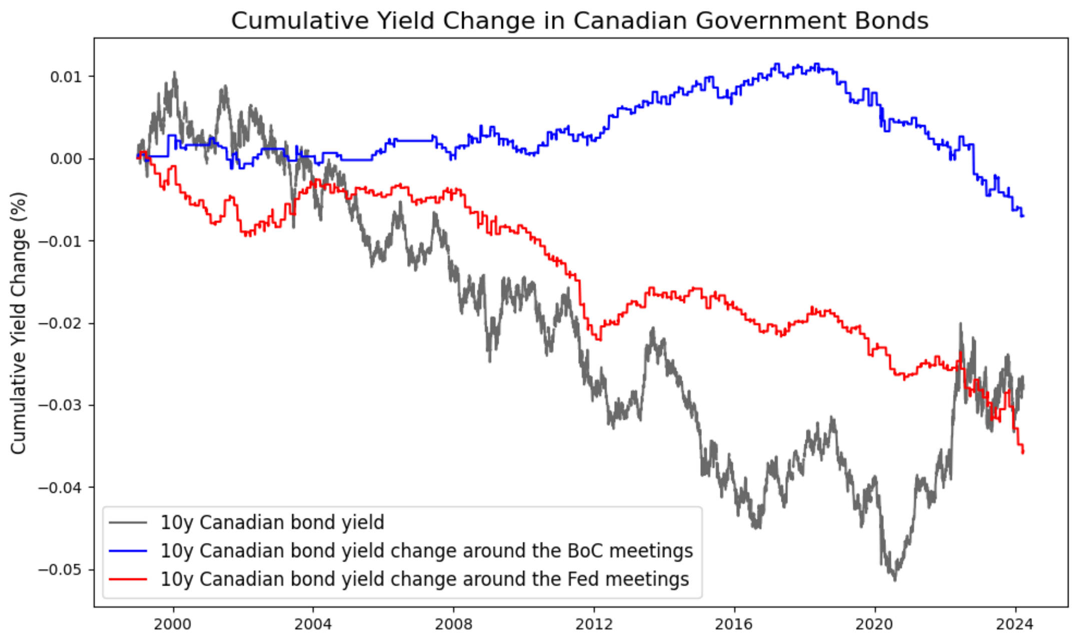


Figure 8: ΔYield in 3-days Around the BoC and FOMC Announcements (1999-2024)



Using the cross-border spillover regressions as in the previous cases, the results are particularly striking. Illustrated in Table 1, 100 basis points decline in the U.S. Treasuries is associated with 59 basis points decline in the long-term Canadian bonds around the 3-day FOMC announcement windows, and this result is statistically significant at the 0.01 level. Standardizing for the results, for one s.d. change in U.S. Treasuries is associated with 0.81 change in Canadian bond yields.

4.5 Swiss Confederation Bond Yields

Figure 9 and 10 accurately indicate that neither the 3-day windows around the FOMC meetings nor those around the Swiss National Bank meetings have any explanatory power of declining long-term yields. Furthermore, there exist no structural breaks attributable to the Global Financial Crisis. This descriptive result is partly supported by the cross-border spillover regression. In the Column 5 of Table 1, for 100 basis points decline in the U.S. Treasuries, the yield change in the 10-year Swiss Confederation Bonds is 10.5 basis points. Given that these results differ significantly from those of other countries in the sample, further investigation is warranted.

There are significant macro-financial differences between Switzerland and the rest of the sample. First, the statistics and Cwik and Winter (2024) suggest that the Swiss National Bank conducts sizeable currency intervention in order to influence inflation or to protect the "safe haven" status of the Swiss Franc. Further, Bacchetta et al. (2022) states that the exchange rate affects the real interest rates in Switzerland, through the convenience yield, mediated by a valuation effect.

4.6 Australian Government Bond Yields

Figures 11 and 12 exhibit a overview compared to the previous figures. This is mainly because neither the Fed's nor the RBA's 3-day monetary policy decision windows seem to have much impact on 10-year bond yield changes. Indeed, if observing the trend, the bond yield movement in the RBA decision windows is in the opposite direction to the trend in bond yields. On the other hand, even if the Fed's influence on bond movements is less than in other cases such as Canada or Germany, there is a noticeable co-movement, especially in certain sub-time periods. Nevertheless, this weak and ineffectual co-movement can only account for a too little portion of the variation. For the spillovers around the 3-day FOMC announcement windows, the explained variation of this regression is restricted to 0.009, while the standardized coefficient suggests that for a one standard deviation decline in the

U.S. Treasuries, the decline in the Australian Government Bonds is only 0.096 standard deviation.

