External Finance Premium: Market Finance versus Bank Finance*

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Abstract

This paper is the first to simultaneously examine firms' market-based and bank-based external finance premia and investigate the behavior of corporate bond markets in the United States and the euro area, with a focus on country- and state-level heterogeneity in monetary unions. Using a unique micro-level dataset, we show that market finance premia, measured with corporate bond spreads, are remarkably similar in both the euro area and the US in terms of how little they depend on the issuer's state or country of origin. In neither monetary union is the transmission of monetary policy to corporate bond rates differentiated as a function of the state or country of issuer. Unconditionally, the state or country of origin of the bond issuers explains very little of the variance among corporate bond spreads, in stark contrast to bank loan spreads that are determined at the country level. The euro area corporate bond market is as integrated as the US one, contrary to conventional beliefs. The marked difference between country influences on bank loan and corporate debt spreads is not due to selection effects in bond issuing firms but owes directly to the nature of market finance.

Keywords: Monetary unions, corporate bond spreads, bank loan spreads, monetary policy transmission; firm and country heterogeneity; external finance premium; market finance; bank finance
JEL Codes: E44, E52, E58, G12, G23

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1 Introduction

One might study firms' external finance premium in the US as a function of the state of origin of the borrowing firm and expect to find no effect. One would be right. One might study the same in the euro area, focusing on the borrower's country of origin, and expect to find a strong country effect. One would be wrong. This paper substantiates these statements by showing that the premium paid by firms to access external funds depends on whether funds are sourced from banks or financial markets. Bank finance premium depends on country factors, but market finance premium does not.

For the first time, we are able to simultaneously study the behaviour of corporate bond markets in the two major monetary unions, the United States and the euro area, and to contrast the market-based with the bank-based external finance premia, the additional cost a firm incurs when raising external funds compared to the opportunity cost of holding cash. Our focus is on country or state heterogeneity within monetary unions. The questions we pose are of first order importance but have not been studied before because of the difficulty of bringing together the disparate data that are needed to provide answers. We merge granular data from a variety of sources and use information at the level of individual corporate bonds, their issuers and holders as well as information on individual bank level loans. We document several of important findings about monetary policy transmission, the behavior of corporate bond markets and financial integration in the two monetary unions, using the US as a baseline.

Using micro level data for the US and the euro area at daily frequency over the period 2006-2023 and bond-level panel regressions, we first focus on market-based external finance premium as captured by corporate bond spreads. We study the potential heterogeneity in monetary policy transmission to corporate bond spreads. For instance, would a bond issued by an Italian firm respond stronger to the common monetary policy surprise than its German peer? Conversely, would a bond issued by a Californian firm respond stronger to a Fed monetary policy surprise than its New York peer? We find no differentiated effects. The transmission of monetary policy to corporate bond spreads is homogeneous across bond issuers located in different states or countries in both monetary unions. This may not come as a surprise for the US, but it is surprising in the case of the euro area where discussions on financial fragmentation risks impairing the transmission of monetary policy are recurrent.

Delving deeper, we study whether the irrelevance of issuer state/country of risk applies beyond monetary policy transmission. In both economies, the country or state of the issuers explain a negligible share of the unconditional variance of corporate bond spreads. The country or country-time fixed effects explain less than 10% of the bond spread variance not only in the US but also in the euro area. In the euro area this is in stark contrast to bank loan spreads, which are strongly determined at the country level, as shown by the recent work of Altavilla, Gürkaynak, and Quaedvlieg (2024). While banking remains country dependent, the corporate bond market in the euro area is as integrated as that of the US, contrary to conventional wisdom.

Whether this integration is due to the nature of the bond market or to the bond issuing firms themselves is a fascinating question. We provide an answer by studying the bank-based external finance premium of the same set of (bond issuing) firms. Are these firms' bank loan spreads also independent of their countries of operation? To this end, we add information on the bank loan spreads of these firms using proprietary data from the euro area credit registry, AnaCredit. This is a dataset containing detailed information on individual bank loans in the euro area, harmonised across all member states. We also add bond-level data on the investor composition, the type and nationality of bond holders, with proprietary data from the ECB Securities Holdings Statistics by Sector (SHSS) database.

We find that bank loan spreads of the bond issuing firms are similarly determined as those of other firms, at the country level. This in turn implies that our findings are primarily due to properties of the corporate bond market rather than to bond-issuing firms' specific characteristics. Using security-level data on the ownership structure of corporate bonds, we show that euro area corporate bonds are held by geographically diversified investors. The euro area corporate bond market is less prone to home bias and to potential negative feedback loops with the sovereign bond market, in contrast to the banking system.

Overall, we find that the euro area corporate bond market is *as integrated as* that of the United States. In both monetary unions, monetary policy transmits homogeneously across bond issuers independently of their country or state of origin. We also show that euro area firms' bank-based external finance premium depends on country factors, but their market-based external finance does not. From a policy perspective, the European Union policy initiative to complete the capital markets union has already been successful for the corporate bond market. But this market remains smaller than the US one and making it easier for euro area firms to issue corporate debt will make them financially less dependent on their countries of operation.[1]

Our paper relates to several strands of literature. It relates to the literature on the external finance premium, the additional cost a firm incurs when raising external funds compared to the opportunity cost of holding cash. Here the traditional metric used is the bond premia, since bond interest rates are readily available but bank lending rates are not easily observed (Gilchrist and Zakrajšek (2012) and Gilchrist and Mojon (2018)). A recent exception is Altavilla et al. (2024) who look empirically into the bank loan spreads of euro area firms using AnaCredit data. They find that euro area country heterogeneity matters for bank-based external finance premium: bank loan spreads are strongly determined at the country

[1] See the European Commission report on the future of European competitiveness (2024) and Allen and Yago (2010), as well as T. Beck, Demirguc-Kunt, Laeven, and Levine (2008).

level with country-by-time fixed effects capturing half of the variation in spreads. Our unique dataset enables us to contrast for the first time in the empirical literature the market-based with the bank-based external finance premia of firms and allows focusing on country heterogeneity within monetary unions using granular data.

Our paper also closely relates to the nascent literature on the role that heterogeneity and financial frictions play in the transmission of monetary policy. These studies show that heterogeneity in firm fundamentals and financial frictions play an important role in the transmission of monetary policy (Alder, Coimbra, and Szczerbowicz (2023); Anderson and Cesa-Bianchi (2024); Chiţu, Grothe, Schulze, and Van Robays (2023); Gürkaynak, Karasoy-Can, and Lee (2022); Ottonello and Winberry (2020); Palazzo and Yamarthy (2022)).[2] Most of these studies focus primarily on the United States. Less is known of monetary policy transmission in other economies, on which the literature using micro-level evidence is limited.

We focus on corporate bond spreads as they incorporate forward-looking information on investor risk appetite, have predictive power for future economic activity, while also reflecting the risk-bearing capacity of the financial sector (see e.g. Anderson and Cesa-Bianchi (2024); Gilchrist and Zakrajšek (2012)). This in turn also allows us to enhance our understanding of the bond lending channel (Darmouni, Giesecke, and Rodnyansky (2022)) of monetary policy. As the main alternative to bank loans for long-term investment financing, debt securities, particularly corporate bonds, are closely linked to economic activity and are therefore especially important in the transmission of monetary policy. Recent studies such as Ivashina, Kalemli-Ozcan, Laeven, and Müller (2024) show that corporate debt plays a key role in explaining boom-bust cycles, financial crises, and slow macroeconomic recoveries.[3]

We show that the US and euro area corporate bond spreads are very similar in terms of how little they depend on the issuer's state or country. Unconditionally, states/countries of residence explain almost none of the variance in corporate bond spreads. Conditionally, monetary policy surprises do not produce heterogeneous responses in these dimensions either. Our paper therefore also relates to the classic literature on optimal currency areas pioneered by the seminar work of Mundell (1961) and revisited more recently by Silva and Tenreyro (2010), which suggests that, in contrast to the United States, the euro area is much more heterogeneous and hence subject to asymmetric shocks (Friedman (1997); Krugman (2013)) and financial fragmentation (Fornaro and Grosse-Steffen (2024)). At the same time, a common currency should increase trade, including trade in assets, and thereby foster financial

[2]These studies find that firm characteristics such as leverage, liquidity, distance-to-default and age play a role in monetary policy transmission (Jeenas (2019); Ottonello and Winberry (2020) or in the transmission of jointly identified global risks and monetary policy shocks (Chiţu et al. (2023)).

[3]Cappiello et al. (2021); Darmouni and Papoutsi (2022) provide evidence on the rapid rise in corporate bond financing.

integration and deeper and more liquid financial markets (Ingram (1973)). Our findings are in line with this prediction. While the euro area financial markets still lack the depth and liquidity of the US one, our results suggest that they share similarities with the US in terms of the degree of integration when it comes to corporate bonds.

As one of our main variables of interest is the corporate bond spread, firms' market-based external finance premium, our paper also relates to the literature on bond pricing and the valuation of risky debt, a central question in corporate finance pioneered by Black and Scholes (1973) and Merton (1974). Their structural approach models the stochastic evolution of a firm value over time and derives the firm probability of default as a function of the value of its assets and liabilities.[4] Merton (1974) introduced the *distance-to-default* model, which measures how many standard deviations a firm is away from default using option pricing theory. This distance can be translated into a default probability, as Moody's CreditEdge does for its Expected Default Frequency metric, a variable which we also use here to capture firms' default risk, as discussed in more detail below.

More recently, building on Merton (1974)' distance-to-default, Gilchrist and Zakrajšek (2012) introduced the concept of excess bond premium, i.e. the component of corporate bond spreads that is not directly attributable to expected default risk, showing that the excess bond premium is an effective measure of risk appetite in the corporate bond market and has the ability to predict the probability of a US recession. Our findings show that almost half of the variance of spreads is explained by firm specific fundamentals as captured by distance-to-default, in line with the structural models of corporate debt valuation.

2 Data and descriptive statistics

Our data comes from a variety of sources, including several proprietary datasets. Having access to these sources enables us to construct a uniquely comprehensive, granular dataset on corporate bond markets for the two most important corporate bond issuers worldwide, the euro area and the United States. The dataset merges bond-level characteristics such as maturities, issuance sizes and daily prices with (i) balance-sheet information of the issuer firm and the firm's country or state of operation, (ii) the types

[4] A second generation of structural models have tried to include additional risk factors besides default, such as information asymmetries, liquidity risk, counterparty risk and changes in macroeconomic conditions, to provide more accurate estimates of the fair value of corporate bonds (Chen, Lesmond, and Wei (2007)). Most studies point that a major limitation of structural models is that they significantly overpredict the value of corporate bonds, and thereby under-predict the level of corporate spreads, particularly in crisis times, a feature known in the literature as the *credit spread puzzle*. Other studies find more mixed evidence. Schaefer and Strebulaev (2008), for instance, present micro-level evidence showing that even the simplest structural default model accounts well for default risk of corporate bonds.

and domiciles of the bond holders and (iii) the bank loan rates paid by the bond issuing firms, if the firm also has bank loans. The baseline dataset focuses on non-financial corporations. In extensions, we also construct a database for financial firms, including banks, comparing their bond spread behavior to those of non-financial corporations.

2.1 Data

2.1.1 Firms and bonds

We begin by constructing a detailed, bond level dataset for the euro area and the US by matching senior unsecured corporate bonds traded on the secondary market with balance sheet characteristics of the issuers and the issuers' country or state of operations. To do so, we first select corporate bonds using the Intercontinental Exchange-Bank of America Merrill Lynch (ICE-BofAML) Global Index System. Our focus is on the bonds covered by the Global Corporate Index (G0BC) and the Global High Yield Index (HW00), which report only liquid bonds so as to prevent pricing errors.[5] We then complement the bond-level information from ICE BofAML with Bloomberg and Moody's CreditEdge data. Next we combine the daily bond-level information with annual firm-level balance sheet data from LSEG Datastream and Orbis. Finally, for euro area companies we are able to match each firm to its bank loans by drawing on Anacredit, the credit registry of the European System of Central Banks, providing information at a monthly frequency on individual bank loans above €25,000 to firms.

We focus on senior unsecured bonds issued in domestic currency (euros in EA, dollars in the US) by non-financial firms. We consider corporate spreads constructed from daily data on the prices of senior unsecured corporate debt traded in the secondary market over the period 2006-2023 issued by about 2,000 US and 400 EA non-financial corporations. We also apply an additional filter at the level of the sector in which the bond-issuing firm operates, removing those in Auto Loans and Real Estate Investment Trusts (REITs), which are functionally financial firms.[6] This is a much larger dataset than assembled before in terms of its coverage of firms and contains more information on issuers and holders than available before in the literature. In extensions, we also consider a larger sample encompassing bonds in lower, speculative tranches, as well as bonds issued by financial corporations, including banks.

[5]ICE-BofAML qualify bond securities only when they have (1) a rating provided by S&P, Fitch and Moody's, (2) more than 1 year to maturity, (3) at least 18 months to maturity at issuance, (4) a fixed coupon schedule. ICE Bond Index Methodologies (2023) has more details.

[6]ICE-BofAML states that the Auto Loans sub-category is comprised of debt issued by captive finance subsidiaries of automobile manufacturers. REITs sub-category is comprised of debt issued by companies engaged in real estate as an investor, with a portfolio of properties managed for income and capital appreciation.

We use option adjusted spreads for both the euro area and the US as many of these securities are callable after a fixed period. The spreads are to Treasury yields of matching maturity, as computed by Moody's CreditEdge. For the euro area, we also construct corporate spreads by subtracting from the bond yield either the overnight index swap (OIS) rate of matching maturity as our baseline, or the German Bund yields of matching residual maturity, which we use in robustness analysis.

The country assignment of a bond-issuing firm follows the ICE BofAML and is based on the physical location of the issuer's operating headquarters. Bonds issued by holding companies are assigned to a country based on the location of the majority of operating assets (also known as country of risk). If no single country represents a majority of operating assets, or if this cannot be determined, the country is the issuer's operating headquarters.[7] It is important to emphasise that ICE BofAML is the sole data provider assigning bonds a country of residence and this is not the country where the bond was issued, but the country of operations of the bond *issuer*. This is a crucial element for the questions studied here, allowing us to circumvent potential issues related to the so-called Onshore/Offshore Financial Center (OOFC) countries, as we discuss in more detail below. We use Orbis to apply a similar definition when assigning a US state to the US bond issuing firms.

For the euro area, we can further compare the country assignment from ICE BofAML to the one in the Centralised Securities Database (CSDB) compiled by the European System of Central Banks. In this case however, bonds are assigned to the countries where bonds are issued and not to the country of residence of the firm. There are indeed bonds that are assigned to a different country in CSDB compared to the ICE BofAML. This is related to what R. Beck et al. (2023) call the Onshore Offshore Financial Centers (OOFC) countries, i.e. Ireland, Luxembourg and the Netherlands. They point out that these countries have dual roles both as hubs of investment fund intermediation and as centers for securities issuance by foreign firms and may overstate the degree of financial integration in the euro area.[8] Reassuringly for our case, the ICE-BofAML country classification overcomes this issue, as bonds are assigned according to the issuer's operating headquarters and are not assigned to the country where the bond was issued.[9]

[7]For more details, see ICE Bond Index Methodologies, 2023. Our results are insensitive to dropping the few firms' bonds for which the country of risk is fuzzy.

[8]The results of R. Beck et al. (2023) could perhaps be nuanced when one takes into account not only potentially more favorable regulatory and withholding tax regimes in the OOFC jurisdictions, but also the potential role that custodians or Central Securities Depositories (CSDs) may play in enabling European companies to access a vast investor community. (Euroclear White Paper, 2024, is informative about this.) Netherlands, for instance, is home to one of Euroclear local CSDs, which may artificially overstate its role as an OOFC. There is little research on the role of custodians in facilitating financial integration yet.

