Global Corporate Bond Markets and Local Monetary Policy Transmission

Ahmet Benlialper*

March 30, 2022

Latest version available here.

Abstract

When tight monetary policy curtails domestic supply of credit and raises domestic borrowing costs, firms that tap foreign bond markets to obtain cheaper funding can isolate themselves from contractionary effects of monetary tightening. I investigate whether this prediction holds for euro area non-financial companies. I first show that euro area firms exploit borrowing cost differential between USD and EUR by issuing corporate bonds in USD whenever it becomes cheaper to do so. Using proxies for such opportunistic borrowing behavior, I then find that firms that can borrow opportunistically in global corporate bond markets do not reduce their fixed capital investment as much as other firms in response to monetary tightening. Additional results reveal that this differential firm response is driven by cost-saving opportunities of issuing in global corporate bond markets and not by other types of asymmetries of financial constraints between firms. Overall, these findings confirm that there is significant level of heterogeneity in firms' reaction to monetary policy resulting from firms' differential access to global corporate bond markets. They also suggest that local monetary policy transmission can be impaired when global financial markets offer cheaper funding opportunities to firms.

JEL Classification: E22, E44, E52, F34, F62, G12, G15
Keywords: monetary policy, firm heterogeneity, international financial markets, corporate bonds

*PhD Candidate, Economics Department, ESSEC Business School. Contact: ahmet.benlialper@essec.edu

1 Introduction

Monetary tightening leads to a contraction in credit supply and to a rise in domestic borrowing rates, both of which depressing firm borrowing. In turn, firms cut back some of their externally funded investment. This is how classical investment channel of monetary policy transmission works in its most stripped-down version. This classical approach adopts a closed economy model. With rising global funding opportunities, however, the closed economy approach misses some important aspects of how monetary policy transmission works in an open economy setting. For instance, firms that tap foreign debt markets can isolate themselves from contractionary impacts of local monetary tightening when foreign markets offer cheaper funding opportunities. In doing so, they may not reduce their investment as much as other firms which do not have access to these markets, leading to an impaired and heterogeneous monetary policy transmission. In this paper, I test whether this hypothesis holds for euro area (EA) non-financial companies (NFCs) by focusing on their borrowing activity in global corporate bond markets.

Euro area witnessed a sizeable expansion of its corporate bond markets in the last two decades[1]. Figure 1 shows that this expansion is driven by a shift away from bank loans toward bond finance in the case of EA NFCs. In quantitative terms, bond to loan ratio rose from 13 percent to above 30 percent for EA NFCs in the last two decades, signifying a growing role of bond finance for the EA financial system[2]. While the growing share of bond financing in EA is recently gaining attention by scholars and policymakers (Schnabel (2021); European Central Bank (2021)), there is also a largely neglected aspect of this trend: the international finance dimension. Figure 2 demonstrates that U.S. Dollar (USD) denominated bonds issued by EA NFCs constitute a crucial part of bond financing in magnitude and rose especially after the global financial crisis (GFC). As I will document later, the bulk of these tranches were issued outside EA. Thus, there is a significant international finance dimension of expanding corporate bond markets in the EA which has been overlooked so far. In this sense, this paper contributes to the literature in a unique way by considering this international aspect and studying monetary policy transmission implications of firms' bond issuance in global corporate bond markets.

I ask two main questions in this paper. First, I ask whether borrowing cost differential between issuing in USD and in EUR is a major driver of EA NFCs' USD issuance decision. Utilizing nonlinear panel data models, I show that the answer is yes. This finding implies that EA NFCs exploit borrowing cost differential between EUR and USD by issuing a USD-denominated bond when it becomes cheaper to do so. Following McBrady and Schill (2007), I define this behavior as "opportunistic borrowing". This finding per se is of limited value as opportunistic behavior has already been established in the literature in other contexts

[1] From 2001 onward, outstanding amounts of bonds issued by EA private sector more than doubled, reaching € 17 trillion in 2020.

[2] See Darmouni and Papoutsi (2021) for a detailed exposition of the rising corporate bond market in the EA with a special focus on changing issuer and investor composition.

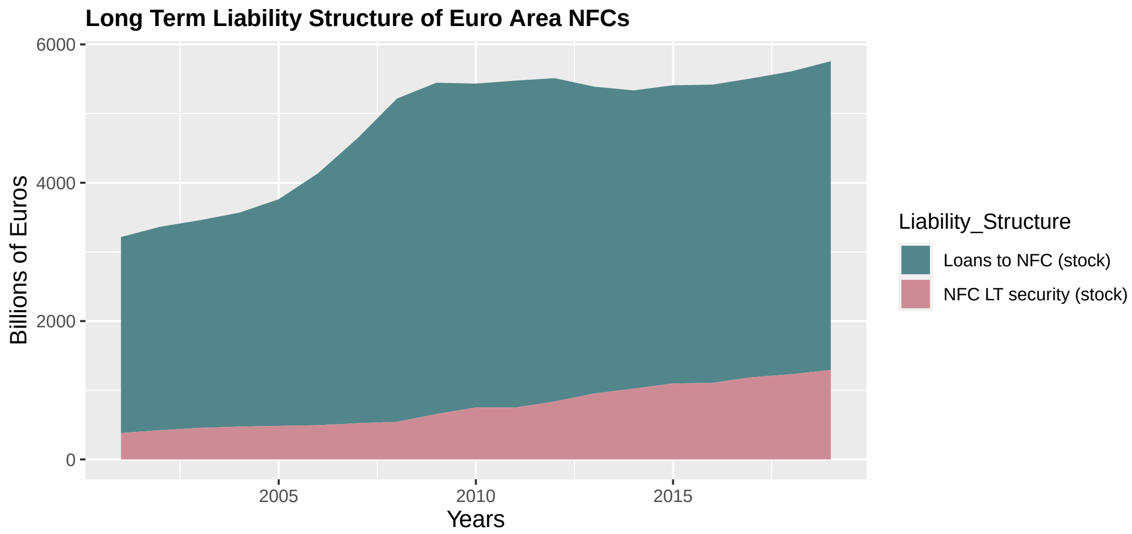

Figure 1: Long-Term Liability Structure of Euro Area NFCs. *Source:* ECB.

(Liao (2020); McBrady and Schill (2007); Gambacorta et al. (2020) and Caramichael et al. (2021))[3] and I simply validate the existence of this behavior for EA NFCs using more recent matched bond-firm level data. However, this finding serves as a bridge to understand firms' differential reaction to monetary policy leading to my second question which constitutes the real contribution of the paper.

Having established opportunistic borrowing behavior of EA NFCs, I then ask whether firms that can borrow opportunistically via their access to global corporate bond markets differ in terms of their fixed capital investment response to unanticipated monetary policy shocks. Opportunistic borrowing behavior has potential effects on monetary policy transmission since it implies that firms can switch across markets/currencies to reduce their borrowing costs[4]. For instance, when a tight monetary policy curtails domestic supply of credit and raises domestic borrowing costs, firms that have access to foreign bond markets can tap these markets in an effort to obtain cheaper funding. Thereby, they can isolate themselves from the contractionary effects of monetary tightening. A (panel) local projection analysis à la Jordà (2005) coupled with high-frequency identification of monetary policy surprises confirms that these firms indeed reduce their fixed capital investment less in response to monetary tightening compared to firms that only borrow in the local bond market.

An important endogeneity concern arises if opportunistically borrowing firms react less to monetary policy since they could be less financially constrained compared to their peers due, for instance, to their higher credibility. If this is the case, then heterogeneous firm

[3]These studies demonstrate that there exist borrowing cost differentials across currencies and firms tend to issue in the cheaper currency.

[4]In this paper, I generally use offshore issuance and foreign currency issuance interchangeably. Even though these two concepts can describe fundamentally different phenomena in certain contexts, they are close substitutes in the case of EA NFCs. For instance, the bulk of USD denominated bonds are issued outside the Eurozone. See Table 1 in Section 4.1 for more details.

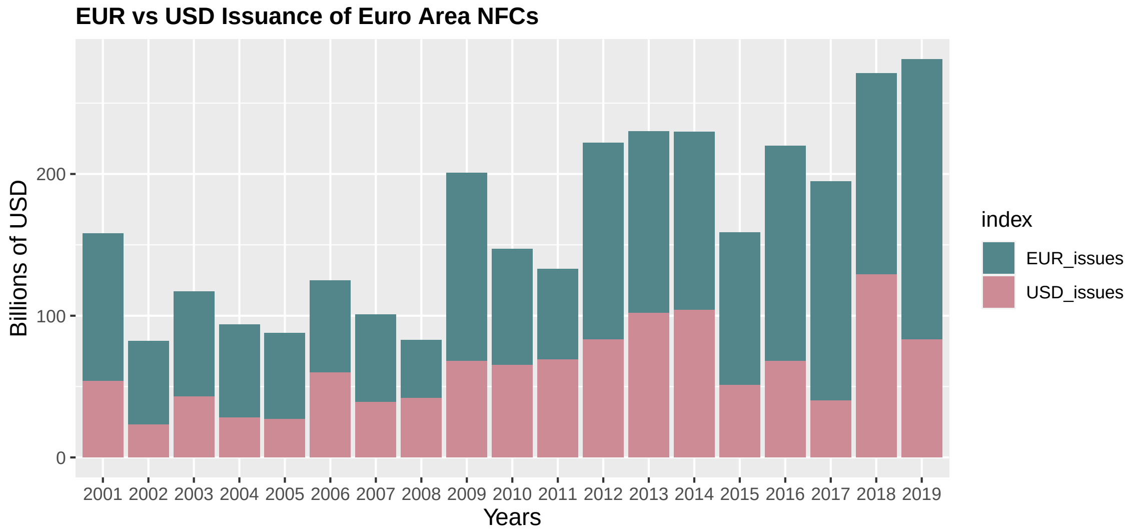

Figure 2: EUR vs USD Issuance of Euro Area NFCs. *Source:* Refinitiv Eikon.

reaction to monetary tightening can also be driven by differential financial constraints firms face that are independent of their access to global corporate bond markets. However, observed heterogeneity is present even after controlling for potential asymmetries of financial constraints between firms that tap global corporate bond markets and firms that do not. Moreover, if informational asymmetries unrelated to firms' differential access to global corporate bond markets are at the heart of heterogeneous firm response, we would expect that such heterogeneity is independent of borrowing cost differential between currencies. Nevertheless, this heterogeneity ceases to exist when issuing in foreign currency is more expensive compared to local currency suggesting that it is cost-saving opportunities of issuing in global corporate bond markets rather than asymmetric financial constraints faced by firms that drive the heterogeneous firm response.

The main contributions of this paper to the literature are twofold. First, to my best knowledge, it is the first paper that studies the implications of global corporate bond markets for monetary policy transmission. The literature so far improved our understanding of monetary policy transmission by identifying several channels through which loan-bond mix of firms interact with monetary policy (Crouzet (2021); Crouzet (2018); Bolton and Freixas (2006) and Darmouni et al. (2020)). Adopting closed economy models, however, these studies remain silent on firms' bond financing opportunities in international markets. With the rising global corporate bond markets, firms with access to these markets can shield themselves from domestic tightening. I show that this prediction holds for EA NFCs. This finding has also policy relevance as it implies that local monetary policy transmission may be impaired when global financial markets offer cheaper funding opportunities to firms and thereby trigger a sort of leakage mechanism. If this is the case, central bank may have to tighten more than what would be required in a closed economy setting to achieve its objectives. The severity of such impairment is expected to increase as global corporate bond markets continue expanding and more firms join these markets.

As to the second contribution, the paper provides a novel form of firm-level heterogeneity by introducing opportunistic borrowing behavior as a determinant of a firm's response to monetary policy. To date, the literature on heterogenous firm responses to monetary policy focused on the role of various forms of financial frictions. Leverage, balance sheet liquidity, size, age, or access to local bond market emerge as sources of such firm-level heterogeneity since they are used as proxies for the level of financial frictions firms face. For instance, the seminal papers by Kashyap et al. (1994) and Gertler and Gilchrist (1994) find that bank-dependent companies and small firms which typically do not have access to external capital markets are more exposed to monetary policy shocks. My analysis, on the other hand, concerns firms that are not bank-dependent since my firm sample consists of firms which have issued a corporate bond at least once during the sample period. Accordingly, I explore whether there is a difference in terms of exposure to monetary policy even among firms all of which have access to local external capital markets. This difference in exposure is due to the -so far neglected- international finance dimension since I differentiate firms by their access to global corporate bond markets.

1.1 Related Literature

This paper contributes to at least four strands of the literature. First, it relates to a small stream of corporate finance literature studying interactions of bond vs loan financing decision of firms with monetary policy transmission. An implicit assumption of the popular bank lending channel view is the imperfect substitutability of bank loans and bonds. According to this view, should bonds be perfect substitutes of bank loans, the only effect of monetary tightening would materialize via the standard interest rate channel as firms could easily switch from bank loans to bond financing in response to a reduction in loan supply. Consistent with this view, Crouzet (2018) and Altavilla, Pariès and Nicoletti (2019) find that corporate bond issuance increases in response to a negative bank loan supply shock but this shift is not enough to compensate the reduction in bank lending. As a result, aggregate borrowing and investment declines. Similarly, Crouzet (2021) documents evidence suggesting that bank-dependent firms reduce their investment more compared to bond-financed firms in response to monetary shocks[5]. All these papers are based on closed economy models. Hence, they remain totally silent about the international finance dimension of corporate debt structure. By taking neglected global funding opportunities into account, my aim is to enrich our understanding of the implications of corporate sector's debt structure for monetary policy transmission.

Another strand of the literature to which this paper is affiliated is on determinants of offshore bond issuance. While this literature counts many reasons behind the offshore issuance of a firm such as deeper foreign markets, desire to hedge foreign currency cash flows,

[5]On the other hand, Darmouni et al. (2020) present contradictory evidence with the standard bank lending channel. Their findings suggest that bank-dependent firms react less to monetary policy shocks compared to bond-reliant firms. They explain this behavior on the basis of flexibility of bank loan financing compared to bond financing as bond-reliant firms are likely to be more prudent in financially stressful episodes.

funding diversification and signaling (Allayannis et al. (2003); Munro et al. (2011) and Black and Munro (2010)), my paper is more akin to studies emphasizing the importance of borrowing cost differentials across markets/currencies (McBrady and Schill (2007), McBrady et al. (2010); Liao (2020); Gambacorta et al. (2020) and Bruno and Shin (2017))[6]. That said, this literature does not establish a relation between opportunistic borrowing behavior and monetary policy transmission. My paper improves upon this literature by analyzing the nature of this relation and studying associated firm-level effects.

A recently emerging literature discusses reduced effectiveness of monetary policy transmission due to various international leakage channels. Barajas et al. (2018) find that remittance inflows reduce monetary policy effectiveness. Ongena et al. (2021) conclude that foreign currency lending of banks is less affected by domestic monetary policy compared to their domestic currency lending, thereby eroding the impact of monetary policy on multi-currency lenders. Finally, Fendoglu et al. (2019) argue that ample global liquidity reduces effectiveness of monetary policy tightening in Turkey. This effect arises due to banks' borrowing in international wholesale markets in response to tightening domestic funding conditions. My paper contributes to this strand by offering another potential impairment channel that works through NFCs' activities in global bond markets.

Finally, the fourth strand studies heterogeneous investment reactions of firms to monetary policy. Regarding fixed capital investment reactions, Ottonello and Winberry (2020) find that firms with low default risk are more responsive to monetary shocks whereas Jeenas (2019) conclude that firms with less balance sheet liquidity react more. On the other hand, Cloyne et al. (2018) demonstrate that young and no dividend paying firms adjust their fixed capital expenditure more compared to older and dividend paying firms. Regarding inventory investment reaction of firms, Gertler and Gilchrist (1994) and Kashyap et al. (1994) indicate that small firms and firms without access to bond markets react more strongly to monetary shocks. Finally, Ippolito et al. (2018) studies various forms of firm reactions and conclude that firms (especially financially constrained ones) with more unhedged loans on their liability side react more to monetary policy owing to floating rate nature of most loan payments. I contribute to the fixed capital investment branch of this literature by introducing a new form of heterogeneity: firms' access to global corporate bond markets. This access has the potential to be a source of heterogeneous reaction to monetary policy as I elaborate in the coming section.

The plan of the paper is as follows. In Section 2, I briefly explain the mechanism through which the leakage effect could occur and constitute a significant source of heterogeneity in terms of firms' reaction to monetary tightening. In Section 3, I calculate borrowing cost differential between EUR and USD for the corporate sector, which is also called as the "corporate basis" by Liao (2020). With a specific focus on the role of corporate basis,

[6]Most notably, Graham and Harvey (2001) document that 44 % of the firms in their survey respond that lower foreign rates are important/very important drivers of their decision to incur FX debt. Along similar lines, Gozzi et al. (2015) demonstrate that bonds issued abroad tend to have lower yields compared to bonds issued at the home country.