Figure 9: ΔYield in 3-days Around the SNB and FOMC Announcements (2008-2024)

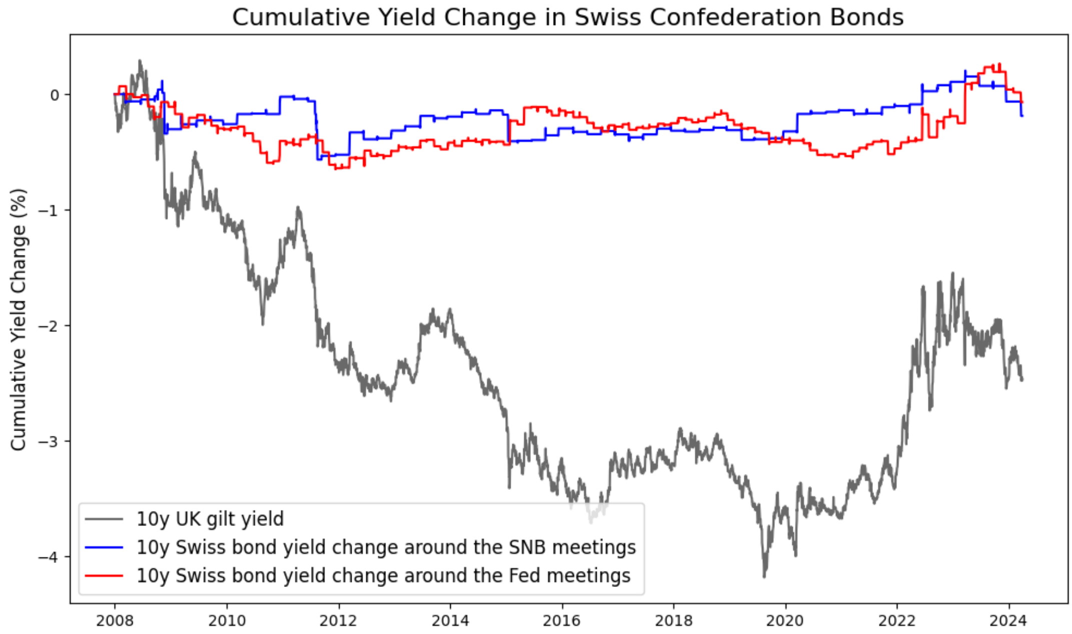


Figure 10: ΔYield in 3-days Around the SNB and FOMC Announcements (2000-2024)

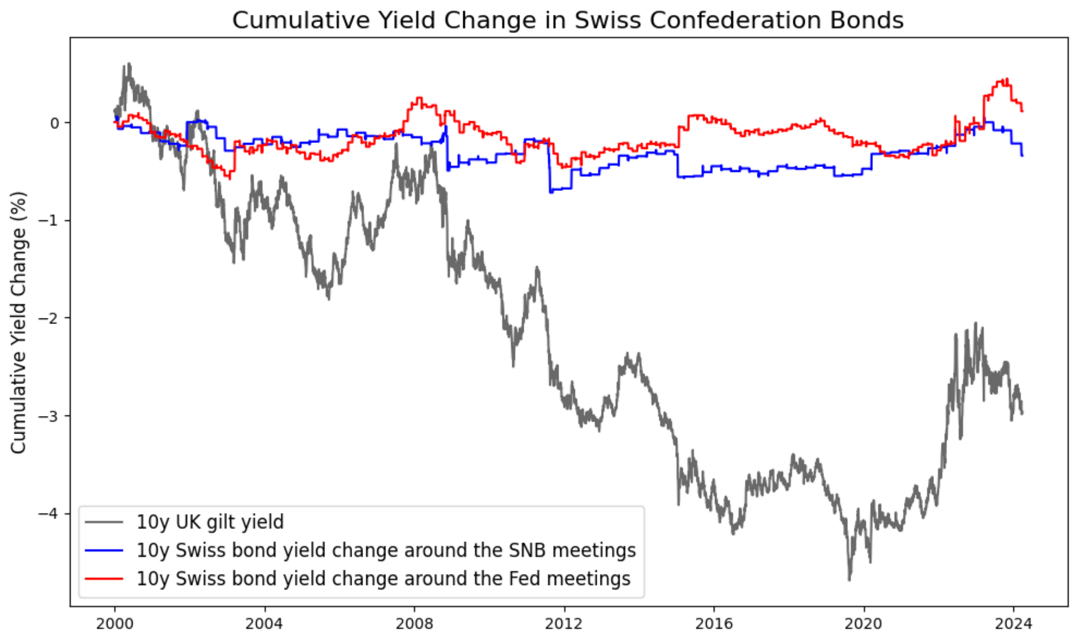


Figure 11: ΔYield in 3-days Around the RBA and FOMC Announcements (2008-2024)