[9]Many bonds that may potentially pose this problem are bonds issued by auto loan companies and REITs, which we do not utilize. We also show robustness to dropping all bonds for which ICE-BofAML

Overall, after filtering and matching bond-level data with balance sheet information of their issuers, our baseline dataset comprises 21,137 USD-denominated bonds issued by 1,986 US non-financial corporations and of 3,957 EUR-denominated bonds issued by 375 EA non-financial corporations.[10] We will show below that differences between issuance intensities of US and EA firms do not drive any of our results on the comparison between the two economies. Within the euro area, our sample comprises 1,200 bonds issued by 102 French firms, 975 German bonds issued by 86 German firms, 350 bonds issued by 39 Italian firms and 279 bonds issued by 30 Spanish firms.

2.1.2 Countries, states, and monetary policy surprises

Our baseline sample includes the 20 euro area countries in changing composition, i.e. countries gradually joining the euro area over the course of our sample period.[11] In robustness, we also consider only the largest ten euro area countries or a sample including the euro area in fixed composition, i.e. euro area composition as of 2006, the beginning of our sample. For the United States, we use all US states. The assignment of a firm to a euro area country of US state is done as explained in the sub-section above.

We use the monetary policy surprises of Jarociński and Karadi (2020) that split pure monetary policy from central bank information surprises and, importantly for our purpose here, are available for both the US and the EA. These surprises are inferred from variations in the front end of the risk-free yield curve, capturing therefore primarily standard rate setting and forward guidance shocks rather than quantitative easing. According to the methodology of Jarociński and Karadi (2020), monetary policy shocks are separated from contemporaneous information shocks by analyzing the high-frequency co-movement of interest rates and stock prices in a narrow window around the policy announcement. A pure monetary policy tightening leads to lower stock market valuation, since the present value of future dividends declines on account of the higher discount rate and declining expected dividends with the deteriorating outlook caused by the policy tightening. Jarociński and Karadi (2020) therefore identify a monetary policy shock through a negative co-movement between interest rate and stock price changes. In contrast, the central bank information shock is identified when interest rates and stock prices co-

and CSDB country assignments differ.

[10]Similar to Anderson and Cesa-Bianchi (2024), we apply the following filters to the bonds available in the G0BC and HW00 indices from ICE-BofAML: senior unsecured securities; with an International Securities Identification Number (ISIN); issued by non-financial companies (excluding auto loans and REITs), whose country of risk is located in the US or in the euro are; denominated in euro for euro area companies, and in US dollars for US firms; with face value of at least 150 million Euro or US dollars; with residual maturity between one and 30 years; with an option-adjusted spread between 5 and 3500 basis points.

[11]Croatia became an euro area member on 1 January 2023 towards the end of our sample, therefore our sample has very few Croatian bonds included.

move positively. We are interested here in the pure monetary policy surprises, purged from central bank information, which are therefore directly comparable to shocks to monetary policy rules in standard models. Appendix figures A.1 and A.2 illustrate the decomposition of ECB and Fed surprises into pure and information surprises. In some of our specifications, we will also use the largest ECB and Fed surprises which are illustrated in the Appendix figures A.3 and A.4, respectively.

In robustness tests, we also use the monetary policy surprises of Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019), which are available only for the EA. The authors map ECB policy communication into yield curve changes and study the information flow on policy dates, identifying a target, timing, path (or forward guidance) and quantitative easing surprises. They show the prevalence of target surprises in the press release window. In the press conference window, the path (forward guidance) and QE surprises dominate and a different factor emerges, which they call timing. According to the authors, this type of surprise captures the revision of policy expectations by shifting the expected policy action between the current meeting and the next or the one following, in a way that leaves longer-term policy expectations almost unchanged. In essence, market participants extract two distinct types of guidance from the press conference. One that is informative about the medium run, peaking at about two years (i.e. forward guidance) and one for the near future, peaking at about six months maturity, which the authors call timing. We will use the target, timing and forward guidance surprises in robustness.

2.2 A first look at the data

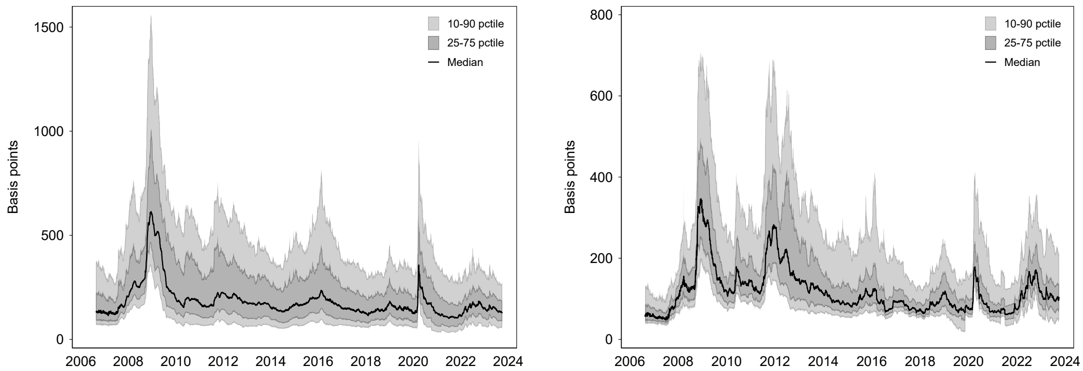
Figure 1 plots the median spreads in the EA and the US together with the 25th and 75th percentiles from our dataset. Heterogeneity in both time series and cross-sectional dimensions are evident. Global Financial Crisis and the Covid pandemic are visible as spikes in corporate bond spreads in both economies, with the EA figure also showing the effects of the European crisis. It is noteworthy that while the EA spreads have been more volatile, US spreads have been higher, especially at the higher-end of the spread distribution in crisis times. This point chimes with the findings in Cesa-Bianchi and Eguren Martin (2021) who document that in crisis times USD denominated bonds increase by more than non-USD denominated bonds, which is explained by the US dollar hegemony in the international financial system, its superior liquidity and its dominance as a funding currency. [12]

Figure 2 shows that in the euro area the distributions of bond issuing firms by size are generally

[12]More particularly, the authors document a 'dash for dollars' in corporate bond markets during the Covid-19 turmoil period. Within-firm variation of corporate bond spreads and transaction volumes reveals that US dollar-denominated bonds experienced larger spread increases and selling pressures relative to non-dollar bonds, as investors sold their dollar-denominated assets to meet immediate dollar obligations.

Figure 1: Option adjusted spreads

(a) US　　　　　**(b)** EA



Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The figures plots the panel of daily corporate bonds spreads in basis points for the US (panel a) and the EA (panel b) over 2006 to 2024.

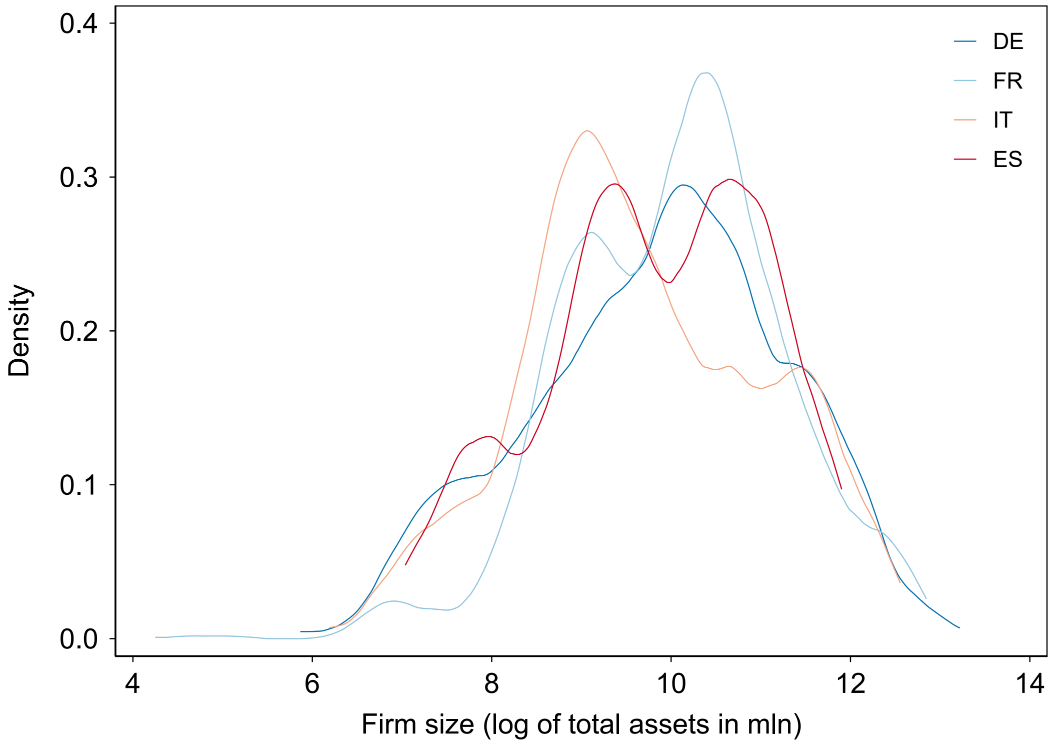
similar across the largest euro area countries. Importantly, the figure shows that, contrary to what one may expect, Italian or Spanish firms do not have to be larger than German ones to be able to issue bonds.

The median corporate bond across major EA countries has a size between 600-750 million euros, between a 7- to 8-year maturity, a BBB1 or BBB2 credit rating, and trades between a 133 to 186 basis point spread. The median bond issuing firm across major EA countries has a low probability to default (as measured by the expected default frequency, sourced from Moody's CreditEdge, based on Merton's distance-to-default, see section 2 above for details) over the one-year horizon, has assets between 15 and 27 million, has between 8 to 11 bonds outstanding on an average day with some firms in the largest countries having more than 40 bonds trading on a given day.

It is important to note here that there are almost five times as many traded corporate bonds in the US compared to the EA.[13] In the US, the median corporate bond has a size of about 450 million dollars, but there are also bonds of more than 15 billion dollars (the so-called jumbo bonds). The median US corporate bond has a 10-year maturity and a spread of 160 basis points. The median bond issuing US firm has about 7 million dollars of assets, a low probability to default over the one-year horizon of about 0.13 percent (albeit higher than the median European firm whose expected default probability ranges

[13] For instance, on 16 December 2021 there were about 6038 traded corporate bonds for the US and 1240 ones for the EA. Naturally, the number of bonds are much larger than the number of firms issuing them. On that day, the traded non-financial corporate bonds in our sample were issued by 844 firms in the US and 222 firms in the EA.

Figure 2: Distribution of euro area firms by size



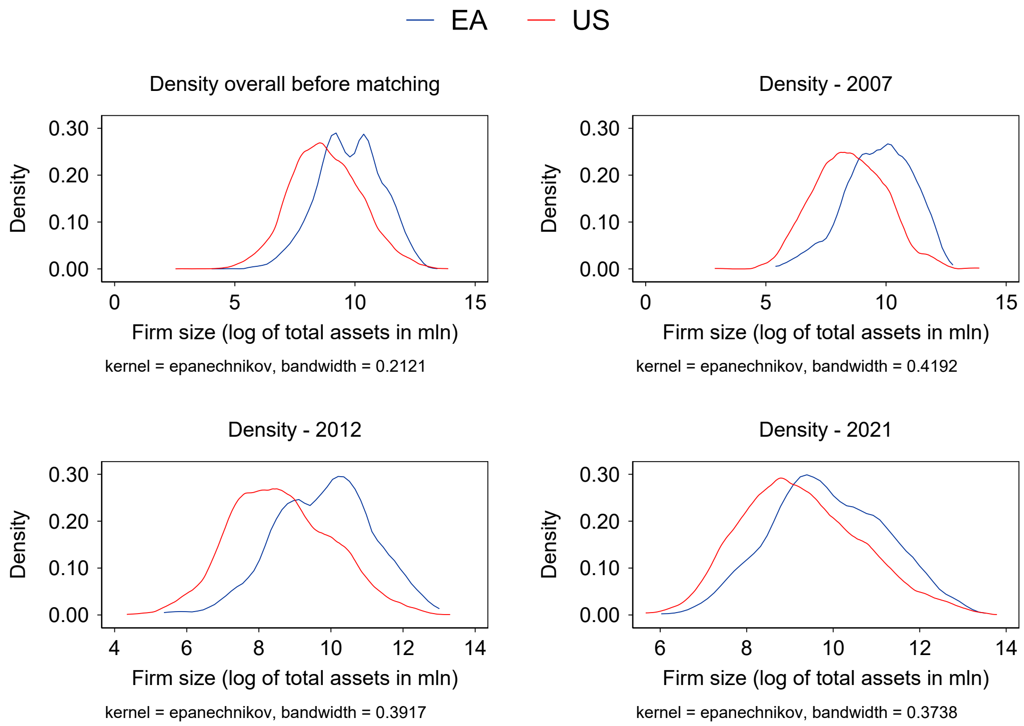
Sources: ICE BofA Merrill Lynch, LSEG and authors' calculations.
Notes: The chart shows the distributions of firms in the big-4 euro area countries by size, measured as log of total assets, over the sample.

between 0.04 to 0.10 percent), has 10 bonds outstanding on an average day, with some firms having more than 100 traded bonds.[14] Tables B.1 and B.2 in the Appendix provide detailed information and summary statistics on bonds and bond-issuing firms for the sample that excludes junk bonds. Tables B.1 and B.2 also in the Appendix provide similar information and summary statistics on bonds and bond-issuing firms for the extended dataset that includes also junk bonds, with figures A.8 to A.12 examining the heterogeneity of corporate bond spreads and firm default risk across major euro area countries.

Statements about the similarities and differences between corporate bond spreads in the US and EA are necessarily conditional on distributions of bond issuing firms in the two economies. Figure 3 shows

[14]The firms having a large number of bonds traded on an average day may be those that are most financially sophisticated, as in Mota and Siani (2023). According to this study, some firms strategically use bond issuance and issuance of particular types of bonds not only to minimize their cost of capital but also to diversify their investor base. Investor specialization in certain bond characteristics allows firms to effectively shape their bondholder composition through issuance decisions.

Figure 3: Distributions of EA and US bond issuing firms by size



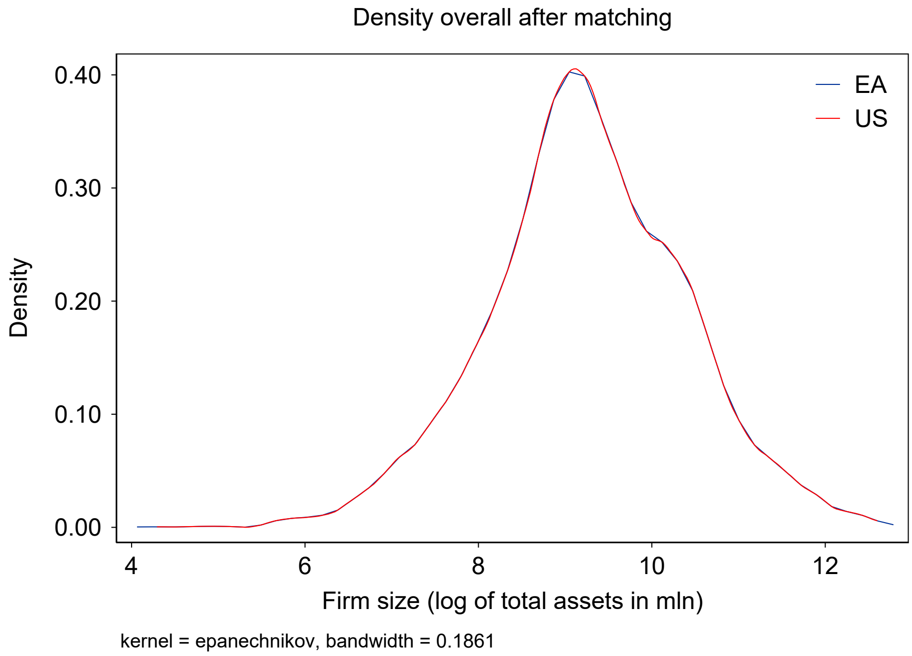
Sources: ICE BofA Merrill Lynch, LSEG and authors calculations.
Notes: The figure shows the kernel density of bond issuing firms' sizes as measured by log of total assets (expressed in millions of euros) in the EA and the US pooled over time and at the beginning of the sample in 2007, during the EA crisis in 2012, and towards the end of the sample in 2021, for each fiscal year.

these distributions pooled across time and on three selected dates. The figure plots the kernel density of firm sizes as measured by the log of total assets in the EA and the US. The US is a relatively more bond-based economy than the EA hence the larger incidence of smaller firms issuing bonds there, seen in the pooled data shown in panel (a) is not surprising. Strikingly, this observation in the pooled data masks significant changes over time. While early in the sample (panel (b)) smaller EA firms did not issue bonds at all, more recently (panel (d)) issuance by smaller EA firms have essentially caught up with their US counterparts.[15] At the other end of the distribution, there are no EA firms with comparable sizes to US superstar firms such as Amazon, hence the US distribution continues to have a more pronounced

[15]This echoes findings by Darmouni and Papoutsi (2022) and Cappiello et al. (2021).

right skew.[16]

Figure 4: Distributions of US and EA firms by size after applying a matching algorithm



Sources: ICE BofA Merrill Lynch, LSEG and authors calculations.
Notes: The chart shows the kernel density of firms by size measured as the log of total assets in EUR mln in the EA and the US after applying a matching algorithm using a caliper of 5 mln EUR in order to find the closest US match for an EA firm.