Section 4 studies determinants of foreign currency issuance choices of firms. Section 5 analyzes heterogeneous reaction of firms to monetary policy surprises in terms of their fixed capital investment behavior. Section 6 shows that baseline results survive various robustness checks. Finally, Section 7 concludes and discusses avenues for further research.

2 The Leakage Mechanism and the Eurozone

Standard bank lending and interest rate channels of monetary policy transmission predict that monetary tightening leads to a contraction in loan supply and an increase in bank lending rates. In turn, credit squeeze and higher borrowing costs would induce firms to cut back externally funded investment. There is, however, another way out for firms in need of external finance. If they have the sufficient means, they can resort to domestic or global corporate bond markets to substitute for reduced and costlier loan financing. To the degree that they offset reduction in bank loans and the rise in lending rates in this way, they can maintain their investment at desired levels.

That said, local bond market may not serve as a spare tyre for firms due to various reasons. For instance, International Monetary Fund (2016) discusses that monetary policy affects investor behavior in the domestic bond market as well by moving the risk premia, leading to reduced risk appetite during tightening episodes. This would drive up the cost of credit in the local bond market. Moreover, Schnabel (2021) and European Central Bank (2021) argue that the rise of non-banks in the euro area, in fact, strengthened monetary policy transmission due to higher responsiveness of non-banks' (compared to banks') balance sheets to policy changes that primarily affect the long end of the yield curve. Then, given the high share of debt securities in non-banks' asset portfolio (around 40% in the euro area), rising domestic corporate bond markets, if anything, might have fostered the impact of monetary policy on corporate sector especially when policy change aims long term rates. Hence, euro area evidence suggests that domestic bond market acts as a complement to rather than as a substitute for loan financing. If so, domestic bond market may fail to offer a resort for firms in need of external finance and remain unable to attenuate the effectiveness of the bank lending channel.

Since the investor base in global corporate bond markets is likely to be much less affected by local monetary policy changes, however, the complementary relation between loan finance and bond finance should exist only in the case of local bond market. Global corporate bond markets could well emerge as an alternative and cheaper funding source for firms. In fact, the literature on determinants of firms' offshore bond issuance decisions demonstrate that firms borrow in foreign debt markets with lower cost of borrowing motives. Moreover, a recent study by Cortina et al. (2021) shows that firms switch internationally across markets in times of crisis and change the currency composition of their debt. By moving away from crisis-hit markets, they compensate, even if partly, the decline in borrowing in these markets and maintain the maturity of their debt.

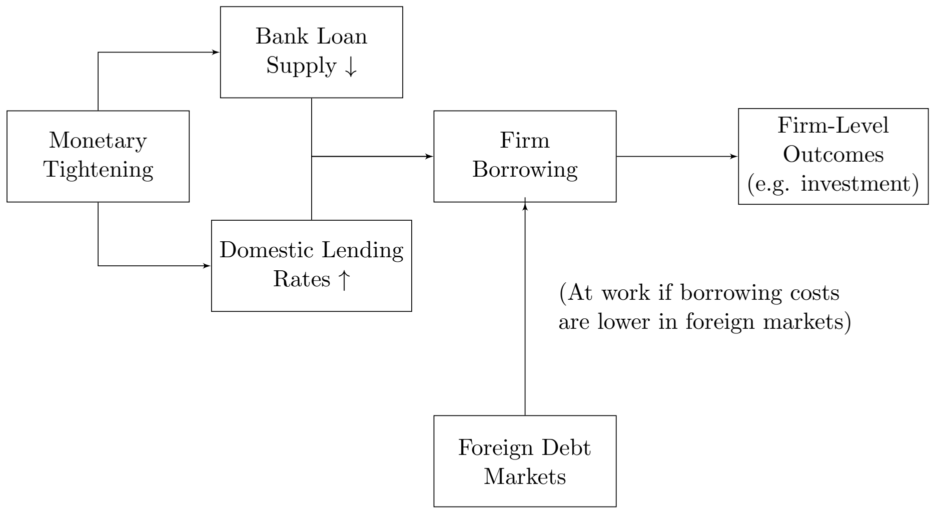

Figure 3: The Exposition of How Global Corporate Bond Markets Can Impair Monetary Policy Transmission

These two observations tell us that a certain set of firms actively seek the best conditions in global debt markets by switching across markets/currencies. Under monetary tightening, such active debt management would prompt them to seek for alternative markets/currencies through which they can secure cheaper funding. Consequently, they would be, even if partially, isolated from tightened domestic funding conditions and might not reduce their investment as much as other firms[7]. Figure 3 illustrates this leakage channel working through firms' activity in global debt markets[8].

This mechanism is likely to exist in many countries, not only in EA. However, studying the Eurozone brings forth several advantages promoting the robustness of the analysis. First, the Eurozone is largely free from problems associated with bond market incompleteness. In small economies with insufficient level of bond market depth, issuers are likely to have difficulty in issuing sophisticated debt securities. Instead, they could issue offshore where they could meet a much larger investor base that matches the interests of the issuers. Thus, they might have a natural tendency to issue offshore independent of opportunistic borrowing motives. This would pose a serious problem for my analysis in terms of properly identifying opportunistically borrowing firms. In the Eurozone, this problem is much less severe thanks to well-developed corporate bond markets. Second, the way I define opportunistic borrowing allows firms to hedge their FX borrowing operations. The most

[7]This mechanism can be reinforced if local monetary tightening renders borrowing in foreign currency cheaper compared to borrowing in local currency. The results reported in Appendix C verify this prediction by showing that monetary policy differential measured by the difference between ECB and FED controlled rates is a significant determinant of currency-induced borrowing cost differential between EUR and USD.

[8]Even though the mechanism depicted in Figure 3 requires borrowing costs are lower in foreign markets, it can still be active due to quantity effects when borrowing costs in foreign markets are higher but global liquidity is somehow abundant. In that case, domestic firms could still tap foreign debt markets to compensate for the decline in their domestic borrowing without opportunistic borrowing motives. Nevertheless, I focus on borrowing cost differential between domestic and foreign markets in this paper since measuring such quantity effects pose considerable practical challenges.

natural way for a firm to hedge its FX exposure is to enter into a swap agreement. Yet, this requires the availability of swap counterparties. For less frequently traded currency pairs, lack of swap counterparties could prevent firms from engaging in hedged opportunistic borrowing. A large currency swap market between EUR and USD removes this problem. Finally, a rapidly expanding corporate bond market for the EA makes an interesting case and increases the policy relevance of the paper.

3 Corporate Basis

There is one condition to be satisfied for firms to be able to borrow opportunistically in global corporate bond markets: borrowing in the foreign currency should be cheaper compared to domestic currency. There are several ways to measure borrowing cost differentials between currencies. First, the simplest method is to compare nominal interest rates, such as money market rates as in Bruno and Shin (2017)[9]. This could prove to be a good indicator only if the majority of firms engage in unhedged FX borrowing as in the case of many emerging market economies[10]. Second, deviation from covered interest parity (CIP) in benchmark rates is another proxy that measures borrowing cost differential between two currencies assuming that borrowers hedge their open FX positions. However, since firms can face different credit spreads in different currencies, CIP deviation based on benchmark rates might not reflect the true long-term borrowing conditions of the corporate sector.

Another measure introduced lately by Liao (2020) is corporate basis which focuses on currency related differences in borrowing costs in corporate bond markets. Corporate basis remains largely free from problems associated with other approaches. First, its construction entails a bottom-up approach through the use of bond-level data. Thus, unlike other proxies, it is designed specifically for corporate sector's borrowing conditions. Second, it allows firms to hedge their FX debt. Third, it controls for bond-level and issuer-level characteristics that might affect borrowing cost differential between currencies, thereby providing us a more refined currency-induced borrowing cost differential. For all these reasons, corporate basis arguably stands out as the best proxy for borrowing cost differential between currencies in corporate bond markets. In this section, I calculate the corporate basis between EUR and USD for EA firms[11].

[9] Gutierrez et al. (2021) provide a more sophisticated approach by measuring the difference between interest rates for loans denominated in USD and in domestic currency in a regression framework. This way, they are able to control for loan-level and firm-level characteristics and purge their interest rate difference measure from effects that are not related to the currency in which the loan is denominated.

[10] Even so, it might still fail to be a good proxy unless expected exchange rate movements between domestic currency and USD are of negligible nature. In this vein, Gutierrez et al. (2021) provide an interest rate difference measure that is adjusted for uncovered interest parity.

[11] It is important to make this calculation exclusively for the EA firms since corporate basis between the two currencies could be significantly different for firms of different countries. For instance, Liao (2020) shows that borrowing cost of US firms when issuing in USD is significantly lower compared to borrowing costs faced by other countries' firms when issuing in USD.

3.1 Calculation of Corporate Basis

Calculation of corporate basis is based on Liao (2020). In simplest terms, corporate basis is defined as follows:

$$CB_t = (rb_t^{€} - rb_t^{\$}) + (f_t - s_t) \tag{1}$$

where $rb_t^{€}$ is the risky bond yield in EUR, $rb_t^{\$}$ is the risky bond yield in USD and $f_t - s_t$ is the forward premium. In words, corporate basis measures how much a EA firm can expect to gain by issuing in USD instead of in EUR and then swap USD into EUR, i.e. cost saving resulting from synthetic local currency (EUR) borrowing[12]. If we add and subtract risk-free yields ($rf_t^{€}$ and $rf_t^{\$}$) to CB_t, we get:

$$CB_t = [(rb_t^{€} - rf_t^{€}) - (rb_t^{\$} - rf_t^{\$})] + [(rf_t^{€} - rf_t^{\$}) + (f_t - s_t)] \tag{2}$$

where the first term is the credit spread differential (CSD) between EUR and USD and the second term is the deviation from the CIP condition based on risk-free rates. Simply put, we have:

$$CB_{€\$t} = CSD_{€\$t} + CIPdev_{€\$t} \tag{3}$$

Corporate basis, defined this way, implies that risk is priced differently depending on the currency of the bond issued. This, in turn, results from the segmentation of credit market along currency lines (Liao, 2020) which is mostly a post GFC phenomenon. I will exploit this segmentation of credit market to identify episodes when borrowing in USD provides cost-saving opportunities to EA firms.

Appendix A explains the details of how credit spread differential is calculated using bond-level data. The estimated credit spread differential is presented in Figure 4 along with its 95% confidence interval. The values below zero imply that credit spread of EUR denominated bonds is less than that of USD denominated bonds. Figure 4 shows that credit spread differential falls sharply around 2008-2009 which matches the turmoil in US financial markets when bond spreads soared in the US. After the launch of ECB's asset purchase program in 2014, credit spread differential decreases again significantly. Figure 5, on the other hand, depicts credit spread differential, CIP deviation and corporate basis on the same graph. CIP deviation, proxied by the negative of 5-year cross-currency basis, rises substantially around the GFC when dollar shortage became a major problem for European banks and then moves upward again around the Eurozone sovereign crisis of 2011-2012.

[12] It is possible to calculate corporate basis for currencies other than USD. However, the overwhelming majority of corporate bonds issued by EA firms are denominated either in USD or in EUR. Hence, I restrict my analysis to EUR-USD pair.

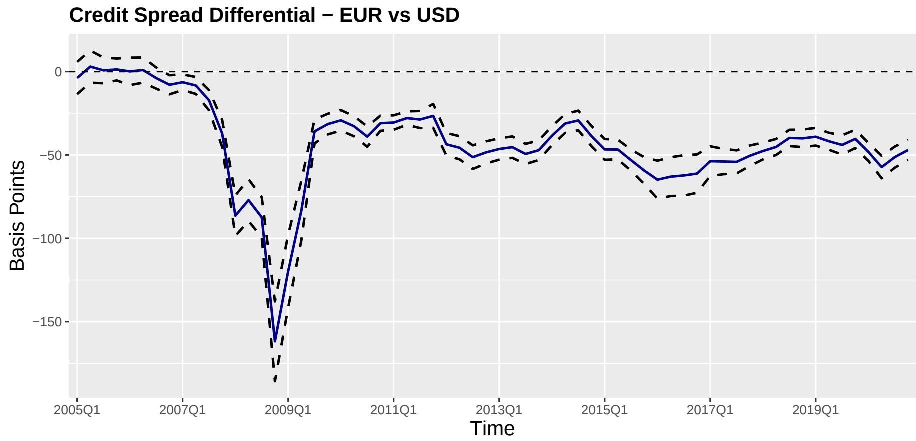

Figure 4: Credit Spread Differential - EUR vs USD. *Source:* Author's calculations, Refinitiv Eikon and Datastream.

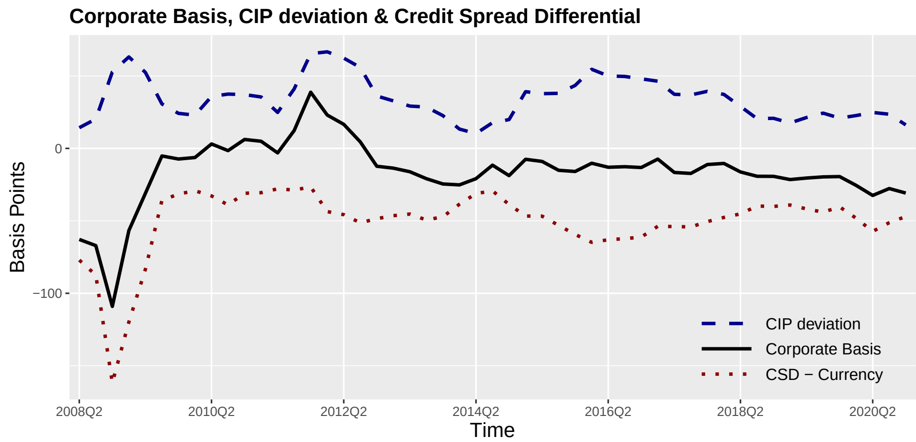

Figure 5: Corporate Basis, CIP Deviations & Credit Spread Differential
Source: Author's calculations, Refinitiv Eikon and Datastream.

4 The Choice of Foreign Currency Issuance

The main purpose of this section is to see whether corporate basis drives foreign currency issuance decision of EA NFCs. If it does, this implies that firms resort to global corporate bond markets to reduce their borrowing costs. In turn, this information will be used when studying heterogeneous firm responses to monetary policy surprises.

4.1 Data and Methodology

After applying several filters to the raw bond dataset obtained from Refinitiv Eikon and consolidating the bonds at the ultimate parent level, I end up with 5375 corporate bonds (4302 EUR + 1073 USD) issued by 1199 distinct EA private NFCs in consolidated basis between 2008 Q2 and 2019 Q4. The details of the filtering procedure along with summary statistics of the resulting bond dataset are presented in the Data Appendix B.2. There, I also show that Refinitiv Eikon's bond dataset is fairly representative of overall market trends by comparing it with ECB's aggregate corporate bond issuance data. Table 1, on the other hand, summarizes the relationship between offshore issuance and issuances in USD. In this paper, I generally use these two different concepts interchangeably. The reason I do this is that the vast majority of USD issuances take place outside the Eurozone border and mostly via subsidiaries. Similarly, bonds issued in the US are typically USD-denominated and issued by subsidiaries of European firms.

Table 1: Bond Issuances in USD vs Offshore Issuances by EA NFCs

USD Issuance vs Offshore Issuance

	USD denom.	Issued in US
Total Tranches	1073	839
USD denom.	1073	676
Issued in US	676	839
Issued in Eurobond Market	338	-
Issued in Euro Area	34	-
Issued by Parent	320	272
Issued by Subsidiary	753	567

Source: Refinitiv Eikon.

