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The Effect of United States Monetary Policy on Foreign Firms: Does Debt Maturity Matter?*

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Abstract: *We provide novel evidence that corporate debt maturity plays an important role in the transmission of United States (US) monetary policy to foreign firms. Using an identification strategy that explores the ex-ante maturity structure of long-term debt to predict firms' financial positions in a given year, we show that the effect of US monetary policy shocks on foreign firms is amplified by financing constraints. After a contractionary shock, financial conditions in foreign countries become tighter, and firms with a high proportion of long-term debt maturing right after the shock significantly decrease investment and sales. We find that firms in emerging economies are much more affected by these shocks compared to those in advanced economies, and the amplification effect of US monetary policy shocks by financing constraints is present only in emerging economies.*

Keywords*:* Monetary policy, financial constraints, foreign firms
JEL Classifications: E52, F30, G32

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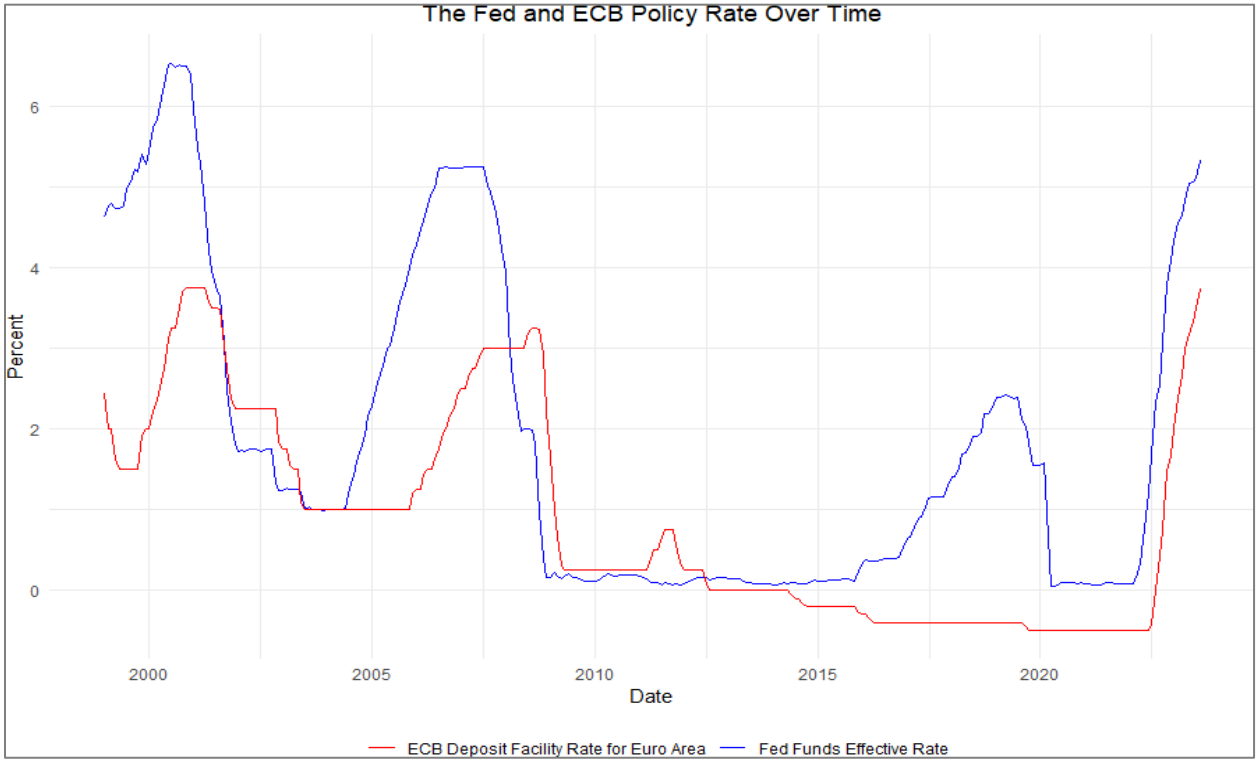
1. Introduction

Beginning in 2022 and continuing through 2023, the United States (US) Federal Reserve implemented monetary policy tightening measures to combat inflationary pressure caused by the spike in commodity prices due to Russia's invasion of Ukraine, and expansionary fiscal and monetary policy during the Covid-19 pandemic (Figure 1). The global economy is interconnected, and US monetary policy significantly impacts macroeconomic conditions in other nations. Miranda-Agrippino and Rey (2020) show that by affecting the global financial cycle, US monetary policy lowers the provision of domestic credit globally and decreases international credit flows. This can deteriorate financial conditions in advanced and emerging economies, affecting firms located in those countries.

Figure 1: Federal Reserve and European Central Bank Policy Rates, 1999–2023



Note: The figure depicts the Federal Reserve and European Central Bank policy rates from 1999 to 2023. The red line represents the ECB Deposit Facility Rate, and the blue line represents the Fed Funds Effective Rate.
Source: FRED.

Economic shocks are both amplified and propagated over time by financing constraints because they lead to changes in firms' balance sheets (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). A contractionary US monetary policy shock can result in tighter foreign financial conditions, affecting borrowing costs through an external finance premium. As a result, foreign firms may not be able to invest in positive net present value projects due to their greater challenges to refinance their debt.[5] This could translate to reduced access to credit and, as a result, lower production capacity and investment.

Our paper provides novel evidence that corporate debt maturity plays an important role in the transmission of US monetary policy to foreign firms. Using the ex-ante maturity structure of long-term debt to predict firms' financial position in a given year, we show that the effect of US monetary policy shocks on foreign firms is amplified by financing constraints. After a contractionary shock, financial conditions in foreign countries become tighter, and firms with high proportions of long-term debt maturing right after the shock significantly and differentially decrease investment and sales.

We uncover heterogeneous impacts of the transmission of US monetary policy shocks to foreign firms. Firms in emerging economies are more affected than those in advanced economies in response to these shocks. Financing constraints amplify the effect of US monetary shocks in emerging economies, but no amplification is found for more constrained firms in advanced economies. This suggests that the less-developed financial markets and higher credit constraints of emerging economies (Carrière-Swallow and Céspedes, 2013), make it challenging for firms in emerging economies to successfully roll over their debt obligations relative to their counterparts in advanced economies.

The financing constraint effect through foreign firms' debt maturity has gained significance as debt in emerging economies surged from 80.9% of gross domestic product (GDP) in 2008 to 159.9% by March 2023. In advanced economies, this debt level increased from 238.8% of GDP in 2008 to 269.2% in 2023.[6] This rapid rise in debt levels can have profound implications for firms' abilities to meet their financial obligations. The International Monetary Fund (2023) documents a growing presence of financially vulnerable small and mid-sized companies in advanced and emerging

[5] We refer to foreign firms as firms located outside the US and Canada, i.e. publicly traded companies in global markets (excluding the US and Canada).
[6] Calculation by the authors based on Bank of International Settlements (BIS) total credit statistics.

economies that face difficulties meeting their interest obligations, together with an uptick in defaults amongst highly leveraged firms. This situation is expected to deteriorate further in 2024 as over US$5.5 trillion in corporate debt matures. As Jordà et al. (2022) highlight, elevated frictions in corporate debt resolution can slow recoveries and lead to subdued investment and the persistence of 'zombie firms'. This paper uses the financial index developed by Goldman Sachs on high-frequency monetary policy shocks and quarterly firm-level data to show that after a US contractionary shock, local financial conditions deteriorate, and more financially constrained firms exhibit a much more pronounced reduction in investment and sales than their peers. Applying the local projections method (Jordà, 2005), we find that six quarters after a contractionary shock, the financial index reduces by 0.374% in emerging economies versus only 0.063% in advanced countries. This is consistent with the idea that US monetary policy affects the global financial cycle (Miranda-Agrippino and Rey, 2022) and provides a strong mechanism for our main findings that corporate debt maturity plays an important role in the transmission of US monetary policy to foreign firms, and the amplification of the shock by financing constraints is only observed on firms located in emerging economies.

We uncover significant impacts of US monetary policy shocks on firms in emerging economies. After a US monetary policy contraction, firms with an average level of debt maturing within one year cumulatively decreased their long-term investment (capital expenditures) by 29.5%, short-term investment (receivables and inventories) by 8.7%, and sales by 20.4% (reaching its trough after six quarters). Notably, financing constraints amplify these adverse effects. Financing constraints exacerbate the impact of monetary policy shocks, leading to an additional cumulative reduction in long-term investment by 5.4% after six quarters and a further decrease in short-term investment by 1.4% after four quarters, gradually dissipating thereafter. As firms require short-term investments in accounts receivable and inventories to operate, this decrease in short-term investment translates into further reductions in sales by 2.5% after four quarters.

The effect of US monetary policy is much smaller for firms in advanced economies, with no amplification observed for financially constrained firms. These latter findings are consistent with the fact that in contrast to emerging economies, we do not observe a pronounced deterioration in local financial conditions within advanced economies. As a result, firms operating in advanced economies do not experience tighter financial conditions and, consequently, encounter fewer challenges when refinancing their debt.

This paper contributes to the macro-finance literature in two ways. First, we provide fresh evidence that debt maturity plays an important role in the transmission of US monetary policy to foreign firms. Second, our findings show that financing constraints amplify spillovers of US monetary policy, and the effect is heterogeneous across emerging and developed countries. In particular, we are the first paper to show that foreign firms facing refinancing constraints suffer more than other firms after a contractionary US monetary policy shock, and this effect is only present for firms in emerging economies. In sum, the paper provides novel empirical evidence that debt rollover risk influences mainly emerging economy firms in the face of increased borrowing costs resulting from US monetary policy tightening.

Standard macroeconomic models often overlook the financial sector, simply assuming efficient allocations. To address this, Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) introduce frictions, such as enforcement issues for lenders, that create borrowing constraints for firms and emphasise the significance of firms' financial conditions in shaping economic outcomes. Gilchrist and Zakrajšek (2012) empirically test this framework, collectively demonstrating the significant role of credit market conditions in amplifying the effects of monetary policy shocks on real economic activity. Our paper contributes to the literature on borrowing constraints by providing evidence that borrowing constraints play a significant role in how US monetary policy is transmitted to firms abroad.

Several papers use the ex-ante debt maturity structure as a measure of firm financial constraint (Almeida et al., 2012; Carvalho, 2015; Cortes and Rocha, 2021). For instance, Carvalho (2015) shows that financial frictions, especially rollover risk, play a vital role in amplifying the effects of aggregate economic downturns caused by the negative externalities of financially constrained firms during adverse economic conditions. Closer to our work, Jungherr et al. (2022) provide empirical evidence that firms' investment is more responsive to monetary policy when a higher fraction of their debt matures. However, they only focus on a subset of listed US firms that issue corporate bonds. Our contribution is to demonstrate the role of financial constraints in the transmission of US monetary policy to foreign firms and show that this effect is heterogeneous across firms in emerging and advanced economies.

The transmission of US monetary policy to economies outside the US borders via the financial frictions channel relates to a mature yet active international macroeconomic spillover effect of US

monetary policy literature.[7] Di Giovanni and Rogers (2022) and Saxegaard et al. (2022) are particularly closely related to our work, as we also investigate the impact of US monetary policy on foreign firms. However, we differ from their work in several dimensions.

Di Giovanni and Rogers (2022) use proxy measures, such as net worth and firm size, to assess financial constraints, and Saxegaard et al. (2022) use firms' debt-to-asset ratio. We employ a more refined approach focusing on the specific metric of debt maturity, thereby introducing the critical element of debt rollover risk into our analysis. This distinction enhances the precision of our identification strategy and introduces the importance of corporate debt maturity in the context of foreign firms, an aspect not addressed by the previous literature. Furthermore, our investigation operates at a higher frequency, analysing quarterly data rather than the annual approach of Di Giovanni and Rogers (2022). Our findings reveal intriguing and novel insights. We uncover that, in response to US monetary policy shocks, financial conditions strongly deteriorate in emerging economies. As a result, firms facing refinancing constraints in those countries are particularly affected by US monetary policy spillovers. In contrast, no amplification effect of financing constraints is observed for firms in advanced economies, as the effect of US monetary policy shocks weakly affects financial conditions in advanced economies.

Our paper is structured as follows. Section 2 presents the data. Section 3 outlines the empirical strategy. Section 4 discusses the relationship between US monetary policy and financial conditions. Section 5 discusses the real effects of US monetary policy on advanced and emerging economies firms. Section 6 provides robustness exercises. Section 7 concludes.

2. Data

We use three main sources of data: COMPUSTAT's Global Fundamentals Quarterly, the International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022). The first dataset provides balance-sheet information of publicly traded

[7] Bhattarai, Chatterjee, and Park (2020) and Kalemli-Özcan (2019) show that the uncertainty and fluctuations in risk perceptions that arise from the US financial system negatively affect foreign financial markets. Bruno and Shin (2015) find that the banking sector acts as a vital channel of US monetary transmission across borders due to fluctuations in risk-taking appetites. Di Giovanni and Hale (2022) find that international production networks act as transmission channels of US monetary policy shock to foreign firms.

companies in global markets (excluding the US and Canada).[8] The second contains country-level macroeconomic variables. The third has information on monetary policy shocks. Our baseline sample covers the years 1999–2022, 23,172 firms, 23 advanced countries, and 20 emerging market economies. Table 1 presents the country sample and the number of firms in each country. Using COMPUSTAT Global Quarterly data has three benefits: it is available at a quarterly frequency suitable for analysing the effect of US monetary policy on foreign firms; it constitutes a long panel, allowing for within-firm variation; and it offers comprehensive balance-sheet information needed to construct our key variables.

Our data selection criteria and filters follow Almeida et al. (2012) and standard practice in the corporate finance literature. We exclude financial firms (SIC codes 6000–6999), regulated utilities (SIC codes 4900–4949), and not-for-profit organisations and governmental enterprises (SICs greater than 8000). We require firms to provide valid information on their total assets, sales, capital expenditures, and cash holdings. We also require that a firm's quarterly sales be positive and that the log of sales growth not exceed 100%. We exclude firm-years for which asset growth is above 100%, and property, plant and equipment, investment, and cash holdings are greater than assets. Finally, we set the currency as the US dollar for all countries, deflate the variables using the country-specific GDP deflator, and winsorise at 1% all outcome variables and firm controls.