To show that our results are not due to issuing firm size distribution differences between the EA and the US, we will also perform our analysis on samples where the size distributions are the same as a robustness test. To construct these samples we take the EA distribution (which has fewer firms and a narrower distribution) and for each EA firm find the nearest matching US firm by size, as long as the best match is within 5 million euros by assets. We drop the unmatched firms in both economies. The resulting firm size distributions are shown in Figure 4. By design, we have almost identical size distributions in the two economies. This matched sample has 208 EA firms matched with 400 US firms, but more bonds in the US as US firms issue more bonds (we have 4,974 US bonds vs. 1,552 EA bonds). We will show

[16] Many US companies, particularly well known blue chips, have engaged in bond mega deals of at least 10 billion dollars, the so-called jumbo bonds, since 2015 .

below that our results are essentially the same if we condition on this sample. Size differences of bond issuing firms between the EA and the US do not drive our results.

3 Conditional analysis: Transmission of monetary policy to corporate bond spreads

Our main object of interest is the euro area where heterogeneity at the level of countries is an ongoing concern for policymakers. Altavilla et al. (2024) show that half of the variance in bank loan rate spreads over OIS in the euro area are common at the level of countries, justifying the attention paid to this level of aggregation. They also show heterogeneity in the transmission of monetary policy to bank loan spreads. Here, we focus on corporate bond spreads and use the US as a baseline where the monetary union is a mature one with integrated capital markets. We will compare the country-level differences for corporate bond spreads in the EA to state-level differences in the US.

We begin with the conditional analysis and ask to what extent differences in country or state of origin affects monetary policy transmission to corporate bond spreads. Corporate bond spreads can be decomposed into expected default risk and an excess bond premium, with the latter component essentially capturing investors' risk appetite, as suggested e.g. by Gilchrist and Zakrajšek (2012). Therefore, we consider two main channels through which monetary policy shocks transmit to corporate bonds spreads.

A first channel is expected default risk. A surprise monetary policy tightening results in tighter financing conditions, which makes servicing corporate debt more challenging. Tighter financing conditions may also hurt future earnings, hence increasing the probability of firm default. Investors may require higher compensation for holding riskier corporate bonds as a result, in turn leading to wider credit spreads (see e.g. Anderson and Cesa-Bianchi (2024)).

Another channel is risk appetite and the excess bond premium. A surprise monetary policy tightening results in an increase in the risk premium component of bond spreads, i.e. the extra yield over risk-free rates not directly attributable to expected default risk. One would expect that the state of a bond-issuing firm in the US does not matter for transmission of the Fed's monetary policy but may expect the country of a euro area bond-issuing firm to matter for transmission of the ECB's monetary policy for various reasons. The euro area is conventionally regarded as not a an optimal currency area given the absence of a fiscal union and limited capital and labor mobility across EA countries (see also e.g. Fornaro and Grosse-Steffen (2024)). And various frictions, such as heterogeneity in corporate tax regimes, legal systems, trading and post-trading infrastructures, contribute to possible fragmentation of euro area financial markets along national lines. Moreover, sovereign ratings vary widely across euro area countries. For instance, some countries like Germany, the Netherlands and Luxembourg have a top notch AAA-rating, while others have below or just above investment-grade ratings (e.g. BBB for Italy and BBB- for Greece). Heterogeneity in sovereign ratings, coupled with the so-called sovereign ceiling, the conventional assumption that firms cannot be better rated than their own sovereign, may encourage investors to demand higher compensation for holding corporate bonds issued by firms based in euro area countries with lower sovereign ratings, with less favorable tax regimes, legal systems or that are simply harder to trade across national borders.

The differential effect of ECB policy on euro area sovereign yields is well studied and documented (e.g. Altavilla, Canova, and Ciccarelli (2020); Demir, Eroğlu, and Yildirim-Karaman (2022); Eser and Schwaab (2016); Von Borstel, Eickmeier, and Krippner (2016)), with policymakers also paying close attention to country heterogeneity.[17] We will now ask whether national differences translate to monetary policy differentially affecting corporate bond spreads as well.[18] We will begin by establishing the US baseline by analyzing the effect of issuer's state on corporate bond spread responses to Fed policy surprises and then will compare the euro area results to this baseline.

Empirical framework. Given the nature of our data and question of interest, an event study methodology serves us well. We estimate a regression equation of the form:

$$\begin{aligned}\Delta y_{ijsc,t} =& \beta_1 \left(\varepsilon_t\right) + \beta_2 \left(\varepsilon_t \times \mathbb{1}_{ij}^{\text{low-rated sov.}}\right) + \beta_3 \mathbb{1}_{ij}^{\text{low-rated sov.}} + \\ & \gamma \boldsymbol{Z}_{ij,t} + \alpha_i + \alpha_j + \alpha_s + e_{ijsc,t},\end{aligned} \tag{1}$$

where changes in spreads over a one-week window, t, of bond i issued by the firm j belonging to sector s in country or state c around FOMC/ECB announcements, $\Delta y_{ijsc,t}$, are regressed on monetary policy surprises, ε_t, interacted with a dummy, $\mathbb{1}_{ij}^{\text{low-rated sov.}}$, which is equal to 1 if the bond-issuing firm is located in a lower-rated country or state. Lower-rated states or countries refer to US states or EA countries whose ratings are below AA throughout our sample.[19] We also add a vector of control variables, $\boldsymbol{Z}_{ij,t}$,

[17]To this end, the ECB Governing Council approved in July 2022 the establishment of the Transmission Protection Instrument (TPI) to support the effective transmission of monetary policy smoothly across all euro area countries. Subject to fulfilling established criteria, under TPI, the Eurosystem will be able to make secondary market purchases of securities issued in jurisdictions experiencing a deterioration in financing conditions not warranted by country-specific fundamentals, to counter risks to the transmission mechanism to the extent necessary.

[18]Remember that corporate bond spreads are over OIS so are not mechanically affected by sovereign spreads.

[19]This specification is varied in robustness tests by changing the classification of countries. In the baseline, the sample includes the 19 euro area countries in changing composition, i.e. including countries gradually joining the euro area over the course of our sample period. Results remain robust if one considers the euro area in fixed composition, i.e. euro area composition as of 2006, the beginning of our

including firm default risk, as captured by Moody's Expected Default Frequency measure, and bond ratings. We leverage the granularity of our dataset to control for unobserved heterogeneity with bond, firm and sector-level fixed effects. We are interested in the interaction coefficient β_2 to gauge whether spreads react more strongly for firms of similar characteristics but located in lower-rated countries or states.

Similar to Anderson and Cesa-Bianchi (2024), we consider in the baseline specification one-week changes in the spread from the day before FOMC/ECB surprises to five trading days after the announcement to take into account the fact that corporate bond markets may take time to react depending on their degree of liquidity. We vary the window in robustness tests and consider either shorter or longer windows of up to 10 days after the announcement, as in Gertler and Karadi (2015) and Gilchrist, Wei, Yue, and Zakrajšek (2024).

3.1 Monetary Policy transmission to corporate bond spreads in the United States

Table 1 reports the result of estimating equation (1) for the US, our baseline. It shows that the estimated effect of a one basis point contractionary monetary policy surprise in the full sample leads to a 0.9 basis points increase in corporate bond spreads on average in the US. This estimated coefficient is similar to what is found by Anderson and Cesa-Bianchi (2024) and suggests that the cost of external finance of firms rises by more than the risk free rate following a monetary policy tightening. (Remember that we are looking at spreads so no effect would imply corporate bond yields moving in lock step with the policy rate and a positive coefficient implies spreads changing in the same direction of the base effect.) Column (3) of Table 1 shows that the coefficient is slightly lower although of same statistical significance when multidimensional fixed effects at the bond, firm and sector levels, as well as further control variables (i.e. firm specific expected default risk and bond-level ratings) are added.

Turning to our object of interest, differentiating borrowers by their state of origin does not make a material difference in how spreads react to monetary policy. The interaction coefficient of monetary policy surprise with the dummy on whether the firm is located in a lower-rated state is not statistical significant, as reported in columns (2) and (4) of Table 1. This in turn suggests that there is no segmentation by geography in the US and the corporate bond market is highly integrated, as one would have expected.

sample. We also considered a specification where core countries are only the stable-AAA-rated countries that kept their AAA-rating throughout the sample period (Germany, Luxembourg and the Netherlands), with the remaining countries constituting the periphery group. Our results do not change.

It is worth noting that not only is the interaction term statistically insignificant, it is also order of magnitude smaller than the base effect. Further, we find this result even when not controlling for any issuing firm characteristics and fixed effects, hence the insignificance is not due to collinearity between the state and resident firm characteristics. This is a strong result. The low R^2 is expected given the noise in the fixed income market, especially when one is using week-long event windows as here.

Table 1: Corporate bond spreads responses to monetary policy in the US

	(1) Average effect	(2) Lower rated US state	(3) Average effect with controls	(4) Lower rated US state with controls
Fed surprise	0.9099***	0.8618***	0.7042***	0.6735***
	(0.2473)	(0.2507)	(0.2569)	(0.2372)
Fed surprise x Lower rated_state		0.0808		0.0534
		(0.0783)		(0.0779)
N	398659	398659	335359	335359
R^2	0.0079	0.0079	0.0165	0.0166
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	110	110	110	110

Notes: The table reports the results from estimating specification (1) and shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and Karadi (2020). The dependent variable, $\Delta y_{ijsc,t}$ is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the Fed announcement and 5 days after the announcement. Lower rated country is a dummy equal to 1 if the US state has a rating below AA+ according to the 4 major rating agencies. Spreads are measured in basis points. Columns (1) to (4) report estimated responses to all Fed surprises, columns (3)and (4) report responses to large ECB surprises, while column (5) reports estimated responses to large Fed surprises. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006-Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

3.2 Monetary policy transmission to corporate bond spreads in the Euro Area

We now turn to our main object of interest, the corporate bond market in the euro area. Table 2 reports the estimates for the baseline specification (1) for the EA. As shown in the descriptive section above, the distribution of euro area firms, in contrast to the US one, was overall skewed towards larger firms that might better weather shocks stemming from average monetary policy surprises, especially early in our sample period. We hence focus here on large monetary policy surprises defined as one and a half standard deviation above their mean in absolute value. This corresponds to the 10 largest surprises, which are above 6 basis points in our dataset.[20]

Table 2: Corporate bond spreads responses to monetary policy in the euro area

	(1) Average effect All ECB surprises	(2) Lower rated EA country All ECB surprises	(3) Average effect Largest ECB surprises	(4) Lower rated EA country Largest ECB surprises	(5) Average effect Fed spillovers	(6) Average effect Horse race ECB and Fed surprises	(7) Lower rated EA country Fed spillovers
ECB surprise	0.7336	0.7095	3.7397**	3.7113**		0.5876	
	(0.7670)	(0.6849)	(1.2558)	(1.1964)		(0.7188)	
ECB surprise x Lower rated_Country		0.1046		0.1457			
		(0.5017)		(0.8222)			
Fed surprise					0.4251**	0.3556**	0.4035**
					(0.1767)	(0.1779)	(0.1593)
Fed surprise x Lower rated_Country							0.1053
							(0.1793)
N	86899	86899	4467	4467	62501	163016	62501
R^2	0.0248	0.0249	0.2780	0.2778	0.0197	0.0113	0.0197
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	No	No	No
Double clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	169	169	10	10	110	280	110

Notes: The table reports the results from estimating specification (1) and shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and Karadi (2020), the dependent variable, $\Delta y_{ijsc,t}$, is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the ECB announcement and 5 days after the announcement. Lower rated state is a dummy equal to 1 if the EA country has a rating below AA according to the 4 major rating agencies. Spreads are measured in basis points. Columns (1) and (2) report estimated responses to all ECB surprises, columns (3)and (4) report responses to large ECB surprises. Columns (5) to (7) report estimated responses to all Fed and ECB surprises in our sample. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006-Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

Similarly to the US, on average, spreads move in the same direction of the monetary policy surprise. Although the point estimate is much higher, the standard errors are larger as well, one cannot reject the hypothesis that average US and EA spread responses are the same. We also see that the EA corporate bond spreads also respond to US monetary policy surprises (Column 3) echoing the findings of Ca' Zorzi et al. (2020) showing that the Federal Reserve monetary policy strongly affects financing conditions in the euro area and consistent with a US centered global financial cycle (see e.g. Miranda-Agrippino and Rey (2020)).

Given the persistent worries about heterogeneous transmission of monetary policy in the euro area, we present surprising results in Table 2. Regardless of the monetary policy impulse and the inclusion of additional controls or not, spreads of bonds issued by firms in lower rated economies are *not* differentially affected. The euro area corporate bond market is as geographically unified as the US one conditional on monetary policy surprises.

Using a battery of tests, some reported in section 6, some relegated to the appendix, we will show that this result of no country effects in monetary policy transmission to corporate bonds spreads in the

[20]The maximum pure monetary policy surprise was about 18 basis points. Figure A.3 in the Appendix illustrates these 10 largest surprises together with the dates of the ECB Governing Council meetings when they occurred.

EA is very robust. But that stands in stark contrast to findings about pervasive country effects in bank loan spreads' reaction to monetary policy surprises (Altavilla et al. (2024)) and heterogeneous monetary policy transmission to member countries' real variables (see for instance Ciccarelli, Maddaloni, and Peydró (2013); Dominguez-Torres and Hierro (2019); Georgiadis (2015); Mandler, Scharnagl, and Volz (2022)).[21] Why is monetary policy transmission to corporate bond spreads (pleasantly) different? And does the difference of the corporate bond market manifest itself only conditional on monetary policy? The remainder of the paper will study these questions.

4 Unconditional Analysis: How much do countries of origin affect corporate bond spreads in the euro area?

We now leave monetary policy impulses aside and turn to study to what extent unconditional corporate bond spreads are determined at the level of the state or country of residence of the issuer. We thus analyze whether country of origin of the bond-issuing firm matters for explaining variations in the levels of corporate bond spreads in the EA and the US, applying a methodology similar to Altavilla et al. (2024). Leveraging the size and granularity of our dataset, we explore (rather than absorb) fixed effects by sequentially extracting fixed effects that aggregate spreads at country or state level first and then at the firm and bond levels. That is, we measure:

$$y_{i,j,c,t} = \mu_c + \varepsilon_{i,j,c,t} \tag{2}$$

where $y_{i,j,c,t}$ is the spread (in level) at time t of bond i belonging to firm j in country c and μ_c are the country fixed effects. Given the size of our data we can also allow this fixed effect to be time varying,

$$y_{i,j,c,t} = \mu_{c,t} + \varepsilon_{i,j,c,t} \tag{3}$$

where $\mu_{c,t}$ are the country-time fixed effects.