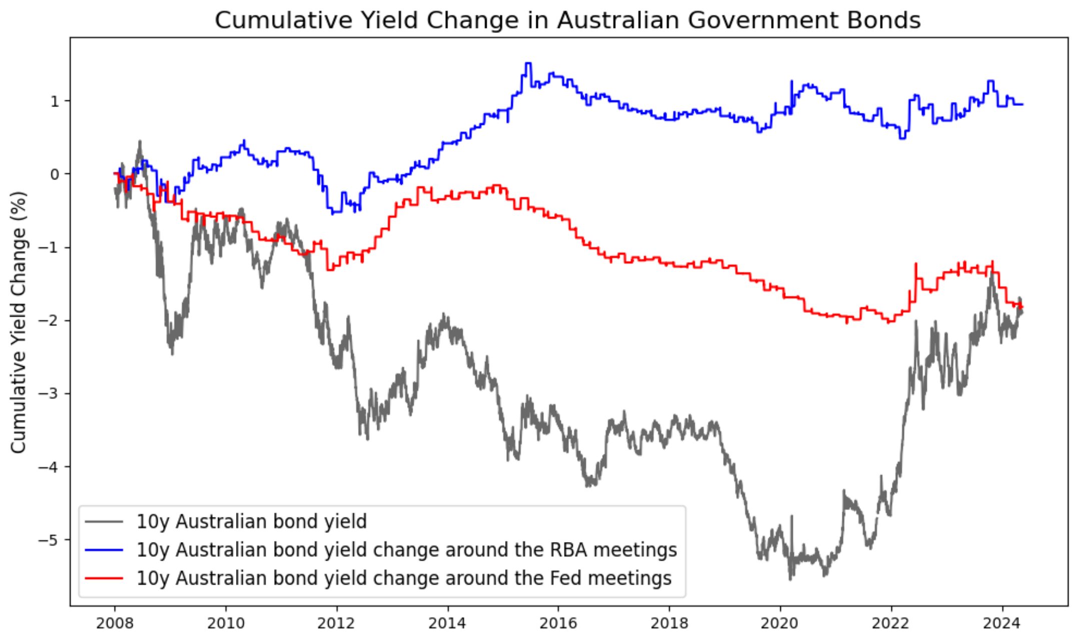


Figure 12: ΔYield in 3-days Around the RBA and FOMC Announcements (1997-2024)