Concerning empirical investigation, I consider four main specifications. The first introduces a binary dependent variable taking 1 if firm i issues a USD-denominated bond at quarter t and 0 otherwise as in (4). In this case, I estimate a panel Probit model with the following explanatory variables: firm size proxied by the logarithm of firm's total assets; leverage defined as the total debt of the firm divided by its total assets; balance sheet liquidity proxied by the sum of cash and short-term investments of the firm divided by its total assets; sales growth given by the quarterly change in net sales; cash flow over total assets where cash flow is calculated as the sum of net income before extraordinary items, depreciation and amortization; short term debt over total assets and finally the corporate basis. Summary statistics of the firm balance sheet and income statement variables are presented in Data Appendix B.3. All explanatory variables except corporate basis are lagged by one quarter to reduce endogeneity concerns and winsorized at 1^{st} and 99^{th} percentile. All explanatory variables including corporate basis are standardized.

$$USD^1_{it} = \begin{cases} 1, & \text{if } USDiss_{it} > 0 \\ 0, & \text{otherwise} \end{cases} \tag{4}$$

The second specification mimics the same Probit exercise with the same independent variables but with a slightly different dependent variable. This time, I treat the value of the dependent variable in no bond issuance quarters as missing. Mathematically, the dependent variable takes the form of (5):

$$USD_{it}^2 = \begin{cases} 1, & \text{if } USDiss_{it} > 0 \\ 0, & \text{if } USDiss_{it} = 0 \text{ \& } EURiss_{it} > 0 \\ NA, & \text{if } USDiss_{it} = 0 \text{ \& } EURiss_{it} = 0 \end{cases} \tag{5}$$

The dependent variable in the third specification is the amount of USD issuances of a given firm to its total issuances at each quarter as in (6). This allows the dependent variable taking values between 0 and 1. In this case, I estimate a two-limit panel Tobit model with the same explanatory variables as in the Probit specification[13]. In the last specification, I repeat the Tobit exercise but treat the values of the dependent variable as missing if firm i did not issue a bond in EUR or USD at quarter t. In mathematical terms, the dependent variable in this case is given by (7). Finally, I include quarter, country and industry-fixed effects using Thomson Reuters Business Classification codes at the 2-digit level in all specifications.

$$USD_{it}^3 = \begin{cases} \frac{USDiss_{it}}{USDiss_{it}+EURiss_{it}}, & \text{if } USDiss_{it} + EURiss_{it} > 0 \\ 0, & \text{otherwise} \end{cases} \tag{6}$$

$$USD_{it}^4 = \begin{cases} \frac{USDiss_{it}}{USDiss_{it}+EURiss_{it}}, & \text{if } USDiss_{it} + EURiss_{it} > 0 \\ NA, & \text{otherwise} \end{cases} \tag{7}$$

4.2 Results

The results of the currency choice model regressions are given in Table 2. Column 1 presents results for the Probit case where the dependent variable is given by (4). Size, leverage, cash flow and corporate basis are statistically significant at conventional levels with expected signs. We observe that as firm size increases, the probability of the firm issuing in USD increases. This is consistent with the notion that large firms are tapping global markets more frequently than others. The same is true for the leverage: more leveraged firms have higher propensity to tap foreign markets. On the other hand, firms with abundant cash flow are less likely to issue in USD. Finally, and most importantly for this paper, corporate basis is a significant determinant of a firm's USD issuance decision. As corporate basis increases (in other words, as issuance in USD becomes cheaper compared to issuing in EUR), the probability that a given firm issues a corporate bond in USD increases.

Column 2 repeats the same Probit exercise with the dependent variable given in (5). In this case, size and corporate basis continue to be statistically significant whereas leverage and cash flow cease to be significant predictors of firms' USD issuance decision. Column 3 and 4 present the results for the Tobit case with dependent variables given by (6) and (7),

[13] Theoretically, fixed effects Tobit/Probit model suffers from incidental parameters problem leading to inconsistent coefficient estimates. However, bias approaches zero for large T. Moreover, using a Monte-Carlo analysis, Greene (2004) shows that slope coefficients can be estimated consistently even for small T in the case of Tobit model.

respectively. The results are in accordance with Probit case with size and corporate basis being significant determinants of USD issuance decision of EA NFCs.

In terms of economics significance, reported average marginal effects indicate that the impact of corporate basis on USD issuance decision is substantial. In the case of the first model, a one standard deviation increase in corporate basis leads to a 0.5 percentage point (pp) higher probability of issuing in USD, almost a quarter of the unconditional probability that a given firm issues in USD in any quarter (2.1 pp). The marginal effect of corporate basis rises to 3.7 pp in the second model in which no bond issuance quarters are removed from the dataset. Tobit models yield similar results[14].

Columns 5-8 report the results of the same analysis done in columns 1-4 with a new firm sample where firms operating in the energy sector are excluded. As discussed previously, one of the main reasons behind a firm's offshore issuance choice is to hedge foreign exchange cash flows. As firms in the energy sector typically have high levels of foreign exchange cash flows, they might issue USD-denominated bonds in order to hedge those cash flows rather than to exploit borrowing cost differentials. By removing firms in the energy sector, I intend to address this concern to some extent by having a more homogeneous firm sample in terms of offshore issuance decisions. The results with the reduced firm sample are qualitatively similar to columns 1-4 with size and corporate basis remaining significant predictors of firms' USD issuance decision in all cases.

Finally, columns 9 and 10 present the results of the Probit analysis for the sub-periods 2008Q2-2013Q4 and 2014Q1-2019Q4, respectively. This breakdown shows us that corporate basis remains to be statistically significant during the 2008-2013 sub-period and ceases to be so in the 2014-2019 sub-period. This difference hints us that firms may be ignoring changes in corporate basis when the basis is in the negative territory as was the case after 2013 (see Figure 5). After all, from a EA firm's perspective, a negative corporate basis implies that issuing in EUR is cheaper compared to issuing in USD and movements within the negative territory does not change this fact.

[14] If we limit the sample to firms that issued a USD denominated bond at least once in the sample period, the marginal effect of one standard deviation change in corporate basis rises to 2.1 pp and 4.7 pp in models 1 and 2, respectively. These results are not reported in the paper but are available upon request.

Table 2: Regression Results of Firms' Currency Choice Model

	1	2	3	4	5	6	7	8	9	10
Size	0.684^{***}	0.492^{***}	8.073^{***}	2.383^{***}	0.693^{***}	0.533^{***}	8.228^{***}	2.592^{***}	0.816^{***}	0.599^{***}
	(0.057)	(0.092)	(1.550)	(0.597)	(0.060)	(0.096)	(1.682)	(0.668)	(0.086)	(0.081)
Leverage	0.075^{*}	0.069	0.932^{*}	0.199	0.066	0.012	0.843	0.208	0.050	0.130^{**}
	(0.040)	(0.073)	(0.491)	(0.350)	(0.043)	(0.076)	(0.535)	(0.381)	(0.061)	(0.055)
Bal. Sheet Liq.	0.016	0.160^{*}	0.203	0.631	0.037	0.163^{*}	0.456	1.007^{**}	0.067	-0.066
	(0.047)	(0.089)	(0.564)	(0.431)	(0.051)	(0.092)	(0.613)	(0.485)	(0.066)	(0.075)
Corporate Basis	0.132^{***}	0.203^{***}	1.579^{***}	1.142^{***}	0.132^{***}	0.218^{***}	1.591^{**}	1.122^{**}	0.144^{**}	-0.001
	(0.043)	(0.078)	(0.577)	(0.437)	(0.045)	(0.084)	(0.620)	(0.467)	(0.057)	(0.049)
Sales Growth	-0.022	-0.121	-0.297	-0.829^{*}	-0.010	-0.107	-0.162	-0.736	-0.023	-0.013
	(0.048)	(0.099)	(0.594)	(0.494)	(0.050)	(0.101)	(0.632)	(0.536)	(0.077)	(0.065)
Cash Flow	-0.143^{***}	-0.081	-1.751^{***}	-1.119^{***}	-0.075	-0.114	-0.922	-0.534	-0.116^{*}	-0.179^{***}
	(0.041)	(0.077)	(0.566)	(0.402)	(0.051)	(0.086)	(0.637)	(0.452)	(0.064)	(0.055)
ST Debt	0.053	0.035	0.622	-0.019	0.043	0.008	0.508	0.117	0.043	0.042
	(0.044)	(0.080)	(0.541)	(0.421)	(0.052)	(0.099)	(0.638)	(0.510)	(0.067)	(0.062)
Intercept	-2.945^{***}	-2.378^{***}	-35.15^{***}	-10.48^{***}	-2.889^{***}	-2.103^{***}	-35.49^{***}	-10.55^{***}	-3.192^{***}	-2.824^{***}
	(0.196)	(0.289)	(6.542)	(2.212)	(0.205)	(0.314)	(7.04)	(2.46)	(0.301)	(0.268)
Mean (Y)	0.021	0.231	0.019	0.214	0.020	0.234	0.019	0.216	0.024	0.018
Marginal Effect of										
Corporate Basis	0.005^{***}	0.037^{***}	0.005^{***}	0.039^{***}	0.005^{***}	0.041^{***}	0.005^{***}	0.038^{***}	0.006^{**}	-0.000
	(0.002)	(0.014)	(0.002)	(0.014)	(0.002)	(0.016)	(0.002)	(0.014)	(0.002)	(0.002)
Observations	10782	963	10782	963	9850	845	9850	845	5298	5484
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note:	*p<0.1; **p<0.05; ***p<0.01									

Notes: The table provides coefficient estimates from regressing dependent variables in (4), (5), (6) and (7) on firm characteristics and corporate basis. Columns 1-4, 9 and 10 use the whole firm sample whereas firms in the energy sector are excluded in columns 5-8. Columns 1-8 are based on the whole sample period while columns 9 and 10 use 2008Q2 - 2013Q4 and 2014Q1 - 2019Q4 sub-periods. The dependent variables in columns 1-4 are (4), (5), (6) and (7), respectively. Similarly, dependent variables in columns 5-8 are (4), (5), (6) and (7), respectively. Finally, dependent variable in columns 9 and 10 is given by (4). All models include sector, quarter and country fixed effects.

5 Heterogeneous Firm Reactions to Monetary Policy Surprises – Fixed Capital Investment

In this section, I study investment reactions of EA NFCs to monetary policy announcements. This requires a careful identification of exogenous monetary shocks. In this paper, I follow the high-frequency identification approach popularized by Gürkaynak et al. (2005) and Bernanke and Kuttner (2005).

5.1 High Frequency Identification of Monetary Policy Surprises and the Information Effect

In a nutshell, high-frequency identification (HFI) of monetary policy surprises involves an event-study analysis through which changes in prices of specific asset types such as stock prices, government bond yields of various maturities or interest rate futures are measured around a short time interval (typically intraday movements) surrounding monetary policy announcements. Provided that there is no other major event that would move these assets' prices within such a short period, we can safely argue that changes in asset prices are mainly driven by monetary policy announcements. Since the expected component of monetary policy changes is most likely to be priced in before the announcement in forward-looking asset markets, such HFI amounts to measuring solely the surprise component of monetary policy announcements[15].

In this paper, I use the recently published, regularly updated and publicly available Euro Area Monetary Policy Event Database (EAMPD) à la Altavilla, Brugnolini, Gürkaynak, Motto and Ragusa (2019). EAMPD allows us to observe movements in the yield curves of German, French, Italian and Spanish government bonds and of Overnight Index Swap (OIS) rates. I choose working with the OIS rates as its term structure is typically the best proxy of the risk-free yield curve in the EA (European Central Bank, 2014)[16]. Given that surprise data for OIS maturities greater than three years is not available before 2011, I use OIS rates with 1-month, 3-month, 6-month, 1-year, 2-year and 3-year maturities. This choice also allows us to capture the impact of conventional monetary policy target rate changes

[15] The major advantage of HFI of monetary policy surprises is that it largely eliminates the endogeneity problem associated with the omitted variable and simultaneity biases which would likely exist in lower frequency analysis. For instance, using monthly or even weekly frequency, it is not easy to establish a causal relationship between monetary policy announcements and asset prices. It is quite possible that central bank and asset prices are both responding to some other external shock in which case measuring the impact of monetary policy suffers from an omitted variable bias problem. Alternatively, central bank may also be responding to abrupt movements in asset prices to calm financial markets in which case the simultaneity related bias would lead to inconsistent estimates. HFI removes these concerns to a great extent by narrowing the time interval during which asset price changes are measured so that they can exclusively be attributed to monetary policy surprises.

[16] An overnight index swap is an interest rate swap whereby swap counterparties exchange fixed-rate cash flows with floating-rate cash flows with the floating leg being tied to the geometric average of an overnight interest rate, EONIA in the case of euro area. Being quoted in the fixed rate, these swaps reflect market's expectations about future EONIA rates. As EONIA follows ECB's monetary policy rate very closely, OIS rates also provide valuable information about expectations of ECB's future policy stance.

along with the impact of forward guidance and quantitative easing[17]. Altavilla, Brugnolini, Gürkaynak, Motto and Ragusa (2019) present OIS rate changes for three time intervals, namely the press release window, the press conference window and monetary event window that comprises the first two windows[18]. I use monetary event window in my analysis to study the impact of both target rate changes and unconventional policies.

To purge the monetary policy surprise series from the information effect that they carry, I apply "poor man's sign restrictions" as suggested by Jarociński and Karadi (2020)[19]. This approach involves keeping the level of monetary policy surprise same if it is of the opposite sign with the stock market's reaction around the event window and restricting it to zero otherwise. When applying this restriction, I compare the signs of 2-year maturity OIS surprises and changes in EURO STOXX 50 index around monetary policy announcement events as drawn in Figure 6[20]. If their signs are the same, then I set the OIS surprise value for each maturity to zero. After applying the restrictions where necessary, I aggregate OIS surprises to quarterly frequency for each maturity by summing OIS surprise changes that happen at the same quarter. Finally, I take the first principal component of these restricted and aggregated surprise series as my measure of true monetary policy surprises which I call as OISPRCT.

[17]Studies on the impact of monetary policy focusing on pre-GFC period typically use changes in short-term rates such as 1-month Fed fund futures as proxy for monetary policy surprises. After hitting the zero lower bound, however, central banks expanded their policy toolkit to affect long-term rates. Thus, high frequency changes in short-term rates may not capture the true monetary policy stance post-GFC. In line with this, Wright (2012) uses US Treasury bond futures of 2,5,10,30-year maturity whereas Gertler and Karadi (2015) uses 1-year and 2-year government bond rates as their policy indicators. Besides, Gürkaynak et al. (2021) show that the surprise effect of monetary policy materialized mostly through forward guidance both before and after the zero lower bound period.

[18]ECB's monetary policy announcements have two distinct phases. In the first phase, a press release is delivered stating the policy decision without further explanation. It is followed by the second phase when a press conference is held communicating the rationales behind the decisions taken which also shapes expectations regarding the future path of monetary policy. See Altavilla, Brugnolini, Gürkaynak, Motto and Ragusa (2019) for detailed characteristics of ECB's monetary policy announcements and a chronological exposition of each monetary policy announcement event.

[19]In recent years, a growing number of studies emphasize the need to purge monetary policy surprises from the information shocks that they carry when constructing true monetary policy surprises (Jarociński and Karadi (2020), Nakamura and Steinsson (2018) and Miranda-Agrippino and Ricco (2021)). Information shocks are at work when monetary policy announcement implicitly reveals central bank's assessment of the state of the business cycle. For instance, a surprise policy rate hike could induce lower stock prices and lower investment through a genuine monetary shock effect while it could also be suggestive of a stronger economic outlook than what is perceived before by market participants leading to a strong information effect. If the information effect dominates the genuine effect, then it is possible that the market responds to monetary policy changes in ways that contradict the standard theory. In this vein, Jarociński and Karadi (2020) show that positive interest rate changes that are accompanied by positive stock returns -indicative of a strong information shock- around monetary policy announcements lead to higher real activity and higher price level. This concern is particularly important for the Eurozone given ECB's highly transparent monetary policy implementation.

[20]I use the 2-year rate due mainly to two reasons. First, the 2-year rate is likely to represent the stance of monetary policy best since it has the highest correlation with the first principal component of various maturities. Second, while it is widely used in the literature since it captures the impact of unconventional monetary policy, the 2-year rate is also largely free from the zero lower bound as shown by Swanson and Williams (2014) for the U.S. Using 1-year rate as the benchmark instead of 2-year rate produces very similar results.

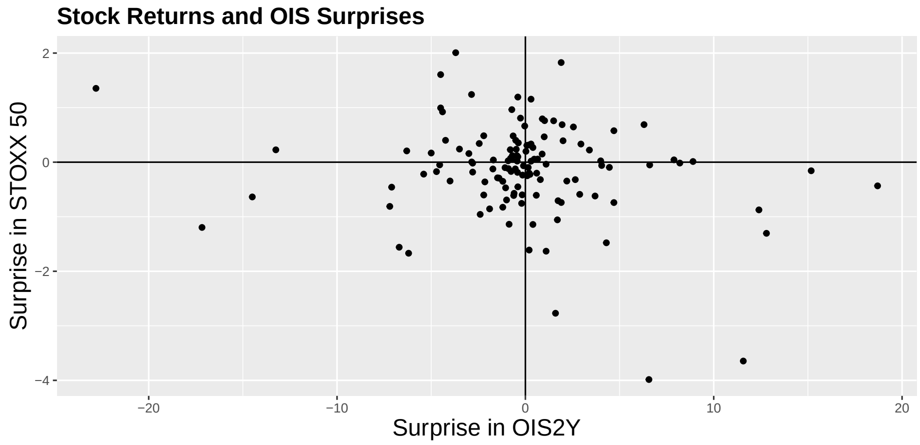

Figure 6: Surprises in STOXX50 and OIS2Y. *Source:* Euro Area Monetary Policy Event Study Database.