We then take the residual from this regression and extract firm level fixed effects

$$\varepsilon_{i,j,c,t} = \mu_{j,t} + \epsilon_{i,j,c,t} \tag{4}$$

where $\varepsilon_{i,j,c,t}$ is the residual spread of Equation (3) and $\mu_{j,t}$ are the firm-time fixed effects. For firms with a single traded security, $\mu_{j,t}$ will absorb all of the residual variation. For firms with multiple securities,

[21] See Dominguez-Torres and Hierro (2019) for a literature overview of the empirical evidence on the regional effects of monetary policy.

$\mu_{j,t}$ will capture the variation common at the level of the firm (having already taken out the variation common at the level of the country), and $\epsilon_{i,j,c,t}$ will be the bond specific component of spreads.

We also study whether firms' default risk have a common country dimension:

$$edf_{j,c,t} = \eta_{c,t} + u_{j,c,t} \tag{5}$$

where $edf_{j,c,t}$ is the firm default risk (as measured by the expected default frequency from Moody's CreditEdge) and $\eta_{c,t}$ are the country-time fixed effects.

Table 3 below shows that country/state or country/state-time fixed effects explain negligible shares of the variance in the level of bond spreads not only in the US but also in the EA. However, firm fixed-effects explain about 40% of the variance of the spread net of country-time fixed effects.

Table 3: Relevance of country fixed effects for corporate bond spreads

	(1) US Spread	(2) US Spread	(3) US ε_i, j, c, t	(4) US Firm default risk	(5) EA Spread	(6) EA Spread	(7) EA ε_i, j, c, t	(8) EA Firm default risk
N	14,993,069	14,985,122	14,993,069	14,993,069	2,708,938	2,702,931	2,708,938	2,708,938
R^2 adjusted	0.04	0.08	0.44	0.02	0.03	0.08	0.41	0.02
Fixed effects	State	State-Time	Firm	State	Country	Country-Time	Firm	Country
Additional controls	No	No	No	No	No	No	No	No

Notes: The table reports the R^2 of Equations (2), (3), (4) and (5). Standard errors are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Dec 2022. Daily data. Data sample excluding the lower tranches of high yield bonds.

The importance of this result is hard to overstate. It is often an article of faith that the euro area is segmented across national boundaries and that a unified capital market does not exist. We find that this is certainly not the case for the corporate bond market. The very visible segmentation in the market for bank loans is perhaps not a good indicator of the dependence of firms' borrowing costs to their countries of operation.

5 Is the corporate bond market or the bond-issuing firms special?

The natural question arises as to whether these findings are explained by salient features of the bond-issuing firms or by properties of the corporate bond market. We tackle this question by applying a similar methodology as in the section above, but for another source of financing of these same bond-issuing firms, their bank loans.

We extend the dataset to include firm-level information on bank loan spreads from the euro area credit registry AnaCredit whenever a bond-issuing firm also contracts bank loans.[22] The bank loan spread is computed as the interest rate on the bank loan (at the time of the issuance of the loan) minus the maturity-matched risk free (OIS) rate. We apply a similar methodology to Altavilla et al. (2024) and consider the set of all new, senior unsecured loans denominated in euros issued by a bank in the euro area to firms in our sample of bond-issuing firms each month.[23]

Here, we study the role of country or country-time fixed effects in explaining the variance of bond issuing firms' *bank loan spreads*. We are specifically interested in the spread, $y_{l,j,b,c,t}$ of loan l, to firm i, provided by bank b, in country c, at time t. This is the measure of bank-based external finance premium for bond issuing firms that are also borrowing from banks, with the spread defined relative to a maturity-matched OIS rate. This is the mirror measure of our main variable of interest, the corporate bond spread, the market-based external finance premium of firms, for the bank-based external finance premium of the same firms.

$$y_{l,j,b,c,t} = \nu_{c,t} + \zeta_{l,j,b,c,t} \tag{6}$$

We know from the work of Altavilla et al. (2024) that in the full AnaCredit sample, where an overwhelming majority of firms do not issue bonds, country-time fixed effects capture half of the variance of bank loan spreads. Table 3 showed that for bond issuing firms' corporate bond spreads, the comparable R^2 is only about 8%. If this difference is because bond issuing firms are special, we would expect their bank loan spreads to be mostly independent of country effects as well. If, on the other hand, it is not the firms but the corporate bond market that is special, the bank loan spreads of the bond issuing firms will be as affected by country effects as the average firm.

Table 4 shows the fixed effects μ_c for country and $\mu_{c,t}$ for country-time, estimated using weighted least squares where the weight of each observation is the amount of the loan. Country-time fixed effects explain more than half of the variation of bank loan spreads for our sample of bond-issuing firms. *It is the corporate bond market that is special and not the bond issuing firms.*

The bank loan spreads of the bond issuing firms are similarly determined as those of other firms: at the country level. We therefore find that euro area firms' bank-based external finance premium depends on country factors, but their market-based external finance does not.

[22] Anacredit is a loan level database comprising all loans to firms in the euro area of at least 25,000 euros.

[23] We look into senior unsecured loans to match our sample of firms issuing senior unsecured bonds. These loans being uncollateralized implies they were not directly affected by various government guarantee mechanisms during the Covid crisis. The sample spans January 2019 to October 2024. This set contains about 35,612 new loans to 280 firms that also have at least one bond outstanding at the time of the bank loan issuance, together with information on a wide variety of loan level characteristics.

Table 4: Role of country fixed effects for bank loan spreads in the euro area

	(1) Bank loan spread	(2) Bank loan spread
Fixed effects	Country-time	Country-time
Cluster	Country, time	Country, time
Controls	No	Yes
R^2 adjusted	0.6374	0.7074
N	61,957	48,872

Note: The table provides the R^2 of the WLS estimates of country-time fixed effects (column 1) and country-time fixed effects controlling for sovereign spreads (column 2) for bank loan spreads in the euro area. Each observation is weighted by the aggregated loan size at the country-time level. Standard errors clustered at country and time level. Sample period: January 2019 - October 2024. Monthly data.

We also study whether the important role of country factors in explaining bank loans spreads may be due to banks' own financing conditions. Using bond level data but at the level of the bond- issuing banks, we find that banks' own bond spreads correlate somewhat with the bank loan spreads suggesting that banks may pass on their financing conditions to the loans they provide (see Table 5).

Table 5: Relevance of creditor's spreads for bank loan spreads

	(1) Bank loan spread	(2) Bank loan spread
Bank bond spr. vs. OIS	0.1816***	0.1816***
	(0.0434)	(0.0433)
N	39,883,850	39,883,850
R^2 adjusted	0.0274	0.7658
Fixed effects	Country bank	Country bank-time
Cluster	Country bank, time	Country bank, time

Sources: Anacredit, LSEG and authors calculations. All spreads are calculated versus the OIS curve. Bank corporate bonds are matched to the residual maturity of the bank loan. Each observation is weighted by the aggregated loan size at the country-time level. Standard errors clustered at country and time level. Monthly data. Sample period: January 2022 - October 2024.

Given these findings a natural question arises: why do firms that have access to the bond market still choose to take out loans, particularly when, as we have shown, loans come with an additional country risk premium priced in? While this question is outside the scope of this paper and we explore it more thoroughly in a subsequent study, we show for now that the median firm active in both bond and loan markets issues four bonds and enters into eight loan agreements. For a median euro area firm, the outstanding volume of bonds exceeds that of loans by a factor of more than ten: nearly 2,000 million euros in bonds versus 110 million euros in loans. Furthermore, bonds issued by a median firm exhibit a lower cost of financing (1.18% versus 1.30%) and are issued with maturities twice as long (eight years compared to four for loans). This is detailed in Table B.14 in the Appendix.

6 Further results and extensions

6.1 Robustness

The results presented above are there regardless of how one looks at the data. They are robust to alternative specifications and choice of fixed effects, alternative definitions of corporate bond spreads, country/state classification, alternative monetary policy surprises, data samples (for instance, samples including or excluding lower tranches of high-yield bonds), different time period samples or data frequency. We detail some of these robustness below and relegate others to the Appendix.

6.1.1 Country-by-country estimates

Our results also hold when running country-by-country estimates. This generalizes our analysis to fully capturing country/state heterogeneity that may not necessarily be adequately picked up by country or state ratings. Readers may indeed wonder why restraining our analysis on a particular dimension of country or state heterogeneity. We therefore apply a more general approach estimating country-specific responses to euro area monetary policy surprises whereby the baseline specification is modified as follows:

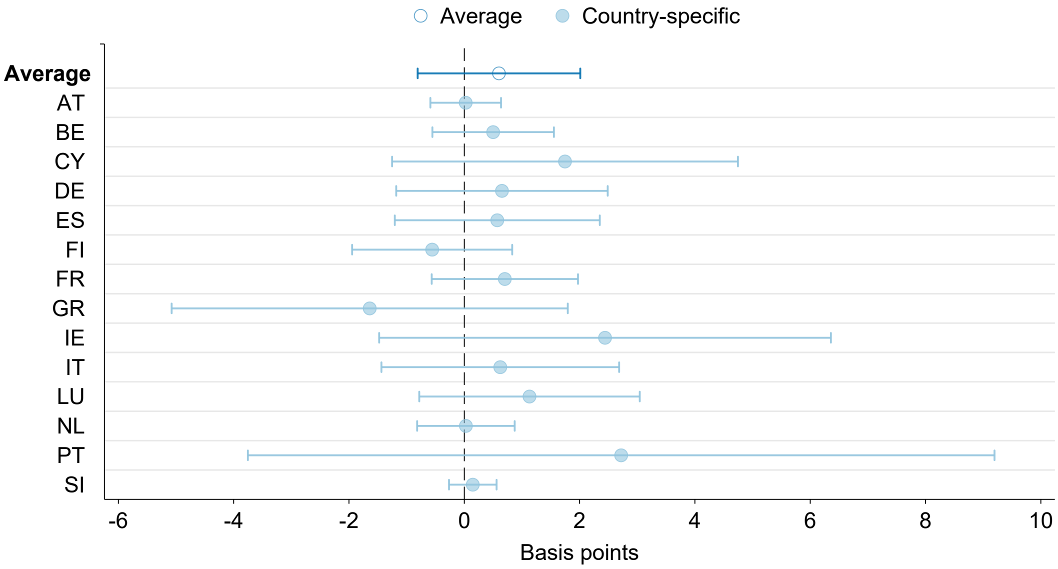
$$\Delta y_{ijsc,t} = \beta_2 \left(\varepsilon_t \times \alpha_c\right) + \gamma \boldsymbol{Z}_{ij,t} + \alpha_i + \alpha_j + \alpha_s + e_{ijsc,t} \tag{7}$$

The coefficients are not statistically significant implying therefore that our results are robust to other dimensions of country heterogeneity over and beyond those that can be captured by sovereign ratings, as shown in Figure 5 below.

6.1.2 Variation of fixed effects

Our results on the monetary policy transmission remain robust to varying the fixed effects and considering sector-by-time fixed effects, given that different sectors can exhibit heterogeneous responses to monetary policy surprises. This approach leverages variation across issuers domiciled in different countries but belonging to the same sector. Some readers might argue that our baseline specification, by controlling only for the average spread levels across sectors, might overlook this aspect. We therefore modify our baseline specification and estimate the following equation:

Figure 5: Country-specific responses to euro area monetary policy surprises



Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG, and authors' calculations. Notes: The chart reports the results from estimating specification (7). It shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and Karadi (2020). The dependent variable, $\Delta y_{ijsc,t}$ is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the ECB announcement and 5 days after the announcement. Spreads are measured in basis points. Standard errors are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data.

$$\Delta y_{ijsc,t} = \beta_1 \left(\varepsilon_t\right) + \beta_2 \left(\varepsilon_t \times \mathbb{1}_{ij}^{\text{low-rated sov.}}\right) + \beta_3 \mathbb{1}_{ij}^{\text{low-rated sov.}} + \gamma \boldsymbol{Z}_{ij,t} + \alpha_i + \alpha_j + \alpha_{s,t} + e_{ijsc,t} \tag{8}$$

Our results remain robust in this case as well, since the interaction coefficient with either the ECB or Fed surprises continue to be statistically insignificant, as shown in Table 6 below:

Table 6: Corporate bond spreads responses to monetary policy in the EA - Variation of the fixed effects

	(1) Average effect All ECB surprises	(2) Lower rated EA country All ECB surprises	(3) Average effect Largest ECB surprises	(4) Lower rated EA country Largest ECB surprises	(5) Average effect Fed spillovers	(6) Average effect Horse race ECB and Fed surprises
ECB surprise x Perif_Country	0.2765	0.2837	3.9461	1.2553		
	(0.6281)	(0.7140)	(2.2276)	(1.0065)		
Fed surprise x Perif_Country					0.1996	0.4877
					(0.1787)	(0.3020)
N	100401	86706	4819	4454	162874	52212
R^2 adjusted	0.1640	0.1714	0.3174	0.4438	0.1751	0.1580
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	No	No
Double clustering	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	170	169	10	10	280	110

Notes: The table reports the results from estimating specification (8) and shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The monetary policy surprise is the pure monetary policy surprise from Jarociński and Karadi (2020), the dependent variable, $\Delta y_{ijsc,t}$, is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the ECB announcement and 5 days after the announcement. Lower rated state is a dummy equal to 1 if the EA country has a rating below AA according to the 4 major rating agencies. Spreads are measured in basis points. The table reports the estimated responses to all ECB surprises (columns (1) and (2)), to largest ECB surprises (columns (3) and (4)) and to Fed surprises (column 5) and to all Fed and ECB surprises (column (6)). Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

6.1.3 Alternative monetary policy surprises, data samples and frequency and further robustness tests

The results for the euro area are also robust to alternative monetary policy surprises. Instead of the pure monetary policy surprise of Jarociński and Karadi (2020), we also use the timing, target and forward guidance surprises from Altavilla et al. (2019). These results are shown in Appendix Table B.9.

Our results remain robust also if one considers the euro area in fixed composition (i.e. euro area composition as of 2006 which is the start of our data sample) or in changing composition (i.e. including also countries that have gradually entered the euro area since 2006 according to their entry year). They are robust also to changing the definition of lower rated or higher rated countries or States. In this case, higher rated countries are considered only those that maintained their AAA rating throughout the sample, including during crises. This definition would minimize concerns over composition effects arising from changes in ratings of euro area sovereigns during the European debt crisis, which would bias the estimates of the effects of monetary policy shocks upwards on AAA-rated countries against downwards on non-AAA-rated countries. They remain robust to further conditioning on whether the bond-issuing firms are highly leveraged. They are also robust to considering only a sample of firms for which the distribution by size is similar for the EA and the US. We present some of these robustness tests below and relegate others to the Appendix.

Our baseline sample consists of both investment grade and high-yield grade bonds. In robustness analysis, we also consider investment grade bonds and only upper tranches of high yield bonds to ensure that our results are not contaminated by potential illiquidity of lower tranches of high yield bonds, as discussed under the data section above. Our analysis remains robust to excluding lower tranches, i.e. bonds rated below BB. The transmission of monetary policy remains homogeneous across bond issuers and the analysis of country fixed effects yields similar results to the baseline ones.