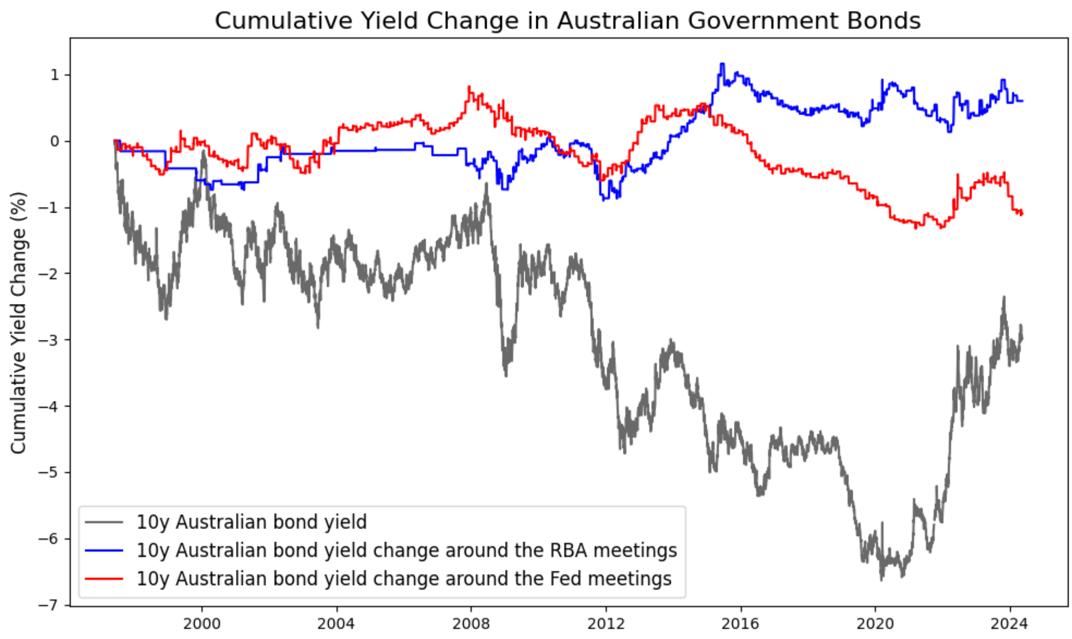


Figure 13: Spillovers from 10yr Treasury to Government Bonds Around FOMC Meetings