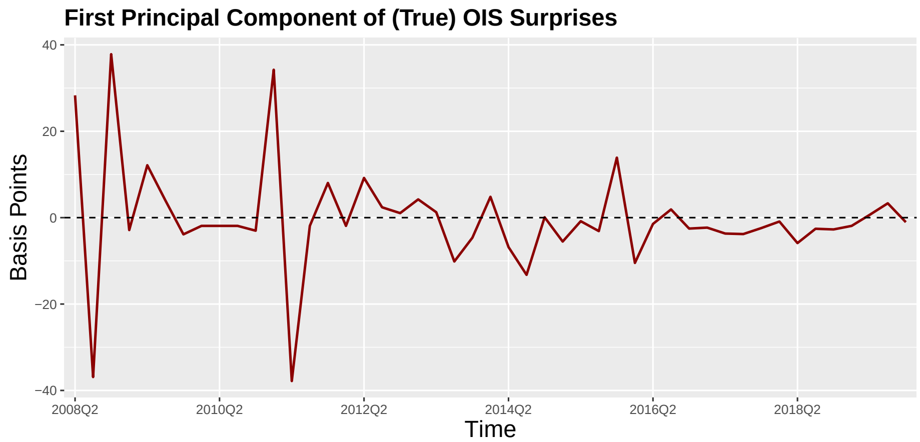

Figure 7: First Principal Component of (True) OIS Surprises. *Source:* Author's calculations based on Euro Area Monetary Policy Event Study Database.

Figure 7 depicts time series of OISPRCT. The correlations between quarterly aggregated surprise changes in OIS rates of various maturities including OISPRCT are given in Figure B.3 in the Data Appendix B.4. Table B.5 in the Appendix presents summary statistics of monetary policy surprises.

5.2 Data and Methodology

Since investment is a slowly moving variable, monetary policy affects it with some lag. Following the recent literature (Jeenas (2019), Ottonello and Winberry (2020), Cloyne et al. (2018) and Crouzet (2021)), I adopt the panel version of local projections approach pioneered by Jordà (2005). More specifically, I consider the following model for each horizon $h = 0, 1, \ldots, 15$.

$$
\begin{aligned}
\Delta_h log(k_{i.t+h}) = log(k_{i,t+h}) - log(k_{i,t-1}) =& f_i^h + sq_{s,t}^h + \theta^h OB_{i,t}\eta_t \\
&+ \sum_{w\in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}
\end{aligned} \tag{8}
$$

where $k_{i,t}$ is the fixed capital stock of firm i, f_i^h represents firm-fixed effects, $sq_{s,t+h}^h$ is sector-time fixed effects controlling for time-varying sector-level heterogeneity, η_t stands for the information effect corrected monetary policy surprise OISPRCT, OB is the opportunistic borrowing dummy to be introduced later in this section and w is one of the quarterly-reported firm characteristics. θ^h measures differential dynamic response of investment to monetary policy for firms which tap international bond markets. (8) is symmetric in the sense that monetary easing and tightening episodes are treated equally. Given that the leakage effect that I mention in Section 2 is likely to be active during monetary tightening episodes, the baseline regression model is a slightly modified version of (8) in the following way:

$$
\begin{aligned}
\Delta_h log(k_{i.t+h}) = log(k_{i,t+h}) - log(k_{i,t-1}) =& f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{i,t}\eta_t^+ \\
&+ \sum_{w\in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}
\end{aligned} \tag{9}
$$

where η_t^+ is interaction of η_t, the monetary policy surprise with a monetary tightening dummy in the spirit of Bernanke and Kuttner (2005). In (9), $\theta^{h,+}$ measures the differential dynamic response of investment to monetary tightening for firms that have the means to borrow opportunistically. A positive $\theta^{h,+}$ implies that these firms do not reduce their investment as much as others in response to monetary tightening. Hence, if the mechanism that I discussed in Section 2 exists, we expect a significantly positive $\theta^{h,+}$.

The firm sample consists of EA NFCs that issued a corporate bond (see Appendix B.2 and Table B.2 for information about the bond sample) at least once between 2008 Q2 and 2019 Q4. The firm-level covariates that I include in the investment dynamics model are quite standard in the literature and include size, leverage, balance sheet liquidity, sales growth, cash flow over total assets and short term debt over total assets. Data Appendix B.3 provide more information about firm-level data. All firm-level covariates are winsorized at 1% and 99% level to reduce the impact of outlier observations.

An important variable in this section is a proxy variable indicating whether a firm borrows opportunistically or not. Unfortunately, it is practically impossible to gauge whether a given firm borrows in foreign markets due to opportunistic motives as there can be other reasons behind a firm's offshore issuance decision. Nevertheless, since corporate basis is a significant determinant of firms' USD issuance as shown in Section 4, there is sufficient ground to be confident that opportunistic borrowing is one of these reasons.

In the baseline case given by (10), the binary opportunistic borrowing variable $OB_{i,t}$ takes 1 if firm i has issued at least one USD-denominated bond until quarter $t-1$ and if corporate basis is positive. It takes 0 otherwise. Bond issuance condition implicitly assumes that if a given firm issued a USD-denominated bond in the past, it has the means to do so should the need arises given large fixed costs of accessing global corporate bond markets. Thus, without any further condition imposed, it rather would serve as an access to global corporate bond markets dummy. To take opportunistic borrowing motives into account, I further impose the condition that corporate basis is positive. The combination of the two conditions allows us to identify firms that are able to borrow opportunistically given by their access to global corporate bond markets when borrowing in USD is cheaper compared to borrowing in EUR. In fact, when the positive corporate basis condition is not imposed, as we shall see shortly, response heterogeneity does not exist suggesting that access to global markets alone is not sufficient to drive heterogeneous firm behavior. Rather, firms react heterogeneously to monetary tightening only when borrowing in USD is cheaper than borrowing in EUR highlighting the importance of favorable borrowing conditions in global markets[21].

$$OB^1_{it} = \begin{cases} 1, & \text{if } USDiss_i \text{ until } t-1 > 0 \ \& \ CB_t > 0 \\ 0, & \text{otherwise} \end{cases} \tag{10}$$

5.3 Results

Before studying heterogeneous firm reactions, I first estimate average effects of monetary policy by removing the sector-time fixed effects and interaction terms from the model. This leads to (11) and (12) where monetary policy surprise is included as a standalone regressor. Similar to the asymmetric case discussed in equation (9), (12) studies the impact of monetary tightening on fixed capital expenditure where η_t^+ is defined as in (9).

$$log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + \gamma^h \eta_t + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h} \tag{11}$$

$$log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + \gamma^{h,+} \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h} \tag{12}$$

Estimated impulse response coefficients of monetary policy surprise terms in (11) and (12) are drawn in Figure 8 and Figure 9, respectively. The coefficients in the figures are scaled so that they represent the change in fixed capital expenditure following a one standard deviation increase in η_t and η_t^+. The same scaling will be held throughout the rest of the analysis. In the symmetric case, γ^h is negative as expected for each horizon. It reaches its minimum around eight quarters after the monetary policy surprise and the effect of monetary policy diminishes thereafter. In economic terms, a standard deviation increase in monetary policy variable leads to a 1%-1.2% reduction in fixed capital expenditure around 3-9 quarters following the monetary policy surprise[22]. Asymmetric case is similar qualitatively

[21] In Section 6, I also consider a slightly modified version of (10).

[22] Notice that the vertical axis represents accumulated (log) change in physical capital and not the investment rate between quarter h and $h-1$.

as shown in Figure 9 with the most notable difference being that the impact of monetary policy is much more pronounced for tightening episodes as shown by higher (in absolute terms) impulse response coefficients. Overall, the average effect analysis suggests that monetary tightening dampens capital expenditure at the firm-level.

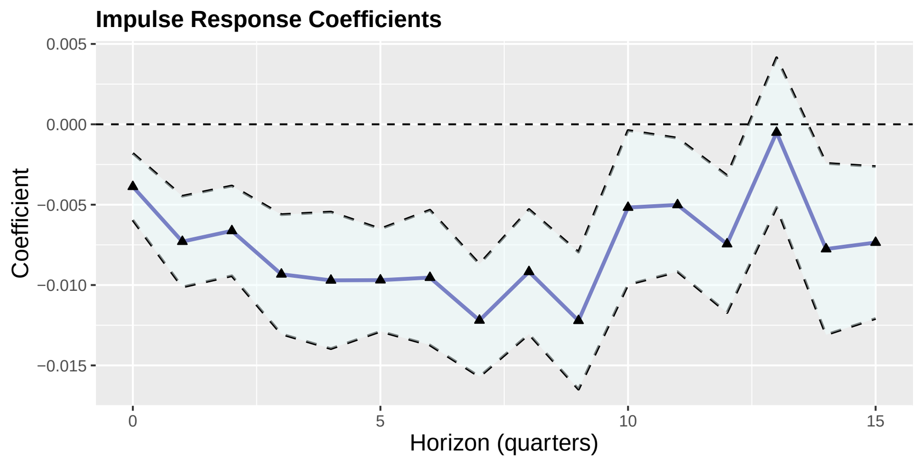

Figure 8: The Average Effect of Monetary Policy Surprises on Firms' Fixed Capital Expenditure

Notes: The figure depicts impulse response coefficients, γ^h estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + \gamma^h \eta_t + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h}$ where η_t represents OISPRCT as defined in 5.1. The coefficient γ^h is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

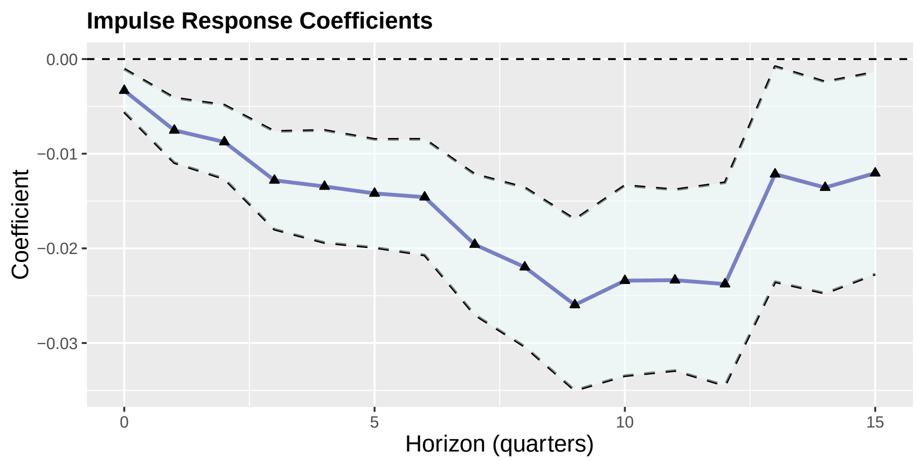

Figure 9: The Average Effect of Monetary Tightening Surprises on Firms' Fixed Capital Expenditure

Notes: The figure depicts impulse response coefficients, $\gamma^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + \gamma^{h,+} \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h}$ where η_t^+ is defined as in 9. The coefficient $\gamma^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

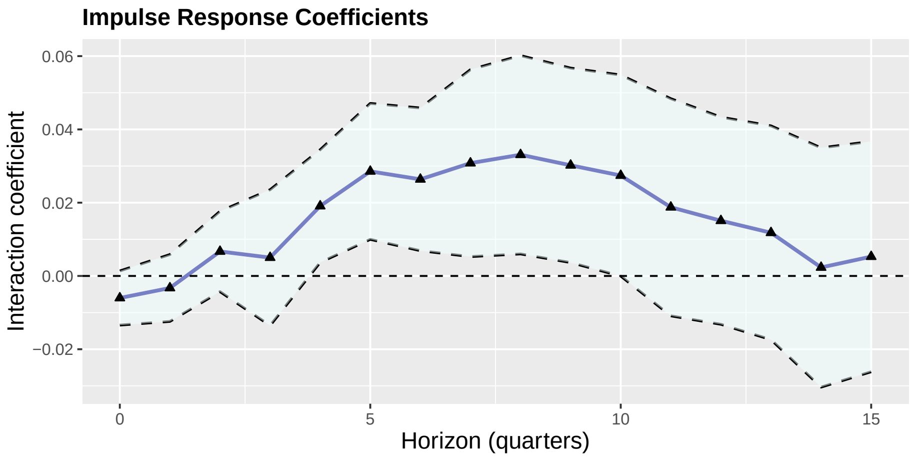

Figure 10: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (10) and OB_{it}^1 is as in (11). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

Next, I study (9). Here, the coefficient of interest is the interaction term, $\theta^{h,+}$ which provides differential responses of firms that can borrow opportunistically to monetary tightening. Figure 10 depicts estimated $\theta^{h,+}$ for each horizon h using OB_{it}^1 given by (10). In Figure 10, $\theta^{h,+}$ becomes significantly positive after around four quarters and ceases to be so after ten quarters.

This finding suggests that the impact of monetary policy on firms' investment decisions is heterogeneous and depends on whether a firm is able to tap global corporate bond markets when issuing in foreign currency provides cost-saving opportunities. In other words, firms that are able to borrow opportunistically do not decrease their investment as much as other firms in response to monetary tightening.

The estimated coefficients from the symmetric case (8) is reported in Figure D.1 in Appendix D for comparison. The symmetric case is qualitatively similar to the asymmetric case (tightening episodes). The main difference between them is that the heterogeneous firm reaction is less evident with larger confidence intervals for the symmetric case underlining that the leakage mechanism works exclusively through monetary tightening.

One caveat is that this heterogeneous firm reaction pertains to the period before 2013. After taper tantrum began in 2013 followed by Federal Reserve's tightening cycle and ECB's quantitative easing efforts, currency hedged borrowing cost of issuing in USD never became lower than the cost of issuing in EUR for EA NFCs evidenced by the negative corporate basis for this period. Thus, it was not quite possible for EA NFCs to borrow opportunistically in global corporate bond markets post-2013[23].

[23]Of course, since corporate basis is an aggregate measure and is calculated by estimation techniques,

In interpreting this result, one should also be cautious since heterogeneous firm response could potentially arise from asymmetric financial constraints faced by firms. If firms that have access to global corporate bond markets proxied by their previous USD issuance are less financially constrained compared to firms that only tap local bond market, then they might be reacting less to monetary tightening independent of their access to global markets. Besides, if these two sets of firms differ in terms of profitable investment opportunities that they have, this could also lead to a differential reaction to monetary policy. In the following section, I discuss these concerns in detail and provide other robustness checks.

6 Robustness Checks and Additional Results

This section presents some further analysis that shows whether the results are robust to changes in methodological details.

6.1 Different Interest Rate Measures

Monetary policy changes are at the heart of the analysis conducted in this paper. Therefore, it is important that results are not very sensitive, at least qualitatively, to the choice of how we measure monetary policy. In this section, I consider four alternatives to the baseline surprise series.

6.1.1 True monetary policy surprises vs original surprises

In Section 5, I used monetary policy surprise series that is purged of the information effect that it carries by imposing restrictions elaborated in Section 5.1. In this section, I do not impose any restrictions and use original surprise series instead. Each OIS surprise variable (with maturities: 1M, 3M, 6M, 1Y, 2Y, 3Y) is aggregated into quarterly frequency and their first principal component is computed. Some descriptive statistics and time series plot of the resultant series (OISPRC) are presented in Table B.6 and Figure B.4 in the Appendix.

6.1.2 Grouping policy changes

In this part, I group each monetary policy surprise observation in three bins that represent easing, tightening and no action with values -1, 1 and 0, respectively. Cutoffs for no action is taken as -10 bps and 10 bps. The resulting surprise series is called OISPRCbins. To illustrate, if the value of the surprise is -12 bps, OISPRCbins takes -1; if surprise is 13 bps, OISPRCbins takes 1; and if surprise is -5 bps or 4 bps, OISPRCbins takes 0. Descriptive statistics and time series plot of OISPRCbins are presented in Table B.6 and Figure B.5.

borrowing in USD might still provide cost saving opportunities to certain firms post 2013. In my analysis, I do not consider such possibilities which are difficult to detect in reliable ways.

6.1.3 A wider term structure

While my current analysis uses up to 3-year OIS rates due to high-frequency data unavailability for longer term rates before 2011, it could be important to consider a wider term structure incorporating rates of 4-10, 20 and 30 years which would reflect better the impact of post-crisis QE and forward guidance efforts[24]. I achieve this by including German bond yields of these longer maturities in my calculation of the first principal component of monetary policy surprises. The resulting series is called widerPRC. Descriptive statistics and time series plot of widerPRC are presented in Table B.6 and Figure B.6.

6.1.4 Nominal interest rates

I also use levels of nominal interest rates instead of high-frequency monetary policy surprises in line with Ippolito et al. (2018). While stock market is forward looking and responds only to unanticipated changes in monetary policy, investment is likely to respond to expected interest rate changes as well through the latter's impact on cost of capital and consumer demand. For this purpose, I aggregate daily OIS rates into quarterly frequency by taking their quarterly average. The underlying rate of swaps is EONIA. Again, I calculate the first principal component of OIS rates of different maturities. The resulting series is called OISPRCnom. Descriptive statistics and time series plot of OISPRCnom are presented in Table B.6 and Figure B.7.