As pointed out in the data description section, our dataset is in daily frequency. Our baseline analysis of fixed effects is done using the daily frequency data. Our results remain robust also when considering data in monthly frequency. Some skeptic readers could indeed argue that some of our results may be explained by bond staleness, i.e. that corporate bonds are not as frequently traded as the government bonds. They may also argue that the bond spreads data are not transaction prices but rather quotes that may not be frequently updated. This in turn might limit the ability of country-by-time fixed effects to capture meaningful variation in daily frequency. When considering our data in monthly frequency (either end-of-month, mid-month or monthly averages), our results remain by and large similar to using daily frequency data. The order of magnitude of country-by-time or state-by-time fixed effects, ranging between 7 to 15%, remain similar for the EA and for the US. We report these results in the Appendix Table B.4.

Country fixed effects have a similar explanatory power also when using data in monthly frequency and at bond issuance, as reported in the Appendix Table B.5. Our results also hold when changing the country of assignment from country of risk to country of residence.

As an aside, if corporate bond ratings have a ceiling imposed by the sovereign rating, as is often assumed, that would mechanically create a correlation of ratings and spreads at the country level. That we do not see that correlation implies no bunching at the sovereign rating. Indeed, corporate bonds may be better rated than their own sovereign. In some instances, more than half of the bonds or issuing firms in Italy, Spain, Portugal and Ireland are better rated than their own sovereign.

6.1.4 Matching EA and US distributions of firms by size

The descriptive statistics section had shown that the distributions of firms by size are not similar across the two economies, especially at the beginning of our sample. The US has smaller and larger firms than the EA that issue bonds. We therefore apply a matching algorithm where EA firms are matched with their closest US firm peer in terms of size. This is not a difficult exercise as the US size distribution is a super set of the EA one. Appendix Table B.3 show the summary statistics of firms after applying the matching algorithm. These firms are now similar not only in terms of size but also across leverage, default risk and ratings after applying the matching algorithm. We run our baseline estimates on the resulting sample and find essentially the same results, as shown in the two tables below.

Table 7: Corporate bond spreads responses to monetary policy surprises in the US - After matching

	(1) Overall	(2) Lower rated US state	(3) Overall, incl. controls	(4) Lower rated US state incl. controls	(5) Lower rated US state incl. controls, largest surprises
Fed surprise	0.8067***	0.7855***	0.6191**	0.6964***	-2.0110
	(0.2799)	(0.2317)	(0.2772)	(0.2194)	(1.8289)
Fed surprise x Perif. state		0.0373		-0.1470	-0.3573
		(0.1592)		(0.2344)	(1.7995)
N	87379	87379	73642	73642	2177
R^2 adjusted	0.0108	0.0108	0.0249	0.0249	0.1189
Fixed effects	Yes	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes	Yes
Number of clusters	110	110	110	110	9

Notes: The table reports the results from estimating specification (1) after matching the US and EA firms by size. It shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and Karadi (2020). The dependent variable, $\Delta y_{ijsc,t}$ is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the Fed announcement and 5 days after the announcement. Lower rated state is a dummy equal to 1 if the US State has a rating below AA+ according to the 4 major rating agencies. Spreads are measured in basis points. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

As in the baseline estimates of Table 1, the estimated effect of a one basis point tightening monetary policy surprise in the matched sample leads to a 0.9 basis points increase in corporate bond spreads on average in the US (see column 1 of Table 7) and to 0.6 basis points increase after controlling for multilevel fixed effects (at the bond, firm and sector level) as well as for bond- and firm-specific characteristics (see column 3 of Table 7). Most importantly, similarly to the baseline estimates, the interaction coefficient of the monetary policy surprise with the dummy on whether the bond-issuing firm is in a lower rated state of the monetary union remains insignificant. There is no differential spread response to monetary policy

Table 8: Corporate bond spreads responses to monetary policy surprises in the EA - After matching

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. controls	(4) Lower rated EA country incl. controls	(5) Lower rated EA country incl. controls, largest surprises
ECB surprise	0.7981	0.6719	0.9628	0.8496	4.6203**
	(0.8300)	(0.7591)	(0.8997)	(0.8230)	(1.4999)
ECB surprise x Perif. country		0.5018		0.4352	-1.2477
		(0.5074)		(0.5290)	(0.9394)
N	58317	58317	49386	49386	2146
R^2 adjusted	0.0132	0.0135	0.0236	0.0239	0.2659
Fixed effects	Yes	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes	Yes
Number of clusters	170	170	169	169	10

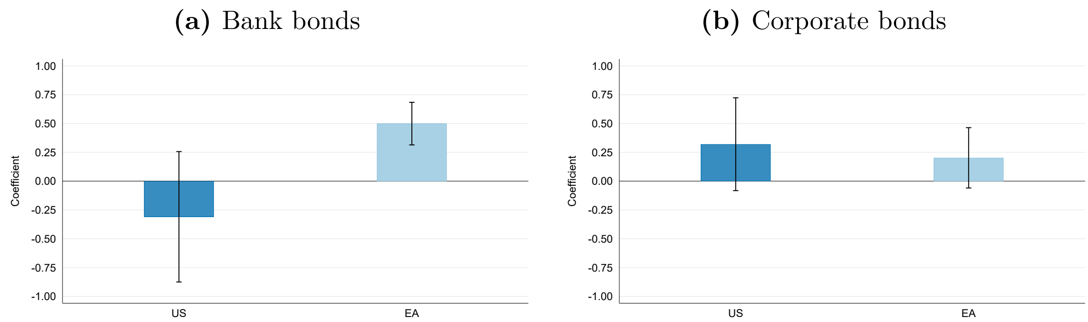
Notes: The table reports the results from estimating specification (1) after matching the US and EA firms by size. It shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and Karadi (2020). The dependent variable, $\Delta y_{ijsc,t}$ is the change in option adjusted spreads of bond i issued by the firm j belonging to sector s located in country c between the day before the ECB announcement and 5 days after the announcement. Lower rated state is a dummy equal to 1 if the EA country has a rating below AA+ according to the 4 major rating agencies. Spreads are measured in basis points. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

of bonds issued by firms located in lower or higher rated states in the United States. Importantly, the same holds also for the euro area (see Table 8). The estimated coefficients remain by and large similar to the baseline specification when all ECB surprises are considered (not only the largest ones) and, most importantly, the interaction coefficient also in the case of the euro area remains statistically insignificant. Hence, size distribution differences do not drive our results.

6.2 Extensions

As outlined in the data section, our baseline dataset and analysis focus on non-financial corporations. We develop several extensions and conducted additional analyses. First, we construct a database covering both US and euro area banks to compare their bond spread behavior with that of non-financial corporations. Second, for the euro area, we examine the composition of the corporate bond investor base using proprietary security-by-security holdings data from the ECB Securities Holdings Statistics by Sector (SHSS). This dataset offers granular insights into the securities held by various categories of euro area investors, disaggregated by instrument type, investor type and nationality, dimensions particularly relevant to our analysis. Third, we analyze loan origination by domestic banks using AnaCredit data. This extension broadens the sample to include the full universe of non-financial corporations in AnaCredit, beyond the subset of bond-issuing firms used in the previous section. Together, these extensions not only reinforce our main findings but also offer insights into why the corporate bond market may exhibit unique characteristics.

Figure 6: Sovereign effects on bank and NFC bonds



Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG, and authors' calculations. Notes: The chart reports the correlations between bank bond spreads and sovereign spreads (panel (a)) and between NFC bond spreads and sovereign spreads (panel (b)), controlling for time fixed effects. For US, state-level 10-year municipal bonds are considered. For EA, country-level 10-year benchmark bonds are considered, and the euro area sovereign crisis (2012 - 2014) is excluded. Sovereign spreads are matched to the residual maturity of the bonds. All spreads are calculated versus the OIS curve. Spreads are measured in basis points. Standard errors are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data.

6.2.1 Correlations with euro area sovereign/US state spreads

We first investigate the correlation between corporate bond spreads and sovereign/state spreads, as well as the correlation between bank bond spreads and sovereign/state spreads in both the US and the euro area.[24] To that end, we extend our baseline dataset to include bonds issued by banks (in addition to those issued by non-financial corporations used in our baseline analysis). The correlation coefficient is low and insignificant for non-financial corporate bonds both in the euro area and in the US, but high and statistically significant for banks bonds, although in the euro area only. This is shown in Figure 6 and provides suggestive evidence that, unlike the banking sector which remains closely tied to domestic and sovereign conditions in the euro area (the bank-sovereign doom loop has already been overwhelmingly documented and stands at the core of the European Banking Union process), the corporate bond market is less tied to sovereign conditions. Why is this the case? We provide a potential explanation below.

[24]More precisely, we examine the correlation between euro area corporate bond spreads and euro area sovereign spread versus the (zero coupon) OIS curve and between the US corporate bond spreads and the US state spread calculated as the 10-year municipal bond yield minus the 10-year zero coupon OIS.

6.2.2 Why are corporate bond markets special? A potential explanation

To provide a potential explanation of why the corporate bond market may exhibit distinct characteristics, we draw on the two additional extensions of our initial dataset: corporate bond investor composition from the SHSS database and bank loan origination from AnaCredit. Specifically, we examine the role of domestic banks as holders of corporate bonds and assess the share of loans originated by domestic banks. These two dimensions allow us to have comparable measures of home bias in both corporate bond holdings and bank lending.

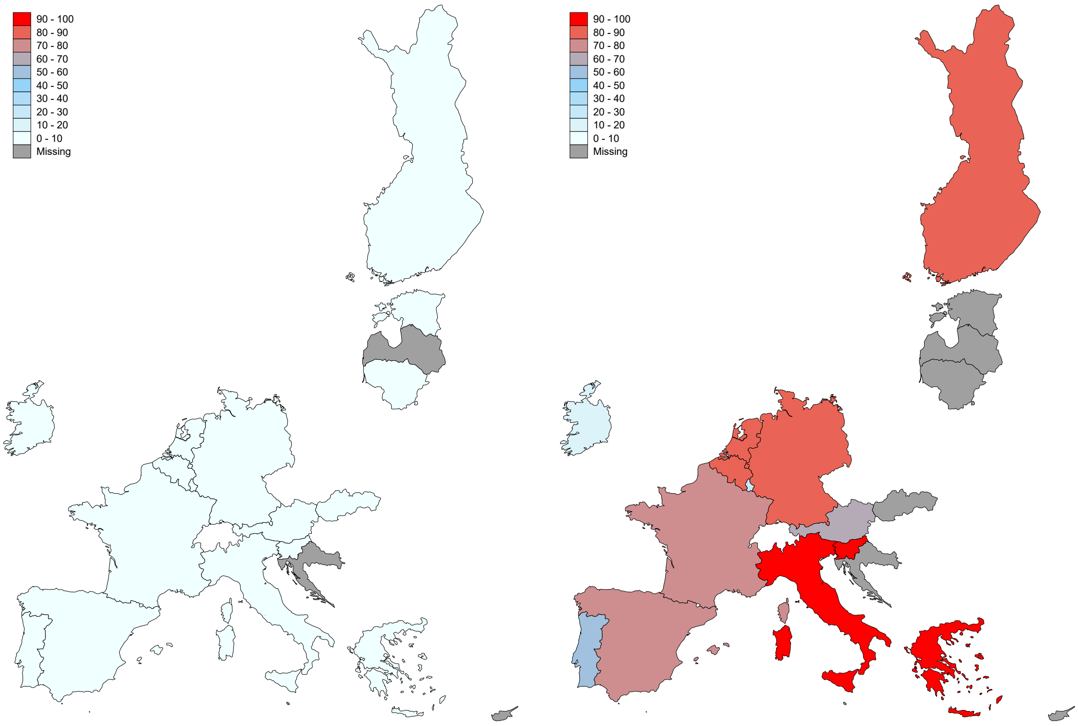
Appendix Table B.15 shows that domestic investors generally account for a small fraction of domestic corporate bonds and also that investors are geographically diversified and disperse. Home bias hence does not appear to be very pronounced, since the largest share of corporate bonds are held by other euro-area investors. This in turn may affect bond pricing, as pointed out in the recently emerging literature on demand-system asset pricing, in particular Koijen and Yogo (2019) or Koijen and Yogo (2023).[25]

Furthermore, Figure 7 below illustrate the share of corporate bonds held by domestic banks (panel a) and the share of bank loans issued by domestic banks to the non-financial corporations in our sample (panel b). There is a stark contrast between the two. While domestic banks hold very little of the bonds issued by domestic non-financial corporates, the share of loans to domestic non-financial corporates are issued predominantly by domestic banks. This in turn points again to the local nature of the banking system in the euro area in contrast to the corporate bond market. The local nature of the euro area banking system can be better seen when comparing the loans issued by domestic banks to our sample of bond-issuing non-financial corporates versus the loans issued by domestic banks to the entire universe of non-financial corporates included in Anacredit (see Appendix Figure A.14). The share of loans issued by domestic banks to all non-financial corporates is overwhelming, in the order of 90%. Banking is threfore local, intimately tied to the sovereign. Since there is one bank extending the loan, the bank matters. In contrast, market finance has many lenders, where the borrowing firm matters.

[25] Our findings on the geographically diverse nature of the investor base of euro area corporate bonds can also be related to the potential role that custodians may play. Euroclear, a European custodian, points to the crucial role of Central Securities Depositories (CSDs) in enabling European companies to access a vast investor community. The paper claims the importance of Euroclear infrastructures to provide broad connectivity between Member States and to serve as a gateway to the international market (for details, see Euroclear, 2024). The role of custodians and payment infrastructures in facilitating financial markets integration remains a topic under researched.

Figure 7: Home bias in corporate bonds and bank loans

(a) NFC bonds held inside the country **(b)** Loans to bond-issuing firms by local banks



Sources: Anacredit, SHSS, CSDB, and authors' calculations.

Notes: The map shows the share of NFCs bonds held by domestic banks (panel (a)) and the share of NFCs loans issued by domestic banks (panel (b)).

Panel (a): the share is calculated as the market value holdings by domestic banks over the bond's outstanding amount at the end of each quarter. The share is trimmed at the 1st and 99th percentile of the yearly holdings distribution. The map shows the median share by country over the sample period. The definition of domestic holdings is based on the firm's country of risk. Sample period: 2009 Q1 - 2024 Q4.

Panel (b): for each country, the share is calculated as the sum of the outstanding nominal amounts for loans issued by domestic banks over the sum of outstanding nominal amounts for loans issued by all banks over the sample period. Only loans at issuance are considered. The definition of domestic bank is based on firm's and bank's country of incorporation. Sample period: December 2019 - January 2024.

7 Conclusion

Using comprehensive micro-level data, we are able to answer several open questions about the behavior of the external finance premium. We first focused on market-based external finance premium, as captured by corporate bond spreads, and studied the transmission of monetary policy exploring the role of country or state heterogeneity in monetary unions. We contrasted the impact of monetary policy surprises on euro area and US corporate bond spreads and showed that the transmission of monetary policy surprises to corporate bond markets is homogeneous across borrowers independently of their country of origin within the monetary union. This is the case for US bond issuers and, more surprisingly, also for euro area ones.

We then studied whether our findings can be more generally applied to corporate bond markets over and beyond monetary policy transmission. It is often assumed that in the euro area country of operations strongly influence local firms' financial conditions. We find that, unconditionally, state- and country-based effects hardly explain corporate bond spreads in the US or in the euro area. The euro area corporate bond market is as integrated as that of the US.

Using confidential information on bank loan rates of bond issuing firms in the euro area, we are able to see that these firms pay premia primarily determined at the level of their banks' country of operation when borrowing from banks. That country is overwhelmingly their own country of operation. Banking is very local for bond issuing and non-issuing firms alike.

Hence, our results on corporate debt spreads are not due to the bond issuing firms being special. There is a fundamental difference between bank and market finance. Banking is local and banks are closely tied to the sovereign spreads of their country of operation. Corporate debt, on the other hand, is diffusely held and is priced independently of the country of issuer. A corollary of this is that corporate debt spreads are not summary statistics of firms' financing costs.