[8] Although we do not observe the currency of denomination of the debt in the COMPUSTAT database, we have information on the amount of long-term debt maturing during the first year after the annual report and the amount of long-term debt that matures in more than one year, which are the two key variables we use to construct our measure of financial constraints.

Table 1: Country-firm Distribution

Advanced Economies		Emerging Economies	
Australia	2,345	UAE	55
Austria	65	Argentina	60
Belgium	117	Brazil	314
Croatia	93	Chile	135
Czech Republic	17	China	3,578
Denmark	170	Colombia	28
Finland	186	Egypt	53
France	760	Hungary	32
Germany	688	India	799
Great Britain	1,957	Indonesia	628
Ireland	86	Mexico	122
Israel	461	Malaysia	1,025
Italy	425	Philippines	171
Netherlands	194	Poland	320
New Zealand	158	Russia	152
Norway	304	Saudi Arabia	139
Portugal	41	Thailand	682
Rep. of Korea	1,965	Turkey	373
Singapore	689	Viet Nam	235
Spain	144	South Africa	268
Sweden	807		
Switzerland	214		
Taiwan	2,117		
Total	14,003	Total	9169

Note: The table shows the number of countries and firms in our sample.
Source: COMPUSTAT's Global Fundamentals Quarterly.

2.1. Outcome Variables and Firm Controls

Outcome variables. We have four main outcomes of interest: $GSFCI_c$, STI_{ijc}, $sales_{ijc}$, and LTI_{ijc}, where i denotes the firm, j the industry, and c the country. *GSFCI* is the Goldman Sachs Financial Conditions Index available at Bloomberg Terminal to measure the financial conditions at the country level. *GSFCI* is given by a weighted average of riskless interest rates, the exchange rate, equity valuations, and credit spreads, where the weights correspond to the direct impact of each variable on GDP. The indices are available daily; we then calculate the average for each quarter. An increase in the *GSFCI* indicates easing financial conditions, and a decrease indicates tightening.

LTI is the log of quarterly capital expenditures (COMPUSTAT's capxy), *STI* is the log of the sum of receivables (COMPUSTAT's rectq) and inventories (COMPUSTAT's invtq), and *sales* is the log of quarterly sales (COMPUSTAT's salesq).[9] We refer to LTI_{ijt} as long-term investments and STI_{ijt} as short-term investments. Intuitively, one can think of long-term investment as capital expenditures and short-term investment as working capital. For instance, consider a construction company paying for costs before billing (receivables) and a manufacturing firm completing an order before delivery (inventories).

Table 2 displays summary statistics for the firm-quarters outcome variables within our sample. Examination of the growth rates reveals that firms in emerging economies experience slower growth rates in investment whilst maintaining similar rates of sales growth. Regarding variability, measured by the standard deviation, firms in emerging economies exhibit higher levels of investment and sales growth variation.

[9] The variable capxy represents 'year-to-date' capital expenditures. We adjust this variable to reflect quarterly values.

Table 2: Firm Data Descriptive Statistics in Real US$: Advanced versus Emerging Economies

Advanced Economies						Emerging Economies				
Variable	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
Long-term Investment (Log)	331,054	0.153	0.389	0.00	2.38	143,988	0.171	0.415	0.00	2.38
Long-term Investment Growth	294,223	-0.021	0.550	-1.00	2.00	127,717	-0.060	0.660	-1.00	2.00
Sales (Log)	331,054	0.840	1.104	0.00007	4.93	143,988	0.840	1.073	0.00007	4.93
Sales Growth	304,472	0.012	0.256	-1.00	2.00	134,286	0.008	0.276	-1.00	1.99
Short-term Investment (Log)	272,224	1.054	1.197	0.0012	5.15	136,032	0.974	1.106	0.0012	5.15
Short-term Investment Growth	251,598	0.022	0.434	-1.00	96.79	126,871	0.012	0.479	-1.00	101.98
Size (Log)	331,054	1.642	1.553	0.01	6.57	143,988	1.681	1.515	0.01	6.57
Asset Growth	304,786	0.00015	0.123	-1.00	1.00	134,315	-0.007	0.109	-1.00	0.996
Long-term Leverage	72,000	0.0019	0.0029	0.00	0.015	32,538	0.00071	0.0022	0.00	0.015
Asset Maturity	75,872	1916.6	10540.2	0	84843	33,490	1487.7	9026.3	0	84843
Cash Holdings/Assets	331,054	0.174	0.176	0.0014	0.803	143,988	0.122	0.125	0.0014	0.803
Book Leverage	246,740	0.254	0.178	0.0016	0.882	118,641	0.275	0.190	0.0016	0.882
Cash Flow/Assets	290,852	0.0054	0.053	-0.247	0.111	124,522	0.020	0.032	-0.247	0.111

Notes: This table provides summary statistics for firm-level variables in our sample. The sample is divided into two major groups: advanced economies and emerging economies. All data are presented at a quarterly frequency, except for the long-term leverage and asset maturity, which is presented at a yearly frequency. The data are derived from deflating to each country's GDP deflator and converting nominal local currency into US dollars.
Source: COMPUSTAT's Global Fundamentals Quarterly and International Financial Statistics (IMF).

Firm controls. Our firm controls are as follows: *Cash flow* represents the ratio of net income plus depreciation and amortisation (ibq + dpq) to the lag of quarterly assets. *Size* is given by the logarithm of total assets. *Cash holdings* are measured as the ratio of cash and short-term investments (cheq) to total assets. *Long-term leverage* denotes the ratio of total long-term debt (dd1+dltt) to total assets. *Sales growth* is the logarithmic difference of saleq between the current and the previous

quarter. *Asset maturity* is the annual weighted average of property, plant, and equipment maturity (ppegt) scaled by depreciation (dp), and current asset maturity (act) scaled by the cost of goods sold (cogs).

In line with Di Giovanni and Rogers (2022), we note variations in the distribution of our firm variables across countries. Of note, firms in emerging economies tend to exhibit higher book leverage with greater variability and have lower cash holdings than their advanced economy counterparts. Although the lower cash holding may be smaller due to deflation and the conversion of local currency to the US dollar, the higher cash flow-to-asset ratio suggests that they generate more cash relative to their asset size.

2.2. Macroeconomic Variables

We use the following macroeconomic variables as controls in our empirical strategy: real domestic GDP growth, the domestic GDP deflator, the domestic CPI inflation rate, the percentage change of the US dollar-to-local currency nominal exchange rate, the domestic central bank's short-term target rate, and the log of the CBOE Volatility Index (VIX). The datasets are obtained from the International Financial Statistics (IFS) available in the International Monetary Fund (IMF) database.

2.3. Measuring Refinancing Constraints

We follow Almeida et al. (2012) and use the ex-ante maturity structure of long-term debt to predict firms' financial position in a given year. Our measure of financial constraint is:

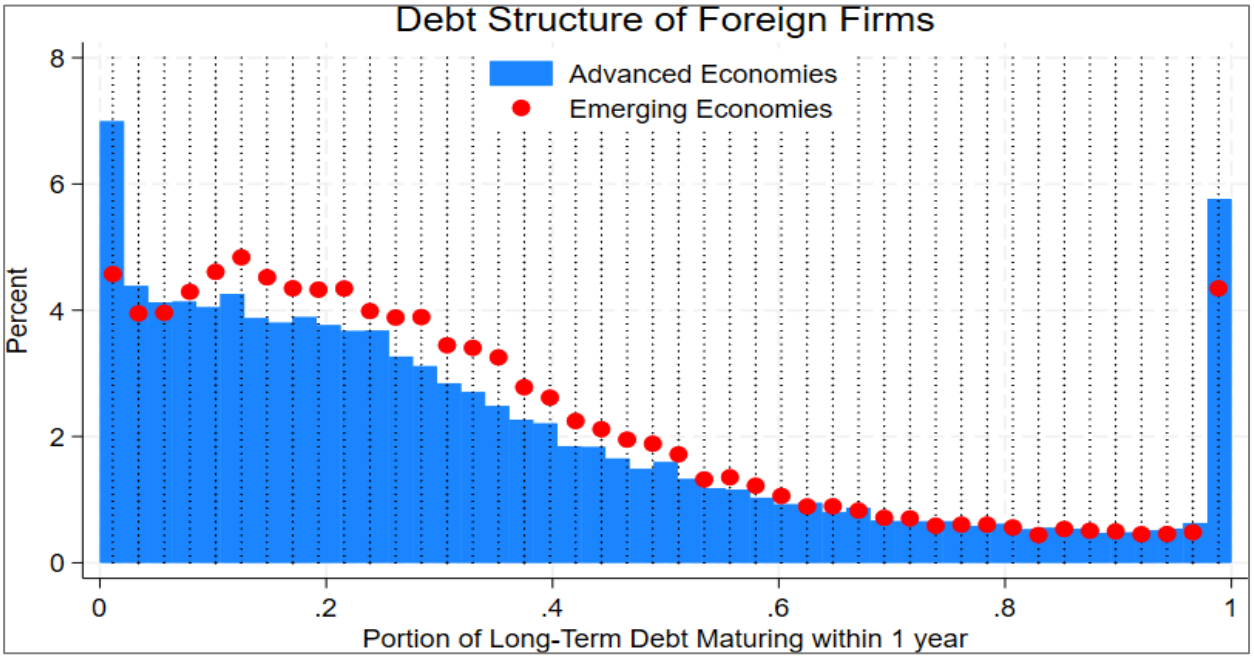
$$RFC_{ijc,t} = \frac{dd1_{ijc,t}}{dd1_{ijc,t} + dltt_{ijc,t}} \qquad (1)$$

COMPUSTAT's *dd*1 is the amount of long-term debt maturing during the first year after the annual report, e.g. the long-term debt maturing in 2008 for firms with a December 2007 fiscal year-end. COMPUSTAT's *dltt* represents the amount of long-term debt that matures in more than one year. Therefore, the one-year lag of the ratio of *dd*1 to *dd*1 + *dltt* is the fraction of a firm's long-term debt due in a given year as predicted in the previous year.

Figure 2 displays the distribution of debt maturity structures for firms in emerging and advanced economies, and Table 3 presents the $RFC_{ijc,t}$ measure for both advanced and emerging economies. When examining the proportion of long-term debt maturing within one year in Table 3, we find that emerging economies' firms have an average of 33% with a standard deviation of 26%,

whilst advanced economies' firms have an average of 33% with a standard deviation of 28%. Table 4 shows that our measure of financial constraint is weakly correlated with other firm characteristics. For instance, the correlation between $RFC_{ijc,t}$ and size is -0.2353, and the correlation between $RFC_{ijc,t}$ and net worth is -0.0472.

Figure 2: Debt Maturity Structure of Foreign Firms



The figure depicts the maturity profile of debt amongst firms in the sample from 1999 to 2022. Each bar represents the percentage of firms with long-term debt maturing within one year.
Source: COMPUSTAT's Global Fundamentals Quarterly.

Table 3: Measure of Financial Constraint: Advanced versus Emerging Economies

$RFC_{ijc,t}$	N	Mean	SD	Min	p25	p50	p75	Max
Advanced Economies	57,594	0.33	0.28	0.00	0.11	0.25	0.47	1.00
Emerging Economies	29,165	0.33	0.26	0.00	0.13	0.26	0.45	1.00

Note: The table shows the $RFC_{ijc,t}$ (see Subsection 2.3) measure in our sample from 1999 to 2022.
Source: COMPUSTAT's Global Fundamentals Quarterly.

Table 4: Correlation between Firm Controls and Financing Constraint Measure

Correlation	Financing Constraint ($RFC_{ijc,t}$)
Financing Constraint ($RFC_{ijc,t}$)	1
Size	-0.2353
Sales Growth	-0.0097
Cash Flow	-0.0472
Cash Holdings	-0.1102
Long-term Leverage	-0.1389

Note: This table shows the correlation between the financial constraint variable described in Subsection 2.3 and firm controls defined in Subsection 2.1.
Source: COMPUSTAT's Global Fundamentals Quarterly.

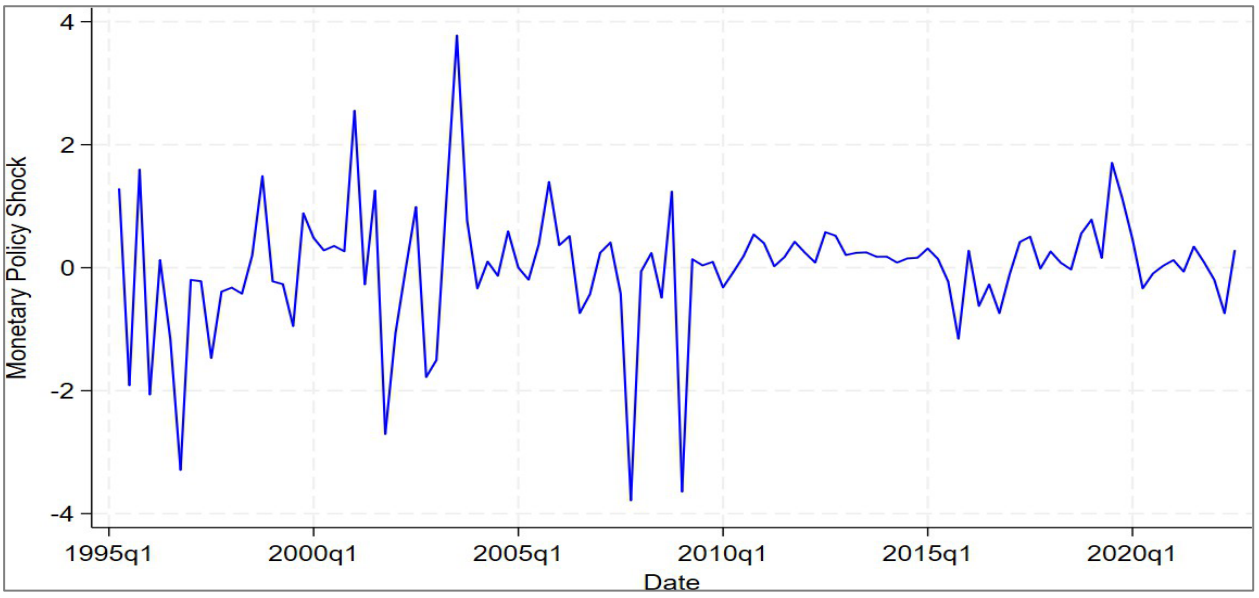
One potential concern with this measure is that the choice between short- versus long-term debt could be correlated with firm characteristics such as size and profitability. For instance, small firms are more likely to use short-term debt. If small firms are also more likely to be financially constrained, we would probably find that firms that use more short-term debt are more affected by monetary policy shocks. However, we use the proportion of long-term debt that matures right after each monetary policy shock to assess how firms are affected by credit contractions. Since cumulative decisions affecting the maturity of a firm's long-term debt were made several years before the monetary policy shock, whether the firm was scheduled to refinance a large fraction of its long-term debt right around the shock is plausibly exogenous to its performance following the shock.