6.1.5 Results

Each of the four alternative monetary policy variables replaces OISPRCT in equation (9). The results with new monetary policy variables are given by Figures D.2-D.5 in Appendix D. Overall, the results are in line with the baseline and suggestive of heterogeneous monetary policy transmission with positive and statistically significant coefficients between 4-10 quarters after monetary tightening.

6.2 Endogeneity Concern I – Asymmetries of Financial Constraints between USD-issuers and EUR-only Issuers

It is possible that the results suggesting a heterogeneous monetary policy transmission of Section 5.3 are driven by asymmetries of financial constraints between USD-issuers and EUR-only issuers[25] in the sense that firms that suffer less from financial frictions may be the ones that are able to issue in USD in global corporate bond markets. Thus, the reason they react less to monetary policy could be the fact that they are less financially

[24] A wider term structure can also help overcome the information effect problem better (see Section 5.1) as shown by Bu et al. (2021).

[25] "EUR-only issuers" refers to firms that issued at least one bond denominated in EUR but never issued a USD-denominated bond throughout the sample period.

constrained anyway independent of whether they tap foreign debt markets. This is an important endogeneity concern which I address in four ways in this paper.

First, all firms in my sample are bond-issuers. This provides a natural control for financial frictions since all firms have access to at least the local bond market, therefore they are not completely bank-dependent. Second, I have $size * \eta_t$, $BSL * \eta_t$ and $cashflow * \eta_t$ in my baseline regressions which already control for the differential effect of monetary policy for larger and more liquid firms. Third, I also add an additional control for financial frictions: Standard & Poors Long Term Issuer Rating. I create three dummies standing for Not Rated, Non-Investment Grade and Investment Grade firms. Interactions of these dummies with monetary policy surprises are included in the model to control for remaining financial frictions. The results are given in Figure D.6.

Finally, if heterogeneous responses are driven by underlying asymmetries of financial constraints between USD-issuers and EUR-only issuers rather than by USD-issuers' cost-saving opportunities in global debt markets, we would expect to see a positive $\theta^{h,+}$ independent of the level of the corporate basis. To test whether this prediction holds, I modify opportunistic borrowing variable as follows[26]:

$$OB_{it}^2 = \begin{cases} 1, & \text{if } USDiss_i \text{ until } t-1 > 0 \ \& \ CB_t < 0 \\ 0, & \text{otherwise} \end{cases} \tag{13}$$

If $\theta^{h,+}$ is not significantly positive under this scenario, it would imply that heterogeneous reaction depends on borrowing cost differential between USD and EUR, hence is unlikely to be driven by underlying asymmetries of financial constraints between firms that are not related to their access to global markets. The results with the modified opportunistic borrowing variable are given in Figure D.7. Insignificant coefficients in this figure suggest that heterogeneous firm response is observed when borrowing in USD is cheaper compared to borrowing in EUR but not vice versa.

Overall, results do not support the idea that financial frictions that are not related to firms' access to global corporate bond markets drive heterogeneous firm reactions to monetary tightening. Rather, it is the ability of certain firms to tap global corporate bond markets when issuing in foreign currency provides cost-saving opportunities that leads to heterogeneous firm reactions.

6.3 Endogeneity Concern II – Profitable Investment Opportunities

It is also possible that firms that have access to global corporate bond markets have more profitable investment opportunities in comparison with other firms. A more profitable firm with ample investment opportunities can be expected to reduce its investment less relative to other firms when monetary policy tightens. If so, heterogeneous firm reaction may emerge

[26] Naming this new variable as "opportunistic borrowing" is at odds with the definition of opportunistic borrowing as explained in the introduction. However, I keep its name as it is to ease comparison with the baseline.

due to different investment opportunities these firms have and not because of cost-saving opportunities of borrowing in global corporate bond markets.

To isolate my analysis from such effects, I control for investment opportunities. In the baseline case, the econometric model already incorporates sales growth which is frequently used as a proxy for investment opportunities firms have. In this section, I also add Tobin's Q along with its interaction with monetary policy surprises. Tobin's Q is another frequently used proxy for profitable investment opportunities in the literature. Q is itself proxied by price-to-book ratio which is also obtained from Refinitive Eikon for each firm in my sample. The results with the modified firm characteristics set are given in Figure D.8 and are largely in line with baseline results.

Finally, it is also possible to use (13) in this section as well. Again, if profitable investment opportunities that firms with access to global corporate bond markets have are driving their differential investment reaction to monetary policy, we would expect this relation to be independent of the level of corporate basis. However, Figure D.7 demonstrates that heterogeneous response disappears when borrowing in USD is not cheaper compared to borrowing in EUR.

6.4 Other Robustness Checks

I further do the following. First, I include $Sector^{*}\eta_t$ in regressions to control for sector-specific effects of monetary policy. Some studies show that some industries (e.g. consumer durables sector) are affected more by monetary shocks due to a higher interest rate elasticity of demand (Peersman and Smets, 2005).

Second, I exclude top 1% of firms in terms of number of bond issuances to remove the concern that the results are driven by a small number of back-to-back issuers.

Third, I tighten the constraint when constructing the opportunistic borrowing variable in a way that it takes 1 only if the firm issued at least one USD-denominated bond in the last five years (instead of anytime until $t-1$). This choice aims to remove the concern that a firm might not be able to borrow in global markets anymore even though it did so in the distant past. Hence, a firm is assumed to have access to global corporate bond markets only if it issued a foreign currency bond within the last five years. This specification leads to (14):

$$OB^3_{it} = \begin{cases} 1, & \text{if } USDiss_i \text{ in the last five years} > 0 \;\&\; CB_t > 0 \\ 0, & \text{otherwise} \end{cases} \tag{14}$$

The results with these alternative specifications are presented in Figures D.9, D.10 and D.11 in Appendix D and are largely in line with the baseline case confirming the heterogeneous firm reaction to monetary policy surprises. In Appendix E, I also adapt the baseline empirical model to inventory investment in order to study heterogeneous inventory investment response of firms to monetary tightening.

7 Conclusion

This paper studies implications of NFCs' activity in global corporate bond markets for local monetary policy transmission in the Eurozone. I propose a leakage mechanism of monetary tightening through which firms may respond to tightened domestic funding conditions by tapping foreign bond markets when incurring FX denominated debt is cost-efficient compared to issuing in local currency. Consequently, these firms isolate themselves, at least partially, from adverse effects of monetary tightening.

To test the predictions of this mechanism, I first show that Eurozone NFCs exploit borrowing cost differentials between USD and EUR by issuing in USD whenever it becomes cheaper to do so. Utilizing proxies for such opportunistic borrowing behavior, I then find that firms that have the means to borrow opportunistically do not reduce their investment as much as other firms in response to monetary tightening. This finding confirms that there is significant level of heterogeneity in firms' reaction to monetary tightening. This heterogeneity is not driven by asymmetric financial constraints faced by USD-issuers and firms that only issue in EUR. Nor is it driven by profitable investment opportunities that opportunistically borrowing firms might have.

These findings have also important policy implications. First, the findings imply that there is a sort of leakage mechanism of monetary policy transmission emanating from offshore bond financing opportunities. Therefore, local monetary policy transmission can be impaired when global financial markets offer cheaper funding opportunities to firms. The magnitude and economic relevance of this leakage depends on the importance of opportunistically borrowing firms in the economy. If these firms' actions constitute or affect a crucial part of overall investment patterns, then such leakages would pose serious threats to the proper functioning of the investment channel of monetary policy transmission. In this case, central bank may need to tighten more than how much it would under a closed economy. Second, this finding also implies that the existing literature on interest rate pass through could be misleading when showing that monetary policy drives borrowing costs of the real sector since domestic lending rates could be largely irrelevant to a -small in number but large in economic magnitude- subset of firms when borrowing in global markets offer cost-saving opportunities to these firms. This is especially important for investment dynamics since bonds issued in global markets tend to have longer maturity and long-term interest rates are more important drivers of investment decisions compared to short-term rates. Finally, such leakage effects will likely matter more for the overall economy if global corporate bond markets continue expanding and more firms tap these markets.

The findings of the paper also provide promising avenues for further research. Even though this paper focuses on NFCs' foreign currency bond issuance, financial firms are the main participants of the corporate bond market in the Eurozone. In line with the predictions of the leakage mechanism that I discuss, banks that issue opportunistically in foreign currency are likely to be affected less by domestic monetary tightening and not contract their credit supply as much as other banks. In turn, firms which have lending relationships with opportunistically borrowing banks are expected to suffer less in terms of securing bank loans. The result is that bank lending channel of monetary policy transmission is impaired.

The findings have also indirect implications for the working of the bank lending channel. As Sobrun and Turner (2015) discuss, as larger and more credible firms switch to foreign debt markets, domestic banks need to find other -less credible- domestic customers to extend loans. This will increase the risk taking of the domestic banking sector. At the same time, these market switching firms are likely to deposit the cash they raise offshore into their local bank accounts, easing the funding constraints of the domestic banks. Both indirect channels work against what central bank aims to achieve by monetary tightening, leading to further impairment. A quantitative investigation of these predictions would be important contributions to the literature on bank lending channel.

References

Allayannis, G., Brown, G. W. and Klapper, L. F. (2003), 'Capital structure and financial risk: Evidence from foreign debt use in East Asia', *The Journal of Finance* **58**(6), 2667–2710.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R. and Ragusa, G. (2019), 'Measuring euro area monetary policy', *Journal of Monetary Economics* **108**, 162–179.

Altavilla, C., Pariès, M. D. and Nicoletti, G. (2019), 'Loan supply, credit markets and the euro area financial crisis', *Journal of Banking & Finance* **109**, 105658.

Barajas, A., Chami, R., Ebeke, C. and Oeking, A. (2018), 'What's different about monetary policy transmission in remittance-dependent countries?', *Journal of Development Economics* **134**, 272–288.

Bernanke, B. S. and Kuttner, K. N. (2005), 'What explains the stock market's reaction to Federal Reserve policy?', *The Journal of Finance* **60**(3), 1221–1257.

Black, S. and Munro, A. (2010), 'Why issue bonds offshore?', *BIS Papers* (52).

Bolton, P. and Freixas, X. (2006), 'Corporate finance and the monetary transmission mechanism', *The Review of Financial Studies* **19**(3), 829–870.

Bruno, V. and Shin, H. S. (2017), 'Global dollar credit and carry trades: a firm-level analysis', *The Review of Financial Studies* **30**(3), 703–749.

Bu, C., Rogers, J. and Wu, W. (2021), 'A unified measure of Fed monetary policy shocks', *Journal of Monetary Economics* **118**, 331–349.

Caramichael, J., Gopinath, G. and Liao, G. Y. (2021), 'U.S. Dollar Currency Premium in Corporate Bonds', *Unpublished Working Paper* .

Cloyne, J., Ferreira, C., Froemel, M. and Surico, P. (2018), 'Monetary policy, corporate finance and investment', *National Bureau of Economic Research Working Paper* (25366).

Cortina, J. J., Didier, T. and Schmukler, S. L. (2021), 'Global corporate debt during crises: implications of switching borrowing across markets', *Journal of International Economics* **131**, 103487.

Crouzet, N. (2018), 'Aggregate implications of corporate debt choices', *The Review of Economic Studies* **85**(3), 1635–1682.

Crouzet, N. (2021), 'Credit disintermediation and monetary policy', *IMF Economic Review* **69**(1), 23–89.

Darmouni, O., Giesecke, O. and Rodnyansky, A. (2020), 'The bond lending channel of monetary policy', *MPRA Paper* (98722).

Darmouni, O. and Papoutsi, M. (2021), 'The rise of bond financing in Europe', *Unpublished Working Paper* .

Du, W., Tepper, A. and Verdelhan, A. (2018), 'Deviations from covered interest rate parity', *The Journal of Finance* **73**(3), 915–957.

European Central Bank (2014), 'Euro area risk-free interest rates: measurement issues, recent developments and relevance to monetary policy.', *ECB Monthly Bulletin* **2014**(07), 63–77.

European Central Bank (2021), 'Non-bank financial intermediation in the euro area: implications for monetary policy transmission and key vulnerabilities', *ECB Strategy Review Occasional Paper Series* (270).

Fendoglu, S., Gulsen, E. and Peydró, J.-L. (2019), 'Global liquidity and the impairment of local monetary policy transmission', *Central Bank of the Republic of Turkey Working Paper Series* (1913).

Gambacorta, L., Mayordomo, S. and Serena, J. M. (2020), 'Dollar borrowing, firm-characteristics, and FX-hedged funding opportunities', *BIS Working Paper* (843).

Gertler, M. and Gilchrist, S. (1994), 'Monetary policy, business cycles, and the behavior of small manufacturing firms', *The Quarterly Journal of Economics* **109**(2), 309–340.

Gertler, M. and Karadi, P. (2015), 'Monetary policy surprises, credit costs, and economic activity', *American Economic Journal: Macroeconomics* **7**(1), 44–76.

Gilchrist, S. and Zakrajšek, E. (2012), 'Credit spreads and business cycle fluctuations', *American Economic Review* **102**(4), 1692–1720.

Gozzi, J. C., Levine, R., Peria, M. S. M. and Schmukler, S. L. (2015), 'How firms use corporate bond markets under financial globalization', *Journal of Banking & Finance* **58**, 532–551.

Graham, J. R. and Harvey, C. R. (2001), 'The theory and practice of corporate finance: Evidence from the field', *Journal of Financial Economics* **60**(2-3), 187–243.

Greene, W. (2004), 'Fixed effects and bias due to the incidental parameters problem in the Tobit model', *Econometric Reviews* **23**(2), 125–147.

Gürkaynak, R. S., Lee, S. S. and Karasoy Can, G. (2021), 'Stock market's assessment of monetary policy transmission: The cash flow effect', *Unpublished Working Paper* .

Gürkaynak, R. S., Sack, B. and Swanson, E. (2005), 'Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements', *International Journal of Central Banking* .

Gutierrez, B., Ivashina, V. and Salomao, J. (2021), 'Why is dollar debt cheaper? Evidence from Peru', *Unpublished Working Paper* .

International Monetary Fund (2016), 'Monetary policy and the rise of nonbank finance', *Global Financial Stability Report, 2016* pp. 49–80.

Ippolito, F., Ozdagli, A. K. and Perez-Orive, A. (2018), 'The transmission of monetary policy through bank lending: The floating rate channel', *Journal of Monetary Economics* **95**, 49–71.

Jarociński, M. and Karadi, P. (2020), 'Deconstructing monetary policy surprises—the role of information shocks', *American Economic Journal: Macroeconomics* **12**(2), 1–43.

Jeenas, P. (2019), 'Firm balance sheet liquidity, monetary policy shocks, and investment dynamics', *Unpublished Working Paper* .

Jordà, Ò. (2005), 'Estimation and inference of impulse responses by local projections', *American Economic Review* **95**(1), 161–182.

Kashyap, A. K., Lamont, O. A. and Stein, J. C. (1994), 'Credit conditions and the cyclical behavior of inventories', *The Quarterly Journal of Economics* **109**(3), 565–592.

Liao, G. Y. (2020), 'Credit migration and covered interest rate parity', *Journal of Financial Economics* **138**(2), 504–525.

McBrady, M. R., Mortal, S. and Schill, M. J. (2010), 'Do firms believe in interest rate parity?', *Review of Finance* **14**(4), 695–726.

McBrady, M. R. and Schill, M. J. (2007), 'Foreign currency-denominated borrowing in the absence of operating incentives', *Journal of Financial Economics* **86**(1), 145–177.

Miranda-Agrippino, S. and Ricco, G. (2021), 'The transmission of monetary policy shocks', *American Economic Journal: Macroeconomics* **13**(3), 74–107.

Munro, A., Wooldridge, P. et al. (2011), 'Motivations for swap-covered foreign currency borrowing', *BIS Papers* (61).

Nakamura, E. and Steinsson, J. (2018), 'High-frequency identification of monetary non-neutrality: the information effect', *The Quarterly Journal of Economics* **133**(3), 1283–1330.

Ongena, S., Schindele, I. and Vonnák, D. (2021), 'In lands of foreign currency credit, bank lending channels run through?', *Journal of International Economics* **129**, 103435.

Ottonello, P. and Winberry, T. (2020), 'Financial heterogeneity and the investment channel of monetary policy', *Econometrica* **88**(6), 2473–2502.

Peersman, G. and Smets, F. (2005), 'The industry effects of monetary policy in the euro area', *The Economic Journal* **115**(503), 319–342.

Schnabel, I. (2021), 'The rise of non-bank finance and its implications for monetary policy transmission', *Speech at the Annual Congress of the European Economic Association* .