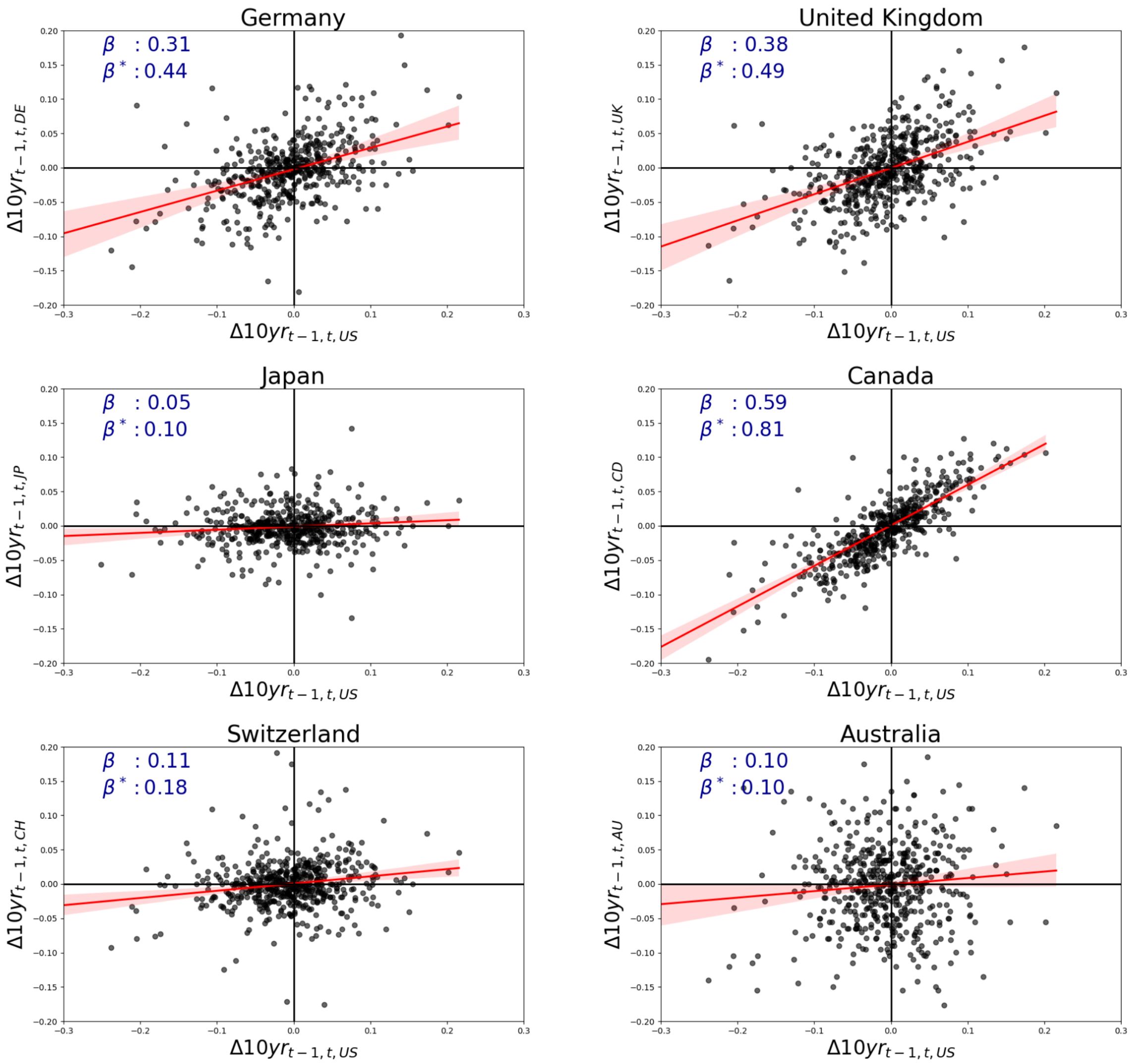


Table 1: Spillovers from 10yr Treasury to Government Bonds Around FOMC Meetings

	$\Delta 10\mathrm{yr}_{Home}$					
	Germany	UK	Japan	Canada	Switzerland	Australia
$\Delta 10\mathrm{yr}_{US}$	0.311***	0.382***	0.046**	0.591***	0.105***	0.095**
	(0.029)	(0.030)	(0.021)	(0.019)	(0.024)	(0.043)
Std. $\Delta 10\mathrm{yr}_{US}$	0.44	0.49	0.1	0.813	0.182	0.095
Observations	477	523	494	482	543	535
R^2	0.193	0.241	0.010	0.661	0.033	0.009

5 Empirical Strategy

In the previous section, I demonstrated the compelling fact that the 3-day windows around the FOMC meetings capture the decline of the interest rates for some of the selected advanced economies, more effectively than the 3-day monetary policy decision window of the national central banks. While this descriptive evidence suggest that the effect of the narrow time windows around the Fed decisions can explain the yield declines of advanced economies, to establish a causal link, a further empirical specification is required. To enhance the robustness of the causal link, I incorporated financial frictions into the model. Hence, the baseline specification is:

$$\begin{aligned}\Delta_{t-1,t}10\text{yr}_i = \beta_0 \ + \ \beta_1\, \text{D(3d FOMC)}_t \ + \ \beta_2\, \text{FXF}_{i,t} \\ + \ \beta_3\, [\text{D(3d FOMC)} \ \times \ \text{FXF}]_{i,t} \ + \varepsilon_{i,t}\end{aligned}$$

where $\Delta_{t-1,t}10\text{yr}$ represents the yield change of 10-year government bond from $t-1$ to t for country i. The dummy variable, D(3d FOMC)_t, for the 3-day FOMC windows takes a value of 1 on the day before, the day of, and the day after the FOMC meeting, and 0 otherwise. $\text{FXF}_{i,t}$ denotes the financial frictions in the foreign exchange markets for country i at time t, which are measured using the Corwin-Schultz bid-ask spread estimator (Corwin and Schultz, 2012). I used bid-ask spreads as a proxy to reflect the liquidity conditions in the FX market. The wider spread translates into lower liquidity in the market and higher transaction costs, and particularly, the times of higher uncertainty and financial distress lead deteriorating liquidity and wider bid-ask spreads. For a detailed construction of the Corwin-Schultz estimator, refer to the Appendix.

Accounting for financial frictions, I isolate the impact of FOMC meeting windows on yield changes better, distinguishing it from broader market dynamics that could confound the results. Moreover, the interaction term between $\text{FXF}_{i,t}$ and D(3d FOMC)_t captures the differential effect of the FX market frictions, e.g., liquidity conditions or transaction costs, during the 3-day FOMC announcement windows. Therefore, β_3 becomes a paramater of interest, providing further insights on the transmission mechanisms of the U.S. monetary policy decisions to global bond markets. Nonetheless, the main threat to the identification is the potential endogeneity of the financial frictions. This endogeneity may arise from simultaneity or bi-directional causality, whereby bid-ask spreads might influence bond yield change and vice versa. Furthermore, as the Corwin-Schultz bid-ask spread estimator, which utilizes daily high and low prices, relies on FX data collected on-the-run, thus contains the risk of measurement error that could also lead to biased estimates.

To address these endogeneity concerns, I employ an instrumental variable (IV) approach, specifically using a lagged one-week averaged bid-ask spreads as an instrument. Since the lagged bid-ask spreads reflect past conditions in the FX market, it is assumed to influence current yield changes but remains unaffected by contemporaneous shocks to the yield. This approach helps to mitigate reverse causality and ensures that the spread is appropriately exogenous in the model. Moreover, the lagged spread is strongly correlated with the current spread, making it a valid instrument. To implement this approach, I use the Two-Stage Least Squares (2SLS) regression technique. In the first stage, I regress the bid-ask spread on the instrument and other exogenous variables, as well as the interaction term on the instruments and exogenous variables:

$$\widetilde{\text{FXF}}_t = \alpha_0 + \alpha_1 \, \text{D(3d FOMC)} + \alpha_2 \, Z_t + +v_t$$
$$[\text{D(3d FO}\widetilde{\text{MC)}} \times \text{FXF}]_{i,t} = \gamma_0 + \gamma_1 \text{D(3d FOMC)}_t + \gamma_2 [\text{D(3d FOMC)} \times \text{FXF}]_{i,t} + \gamma_3 Z_t + w_t$$