Another potential concern is that other measures of financing constraints may better capture the amplification of monetary policy shocks. A common way of measuring financing constraints is to use indices constructed from accounting variables, such as size, age, and leverage (Kaplan and Zingales, 1997; Whited and Wu, 2006; Hadlock and Pierce, 2010). However, Farre-Mensa and Ljungqvist (2016) demonstrate that supposedly constrained firms identified via these methods do not behave differently from supposedly unconstrained counterparts. There is also evidence that refinancing constraints play an important role in the transmission of monetary policy to US firms (Jungherr et al., 2022). Therefore, our measure provides a more refined approach to capture the financial constraints channel and introduces the importance of corporate debt maturity in the context of foreign firms, an aspect not addressed by the previous literature.

2.4. Measuring Monetary Policy Shocks

We adopt the US monetary policy shocks proposed by Gürkaynak, Sack, and Swanson (2005) and extended by Acosta (2022) through Q3 2022.[10] The monetary policy shocks are constructed using a high-frequency identification of changes in the federal funds futures in short time intervals around Federal Open Market Committee (FOMC) meetings. Since this time window is narrow, any rate changes can be attributed to unanticipated shifts in monetary policy, as other shocks are unlikely to occur during this brief period. We convert the high-frequency shocks to a quarterly frequency through time aggregation following Ottonello and Winberry (2020). This process involves constructing a moving average of the raw shocks, where each shock is weighted by the number of days in the quarter after it occurs. This strategy allows us to weigh shocks by how long firms have had to react to them. We denote US monetary policy shocks by MP^{US} and the variation of those shocks for the past 3 decades is presented in Figure 3.

Figure 3: US Monetary Policy Shock



Notes: This figure illustrates the magnitude of the monetary policy shock in standard deviation units from the mean. We adopt the US monetary policy shocks proposed by Gürkaynak, Sack, and Swanson (2005) and extended by Acosta (2022) until Q3 2022. Positive values represent contractionary US monetary policy shocks.
Source: Acosta (2022).

[10] Section 6.3 employs two alternative US monetary policy shocks as a robustness test, the Nakamura and Steinsson (2018) method also extended by Acosta (2022) until Q3 2022 and the E.T. Swanson (2021) method ending in Q2 2019. Notably, we obtain very similar results.

3. Empirical Strategy

3.1. US Monetary Policy and Foreign Countries

We first show how US monetary policy shocks affect advanced and emerging economies financial conditions by using local projections (Jordà, 2005) to estimate:

$$GSFCI_{c,t+h} - GSFCI_{c,t-1} = \alpha^h + \phi_1^h MP_t^{US} + \delta^h X_{c,t-4} + \epsilon_{c,t+h}^h \qquad (2)$$

where *c* denotes the country. $GSFCI_{c,t+h}$ is the country-level log of financial conditions measured in quarter $t + h$, $h = 0, 1, 2, ..., 12$.[11] This regression captures the effect of US monetary policy shocks on foreign economies' financial conditions. We expect $\beta^h < 0$ because a tightening of US monetary policy leads to higher US longer-term yields, tightening foreign countries' financial conditions. $X_{c,t-4}$ is a vector of controls that includes 4 lags of MP^{US}, the CBOE Volatility Index (VIX), domestic short-term interest rates, GDP growth, exchange rate changes, and the Consumer Price Index (CPI). We also include contemporaneous and four lags of the variable *path*. According to Gürkaynak, Sack, and Swanson (2005), *path* is the component of monetary policy announcements that affects the slope of the yield curve. α^h is a set of fixed effects (FE) that includes country FE and quarter FE. Finally, ϵ^h is the error term clustered at the country level.

3.2. US Monetary Policy and Foreign Firms

Using local projections (Jordà, 2005), we show how firm financial constraints affect the transmission of US monetary policy shocks by estimating the following specification:

$$y_{ijc,t+h} - y_{ijc,t-1} = \alpha^h + \beta_1^h MP_t^{US} + \beta_2^h RFC_{ijc,t-1} + \beta_3^h MP_t^{US} X\ RFC_{ijc,t-1}$$
$$+\gamma^h Z_{ijc,t-1} + \delta^h X_{c,t-4} + \epsilon_{ijc,t+h}^h \qquad (3)$$

where *i* denotes a firm, *j* the industry and *c* the country. $y_{ijc,t+h}$ is the firm-level outcome measured in quarter $t + h$, $h = 0, 1, 2, ..., 12$. Outcome variables consist of LTI, STI, and *sales*. These regressions capture the effect of monetary policy shocks on the quarterly cumulative change in long-term investment, short-term investment, and sales. Our primary parameters of interest in the regression are β_1^h, which captures the effect of MP_t^{US} on firms that have the average level of $RFC_{c,t}$ for their respective countries at time *t*, and β_3^h, which represents the additional effect of MP_t^{US} on firm *i* when its $RFC_{ijc,t}$ level is one standard deviation above the country average of $RFC_{c,t}$ on time *t*.

[11] The GSFCI is described in detailed at Section 2.1.

We expect $\beta^h{}_1 < 0$ because a tightening of US monetary policy would deteriorate foreign firms' financial conditions. Similarly, we anticipate $\beta^h{}_3 < 0$ as more financially constrained firms are more vulnerable to monetary policy shocks. In the presence of financing frictions, economic shocks are both amplified and propagated over time because financially constrained firms, when faced with unexpected monetary policy shocks, are likely to reduce investment, exercise caution in borrowing, and consider asset sales as strategies to navigate the challenges presented by tighter financial conditions as illustrated by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997).

$Z_{ijc,t-1}$ is a vector of firm controls that include one lag of long-term leverage, size, sales growth, and cash-flow. Following Carvalho (2015), we also control for asset maturity. To account for the potential differential reactions of larger and smaller firms to US monetary policy shocks, all controls interact with MP_t^{US}.[12] $X_{c,t-4}$ is a vector of macroeconomic controls, which includes 4 lags of VIX, domestic short-term interest rates, GDP growth, exchange rate changes, a global financial crisis (GFC) dummy (interacted with MP_t^{US} and the RFC variable), and the CPI. The GFC dummy is added to take into account the fact that during the financial crisis, the behaviour of financial markets, firms, and economic variables deviated significantly from the non-crisis period. For instance, Almeida et al. (2012) show that debt maturity played a significant role in firms' outcomes during the GFC. Due to the panel data structure of our regression model, we include a set of fixed effects at the quarter, firm, and country×sector levels (α^h). Finally, $\epsilon^h_{ijc,t+h}$is the error term clustered at the time×firm-level.

One concern with our specification is that the effect of US monetary policy shocks on foreign firms could be confounding with potentially correlated domestic monetary policy changes. To avoid this identification issue, we add short-term domestic interest rates in the regression to control for domestic monetary policy changes (as in Di Giovanni and Rogers (2022)). Including this variable allows us to interpret the β^h_1 coefficient as the independent effect of the US monetary policy shock on the outcomes of foreign firms.

[12] In Section 6, we include an additional control, the five-year moving average of *RFC*, and show that the results remain the same.

4. US Monetary Policy and Financial Conditions

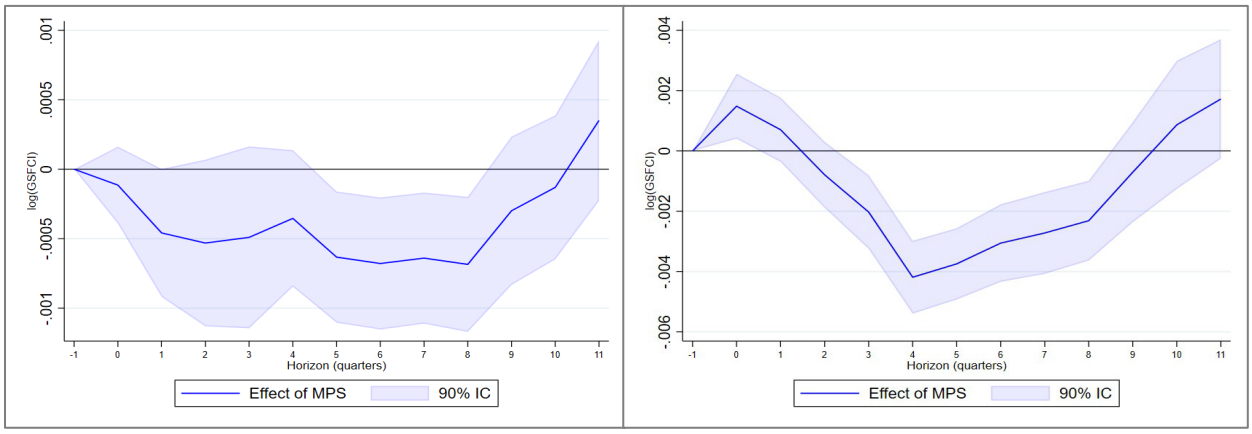
This section shows the effect of US monetary policy shocks on foreign countries' financial conditions. We explore the US monetary policy spillover heterogeneity between emerging and advanced countries, analysing the effect on aggregate financial conditions separately.[13] Figure 4 presents the Impulse Response Functions (henceforth, IRF) for the response of financial conditions to US monetary policy shocks using the baseline specification in Section 3. The blue line represents the effect of a one standard deviation monetary policy contraction (ϕ_1^h). The shaded light blue represents the 90% confidence interval.

Figure 4 (A) shows that contractionary shocks lead to tighter financial conditions in advanced countries. After six quarters, the financial condition index significantly decreases by 0.063%. The results for emerging countries are much stronger. Figure 4 (B) shows that following a contractionary shock, the financial condition index significantly decreases by 0.374% after six quarters, roughly six times as much as the decline in advanced economies. This result is economically significant since the median financial condition growth rate amongst emerging economies is -0.02% per quarter. When the Federal Reserve tightens policy, global asset prices decline, foreign currencies depreciate sharply against the dollar, and financial constraints tighten in foreign economies (Akinci and Queralto, 2018). Since firms in emerging economies are more likely to be financially constrained, the magnitude of the effect of US monetary policy shock on financial conditions in those countries should be even stronger than in advanced countries.

[13] The advanced economies are Australia, Austria, Belgium, Canada, Czech Republic, Finland, France, Germany, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Republic of Korea, Spain, Sweden, Switzerland, and United Kingdom. The emerging economies are Brazil, Chile, China, Dominica, Hungary, India, Indonesia, Malaysia, Mexico, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey.

Figure 4: US Monetary Policy and Financial Conditions in Foreign Countries: Advanced vs. Emerging Economies

(A) Advanced Economies (B) Emerging Economies



Notes: This figure shows the Impulse Response Function (IRF) for the response of financial conditions to US monetary policy shocks using the baseline specification in Section 3 (Equation (2)). We estimate the results separately for advanced and emerging economies. Panels (A) and (B) show the effect on advanced and emerging economies, respectively. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). The shaded light blue represents the 90% confidence interval. The reported standard errors are clustered by country. The horizontal axis shows the impulse-response horizon measured in quarters. Sources: Bloomberg, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

Table 5: Macroeconomic Descriptive Statistics: Advanced versus Emerging Economies

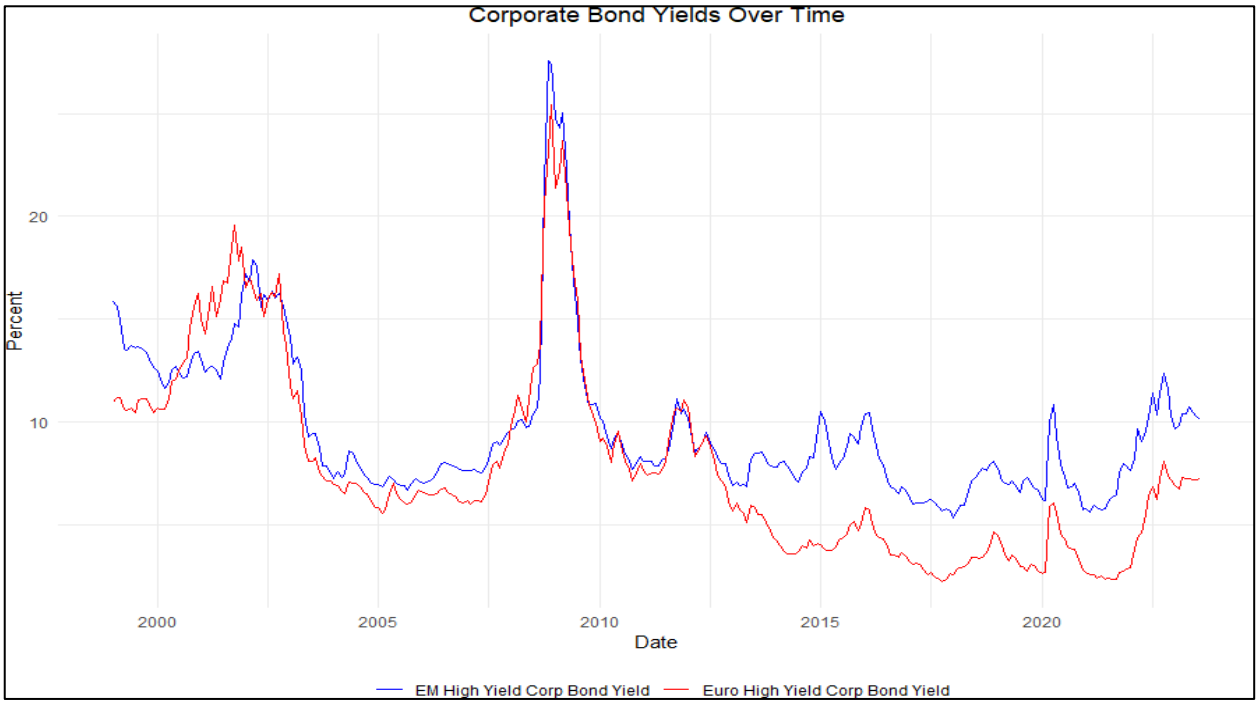
Advanced Economies						**Emerging Economies**				
Variable	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
GDP Growth Rate	2,328	2.32	3.63	-22.63	26.65	1,714	4.04	4.35	-21.80	22.36
Inflation Rate	2,328	1.98	2.01	-2.74	17.49	1,693	6.88	10.53	-3.86	117.08
Domestic Interest Rate	2,037	1.86	1.96	-0.88	13.00	1,534	7.43	7.00	0.10	72.00
VIX (Log)	2,328	2.96	0.33	2.33	4.07	1,940	2.96	0.33	2.33	4.07
Δ Exchange Rate	2,231	-0.04	3.67	-32.28	13.28	1,552	-0.34	3.07	-49.39	7.91

Notes: This table presents summary statistics for the country-level variables in our sample, which are divided into two major groups: advanced economies and emerging economies. All data are presented quarterly from 1999 to 2022, with all variables except VIX reported in percentages.
Source: International Financial Statistics (IMF).