Sobrun, J. and Turner, P. (2015), 'Bond markets and monetary policy dilemmas for the emerging markets', *BIS Working Paper* (508).

Swanson, E. T. and Williams, J. C. (2014), 'Measuring the effect of the zero lower bound on medium-and longer-term interest rates', *American Economic Review* **104**(10), 3154–85.

Wright, J. H. (2012), 'What does monetary policy do to long-term interest rates at the zero lower bound?', *The Economic Journal* **122**(564), F447–F466.

Appendix

A Calculation of Corporate Basis

This Appendix elaborates the specific steps in the calculation of corporate basis. As (2) makes it clear, we need two terms to calculate the corporate basis. The term in the first bracket is credit spread differential between EUR and USD. The second bracket is CIP deviation which is proxied by the cross-currency basis of a given maturity. Corporate basis is, then, simply the sum of credit spread differential and the risk-free CIP deviation.

In this paper, I measure CIP deviations as the 5-year cross currency basis swap based on USD LIBOR and EURIBOR rates multiplied by minus one. For the credit spread differential, however, we do not have a clear-cut proxy. In the most ideal scenario, one can use the bond yield spreads of firms that issue two bonds at the same time, one in USD and the other in EUR, both of which have the same rating and maturity and so on, so that one can compare costs of issuing in USD and in EUR, ceteris paribus. Nevertheless, these cases being rare, it would be misleading to generalize such small number of occurrences.

Eventually, we need to come up with an estimation methodology and I do it by adopting the bottom-up approach using individual bond data pioneered by Gilchrist and Zakrajšek (2012) and estimating a bond pricing model along the lines of Liao (2020). Below, I explain the estimation procedure for credit spread differential between USD and EUR. The bond dataset that is used in estimating the credit spread differential is described in Data Appendix B.1.

$$S_i = \alpha + \beta^{€} D_i^{€} + \sum_{k \in \left\{r,m,a,ai\right\}} \sum_{j=2}^{3} \beta_{ji}^{k} D_{ji}^{k} + \sum_{j=2}^{F} \beta_{ji}^{f} D_{ji}^{f} + \varepsilon_i \tag{A.1}$$

$$CSD_{€\$t} = \hat{\beta^{€}} \tag{A.2}$$

In (A.1), I regress the yield spread of bond i on a couple of bond characteristics such as the currency in which the bond is issued, amount issued, the remaining maturity, the age, and the rating of the bond. I estimate (A.1) at each quarter separately so there is no time subscript on variables. $D_i^{€}$ is a currency dummy taking 1 if the bond is issued in EUR and 0 if in USD. Dummy variables for r, m, a, ai represent rating, remaining maturity, age divided by original maturity, and amount issued of the bond, respectively. When constructing these dummy variables, I put each bond into one of the three bins associated with the bond characteristic variable[27]. Then, each dummy is arranged so that it takes 1 if the bond is in

[27] Rating bins are: no rating, investment grade and high yield. Remaining maturity bins are: 1-5 years, 5-10 years, 10+ years. Age over initial maturity bins are: old (if the ratio is greater than 0.67), mature (if the ratio is between 0.34 and 0.67) and young (if the ratio is smaller than 0.34). Amount issued bins are:

the bin and 0 otherwise. Lastly, D^f_{ji} gives us the firm-fixed effect with F being the number of distinct firms at each quarter.

In (A.2), I define the credit spread differential between EUR and USD as the OLS estimate of $\beta^{€}$ since it gives us the residual spread differential related to the currency of the bond after controlling for basic bond characteristics.

small (if the amount issued is less than \$ 100 mil.), medium (if the amount issued is between \$ 100 mil. and \$ 500 mil.), large (if the amount issued is greater than \$ 500 mil.)

B Data Appendix

B.1 Estimation of Credit Spread Differential

Estimating (A.1) requires data on bond characteristics which I obtain from Refinitiv Eikon for each bond. I match this data with the secondary market bond yield spread data obtained from Datastream using bond International Securities Identification Numbers (ISIN). Spread is calculated by subtracting the maturity-matched USD or EUR swap rate from bond i's yield. I winsorize bond spreads at 5% and 95% level to remove bonds with outlier prices.

Before estimating (A.1), I apply several filters to the raw bond dataset. First, I remove all bonds whose issuer's parent domicile is other than the EA, bonds with principal currency other than USD and EUR, bonds issued before 01.01.2001, bonds with maturity at issuance less than one year, and bonds without ISIN. Second, I apply liquidity related filters to ensure that bonds in my dataset are frequently traded so that they truly reflect pricing movements. To achieve this, I eliminate all bonds with face value less than $10 million notional and bonds with remaining maturity less than one year. Third, I apply homogeneity related filters to have a homogenous sample of bonds so that price comparison among them is meaningful. Accordingly, I exclude all floating rate coupon, convertible, asset based (covered), perpetual, callable and putable bonds from my dataset. This procedure leaves me some 61802 bonds issued by 3512 firms. 52713 of these bonds are denominated in EUR while the remaining 9089 are denominated in USD.

In addition to these filters, I also remove all bonds whose issuer does not have an outstanding bond in the other currency at the same quarter with the aim of improving the precision of the analysis. After this final filter, I merge this dataset with the bond spread data obtained from Datastream. Ultimately, 15772 bonds out of 31923 bonds are successfully merged, of which 12957 is denominated in EUR and 2815 in USD. The whole procedure leaves me with 2825 observations on average per quarter. The summary statistics of this final dataset which is used in estimating (A.1) is given in Table B.1. One notable difference between USD-denominated and EUR-denominated bonds is that the former's mean (or median) amount is much larger than that of the latter while maturities of both types of bonds are similar.

Table B.1: Summary Statistics of Bonds in the Final Sample

Bond Summary

		All Bonds	USD-denom.	EUR-denom.
Number	Tranches	15772	2815	12957
	Firms	213	213	213
Maturity (year)	Min	1	1	1
	Max	100.1	100.1	100
	Mean	6.61	6.85	6.55
	Median	5	5	5
	Sd	5.32	6.5	5.03
Amount(USD mil)	Min	10	10	10
	Max	12218	7000	12218
	Mean	522	949.3	429.27
	Median	122	750	122.2
	Sd	1048	1071.3	1020.22

Notes: Bonds whose issuers have no outstanding bond in the other currency and bonds for which spread data is not available in Datastream are excluded from the sample.
Source: Refinitiv Eikon, Datastream

B.2 Bonds Used in Estimating the Currency Choice Model

Again, I apply some filters to the raw bond dataset. The most important one is the exclusion of bonds issued by banks, other financial institutions, and state agencies so that I have a sample of bonds issued by EA non-financial private companies. This time, I restrict my bond sample to start from 2008 Q2 since corporate basis is very close to zero before the GFC. I also exclude bonds issued after 2019 Q4 in order to remove any external impact caused by the Covid-19 pandemic on the bond market. Next, I remove bonds whose maturity is less than one year and bonds with missing ISIN, currency, issuer, issue date or maturity information. Furthermore, I consolidate all bonds at the ultimate parent level. For instance, if a US subsidiary of a EA NFC issues a bond in the US, I consider it as the liability of the European ultimate parent company. I also remove all bonds whose ultimate parent domicile is other than EA countries and whose ultimate parent operates in financial sector or is owned by a state agency.

The summary statistics of the final sample which will be used both in this section and in the coming sections are presented in Table B.2. In the final sample, there are 5375 bonds (4302 EUR + 1073 USD) issued by 1199 distinct companies in consolidated basis. Again, a simple breakdown of the bond dataset along the currency lines shows that USD issuances are much larger in magnitude compared to EUR issuances. This time, average maturities are different too, with USD issuances having longer maturities.

Table B.2: Summary Statistics of Bonds Used in Estimating the Currency Choice Model

Bond Summary

		All Bonds	USD-denom.	EUR-denom.
Number	Tranches	5375	1073	4302
	Firms	1199	122	1160
Maturity (year)	Min	1	1	1
	Max	100.1	60.54	100.1
	Mean	7.71	10.42	7.04
	Median	6.21	8	6
	Sd	6.94	9.19	6.07
Amount(USD mil)	Min	0.12	0.4	0.12
	Max	9542.5	9542.5	3665.4
	Mean	442.3	840.3	343
	Median	254.8	584.8	146.7
	Sd	598.1	941.1	420.6

Source: Refinitiv Eikon.

In order to check for the representativeness of the bond-level data, I compare the corporate bond issuance data used in this paper with ECB's monthly gross corporate sector's long-term debt security issuance data. I aggregate both datasets into annual frequency and depict their time series in Figure B.1. The correlation coefficient between the two series is 0.90 and Refinitiv Eikon's bond data cover around 91% of ECB data on average[28]. This shows that Eikon's bond dataset sufficiently covers overall market trends.

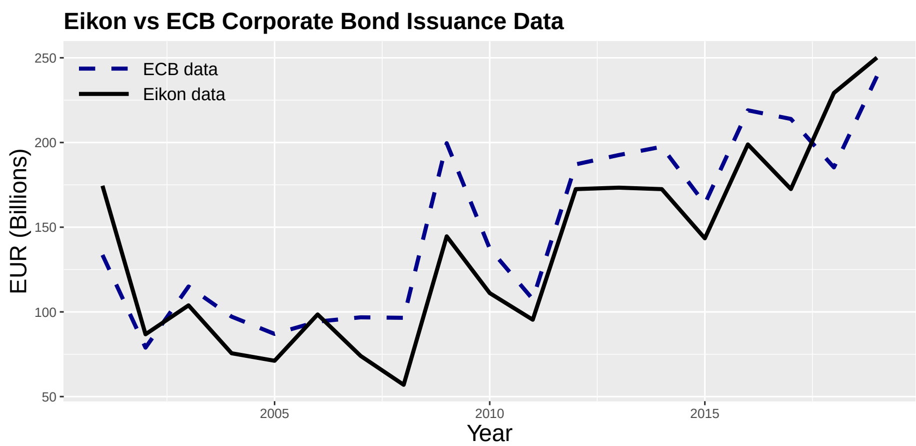

Figure B.1: Eikon vs ECB Corporate Bond Issuance Data. *Source:* Author's calculations, Refinitiv Eikon and ECB.

[28]A certain portion of differences may result from the fact that ECB data is not consolidated at the ultimate parent level.

B.3 Firm-Level Characteristics

This appendix provides detailed information on firms' balance sheet and income statement variables used in the paper. Firm size is proxied by the logarithm of firm's total assets; leverage is defined as the total debt of the firm divided by its total assets; balance sheet liquidity is taken as the sum of cash and short-term investments of the firm divided by its total assets; sales growth is given by the quarterly change in net sales; cash flow is calculated as the sum of net income before extraordinary items, depreciation and amortization and I divide it by total assets; short term debt is divided by total assets; Q is proxied by price-to-book ratio. Finally, fixed capital stock, $k_{i.t}$, is measured as the book value of a firm's tangible capital stock (property, plant and equipment).

Quarterly firm-level data is obtained from Refinitiv Eikon for the time period between 2008 Q2 and 2019 Q4. Figure B.2 presents the correlation matrix for firm characteristics while Table B.3 presents their summary statistics. The most notable difference between USD-issuers and firms which never issued in USD is that the former is significantly larger in size. Summary statistics of the quarterly growth rates of capital stock is reported in Table B.4.

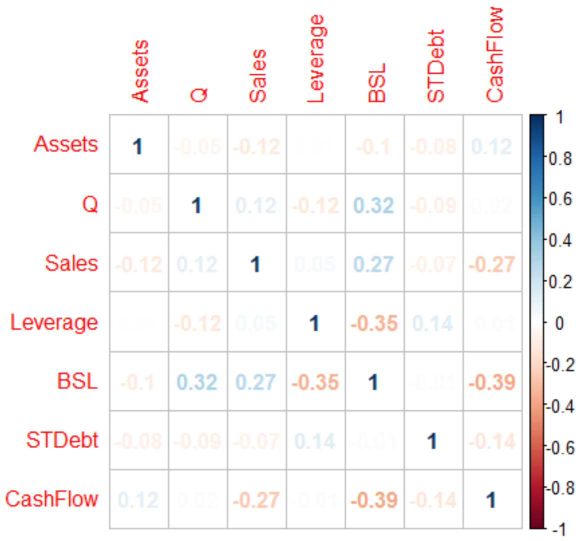

Figure B.2: Correlation Structure of Firm Characteristics. *Source:* Refinitiv Eikon and author's calculations.

Table B.3: Summary Statistics of Firm Characteristics

Sample		Assets (USD mil)	P/B Ratio	Sales Gr. (pp)	Leverage	BSL	ST Debt	Cash Flow
Whole	Mean	12240	2.37	4.02	0.32	0.11	0.01	0.00
	Median	2414	1.64	2.17	0.32	0.08	0.00	0.01
	Std	28227	2.52	7.42	0.16	0.09	0.03	0.02
	5^{th} Perc.	31	0.24	-2.18	0.08	0.03	0.00	-0.03
	95^{th} Perc.	68311	6.71	18.47	0.60	0.29	0.06	0.03
USD Issuers	Mean	35837	2.57	2.47	0.32	0.10	0.01	0.01
	Median	14298	1.93	1.45	0.30	0.10	0.00	0.01
	Std	47078	2.68	3.62	0.15	0.07	0.01	0.01
	5^{th} Perc.	847	0.44	-0.49	0.13	0.03	0.00	-0.01
	95^{th} Perc.	132262	7.06	6.91	0.54	0.26	0.03	0.02
EUR-only Issuers	Mean	6108	2.31	4.41	0.33	0.11	0.01	0.00
	Median	1567	1.57	2.25	0.32	0.08	0.00	0.00
	Std	15880	2.48	8.04	0.16	0.10	0.04	0.03
	5^{th} Perc.	25	0.24	-2.79	0.07	0.03	0.00	-0.03
	95^{th} Perc.	29449	6.70	21.29	0.60	0.33	0.08	0.03

Source: Refinitiv Eikon

Table B.4: Summary Statistics of Firms' Fixed Capital Expenditure

Summary Statistics of Firms' Fixed Capital Expenditure

$\Delta_h log(k_{i.t+h})$	Mean	Median	Std. Dev.	5^{th} Perc.	95^{th} Perc.
$h = 0$	0.013	0.002	0.115	-0.086	0.142
$h = 1$	0.026	0.009	0.191	-0.161	0.281
$h = 2$	0.039	0.015	0.253	-0.222	0.423
$h = 3$	0.052	0.023	0.307	-0.282	0.521
$h = 4$	0.061	0.029	0.357	-0.343	0.607
$h = 5$	0.069	0.038	0.399	-0.397	0.684
$h = 6$	0.079	0.044	0.439	-0.448	0.763
$h = 7$	0.089	0.050	0.477	-0.495	0.837
$h = 8$	0.096	0.058	0.518	-0.547	0.913
$h = 9$	0.105	0.069	0.552	-0.604	0.972
$h = 10$	0.112	0.077	0.588	-0.645	1.029
$h = 11$	0.121	0.086	0.616	-0.688	1.070
$h = 12$	0.130	0.097	0.649	-0.732	1.132
$h = 13$	0.140	0.107	0.666	-0.748	1.174
$h = 14$	0.150	0.115	0.688	-0.774	1.237
$h = 15$	0.159	0.123	0.710	-0.794	1.281

Source: Refinitiv Eikon

B.4 Monetary Policy Variables

B.4.1 Monetary Policy Surprises

This appendix presents summary statistics and figures for the monetary policy surprise series used in the paper. Between 2008 Q2 and 2019 Q4, 122 monetary policy announcement events occurred in total. The detailed information on how monetary policy surprise series is obtained and how I calculate OISPRCT is explained in Section 5.1.

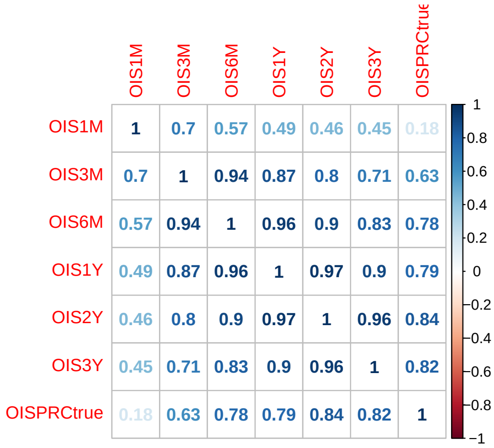

Figure B.3: Correlation Structure of OIS Rate Surprises of Different Maturities. *Source:* Author's calculations based on Euro Area Monetary Policy Event Study Database.