These findings have clear policy and research implications. On the policy side, the project to unify capital markets in the euro area has progressed further than believed for the corporate debt market. But while geographically unified, this market is smaller than that of the US. Helping increase corporate debt issuance will help firms in the euro area be less dependent on their countries of operation in their costs of financing. The research questions we pose are related to this point.

There is a fundamental need to understand why firms in the euro area are not issuing more corporate debt. Relatedly, we need to learn the uses and degree of substitutability of bank and market finance for firms that are able to borrow from both sources. This question is triggered by the observation that many firms borrow from local banks at interest rates higher than their bond yields. A better understanding of the corporate finance will help understand macroeconomic fluctuations better as well.

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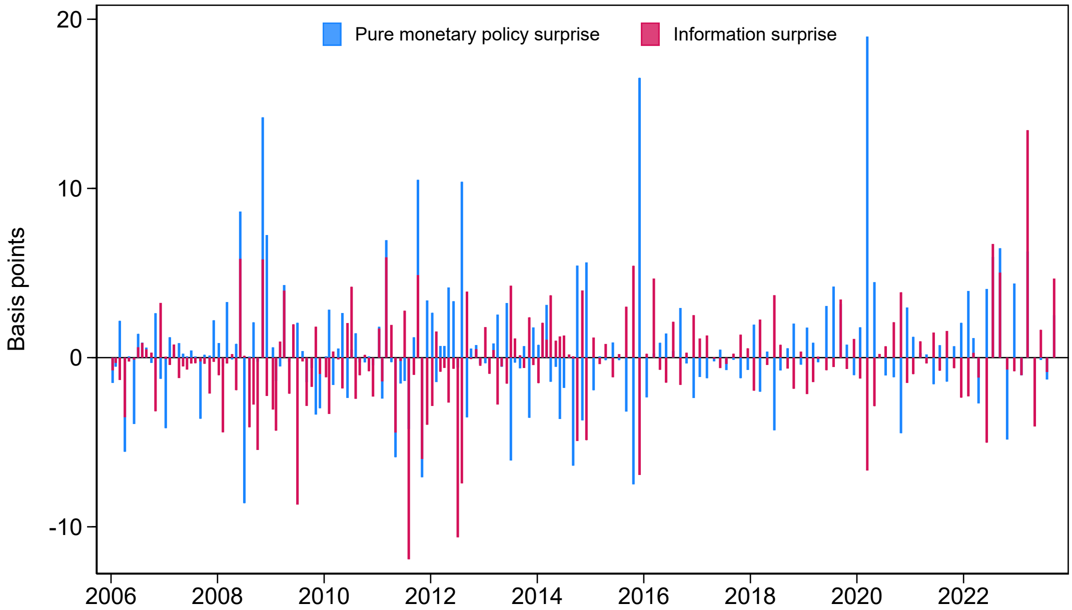
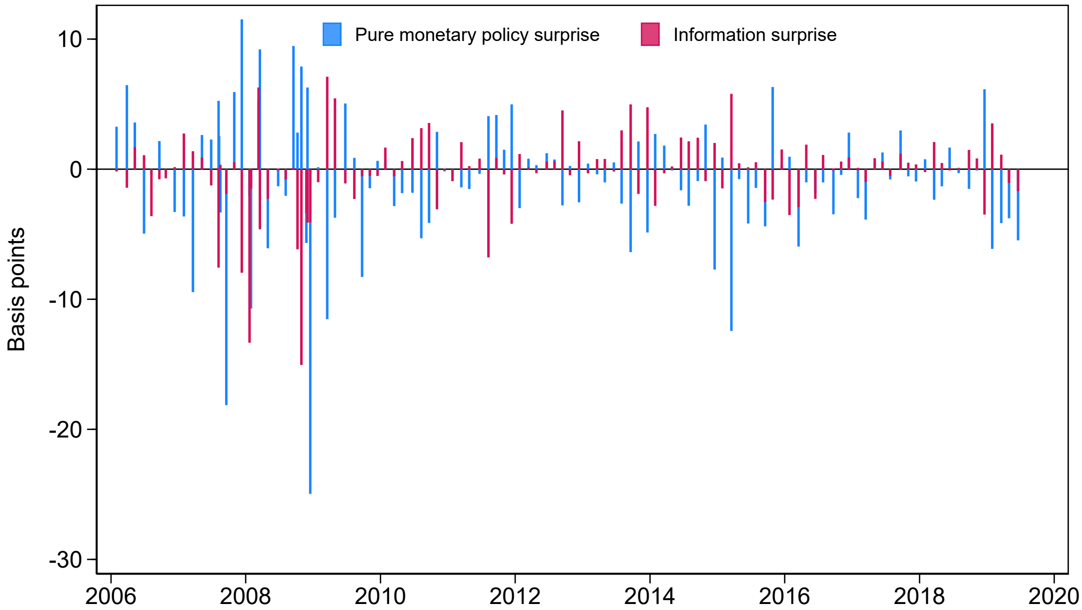
A Appendix: Figures

Figure A.1: ECB pure monetary and information surprises



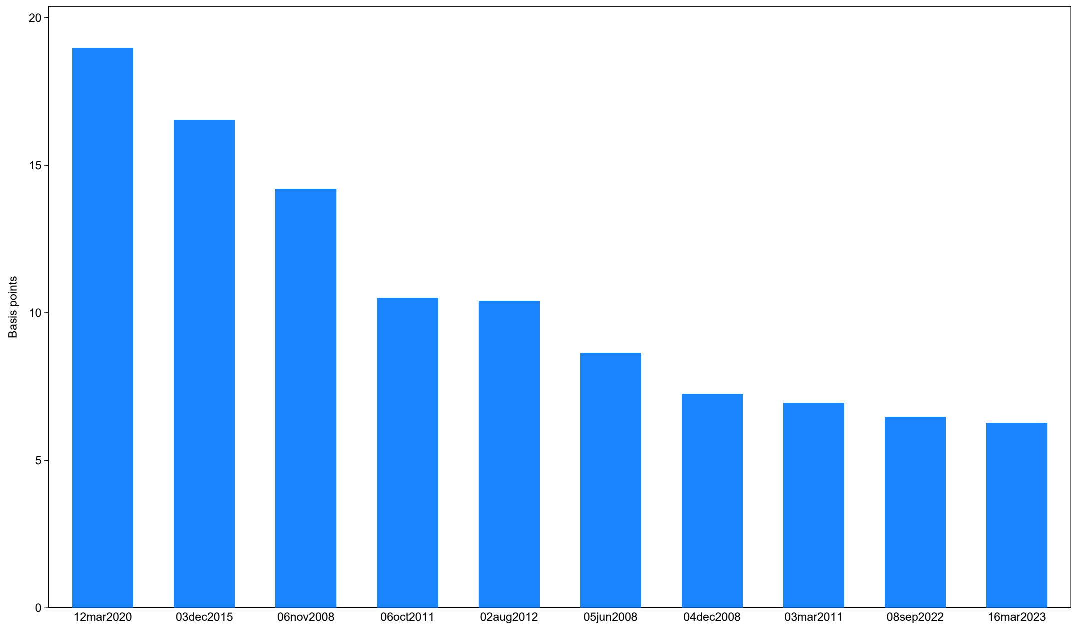
Sources: Jarociński and Karadi (2020).
Notes: The chart shows the ECB pure monetary and information surprises following the decomposition proposed by Jarociński and Karadi (2020).

Figure A.2: Fed pure monetary and information surprises



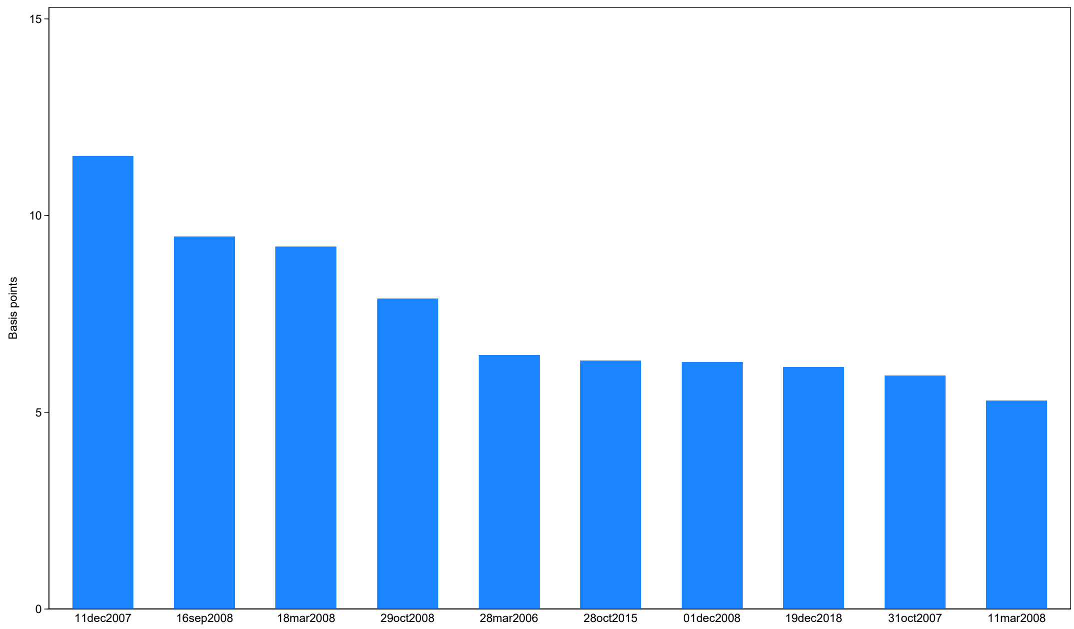
Sources: Jarociński and Karadi (2020).
Notes: The chart shows the Fed pure monetary and information surprises following the decomposition proposed by Jarociński and Karadi (2020).

Figure A.3: Largest ECB monetary policy surprises



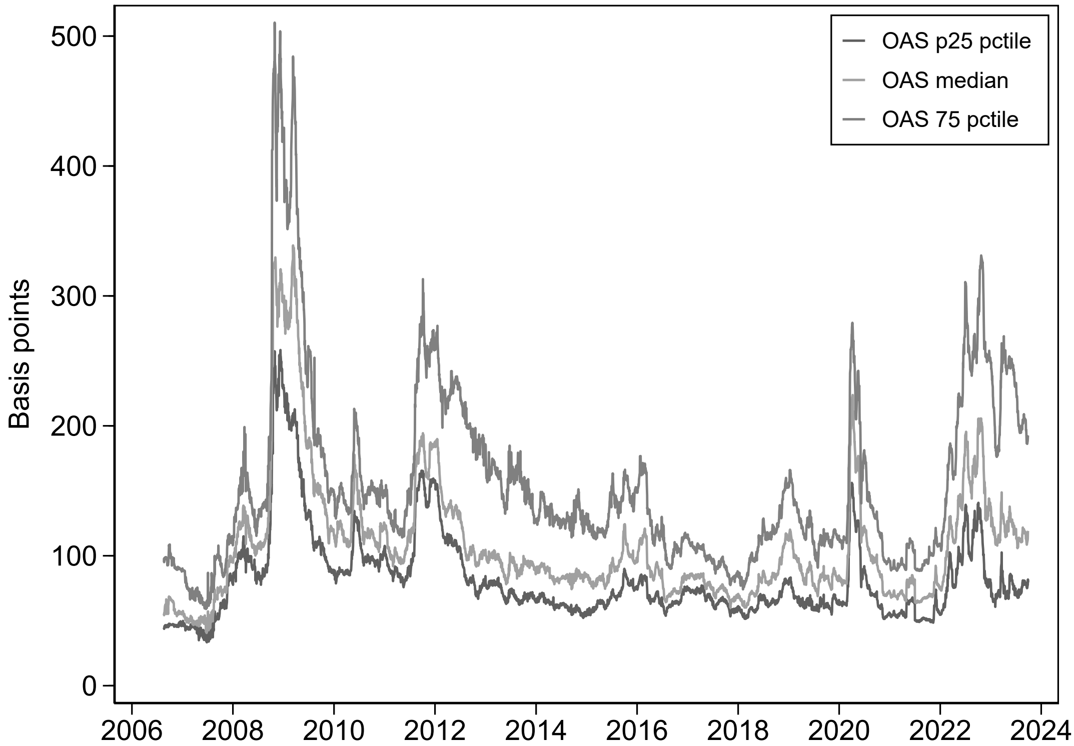
Sources: Jarociński and Karadi (2020).
Notes: The chart shows the largest ten ECB pure monetary surprises following the decomposition proposed by Jarociński and Karadi (2020) and the dates of the ECB Governing Council meetings when these surprises occurred.

Figure A.4: Largest Fed monetary policy surprises



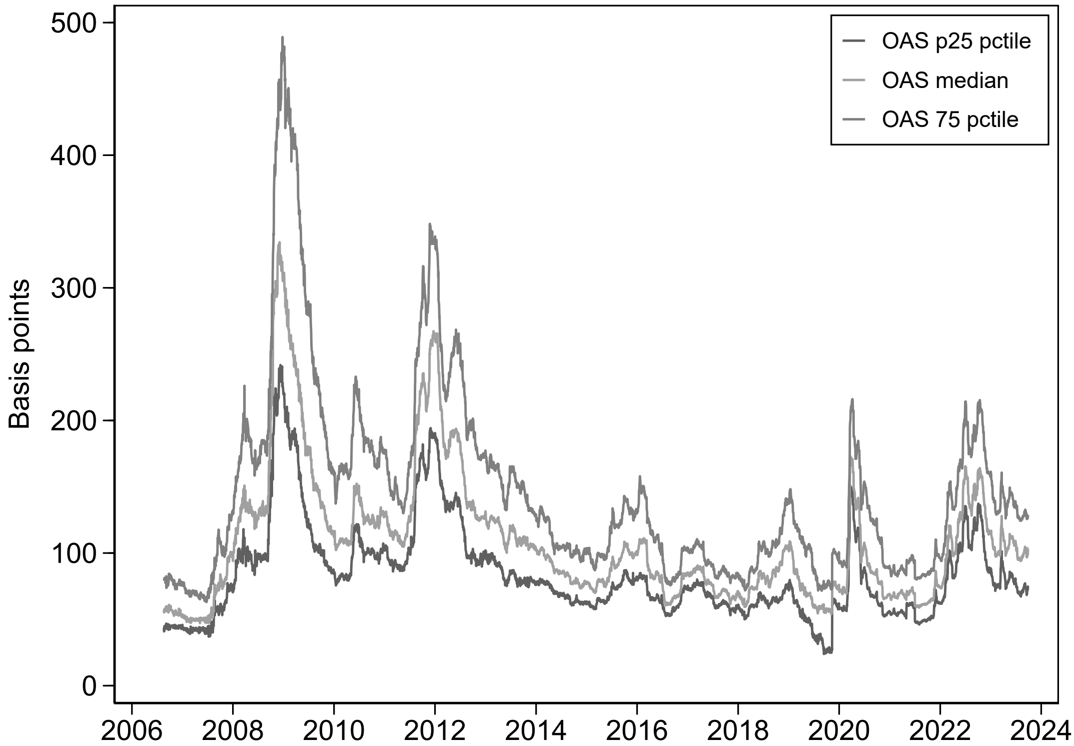
Sources: Jarociński and Karadi (2020).
Notes: The chart shows the largest ten Fed pure monetary surprises following the decomposition proposed by Jarociński and Karadi (2020) and the dates of the FOMC meetings when these surprises occurred.