Using the predicted values from the first stage, we then estimate the second-stage regression, where we regress the yield change on these predicted values and the dummy variable for the FOMC meeting window:

$$\begin{aligned}\Delta_{t-1,t}10\text{yr} = \beta_0 \; + \; \beta_1 \, \text{D(3d FOMC)}_t \; + \; \beta_2 \, \widetilde{\text{FXF}}_t \\ + \; \beta_3 \, [\text{D(3d FO}\widetilde{\text{MC)}} \times \text{FXF}]_{i,t} \; + \varepsilon_t\end{aligned}$$

Hence, while β_1 parameter is interpreted as the effect of the 3-day Fed decision windows over the yield change of 10-year government bond yields for selected economies, the β_3 parameter captures the differential effect due to the financial frictions. The result of the 2SLS regression is presented at the (IV) column of Table 2 and 3. To ensure the validity of the instrumental variable (IV) approach, I conduct several diagnostic tests that assess the strength and relevance of the instruments used in the model. Testing for the underidentification, the Kleibergen-Paap LM statistic implies that the instruments are not underidentified. Furthermore, due to the potential serial correlation in data-generating process, I do not use the Cragg-Donald Wald F-statistic to test for weak instruments.

Instead, using the Kleibergen-Paap rk Wald F-statistic, which requires relatively relaxed assumptions on data-generating process, it is confirmed that the instruments are sufficiently strong, compared to the Stock-Yogo critical values. That is to say, the underidentification and weak instrument concerns are mitigated through the relevant test statistics, i.e., the lagged one-week averaged bid-ask spreads is relevant and has sufficient strength for reliable IV estimates presented in the empirical model.

6 Results

The results are presented in two stages in Table 2 and 3. As daily yield changes are not very large in magnitude, the standardized beta coefficients presented in Table 3 demonstrates the economic significance better.

6.1 Impact of the Fed Announcements on Bond Yields

In the first three columns of Table 2 and 3, I present the results of regressions that were run as a statistical test rather than to infer causality. The coefficients of D(3d FOMC) indicates the effect of 3-day windows around the FOMC meetings on the yield changes. In both Column 1 and 3, the effect is negative and statistically significant at the 10% level. In a 3-day window around the FOMC meeting, the 10-year bond yields decline by -0.45 basis points. While the effect is significant at the 10% level, the p-values are close to 0.05 level, e.g., 0.053 and 0.057 in Column 1 and 3, respectively. This implies that the findings are just marginally significant and should be treated cautiously since their significance might be impacted by little adjustments to the model specification.

The economic magnitude of this decline, however, is relatively small. A potential explanation for this is the strong heterogeneity among countries, observed in Section 4. For example, while the effect of the Fed announcements over the Swiss government bonds appears to be a white noise or the effect over the Australian bonds is remarkably less strong, the German bund yields or Canadian bond yields co-move with the Fed decision windows strongly. In the former cases, currency interventions or national financial conditions may dilute the transmission of US monetary policy to their long-term interest rates. In other words, countries in which the observed effect is less strong drives the overall effect towards a smaller magnitude.

Table 2: Regression Results

	(1)	(2)	(3)	(4)	(IV)
	Δ10yr$_{t,t-1}$	Δ10yr$_{t,t-1}$	Δ10yr$_{t,t-1}$	Δ10yr$_{t,t-1}$	Δ10yr$_{t,t-1}$
D(3d FOMC)	-0.00149*		-0.00147*	-0.00163	-0.00200
	(0.053)		(0.057)	(0.108)	(0.478)
FXF		-0.00164*	-0.00161*	-0.00168*	-0.00584
		(0.090)	(0.095)	(0.099)	(0.153)
D(3d FOMC) $\times$ FXF				0.000595	0.00228
				(0.852)	(0.833)
Observations	40064	39670	39670	39670	38187

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6.2 The Role of Financial Frictions

Columns 2 and 3 of Tables 2 and 3 introduce the role of financial frictions in the FX markets, as captured by the Corwin-Schultz bid-ask spread estimator. The results show that, at the 10% significance level, higher FX frictions—lower market liquidity and higher transaction costs—around the FOMC meetings contribute to the decline of the bond yields. This result could indicate that uncertainty around the Fed's monetary policy decisions cause increased demand of the long-term government bonds by the local and foreign investors, potentially through a "home bias" and safe-haven effect, respectively. The increased demand induced by the higher uncertainty around the Fed decisions would push the long-term bond prices higher in the sample, and in turn, bond yields declines. Nevertheless, as previously mentioned, these results in the first three columns cannot be treated as the causal effect due to the endogeneity concerns. Rather, these regressions are for the purpose of statistical testing.