Table B.5: Summary Statistics of Monetary Policy Surprises

MP Summary							
OIS Maturity	Min	Max	Mean	Median	Std. Dev.	Min. Date	Max. Date
OIS 1M	-6.60	8.24	0.04	0.00	2.87	2012 Q3	2019 Q3
OIS 3M	-9.65	10.25	0.07	0.00	4.06	2011 Q3	2008 Q2
OIS 6M	-14.00	15.00	0.09	0.21	5.72	2011 Q3	2008 Q2
OIS 1Y	-25.75	20.30	-0.09	-0.05	7.79	2008 Q3	2008 Q2
OIS 2Y	-37.50	20.38	-0.42	-0.25	9.23	2008 Q3	2011 Q1
OIS 3Y	-34.70	18.40	-0.84	-0.60	8.12	2008 Q3	2011 Q1
OISPRCT	-37.82	37.83	-0.27	-1.90	12.69	2011 Q2	2008 Q4

Notes: Monetary policy surprises are aggregated into quarterly frequency by summing monetary policy surprises that happen at the same quarter.
Source: Author's calculations on Euro Area Monetary Policy Event Study Database

B.4.2 Monetary Policy Variables Used for Robustness Checks

This appendix presents summary statistics and figures for the monetary policy variables used in robustness checks. I explain how I constructed each variable in Sections 6.1.1-6.1.4 in the main text.

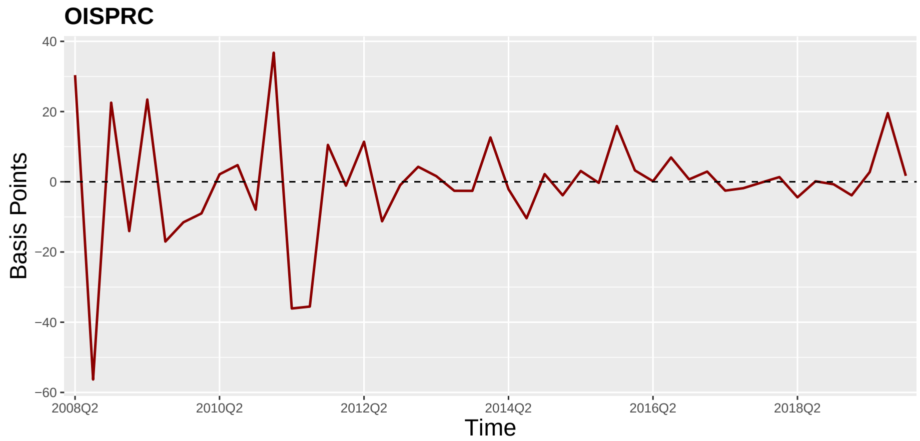

Figure B.4: OISPRC. *Source:* Author's calculations based on Euro Area Monetary Policy Event Study Database.

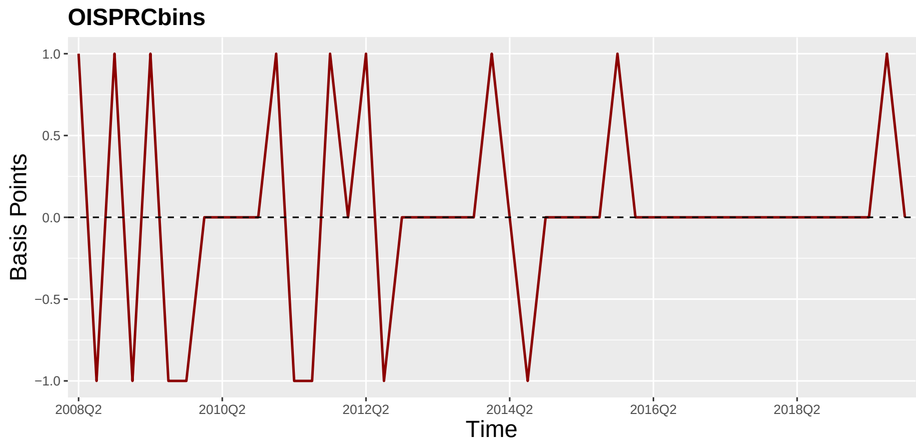

Figure B.5: OISPRCbins. *Source:* Author's calculations based on Euro Area Monetary Policy Event Study Database.

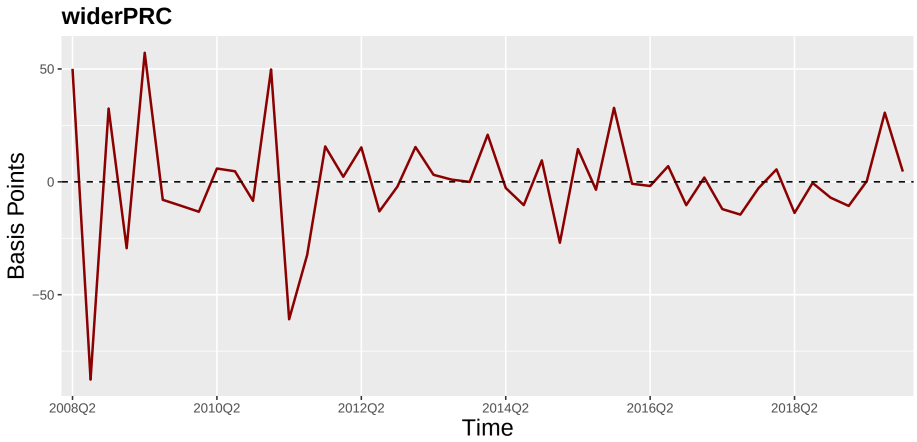

Figure B.6: widerPRC. *Source:* Author's calculations based on Euro Area Monetary Policy Event Study Database

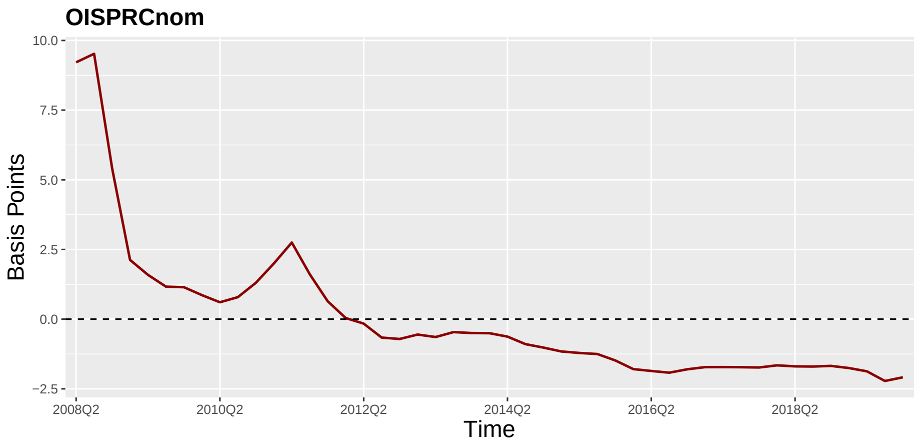

Figure B.7: OISPRCnom. *Source:* Author's calculations and Refinitive Eikon

Table B.6: Summary Statistics of Monetary Policy Variables

MP Summary

OIS	Min	Max	Mean	Median	Std. Dev.	Min. Date	Max. Date
OISPRC	-56.32	36.77	-0.32	0.14	15.69	2008 Q3	2011 Q1
OISPRCbins	0	1	0.02	0	0.61	-	-
widerPRC	-87.71	57.17	-0.07	-0.49	24.90	2008 Q3	2009 Q2
OISPRCnom	-2.22	9.52	0.00	-0.66	2.54	2019 Q3	2008 Q3

Source: Author's calculations on Euro Area Monetary Policy Event Study Database

C Corporate Basis and Monetary Policy

In this part, I study the effect of monetary policy on corporate basis. Theoretically, the impact of monetary policy on corporate basis is ambiguous. Consider equation (2). On one hand, a static interpretation reads an increase in domestic risk-free rate driven by monetary tightening ($rf_t^{€}$) as pulling the credit spread differential (first term on the right hand side) down. However, monetary tightening typically influences risky rates ($rb_t^{€}$) as well leading to higher credit spreads when financial conditions are tight. Similarly, prolonged interest rate reductions can squeeze credit spreads through higher risk appetite and search for yield efforts. Thus, changes in monetary policy can positively affect the first term of the right hand side of equation (2). In a similar vein, a mechanical reading would suggest that a ECB controlled interest rate decline decreases the second term of the right hand side of equation (2) (CIP deviation). However, Du et al. (2018) show that monetary policy differential affects CIP deviation (measured as in equation (2)) negatively. As ECB-Fed differential decreases, higher demand for USD-denominated assets raise the cost of currency hedging in forward and swap markets leading to an increase in the second term of the right hand side of (2).

Due to counteracting forces at work, the direction of the impact of monetary policy on corporate basis needs to be empirically investigated. In Table C.1, I consider six specifications. As currency induced borrowing cost differential is affected by both local and foreign monetary policy, I calculate the difference between ECB controlled rate and Fed controlled rate. I then calculate the four quarter moving average of this differential and regress corporate basis on ECB-Fed differential. In the first three columns, I use monetary policy surprise series. I use OISPRCT for the ECB rate (see Section 5.1). For the Fed rate, I use monetary policy surprise series produced by Bu et al. (2021). The two series are compatible in that they both address the information effect problem, hence are free from this effect to some extent.

In the last three columns, I use interest rate levels instead of surprises. I use OISPRCnom for the ECB rate (see Section 6.1.4). For the Fed rate, I obtain treasury yields of 1-month, 3-month, 6-month, 1-year, 2-year and 3-year maturities from St. Louis Fed's website and compute their first principal component. Sample period is from 2008 Q2 through 2019 Q4. Monetary policy differential seems to be a significant driver of corporate basis across all specifications albeit with differences in significance levels. Overall, results suggest that as monetary policy differential increases between ECB and Fed -indicative of a relative tightening of ECB's monetary policy-, issuing in USD becomes more favorable for EA NFCs in terms of FX-hedged borrowing costs.

Table C.1: Corporate Basis and Monetary Policy (Estimation Results)

	1	2	3	4	5	6
Dep. Variable	CB_t	ΔCB_t	ΔCB_t	CB_t	ΔCB_t	ΔCB_t
Intercept	-2.77^{*}	2.01	2.07	-2.97^{**}	2.13	2.21
	(1.50)	(1.75)	(1.77)	(1.33)	(1.74)	(1.76)
CB_{t-1}	0.62^{***}			0.59^{***}		
	(0.06)			(0.05)		
ΔCB_{t-1}			-0.06			-0.07
			(0.13)			(0.13)
ECB-FED (surp.)	3.19^{*}	5.81^{**}	5.92^{**}			
	(1.82)	(2.42)	(2.45)			
ECB-FED (nom.)				1.53^{***}	1.55^{**}	1.59^{**}
				(0.41)	(0.63)	(0.64)
Multiplier	8.35		5.57	3.76		1.58
R^2	0.70	0.12	0.13	0.76	0.13	0.13
Note:	*p<0.1; **p<0.05; ***p<0.01					

D Additional Results

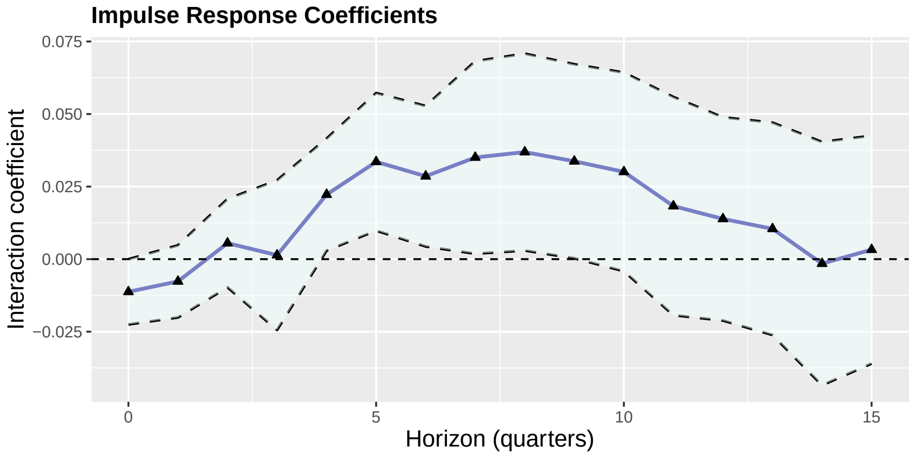

Figure D.1: The Differential Impact of Monetary Policy Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure

Notes: The figure depicts impulse response coefficients, θ^h estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^h OB_{it}^1 \eta_t + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t represents OISPRCT as defined in 5.1 and OB_{it}^1 is as in (10). The coefficient θ^h is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

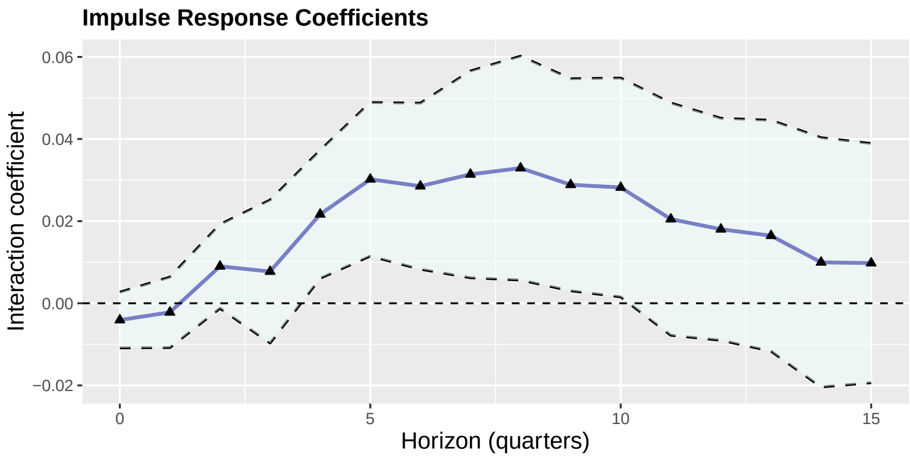

Figure D.2: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (OISPRC)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRC as defined in Section 6.1.1 and OB_{it}^1 is as in (10). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

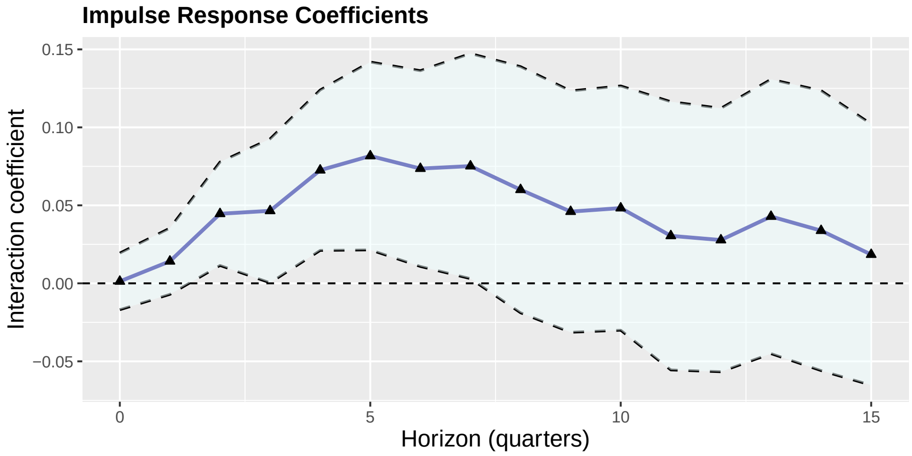

Figure D.3: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (OISPRCbins)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRCbins as defined in Section 6.1.2 and OB_{it}^1 is as in (10). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a unit increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

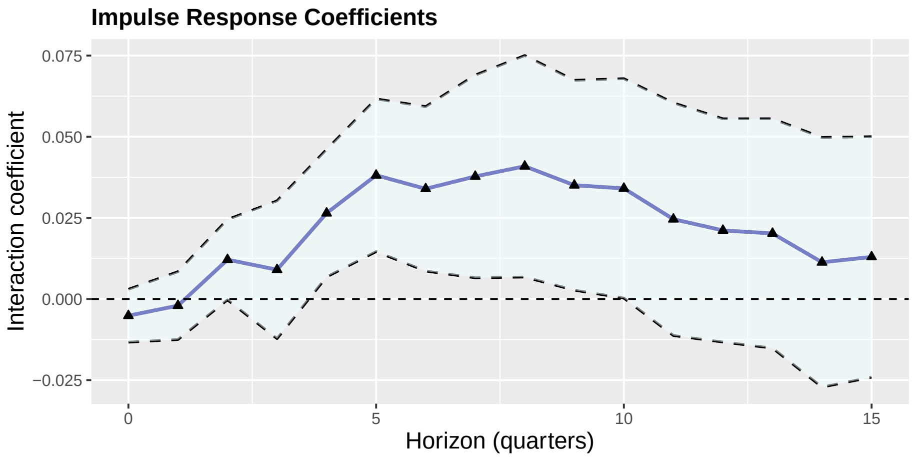

Figure D.4: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (widerPRC)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents widerPRC as defined in Section 6.1.3 and OB_{it}^1 is as in (10). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