Figure A.5: Option adjusted spreads in Germany



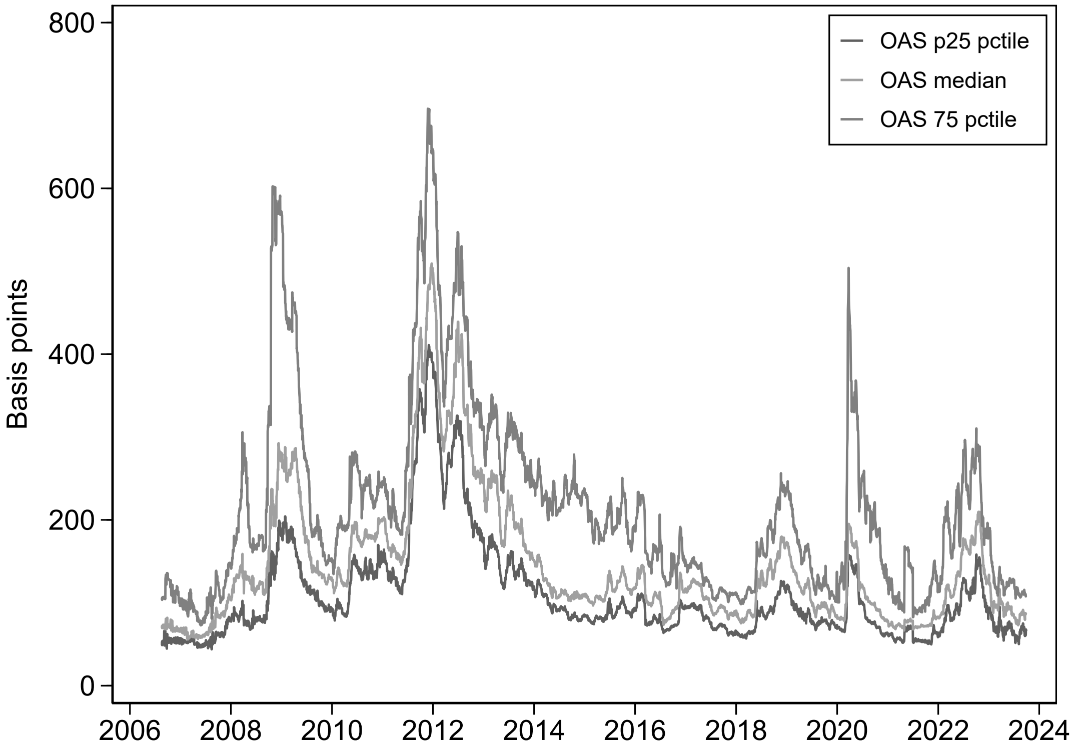
Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The figures plots the panel of daily corporate bonds spreads in basis points for Germany over 2006 to 2023.

Figure A.6: Option adjusted spreads in France



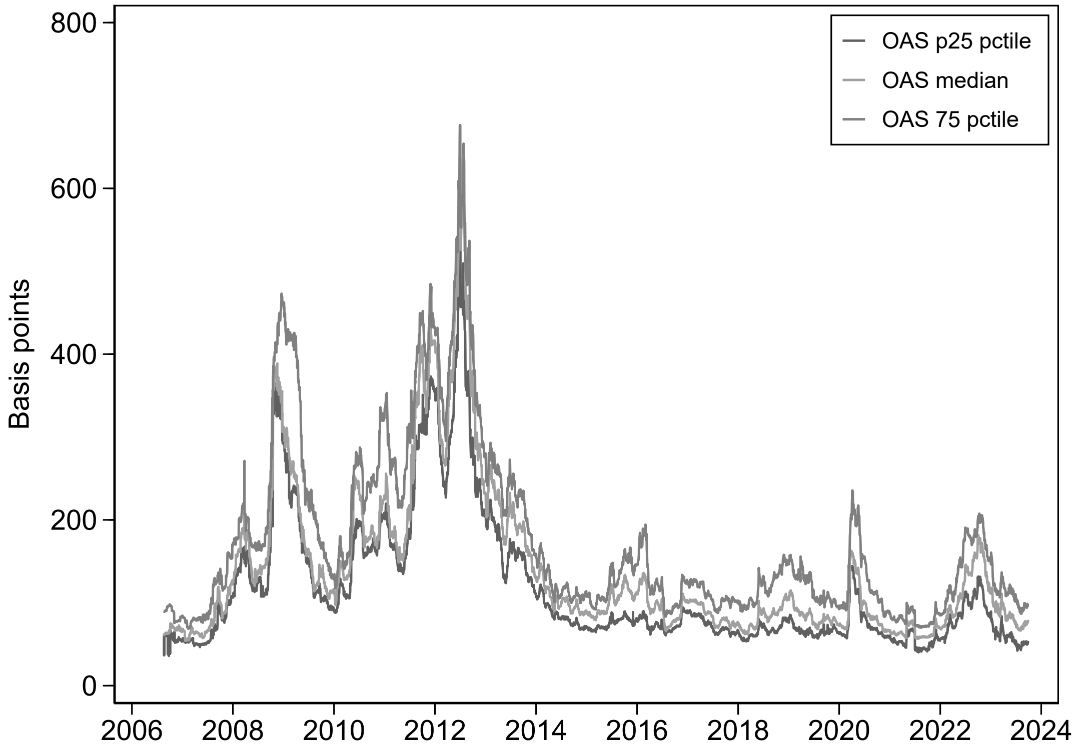
Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The figures plots the panel of daily corporate bonds spreads in basis points for France over 2006 to 2023.

Figure A.7: Option adjusted spreads in Italy



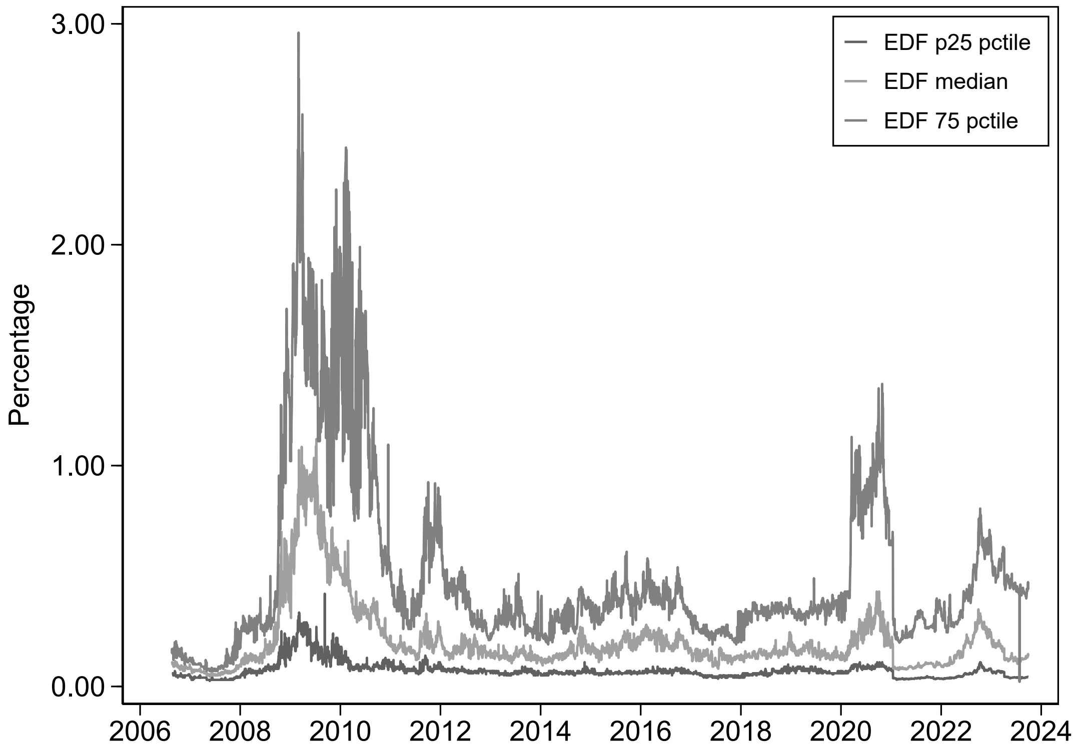
Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The figures plots the panel of daily corporate bonds spreads in basis points for Italy over 2006 to 2023.

Figure A.8: Option adjusted spreads in Spain



Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The figures plots the panel of daily corporate bonds spreads in basis points for Spain over 2006 to 2023.

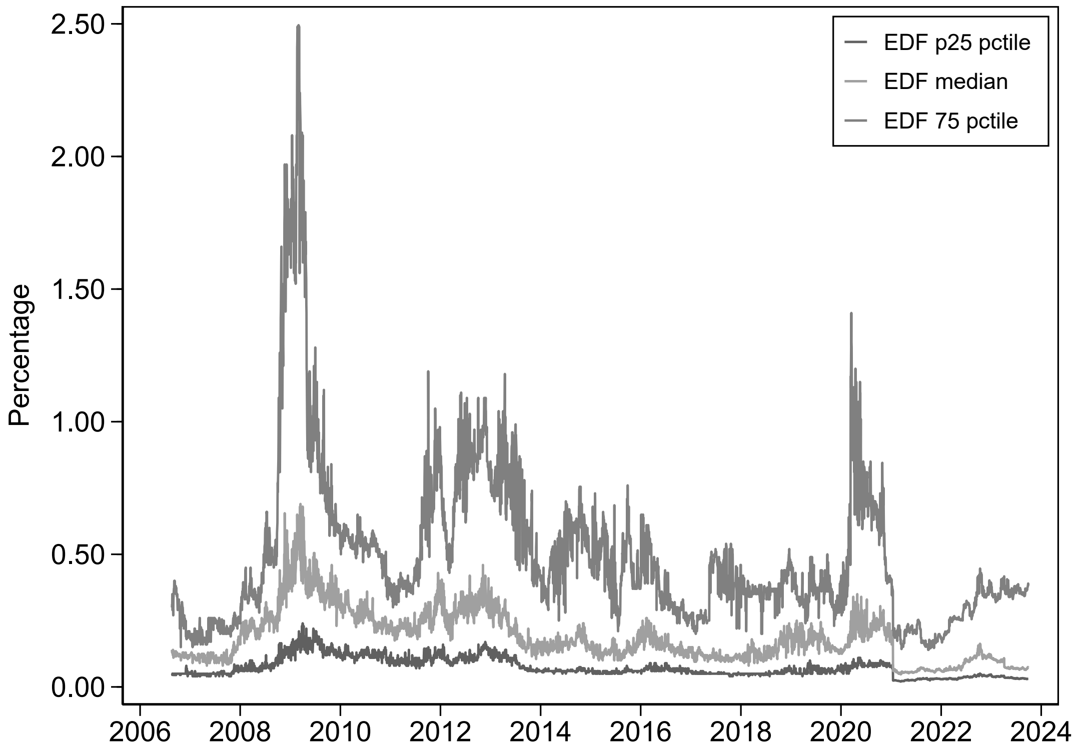
Figure A.9: Firm Expected Default Frequency in Germany



Sources: Moody's CreditEdge and authors' calculations.

Notes: The figures plots the panel of firm expected default frequency for Germany over 2006 to 2023.

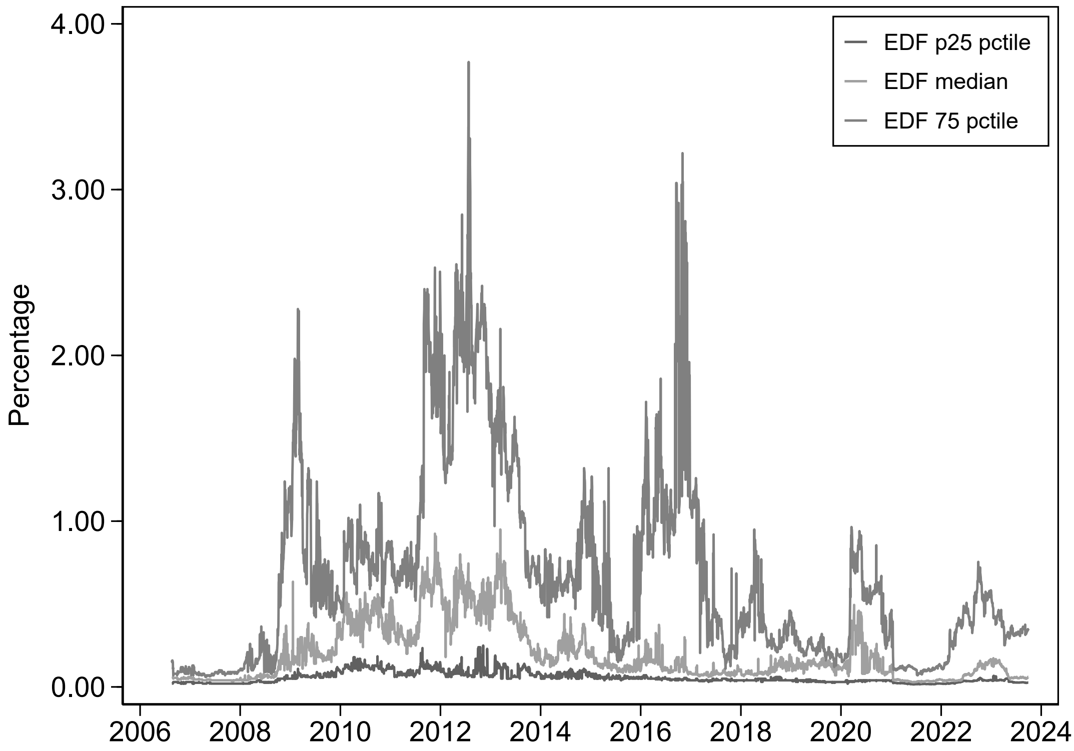
Figure A.10: Firm Expected Default Frequency in France



Sources: Moody's CreditEdge and authors' calculations.

Notes: The figures plots the panel of firm expected default frequency for France over 2006 to 2023.

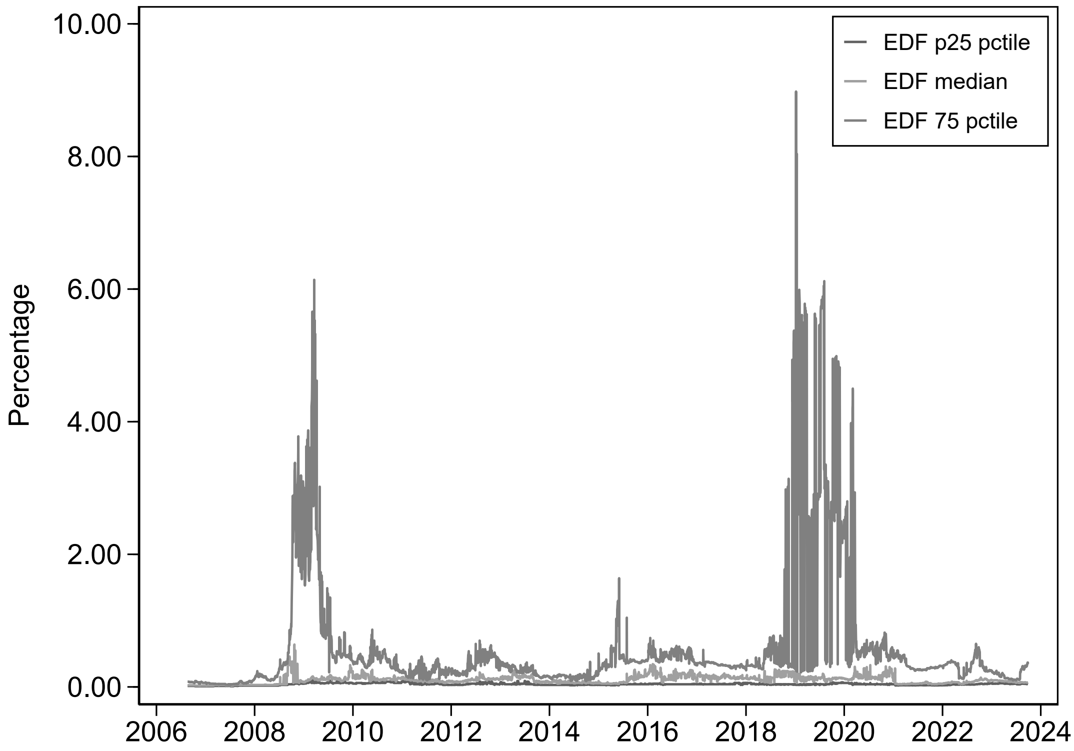
Figure A.11: Firm Expected Default Frequency in Italy



Sources: Moody's CreditEdge and authors' calculations.