In the 4th and 5th columns, the interaction between the FOMC decision windows and the financial frictions is incorporated. In both specifications, the statistical significance of the 3-day Fed windows disappear, meaning that the null hypothesis of no effect cannot be rejected, while the sign of the coefficient for the interaction term is positive. This means that given the presence of higher FX market frictions, there exists less spillovers around

Table 3: Regression Results with Standardized Beta Coefficients

	(1)	(2)	(3)	(4)	(IV)
	$\Delta 10\text{yr}_{t,t-1}$	$\Delta 10\text{yr}_{t,t-1}$	$\Delta 10\text{yr}_{t,t-1}$	$\Delta 10\text{yr}_{t,t-1}$	$\Delta 10\text{yr}_{t,t-1}$
D(3d FOMC)	-0.010*		-0.010*	-0.011	-0.014
	(0.053)		(0.057)	(0.108)	(0.478)
FXF		-0.012*	-0.011*	-0.012*	-0.042
		(0.090)	(0.095)	(0.099)	(0.153)
D(3d FOMC) $\times$ FXF					
				(0.852)	(0.833)
Observations	40064	39670	39670	39670	38187

Standardized beta coefficients; p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

the 3-day FOMC windows, i.e., less decline is observed in the bond yields. This can be interpreted as the existence of FX frictions dilutes the transmission of the US monetary policy to other advanced economies' long-term bonds. However, while this explanation is intuitive, since the coefficients of 2SLS regressions are not statistically significant, it is not possible to propose any causal inference. Given the lack of statistical significance, further investigation is needed to confirm this relationship.

6.3 Economic Significance and Heterogeneity Across Countries

Overall, the results in Table 1 indicate significant cross-border monetary spillovers from the Treasuries to 10-year bonds of selected advanced economies. While these spillovers have larger economic magnitudes in Germany, the United Kingdom and Canada, the effect appears to be weak in Switzerland and Australia. This result is supported by the descriptive evidence in Section 4. Moreover, the results presented in Table 3 an 2 further indicates that long-term bond yields decline around the 3-day FOMC announcement windows. In Section 6.2., I demonstrate that the FX market frictions have inverse relationship with the bond yields. However, potential heterogeneity in the effect of FX market frictions due to the exchange rate policies and market structures are not investigated in this paper. In sum, the U.S. monetary policy decisions transmit heterogeneously to the long-term interest rates of advanced economies around the 3-day FOMC announcement windows, allowing to extend the results of Hillenbrand (2022) circumscriptively to a wider scale, such that the Fed decision windows influence the long-term real interest rates globally.

7 Conclusion

The findings of this paper contribute to the research field on the monetary policy announcements, interest rate dynamics, and the global financial cycle. The limited yet striking evidence suggests remarkable but heterogeneous influence of the Fed announcements over the long-term government bond yields of selected advanced economies. In Germany and Canada, for instance, there were significant cross-border monetary spillovers from the Fed announcements to long-term yields. Whereas, in Switzerland and Australia, the Fed effect over the long-term interest rates were substantially restricted. Throughout this paper, several potential explanatory variables to explain the sensitivity of national long-term bond yields to the Fed announcements have been discussed, namely, exchange rate interventions, unconventional monetary policy, and frictions in the FX markets. Nevertheless, except for the FX frictions, data unavailability prevented the research inquiry to explain the causes of varying degrees of spillover effects from being explored in more detail.

Although lacking statistical significance, the instrumental variable regression suggests that high transaction costs and low market liquidity have a restraining effect on the spillovers from Fed announcements to the long-term bonds of selected advanced economies. This means that the effect of the financial frictions in the global monetary spillovers could be inquired further. Moreover, a future research agenda could focus on a deeper understanding of the mechanisms underlying heterogeneous responses. For this purpose, a more detailed and extensive dataset of granular financial variables or high-frequency monetary policy shocks should be built. This would allow us to better understand how unconventional policies such as quantitative easing (QE) and exchange rate interventions have an impact on the spillovers from Fed announcements to the interest rates in the government bond markets. This would not only allow us to better understand the dynamics of global long-term real interest rates, but also make a valuable contribution to the discourse on the Global Financial Cycle.