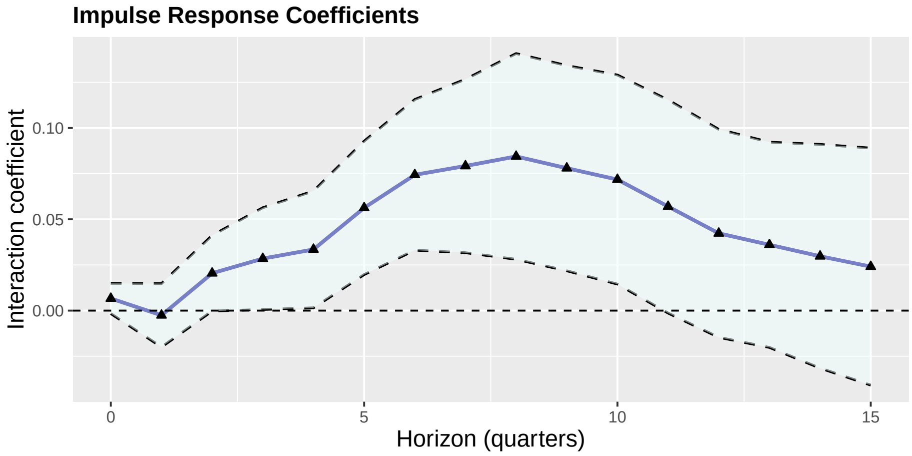

Figure D.5: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (OISPRCnom)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRCnom as defined in Section 6.1.4 and OB_{it}^1 is as in (10). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a 100 basis points increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

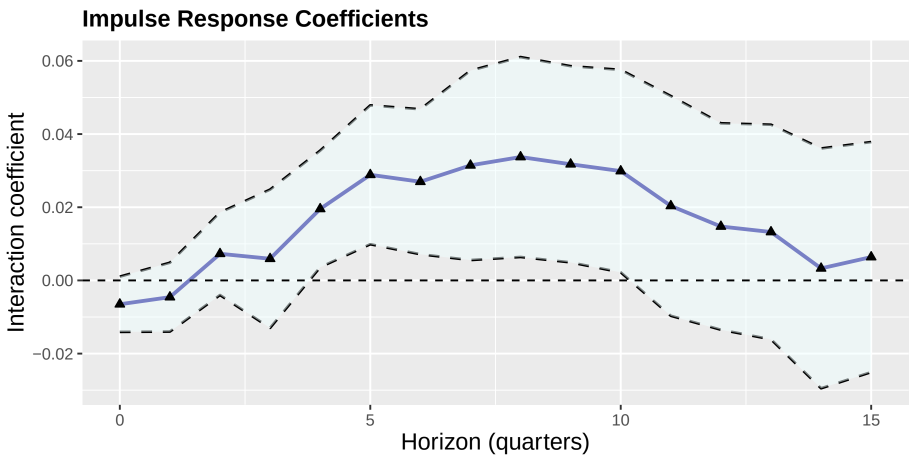

Figure D.6: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (with Bond Ratings)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB_{it}^1 is as in (10). W includes bond rating dummies along with all the firm characteristics as elaborated in Section 5.2. The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

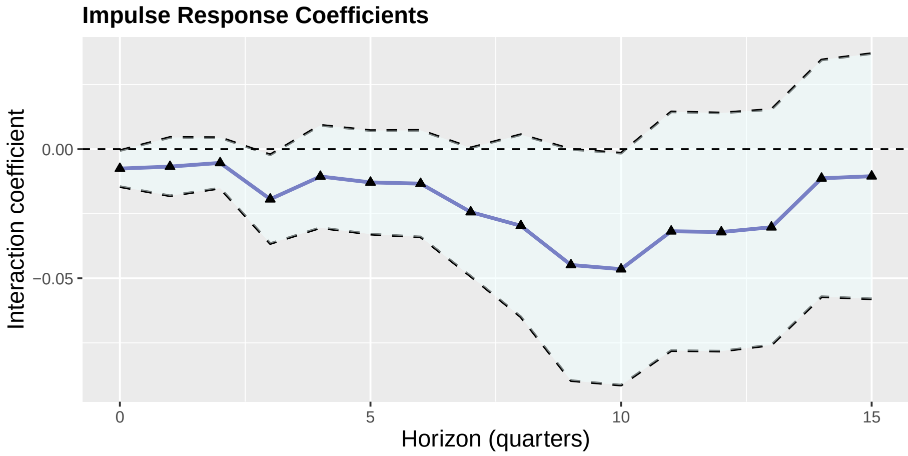

Figure D.7: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (with OB^2_{it})

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+}OB^2_{it}\eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB^2_{it} is as in (13). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

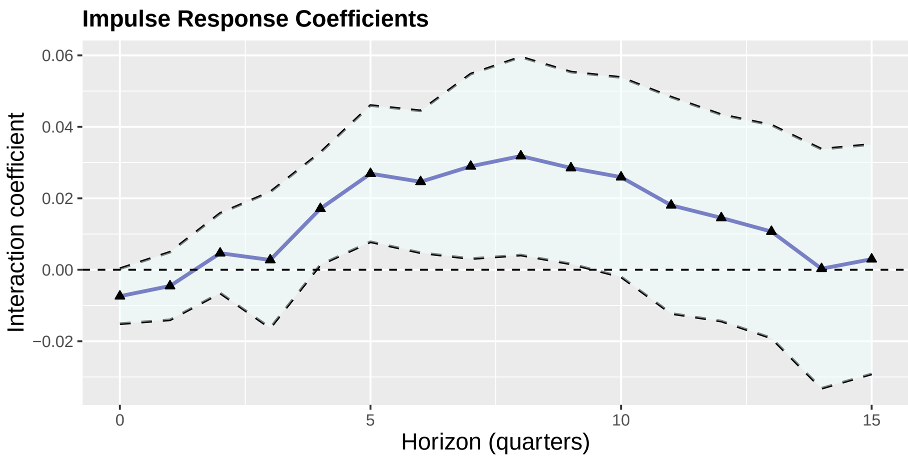

Figure D.8: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (with Tobin's q)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+}OB^1_{it}\eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB^1_{it} is as in (10). W includes Tobin's q proxied by price-to-book ratio along with all the firm characteristics as elaborated in Section 5.2. The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

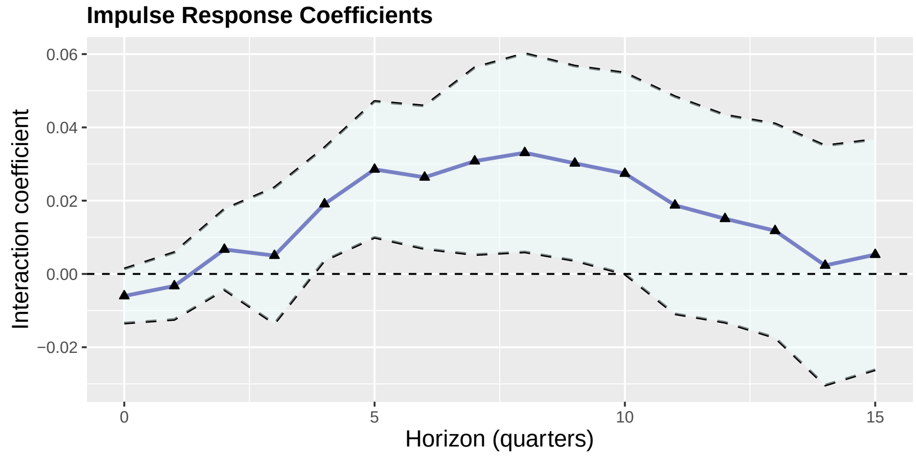

Figure D.9: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (with Sector-Specific Effects)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + \theta^{h,+} OB^1_{it}\eta^+_t + \sum_{w \in W} \alpha^h_w w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η^+_t is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB^1_{it} is as in (10). W includes sector dummies at the 2-digit level along with all the firm characteristics as elaborated in Section 5.2. The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η^+_t. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

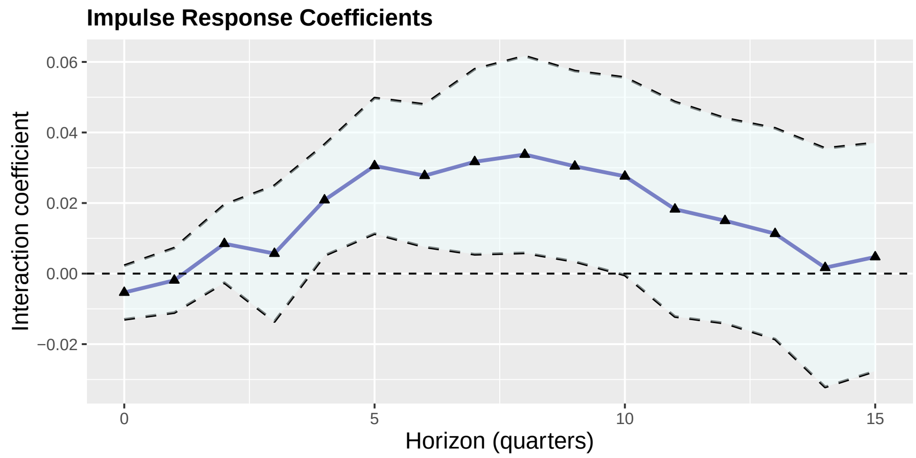

Figure D.10: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (without Top 1% Issuers)

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f_i^h + sq^h_{s,t} + \theta^{h,+} OB^1_{it}\eta^+_t + \sum_{w \in W} \alpha^h_w w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η^+_t is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB^1_{it} is as in (10). Top 1% of firms in terms of number of bond issuances are removed from the sample. The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η^+_t. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

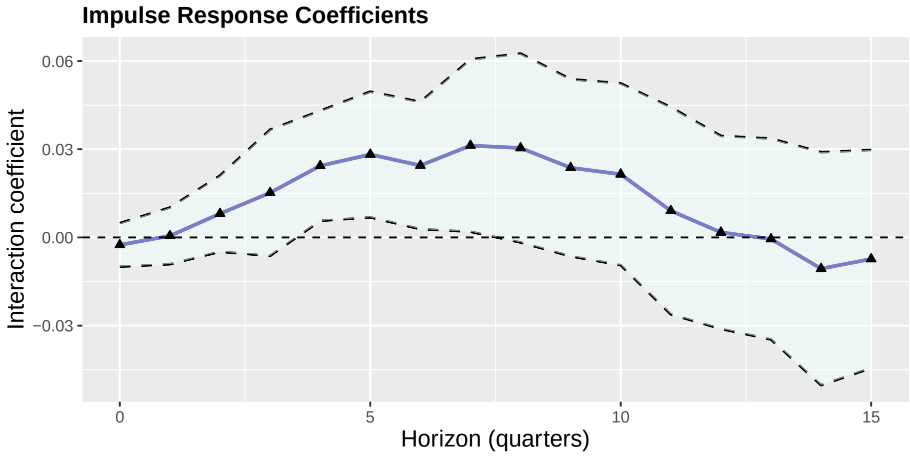

Figure D.11: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Fixed Capital Expenditure (with OB^3_{it})

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(k_{i,t+h}) - log(k_{i,t-1}) = f^h_i + sq^h_{s,t} + \theta^{h,+} OB^4_{it} \eta^+_t + \sum_{w \in W} \alpha^h_w w_{i,t-1}(1 + \eta_t) + \varepsilon_{i,t+h}$ where η^+_t is defined as in (9), η_t represents OISPRCT as defined in Section 5.1 and OB^3_{it} is as in (14). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in fixed capital expenditure following a one standard deviation increase in η^+_t. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

E Heterogeneous Inventory Investment Response to Monetary Tightening

In this section, I repeat the baseline exercise done in Section 5.3, this time for inventory investment response. I estimate equations (12) and (9) with inventories replacing the capital stock $k_{i,t}$ leading to (E.1) and (E.2) :

$$log(inv_{i,t+h}) - log(inv_{i,t-1}) = f_i^h + \gamma^{h,+}\eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h} \tag{E.1}$$

$$\begin{aligned} log(inv_{i,t+h}) - log(inv_{i,t-1}) =& f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ \\ &+ \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h} \end{aligned} \tag{E.2}$$

Estimated coefficients from (E.1) and (E.2) are reported in Figure E.1 and Figure E.2. The average effect is akin to fixed capital investment case both in terms of magnitude and statistical significance implying that monetary tightening dampens inventory investment in my firm sample. The heterogeneous effect is also at a similar level to the baseline in terms of magnitude. However, it is not as strong as what I found for fixed capital investment in terms of statistical significance due possibly to more missing values for inventories in my sample compared to PPE reducing the sample size for inventory analysis. The interaction coefficient is both positive and statistically significant 5-7 quarters following surprise tightening.

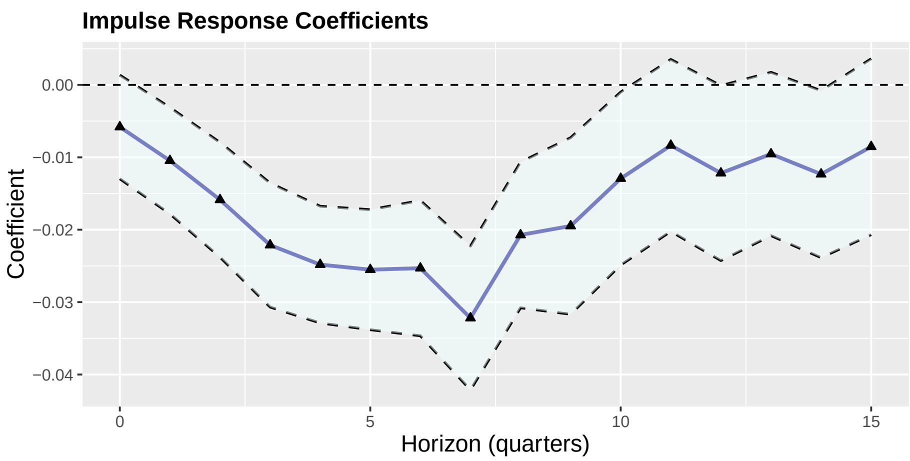

Figure E.1: The Average Effect of Monetary Tightening Surprises on Firms' Inventory Investment

Notes: The figure depicts impulse response coefficients, $\gamma^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(inv_{i,t+h}) - log(inv_{i,t-1}) = f_i^h + \gamma^{h,+}\eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1} + \varepsilon_{i,t+h}$ where η_t^+ is defined as in 9. The coefficient $\gamma^{h,+}$ is scaled so that it represents the change in inventory investment following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.

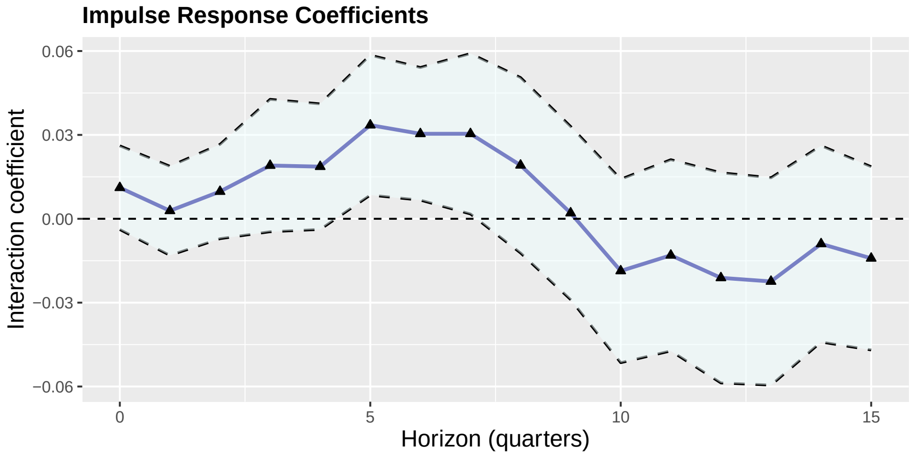

Figure E.2: The Differential Impact of Monetary Tightening Surprises on Opportunistically Borrowing Firms' Inventory Investment

Notes: The figure depicts impulse response coefficients, $\theta^{h,+}$ estimated at each forecast horizon h, from the following regression: $log(inv_{i,t+h}) - log(inv_{i,t-1}) = f_i^h + sq_{s,t}^h + \theta^{h,+} OB_{it}^1 \eta_t^+ + \sum_{w \in W} \alpha_w^h w_{i,t-1}(1+\eta_t) + \varepsilon_{i,t+h}$ where η_t^+ is defined as in (9) and OB_{it}^1 is as in (10). The coefficient $\theta^{h,+}$ is scaled so that it represents the change in inventory investment following a one standard deviation increase in η_t^+. The area between the two dashed lines represents the confidence interval at 90% level. Standard errors are clustered at firm-level.