5. Real Effects: Advanced vs. Emerging Economies

We examine the effects of financial constraints on firms located in both advanced and emerging economies. These two groups exhibit significant institutional distinctions that may give rise to divergent responses amongst their firms. As illustrated in Figure 5, emerging economies faced higher financing costs than advanced economies. Thus, it could be more challenging for their firms to successfully roll over their debt obligations when compared to their counterparts in advanced economies. Emerging economies tend to feature less-developed financial markets and higher credit constraints (Carrière-Swallow and Céspedes, 2013), increasing the likelihood that firms within these economies rely on foreign credit suppliers to meet their financing needs and, consequently, resulting in a higher prevalence of dollar-denominated debt that is more sensitive to US monetary policy.

Figure 5: Emerging Markets and Euro Bond Yield, 1999–2023



Notes: The figure depicts emerging and advanced economies' corporate bond yield from 1999 to 2023. The red line represents advanced economies' corporate bond yield and the blue line represents emerging economies' corporate bond yield.
Source: FRED.

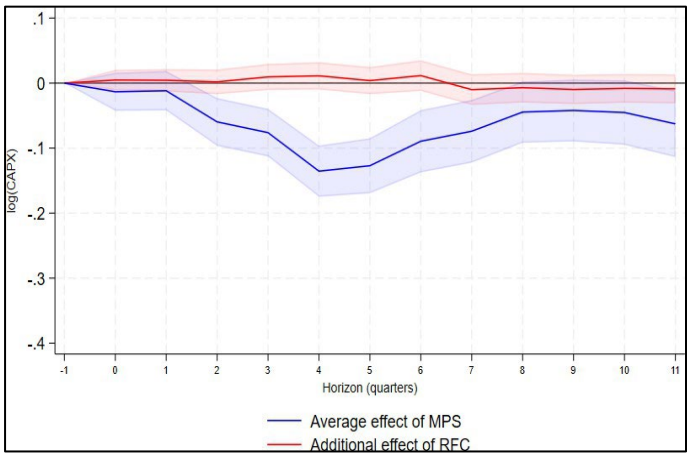
We estimate Equation (6) separately for advanced and emerging economies. We investigate whether a tighter US monetary policy impacts firms' financial constraints more in emerging economies than in advanced economies. The literature shows that emerging economies are more exposed to US monetary policy shocks (Di Giovanni and Rogers, 2022). Consistent with this idea, Figure 6 shows that the average effect of the US monetary policy, represented by the IRF, in blue, is much stronger on emerging economies firms than advanced economies firms. After six quarters, a one standard deviation US contractionary monetary policy shock decreases long-term investment by 29.5% and 12.7% in emerging and advanced economies, respectively.

The same is observed for the effect of US monetary policy shocks on a firm's short-term investment. For firms in emerging economies, a one standard deviation US contractionary monetary policy shock decreases short-term investment by 8.7% after six quarters. The effect is only 4.7% for firms in advanced economies. As firms require short-term investments in accounts receivable and inventories to operate, this decrease in short-term investment translates into immediate reductions in firm sales and production capacity. For emerging economies, a one standard deviation US contractionary monetary policy shock decreases sales by 20.4% after six quarters. For advanced economies' firms, the effect is only 6.2%. This suggests that spillover effects of US monetary policy are quantitatively more important for emerging economies.

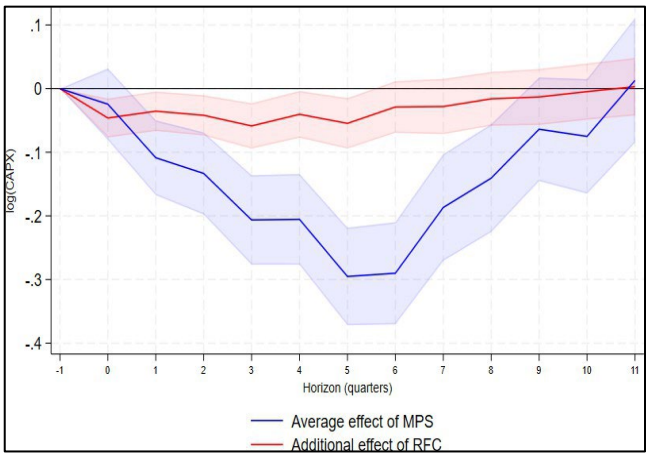
Despite the strong average effects on firms' investment policies, there is no evidence that spillovers of US monetary policy have heterogeneous impacts on firms' outcomes across these two groups of countries conditional on being financially constrained. In other words, does it matter whether a firm is financially constrained in an emerging or an advanced economy? Figure 6 shows that it does matter. The red IRF shows that financially constrained firms in emerging economies are much more exposed to US monetary policy shocks than those in advanced economies. For the three outcomes considered – long-term investment, short-term investment, and sales – we do not observe any amplification effect of US monetary policy shocks on advanced economy firms. This result aligns with our findings in Section 4 that local financial conditions in advanced economies do not deteriorate significantly after the US contractionary monetary policy. As a result, firms do not face adverse conditions when rolling over their debt obligations.

Figure 6: The Effect of US Monetary Policy on Foreign Firms: Advanced vs. Emerging Economies

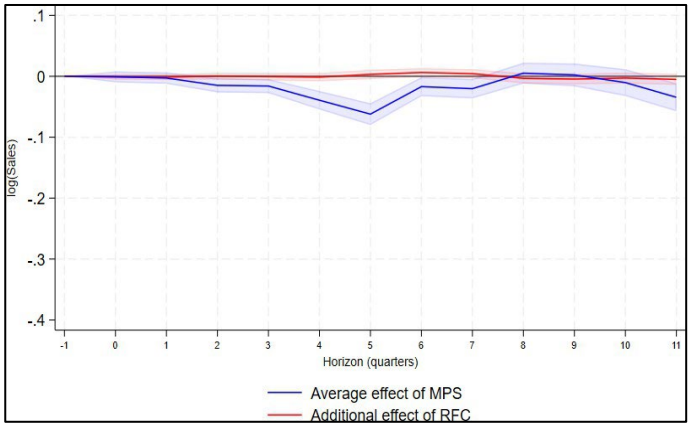
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

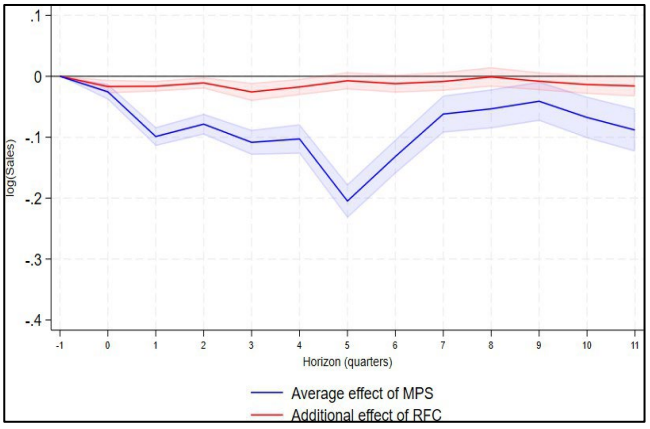
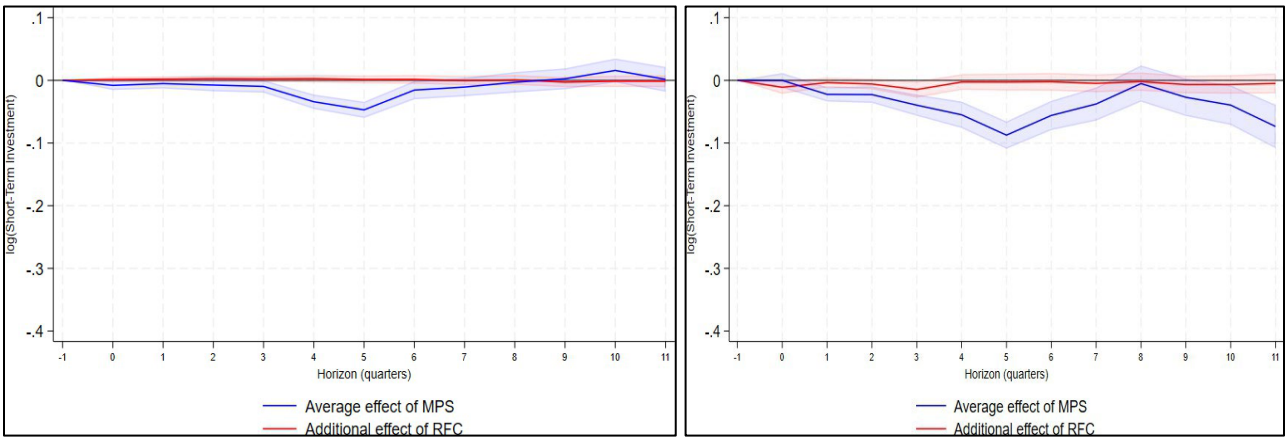


Figure 6: ***Continued***

(E) Advanced Economies - Short-Term Investment

(F) Emerging Economies - Short-Term Investment



Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We estimate the results separately for advanced and emerging economies. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $^3RFC_{c,t}$ (β^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

In contrast, financially constrained firms in emerging economies are further impacted by US monetary policy spillover. A US contractionary monetary policy shock decreases the long-term investment of firms that are one standard deviation above the average of $RFC_{c,t}$ immediately by an additional 4.6%. After six quarters, the additional effect for constrained firms is equal to 5.4%. Similarly, after a contractionary shock, more financially constrained firms immediately decrease their short-term investment by an additional 1.1%. Four quarters after the shock, the additional effect is equal to 1.4%. Again, this additional drop in short-term investment translates into immediate reductions in firm sales. Following the same contractionary shock, more financially constrained firms immediately decrease their sales by an additional 1.7%. Four quarters after the shock, the additional effect is equal to 2.5%.

Overall, our findings suggest that refinancing constraints play an important role in the transmission of US monetary policy to foreign firms, especially those located in emerging economies.

Following increases in US interest rates, foreign conditions deteriorate, and foreign firms decrease capital expenditures, short-term investment in receivables and inventories, and sales. This effect is significantly bigger for financially constrained firms in emerging economies as they face more challenges when refinancing their debt.[14]

Table 6: The Effect of US Monetary Policy on Foreign Firms: Advanced vs. Emerging Economies

Panel A: $h = 4$

	Advanced Economies		**Emerging Economies**	
	MPS	**MPS × RFC**	**MPS**	**MPS × RFC**
Δ log(Long-Term Investment)	-0.076***	0.009	-0.206***	-0.058***
	(0.022)	(0.012)	(0.042)	(0.021)
Δ log(Sales)	-0.015**	-0.001	-0.108***	-0.025***
	(0.007)	(0.003)	(0.012)	(0.009)
Δ log(Short-Term Investment)	-0.009	0.002	-0.039***	-0.014*
	(0.006)	(0.003)	(0.010)	(0.007)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Country × Sector	Yes	Yes	Yes	Yes

Panel B: $h = 6$

	Advanced Economies		**Emerging Economies**	
	MPS	**MPS × RFC**	**MPS**	**MPS × RFC**
Δ log(Long-Term Investment)	-0.127***	0.003	-0.295***	-0.054**
	(0.025)	(0.012)	(0.046)	(0.024)
Δ log(Sales)	-0.062***	0.003	-0.204***	-0.007
	(0.010)	(0.004)	(0.016)	(0.008)
Δ log(Short-Term Investment)	-0.047***	0.001	-0.087***	-0.002
	(0.007)	(0.003)	(0.013)	(0.008)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes

[14] The findings discussed above are also presented in Table 6. We report the results for horizons $h = 4$ and $h = 6$.

	Advanced Economies		Emerging Economies	
	MPS	**MPS × RFC**	**MPS**	**MPS × RFC**
Quarter FE	Yes	Yes	Yes	Yes
Country × Sector	Yes	Yes	Yes	Yes

Notes: This table presents the baseline results of Equation (3) estimated separately for advanced and emerging economies. The dependent variable is the difference in y_{ijc} after four ($h = 4$) and six quarters ($h = 6$), denoted as $y_{ijc,t+h} - y_{ijc,t-1}$. The main independent variable of interest is the US monetary policy shock (MP_t^{US}), which is examined in relation to the refinancing constraint effects ($RFC_{ijc,t-1}$). The interaction term $MP_t^{US} \times RFC_{ijc,t-1}$ captures the amplification effect of the refinancing constraint.Control variables $Z_{ijc,t-1}$ are firm-specific controls, whilst $X_{c,t-4}$ represents 4 lags of country-level controls. Standard errors clustered at the time × firm-level is shown in parentheses. We include a set of fixed effects for quarter, firm, and country×sector (α^h). Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.
Sources: COMPUSTAT's Global Fundamentals Quarterly, the International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

6. Robustness

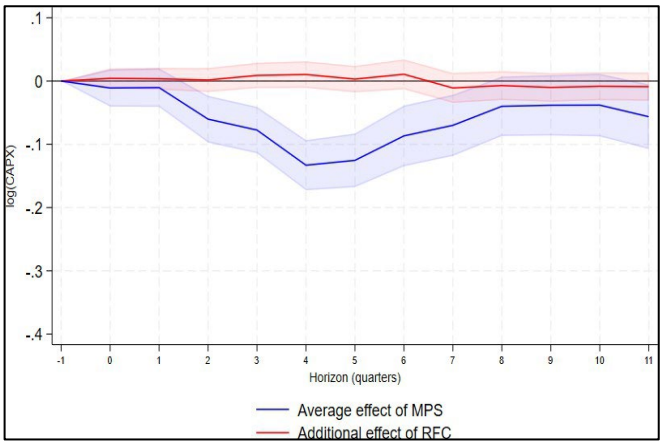
This section reports several robustness tests. We verify that results are robust to the inclusion of several controls and alternative measures of monetary policy shocks.