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Appendix

Data and Code Availability

For the purposes of transparency and reproducibility, all data and source code utilized in this study are publicly accessible in the following GitHub repository.

Estimation of Corwin-Schultz Bid-Ask Spread

Corwin and Schultz (2012) constructed a bid-ask spread estimator using the daily high and low prices. The estimator is based on this insight: During trading, when prices fluctuate, the highest price is likely due to a buyer actively pushing the price up, crossing the spread, and matching the ask. Conversely, the lowest price likely results from a seller pushing the price down, crossing the spread, and matching the bid. Let H and L denote intraday highest and lowest price, respectively. That is, the two-day high and low observations are:

$$H_{t,t+1} = \max(H_t, H_{t+1}) \qquad L_{t,t+1} = \max(L_t, L_{t+1})$$

The sample estimates for the Corwin-Schultz model are:

$$\hat{\gamma} = \left[\ln\left(\frac{H_{t,t+1}}{L_{t,t+1}}\right)\right]^2$$
$$\hat{\beta} = \left(\ln\left(\frac{H_t}{L_t}\right) + \ln\left(\frac{H_{t+1}}{L_{t+1}}\right)\right)^2$$

Under certain assumptions, the closed form for expression become:

$$\alpha = \frac{\sqrt{2\beta} - \sqrt{\beta}}{3 - 2\sqrt{2}} - \sqrt{\frac{\gamma}{3 - 2\sqrt{2}}}$$

$$\hat{S}_{HL} = \frac{2\left(e^{\alpha} - 1\right)}{1 + e^{\alpha}}$$

The corresponding Python code used in this study:

```python
def HLSpreadEstimator(highs, lows):
    beta = (np.log(highs[0] / lows[0]))**2 + (np.log(highs[1] / lows[1]))**2
    H = max(highs)
    L = min(lows)
    gamma = (np.log(H / L))**2
    alpha = (np.sqrt(2 * beta) - np.sqrt(beta)) / (3 - 2 * np.sqrt(2)) -
    ↪  np.sqrt(gamma / (3 - 2 * np.sqrt(2)))
    s = (2 * (np.exp(alpha) - 1)) / (1 + np.exp(alpha))
    s = max(s, 0)
    return s
```

Historical Interest Rates

Figure 14: Long-Term Nominal Interest Rates

Note: In this figure, long-term interest rates refer to 10-year bond yields. The data is obtained from OECD Database.

Table 4: Historical Credit Ratings of Sampled Countries

	S&P	Moody's Ratings	Fitch Ratings
Germany			
2024	AAA	Aaa	AAA
1994			AAA
1986		Aaa	
1983	AAA		
United Kingdom			
2024	AA	Aa3	AA-
2020		Aa3	AA-
2017		Aa2	
2016	AA		AA
2013		Aa1	AA+
1994			AAA
1978	AAA	Aaa	
Japan			
2024	A+	A1	A
2015	A+		A
2014		A1	
2012			
2011	AA-	Aa3	
2009		Aa2	
2007	AA		
2004		Aaa	
2002	AA-		
2001	AA		AA
2000			AA+
1998		Aa1	
1994			AAA
1981		Aaa	
1975	AAA		

	S&P	Moody's Ratings	Fitch Ratings
Canada			
2024	AAA	Aaa	AA+
2020			AA+
2004			AAA
2002	AAA	Aaa	
2001			AA+
2000		Aa1	
1995		Aa2	
1994		Aa1	AA
1992	AA+		
1974		Aaa	
Switzerland			
2024	AAA	Aaa	AAA
2000			AAA
1999			AA
1994			AA-
1994			AA
1988	AAA		
1982		Aaa	
Australia			
2024	AAA	Aaa	AAA
2011			AAA
2003	AAA		AA+
2002		Aaa	
1999	AA+		
1996			AA
1989	AA	Aa2	
1986	AA+	Aa1	

Note: The data is obtained from the World Government Bonds.

Statement of Authorship:

I hereby confirm that the work presented has been performed and interpreted solely by myself except for where I explicitly identified the contrary. I assure that this work has not been presented in any other form for the fulfillment of any other degree or qualification. Ideas taken from other works in letter and in spirit are identified in every single case.