6.1. Additional Controls

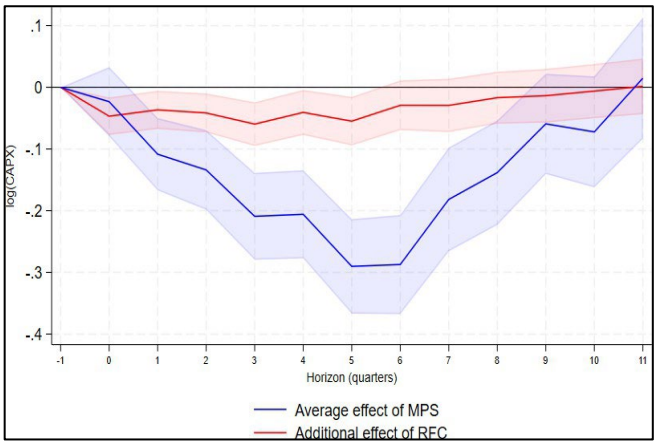
One potential concern with our results is that financially constrained firms may also hold more cash holdings than other firms. If cash holdings are an important firm characteristic in the transmission of monetary policy shocks, our results may not be entirely driven by the RFC measure. We alleviate this concern by including cash holdings and their interaction with the monetary policy shock in our main specification (Equation (6)). Figure 7 shows that the results are virtually unchanged. After a contractionary shock, firms decrease on average their long-term investment, short-term investment, and sales, and financing constraints significantly amplify the effects.

Figure 7: The Effect of US Monetary Policy on Foreign Firms: Cash Holdings as an Additional Control

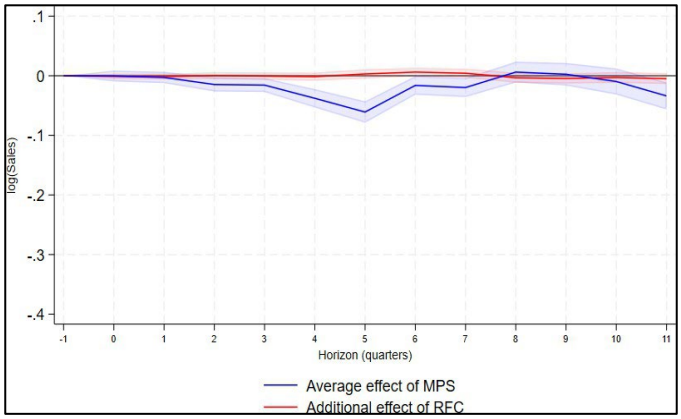
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

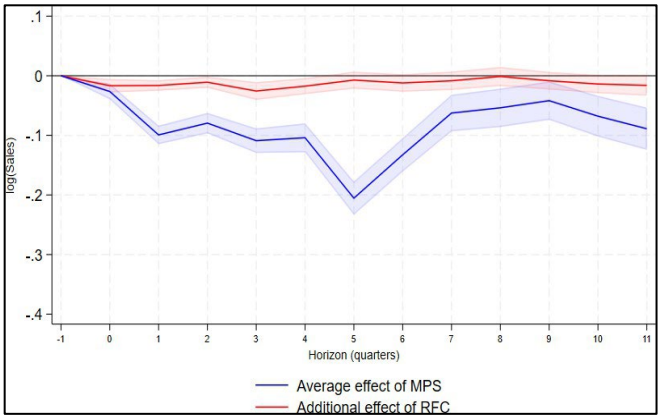
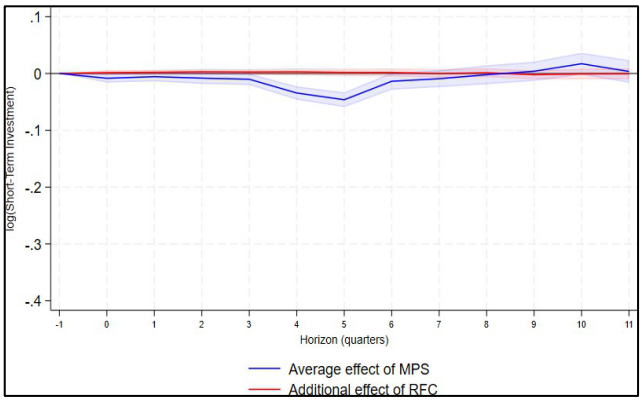
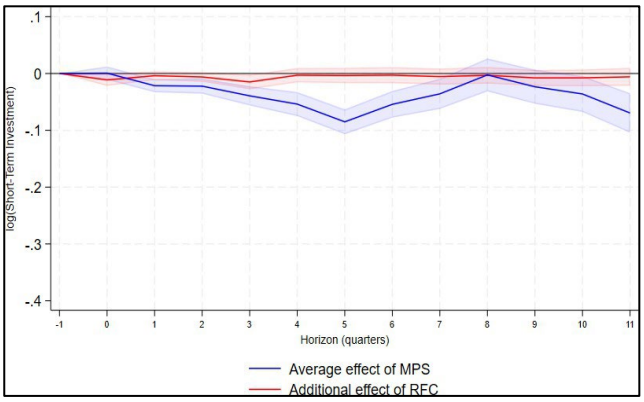


Figure 7: ***Continued***

(E) Advanced Economies - Short-Term Investment



(F) Emerging Economies - Short-Term Investment

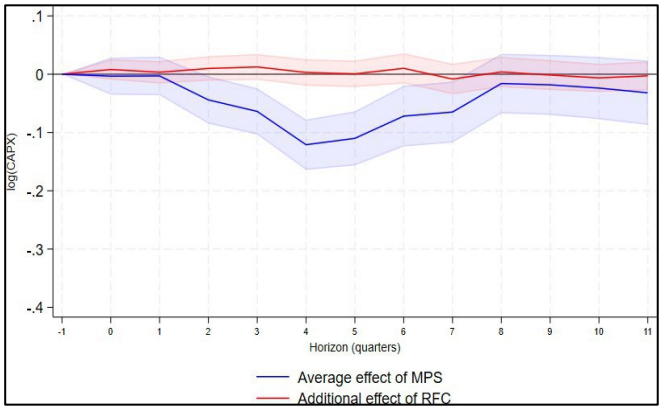


Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add *cash holdings* as an additional control. The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

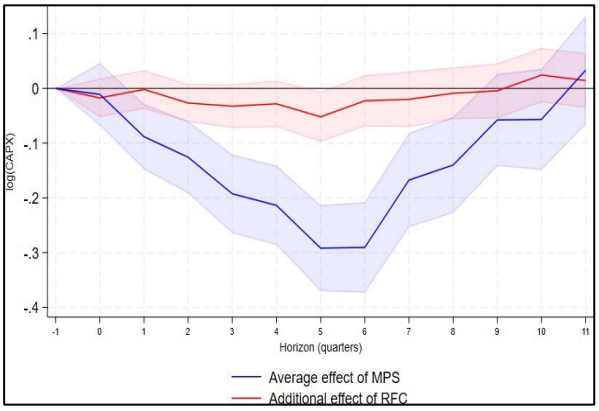
Ottonello and Winberry (2020) show that leverage plays an important role in the transmission of monetary policy to firms. If firms that face refinancing constraints are highly leveraged, then our results may reflect the amplification effect of leverage and not refinancing constraints. We address this by adding *book leverage*, the ratio of total debt to total assets, where *total debt* is long-term debt (COMPUSTAT's dlttq) plus debt in current liabilities (COMPUSTAT's dlcq), and the interaction of this variable with the monetary policy shock. Figure 8 shows that the results remain the same.

Figure 8: The Effect of US Monetary Policy on Foreign Firms: Book Leverage as an Additional Control

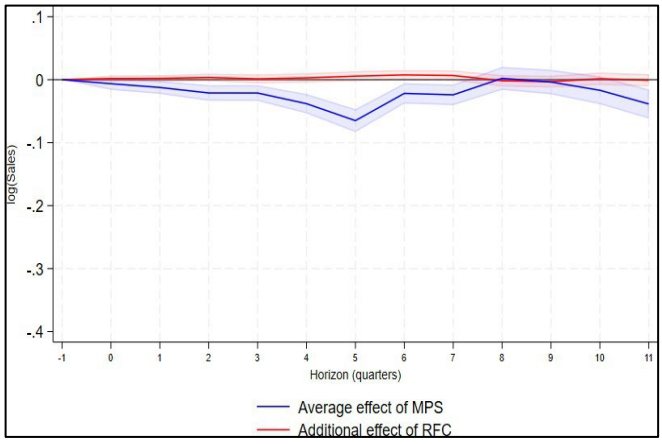
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

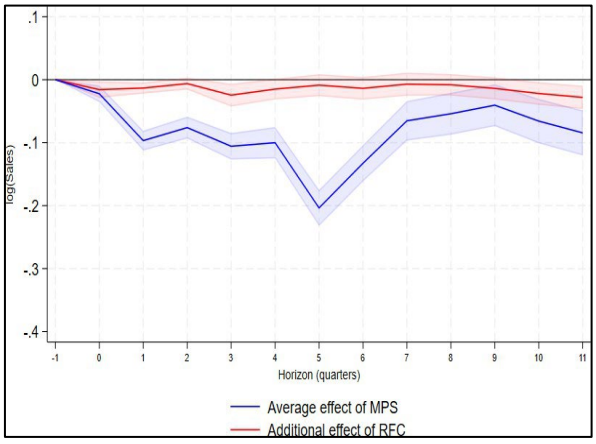
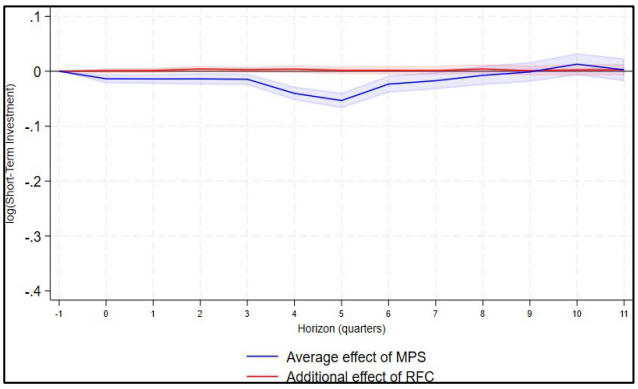
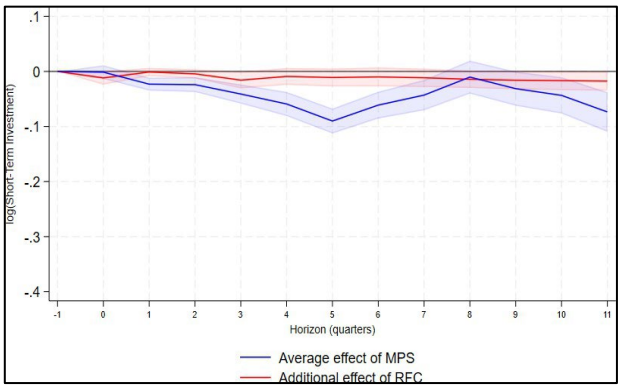


Figure 8: ***Continued***

(E) Advanced Economies - Short-Term Investment



(F) Emerging Economies - Short-Term Investment

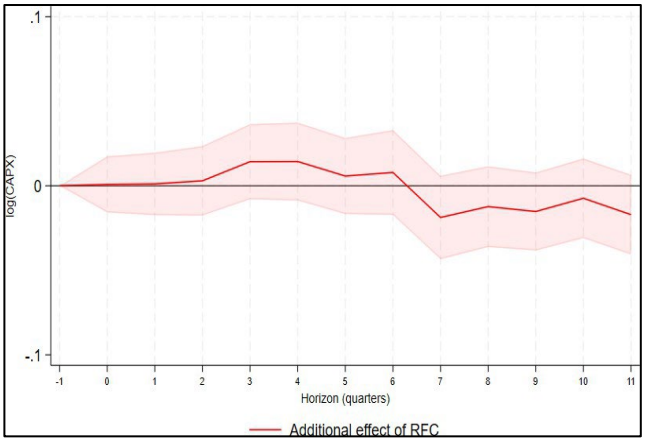


Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add *book leverage* as an additional control. The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

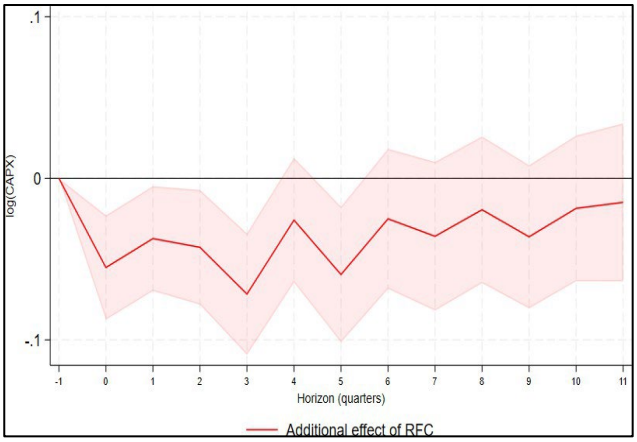
One may still be concerned that our results are due to time-varying unobserved macroeconomic conditions that influence all firms, or all firms within a given industry. We overcome this concern by including industry×time fixed effects in our main specification. Figure 9 confirms that our results are robust to the inclusion of those fixed effects.

Figure 9: The Effect of US Monetary Policy on Foreign Firms: Industry × Time as an Additional Control

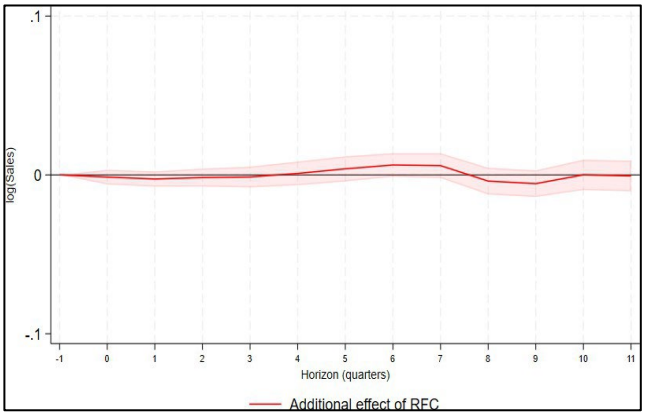
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

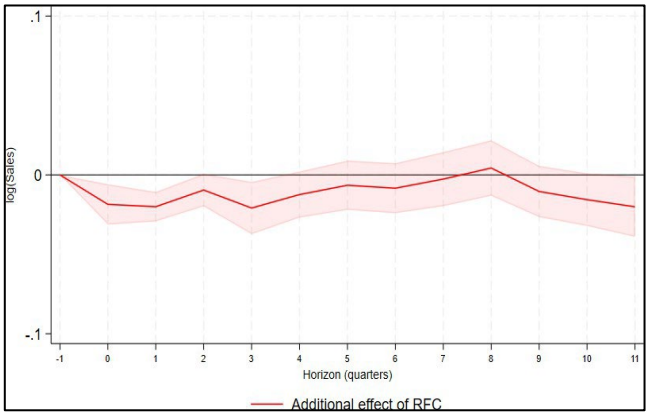
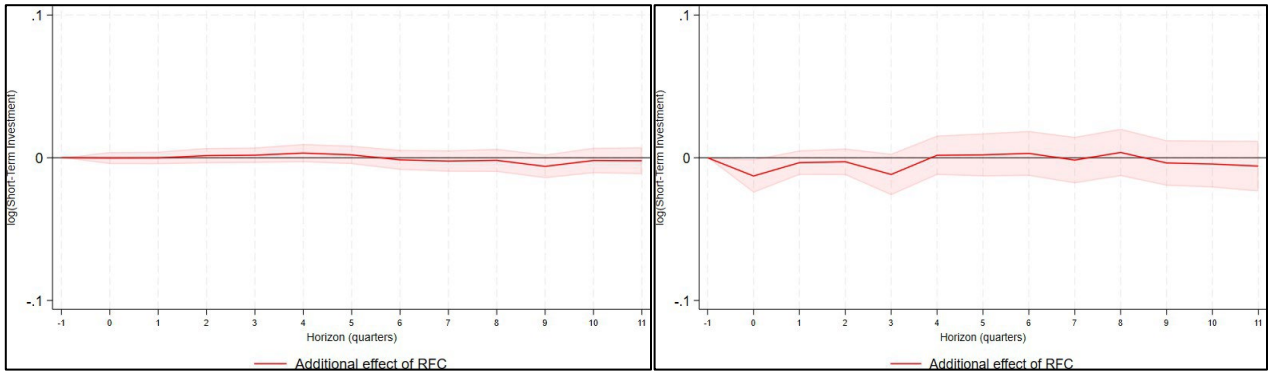


Figure 9: ***Continued***

(E) Advanced Economies - Short-Term Investment

(F) Emerging Economies - Short-Term Investment



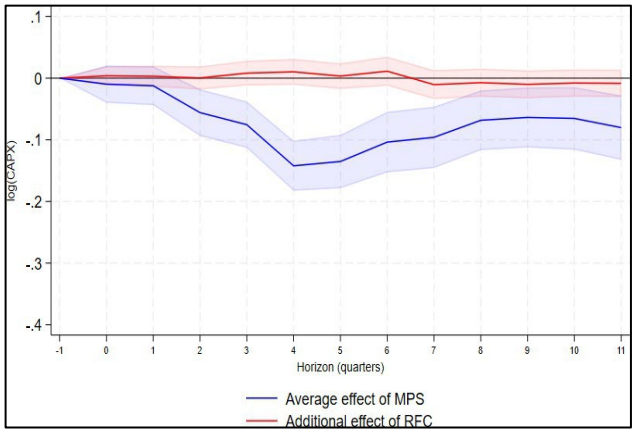
Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add Industry × Time as an additional control. The β_1^h coefficient is absorbed by the fixed effect. The red line represents the additional effect of monetary policy contraction on the firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light red represents the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

6.2. Macro Controls

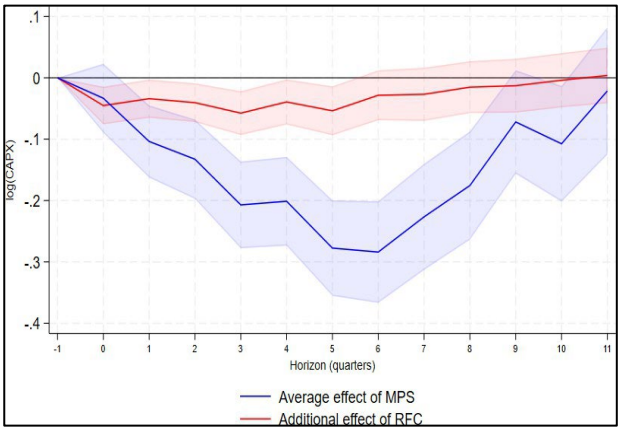
As previously discussed in Section 3, another possible concern with our specification is that the effect of US monetary policy shocks on foreign firms could be confounding with potentially correlated domestic monetary policy changes. To avoid this identification issue, we first include both lagged and contemporaneous short-term domestic interest rates in the regression to control for domestic monetary policy changes. Figure 10 shows that the results are virtually unchanged. We then interact the contemporaneous short-term domestic interest rates with all firm controls, including our measure of financing constraints. If our results are driven by domestic rates, the inclusion of this interaction term should strongly attenuate our channel. Figure 11 shows that our results are robust to the inclusion of these controls, underscoring the fact that our empirical findings are driven by US monetary policy shocks. We also add the GSFCI in the macro control to alleviate concerns related to the results being driven by local financial conditions. Figure 12 indicates that our results remain quantitatively similar.

Figure 10: The Effect of US Monetary Policy on Foreign Firms: Contemporaneous Macro Controls

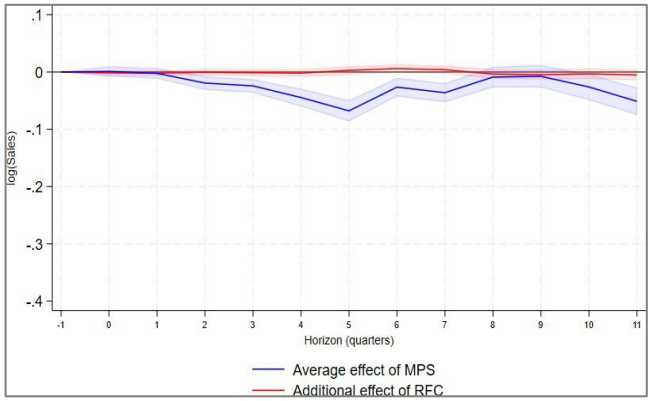
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

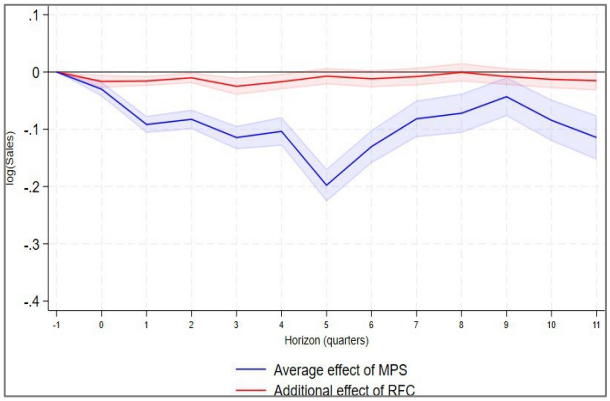
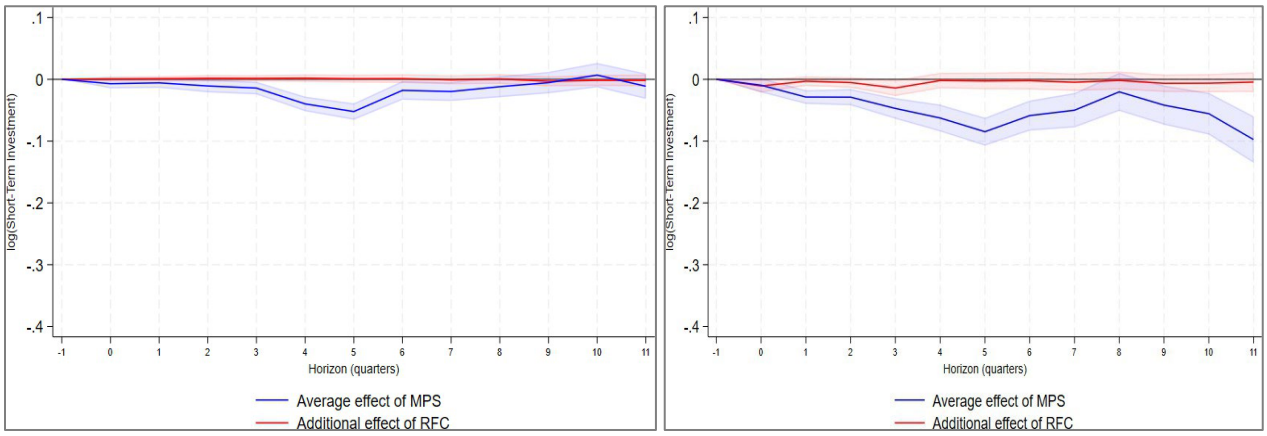


Figure 10: ***Continued***

(E) Advanced Economies - Short-Term Investment

(F) Emerging Economies - Short-Term Investment



Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add contemporaneous macroeconomic controls. The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light red represents the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse- response horizon measured in quarters.

Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

Figure 11: The Effect of US Monetary Policy on Foreign Firms: Interaction of Contemporaneous Short-term Domestic Interest Rates and Firm Controls

(A) Advanced Economies - Long-Term Investment

(B) Emerging Economies - Long-Term Investment

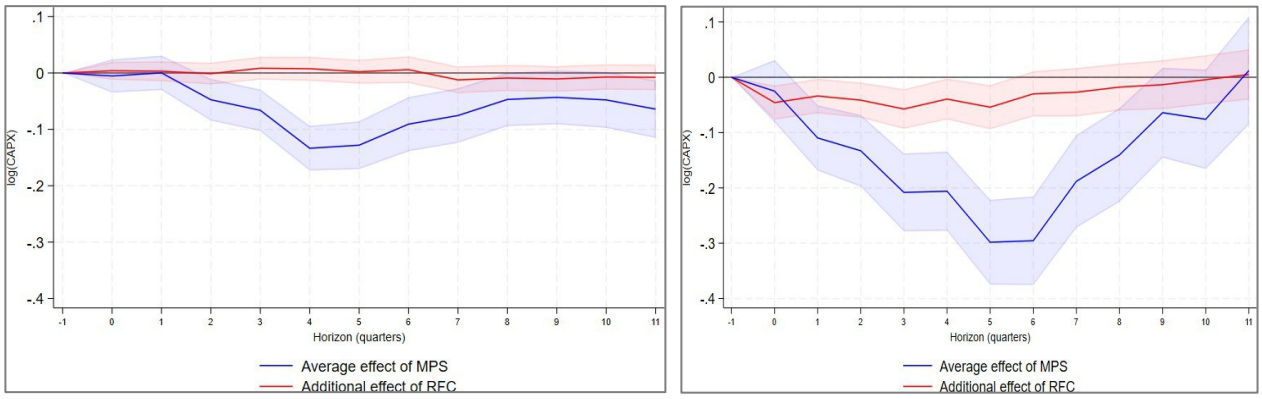
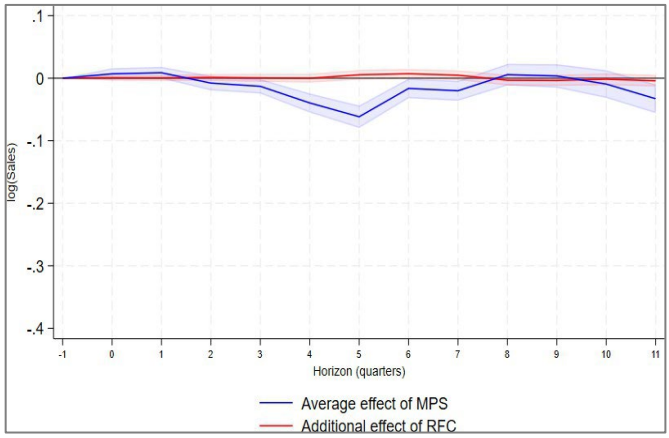
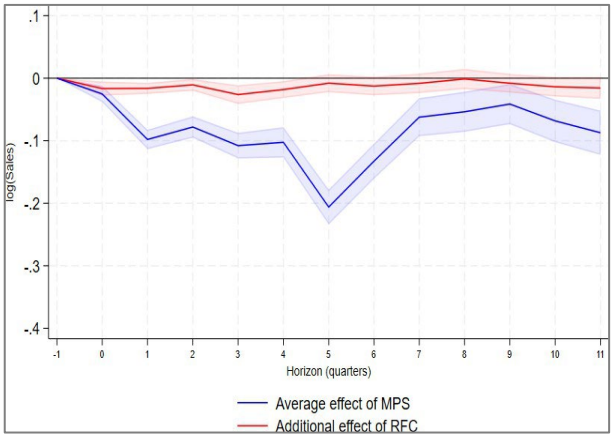


Figure 11: ***Continued***

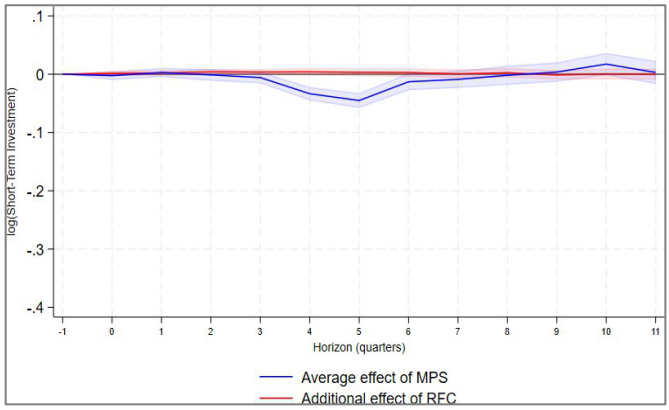
(C) Advanced Economies - Sales



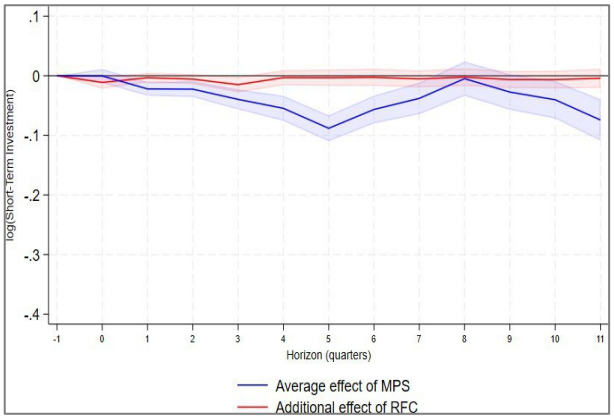
(D) Emerging Economies - Sales



(E) Advanced Economies - Short-Term Investment



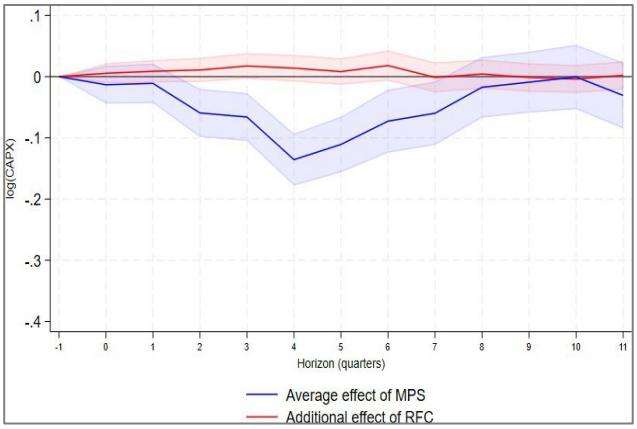
(F) Emerging Economies - Short-Term Investment



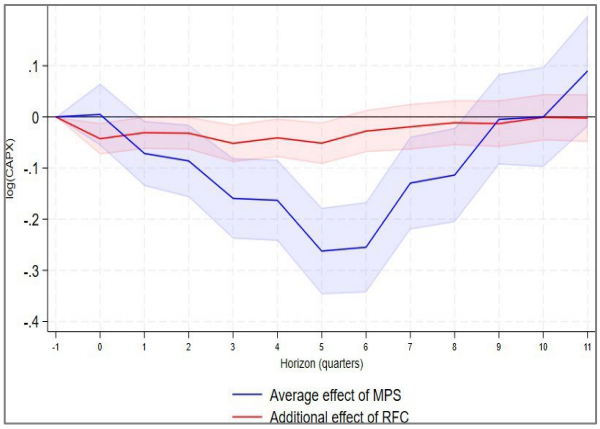
Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add the interaction of contemporaneous short-term domestic interest rates and firm controls (including the *RFC* measure). The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light red represents the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters. Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

Figure 12: The Effect of US Monetary Policy on Foreign Firms: GSFCI as a Control

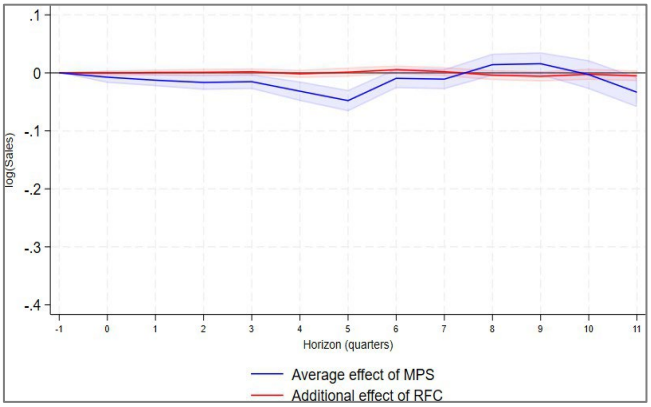
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

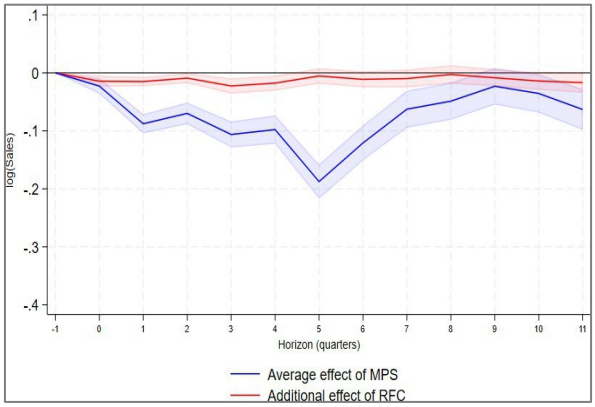
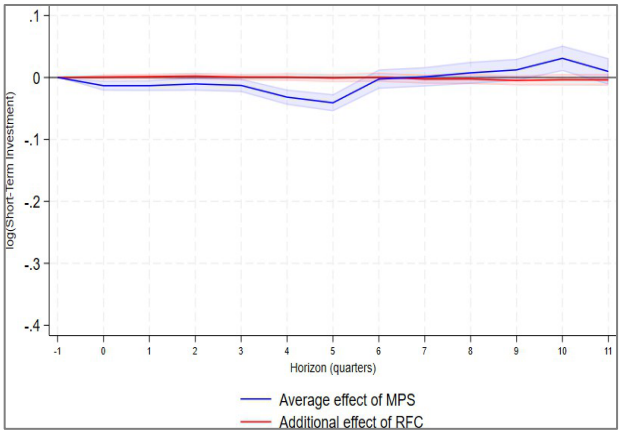
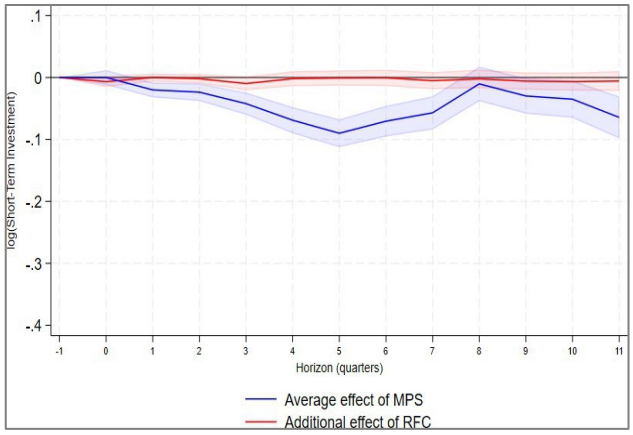


Figure 12: ***Continued***

(E) Advanced Economies - Short-Term Investment



(F) Emerging Economies - Short-Term Investment



Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add GSFCI as an additional control. The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on the firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light red represents the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.

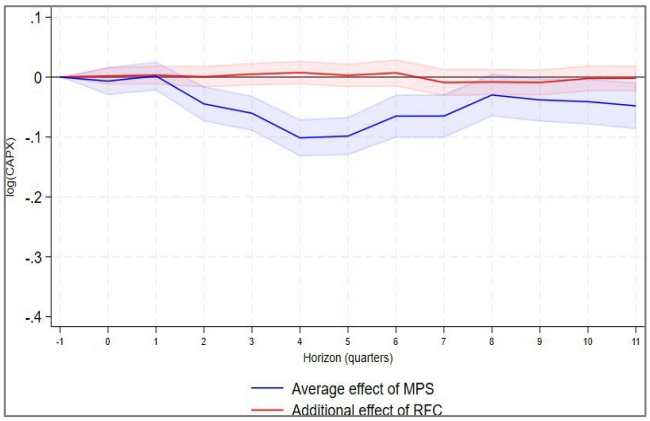
Sources: Bloomberg, COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

6.3. Measures of Monetary Policy Shocks

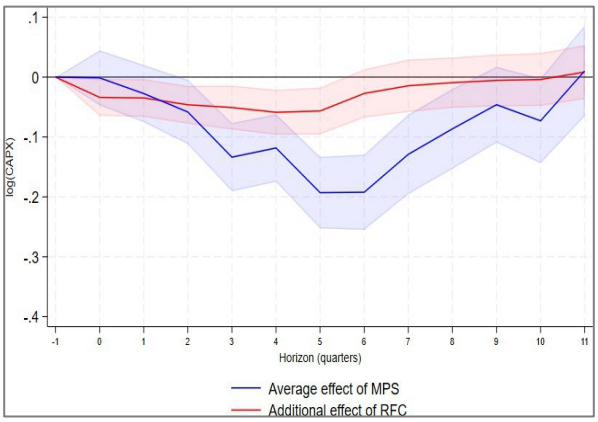
We confirm that our results are robust to alternative US monetary policy shocks. First, we use the US monetary policy shocks proposed by Nakamura and Steinsson (2018) and extended by Acosta (2022) until Q3 2022. We then use the monetary policy shock constructed by Swanson (2021), an extension of Gürkaynak, Sack, and Swanson (2005) that separately identify surprise changes in the federal funds rate, forward guidance, and large-scale asset purchases for each FOMC announcement. Figures 13 and 14 show that our findings are robust to the choice of shock construction.

Figure 13: The Effect of US Monetary Policy on Foreign Firms: Monetary Shocks from Nakamura and Steinsson (2018)

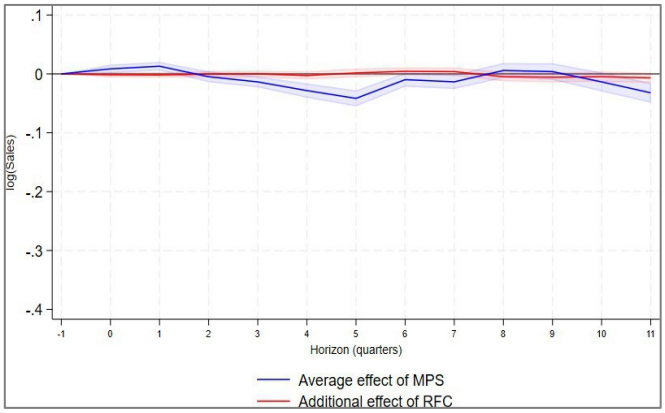
(A) Advanced Economies - Long-Term Investment



(B) Emerging Economies - Long-Term Investment



(C) Advanced Economies - Sales



(D) Emerging Economies - Sales

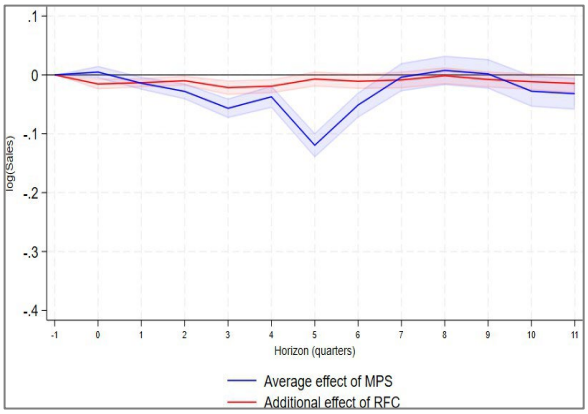
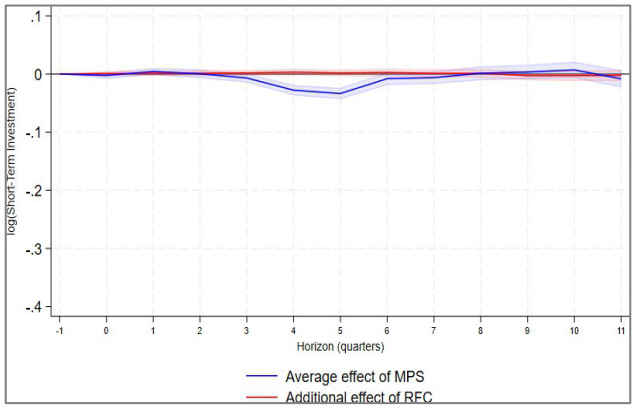
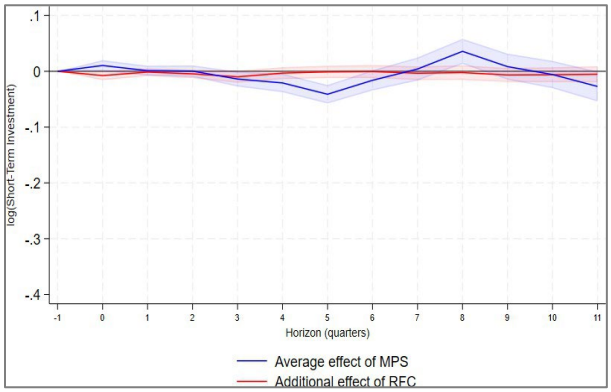


Figure 13: *Continued*

(E) Advanced Economies - Short-Term Investment



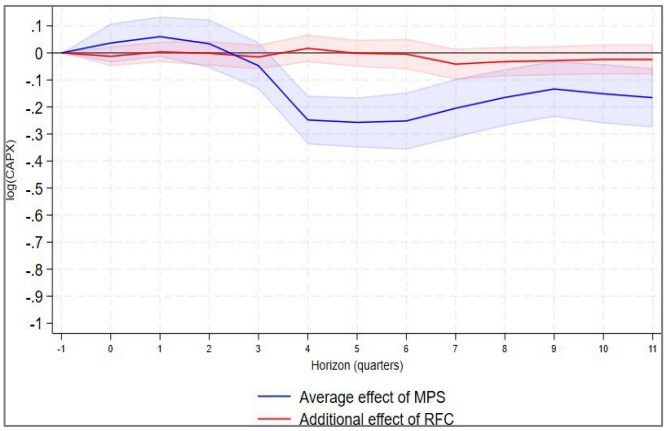
(F) Emerging Economies - Short-Term Investment



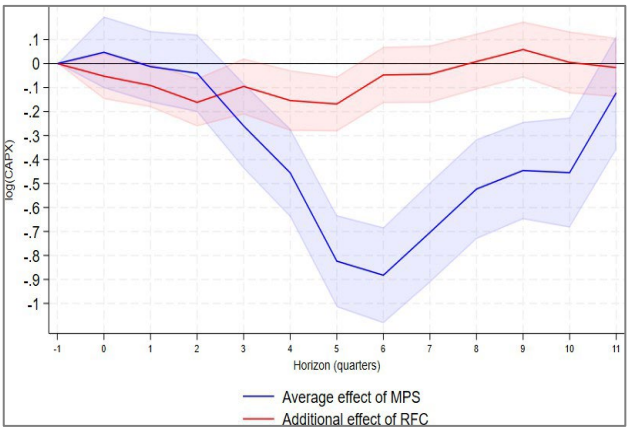
Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Nakamura and Steinsson (2018). The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on the firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Nakamura and Steinsson (2018) shocks by Acosta (2022).

Figure 14: The Effect of US Monetary Policy on Foreign Firms: Monetary Shocks from Swanson (2021)

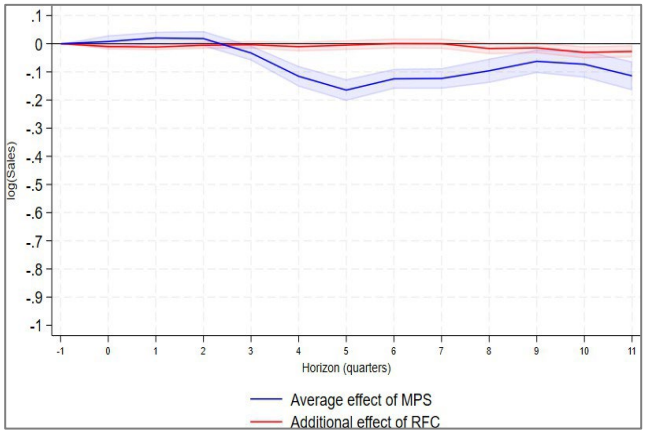
(A) Advanced Economies - Long-Term Investment



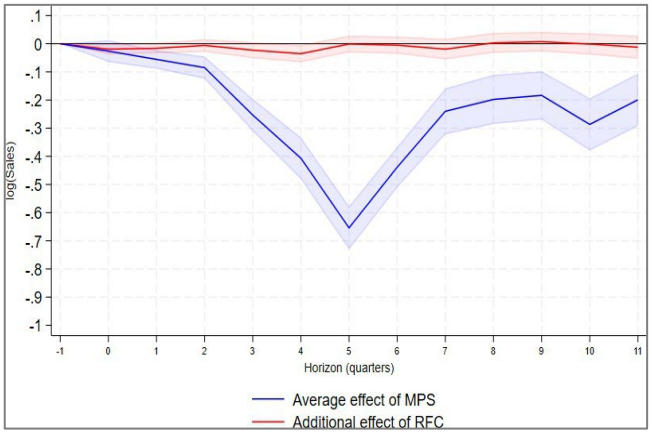
(B) Emerging Economies - Long-Term Investment



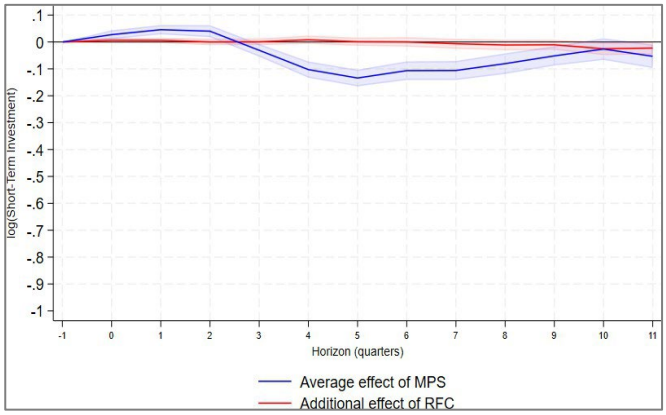
(C) Advanced Economies - Sales



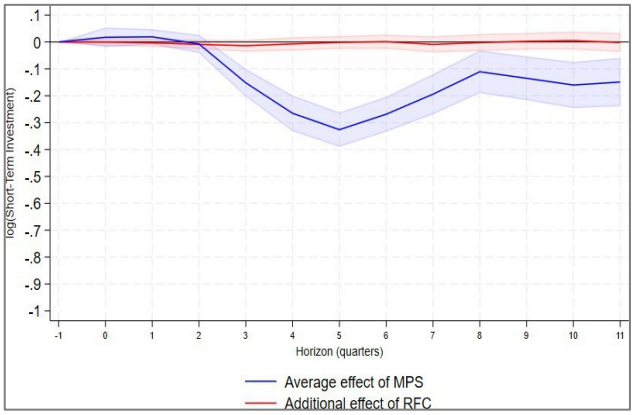
(D) Emerging Economies - Sales



(E) Advanced Economies - Short-Term Investment



(F) Emerging Economies - Short-Term Investment



Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Swanson (2021). The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on the firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and shocks from Swanson (2021).

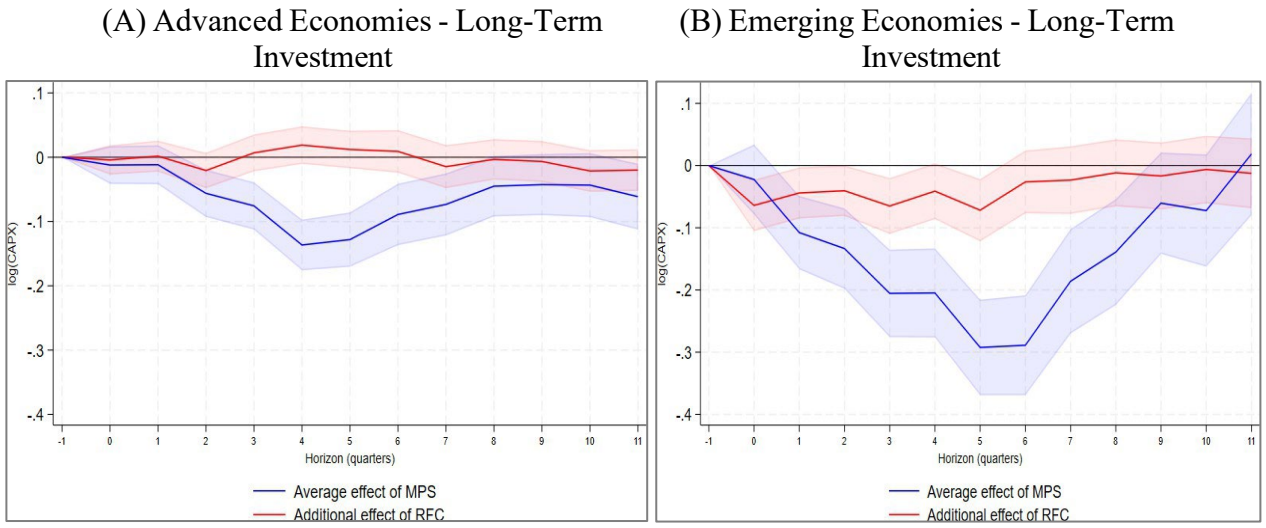
6.4. Persistent Differences in Debt Maturity

Carvalho (2015) highlights that one concern when using corporate debt maturity as a measure of financing constraints is that the results might be capturing persistent differences in debt-maturity structure across firms. For instance, the results might capture firms that rely on shorter-term debt.

Firms issuing shorter-term debt will be more likely to have their debt largely maturing in a given year. We address this concern as follows. First, we construct RFC_{5Y}, the five-year moving average of RFC_{ijt}.[15] Next, we estimate the baseline specification in Section 3 (Equation (6)) with RFC_{5Y} as an additional control variable separately for those two groups (emerging and advanced economies).[16]

Figure 15 shows the IRF for the response of investment and sales to US monetary policy shocks. We find a statistically significant and similar magnitude effect on investment and sales. This confirms that we are not capturing persistent differences in debt-maturity structure across firms.

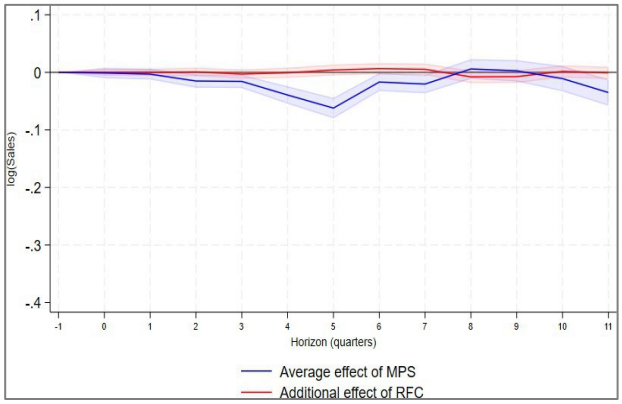
Figure 15: The Effect of US Monetary Policy on Foreign Firms: Five-year Moving Average of RFC_{ijt} as an Additional Control



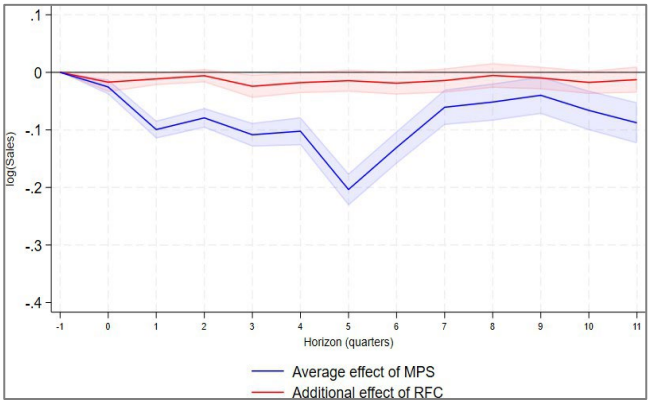
[15] We discuss the definition of RFC_{ijt} in Subsection 2.3.

[16] Carvalho (2015) uses the amount of long-term debt due in 3 years in his analysis. However, COMPUSTAT Fundamentals Global only provides information for the amount of long-term debt maturing during the first year after the annual report.

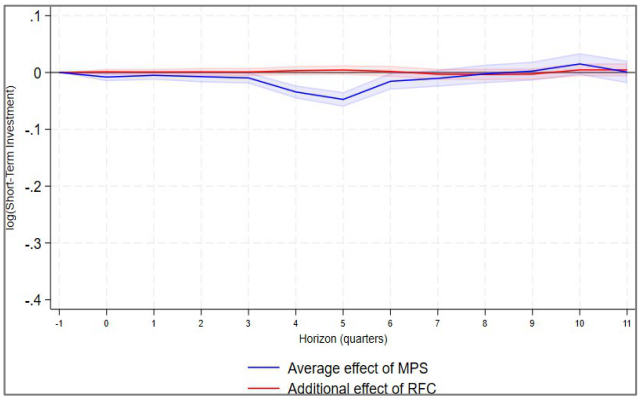
(C) Advanced Economies - Sales



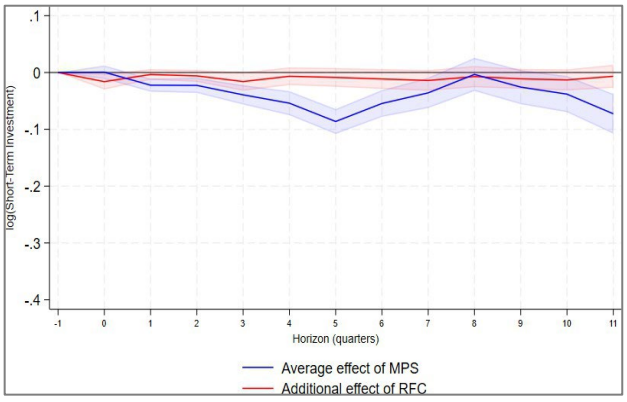
(D) Emerging Economies - Sales



(E) Advanced Economies - Short-Term Investment



(F) Emerging Economies - Short-Term Investment



Notes: This figure shows the Impulse Response Function (IRF) for the response of long-term investment, sales, and short-term investment to US monetary policy shocks using the baseline specification in Section 3 (Equation (6)). The three outcome variables are described in Section 2. We use monetary policy shocks from Gürkaynak, Sack, and Swanson (2005). We add RFC_{5Y}, the five-year moving average of RFC_{ijt}, as an additional control. The blue line represents the effect of a one standard deviation monetary policy contraction on the average $RFC_{c,t}$ firm (β_1^h). The red line represents the additional effect of monetary policy contraction on firm i that is one standard deviation above the average of $RFC_{c,t}$ (β_3^h). The shaded light blue and red represent the 90% confidence interval. The reported standard errors are clustered by firms and time. The horizontal axis shows the impulse-response horizon measured in quarters.
Sources: COMPUSTAT's Global Fundamentals Quarterly, International Financial Statistics (IMF), and the updated Gürkaynak, Sack, and Swanson (2005) shocks by Acosta (2022).

7. Conclusion

In this paper, we provide novel evidence that corporate debt maturity plays an important role in the transmission of US monetary policy to foreign firms. Using an identification strategy that predicts firms' financial position in a given year, we show that financing constraints amplify the effect of US monetary policy on foreign firms. We also provide empirical evidence of heterogeneity in the transmission of US monetary policy to foreign economies. We find that financial conditions in emerging economies are significantly tighter than in advanced countries after contractionary shocks, and, as a result, the amplification effect of US monetary policy shocks by financing constraints is present only in emerging economies. When the Federal Reserve tightens policy, emerging economies face higher financing costs than advanced economies. Therefore, it is more challenging for their firms to successfully roll over their debt obligations than their counterparts in advanced economies.

Our findings indicate that US monetary policy spillovers propagate through the economy over time in ways that interact with corporate debt maturity. The effect of the shock is economically significant, heterogeneous across countries, and amplified by financing constraints. The transmission of US monetary policy through foreign firms' debt maturity highlights the importance of the relationship between US monetary policy, financing constraints, and foreign firms in advanced and emerging economies.

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