Notes: The figures plots the panel of firm expected default frequency for Italy over 2006 to 2023.

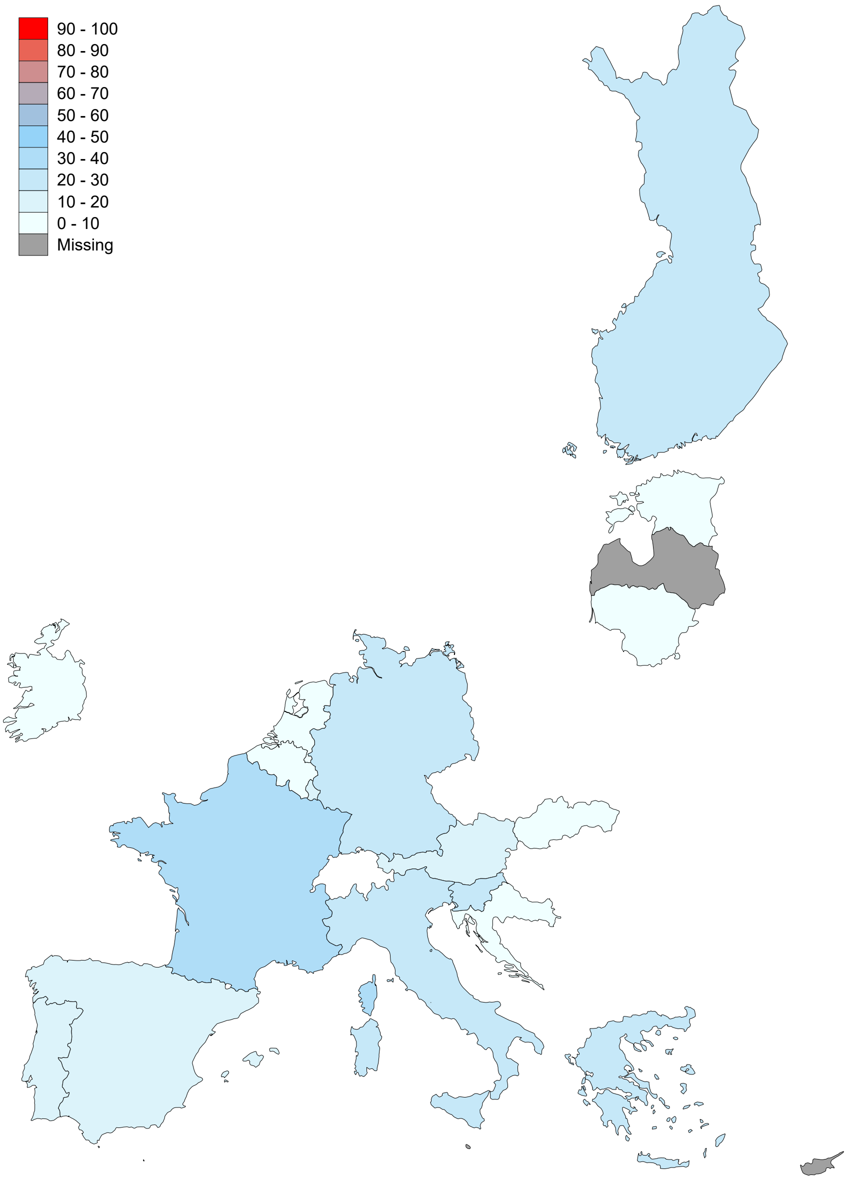
Figure A.12: Firm Expected Default Frequency in Spain



Sources: Moody's CreditEdge and authors' calculations.

Notes: The figures plots the panel of firm expected default frequency for Spain over 2006 to 2023.

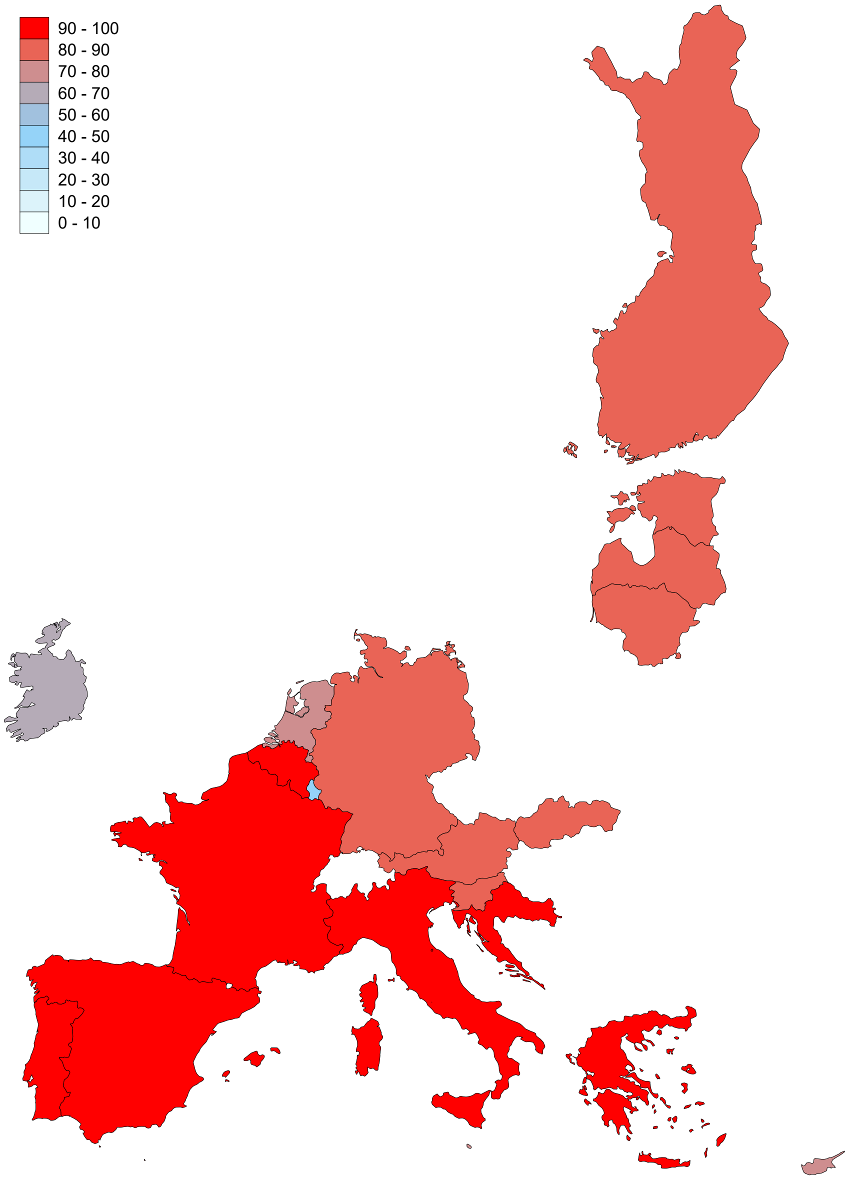
Figure A.13: Share of NFCs bonds held domestically



Sources: SHSS, CSDB, and authors' calculations.

Notes: The share is calculated as the market value holdings by all domestic sectors over the bond's outstanding amount at the end of each quarter. The share is trimmed at the 1st and 99th percentile of the yearly holdings distribution. The map shows the median share by country over the sample period. The definition of domestic holdings is based on the firm's country of risk. Sample period: 2009 Q1 - 2024 Q4.

Figure A.14: Share of NFCs loans issued by domestic banks, universe of NFCs in Anacredit



Sources: Anacredit, CSDB, and authors' calculations.

Notes: For each country, the share is calculated as the sum of the outstanding nominal amounts for loans issued by domestic banks over the sum of outstanding nominal amounts for loans issued by all banks over the sample period. Only loans at issuance are considered. The definition of domestic bank is based on firm's and bank's country of incorporation. Sample period: December 2019 - January 2024.

B Appendix: Tables

Table B.1: Bond characteristics

DE	Mean	SD	Min	Median	Max
No. of bonds per firm/day	13	10	1	10	41
Bond volume (mil)	781	401	25	750	3000
Maturity at issue (years)	8	4	2	7	30
Remaining maturity (years)	5	4	1	4	30
Bond Rating	BBB1	AA1	AA3	BBB1	CC2
OAS spread (bp)	138	151	5	100	3498
Coupon rate (pct)	3	2	0	2	12
ES	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	12	8	1	11	40
Bond volume (mil)	762	382	0	700	2250
Maturity at issue (years)	8	3	2	8	20
Remaining maturity (years)	5	3	1	5	20
Bond Rating	BBB2	AAA	AA3	BBB2	C2
OAS spread (bp)	186	262	5	109	3498
Coupon rate (pct)	3	2	0	3	10
FR	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	10	7	1	8	40
Bond volume (mil)	709	322	0	650	3650
Maturity at issue (years)	9	4	1	8	30
Remaining maturity (years)	6	4	1	5	30
Bond Rating	BBB1	AA1	AA1	BBB1	C2
OAS spread (bp)	133	141	5	96	3495
Coupon rate (pct)	4	2	0	4	11
IT	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	11	8	1	9	40
Bond volume (mil)	803	382	42	750	2750
Maturity at issue (years)	9	4	3	8	23
Remaining maturity (years)	5	4	1	5	23
Bond Rating	BBB2	AA1	A1	BBB2	C2
OAS spread (bp)	183	167	5	130	3470
Coupon rate (pct)	4	2	0	4	12
US	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	17	20	1	10	153
Bond volume (mil)	583	568	0	457	15000
Maturity at issue (years)	15	10	1	10	90
Remaining maturity (years)	9	8	1	6	30
Bond Rating	BBB2	AA2	AAA	BBB2	C2
OAS spread (bp)	239	265	5	164	3500
Coupon rate (pct)	6	2	0	6	15

Table B.2: Firm characteristics

DE	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.59	3.45	0.01	0.09	50.00
EDF 5-Year (%)	0.74	1.71	0.01	0.39	50.00
EDF 10-Year (%)	0.88	1.20	0.01	0.62	50.00
Leverage ratio	0.30	0.14	0.01	0.27	1.32
Firm rating	Baa2	Aa1	Aa3	Baa2	C
Firm assets (EUR mln)	46.83	60.82	0.35	26.06	551.85
ES	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.45	1.54	0.01	0.05	23.31
EDF 5-Year (%)	0.76	1.44	0.03	0.30	14.84
EDF 10-Year (%)	0.93	1.08	0.03	0.58	10.10
Leverage ratio	0.45	0.16	0.13	0.45	1.83
Firm rating	Baa2	Aa1	Aa2	Baa2	C
Firm assets (EUR mln)	32.83	33.16	1.14	18.73	147.61
FR	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.40	1.70	0.01	0.06	48.67
EDF 5-Year (%)	0.59	1.02	0.01	0.29	25.70
EDF 10-Year (%)	0.76	0.78	0.01	0.53	17.03
Leverage ratio	0.32	0.13	0.00	0.30	0.77
Firm rating	Baa1	Aa1	Aaa	Baa1	C
Firm assets (EUR mln)	46.98	60.92	0.07	26.41	379.44
IT	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.69	3.35	0.01	0.06	50.00
EDF 5-Year (%)	0.80	1.75	0.01	0.32	23.28
EDF 10-Year (%)	0.88	1.15	0.01	0.58	13.97
Leverage ratio	0.38	0.15	0.00	0.38	1.34
Firm rating	Baa1	Aa1	Aa2	Baa2	C
Firm assets (EUR mln)	41.01	52.21	0.49	15.01	283.43
US	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	1.90	6.78	0.01	0.13	50.00
EDF 5-Year (%)	1.52	3.79	0.01	0.40	50.00
EDF 10-Year (%)	1.41	2.57	0.01	0.63	50.00
Leverage ratio	0.38	0.22	0.00	0.35	7.03
Firm rating	Baa3	Aa2	Aaa	Baa3	C
Firm assets (EUR mln)	21.42	46.17	0.01	6.73	1068.63

Table B.3: Firm characteristics - Post matching

DE	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.4	1.4	0.0	0.1	35.0
EDF 5-Year (%)	0.7	0.9	0.0	0.4	17.5
EDF 10-Year (%)	0.9	0.8	0.0	0.7	11.2
Leverage ratio	0.3	0.1	0.0	0.3	1.3
Firm rating	Baa2	Aa1	Aa3	Baa2	C
Firm assets (EUR mln)	27.1	42.0	0.4	13.8	296.6
ES	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.6	1.8	0.0	0.1	23.3
EDF 5-Year (%)	0.9	1.7	0.0	0.3	14.8
EDF 10-Year (%)	1.1	1.2	0.0	0.6	10.1
Leverage ratio	0.5	0.2	0.1	0.4	1.8
Firm rating	Baa2	Aa1	Aa2	Baa2	C
Firm assets (EUR mln)	24.3	28.3	1.1	12.5	147.6
FR	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.5	1.9	0.0	0.1	48.7
EDF 5-Year (%)	0.7	1.2	0.0	0.3	25.7
EDF 10-Year (%)	0.9	0.9	0.0	0.6	17.0
Leverage ratio	0.3	0.1	0.0	0.3	0.8
Firm rating	Baa1	Aa1	Aaa	Baa2	C
Firm assets (EUR mln)	23.1	22.4	0.1	16.1	150.7
IT	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.8	3.9	0.0	0.1	50.0
EDF 5-Year (%)	0.8	2.0	0.0	0.3	23.3
EDF 10-Year (%)	0.9	1.3	0.0	0.6	14.0
Leverage ratio	0.4	0.2	0.0	0.4	1.3
Firm rating	Baa1	Aa1	Aa2	Baa2	C
Firm assets (EUR mln)	24.9	35.0	0.5	10.4	147.6
US	Mean	SD	Min	Median	Max
EDF 1-Year (%)	1.5	5.7	0.0	0.1	50.0
EDF 5-Year (%)	1.2	3.1	0.0	0.3	45.9
EDF 10-Year (%)	1.1	2.1	0.0	0.5	45.9
Leverage ratio	0.4	0.2	0.0	0.4	2.3
Firm rating	Baa3	Aa2	Aaa	Baa3	C
Firm assets (EUR mln)	19.2	29.6	0.1	10.3	296.6

Table B.4: Fixed effects analysis in monthly frequency

	(1) US Spread	(2) US Spread	(3) US ε_i, j, c, t	(4) US Firm default risk	(5) EA Spread	(6) EA Spread	(7) EA ε_i, j, c, t	(8) EA Firm default risk
N	804562	804142	804472	804567	131313	131163	131301	131317
R^2 adjusted	0.0428	0.0781	0.6787	0.0210	0.0523	0.1304	0.6304	0.0432
Fixed effects	State	State-Time	Bond, firm, sector	State	Country	Country-Time	Bond, firm, sector	Country
Additional controls	No	No	Yes	No	No	No	Yes	Yes

Notes: The table reports the R^2 of Equations (2), (3), (4) and (5) when using data aggregated at monthly frequency. Standard errors are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Monthly data.

Table B.5: Fixed effects analysis in monthly frequency at bond issuance

	(1) US Spread	(2) US ε_i, j, c, t	(3) US Firm default risk	(4) EA Spread	(5) EA ε_i, j, c, t	(6) EA Firm default risk
N	8983	8703	8983	1647	1594	1647
R^2	0.090	0.648	0.037	0.108	0.508	0.091
R^2 adjusted	0.0862	0.6078	0.0323	0.1016	0.4394	0.0850
Fixed effects	State	Firm, sector	State	Country	Firm, sector	Country
Additional controls	No	Yes	No	No	Yes	Yes
Double clustering	Firm, time	Firm, time	Firm, time	Firm, time	Firm, time	Firm, time

Notes: The table reports the R^2 of Equations (2), (3), (4) and (5) when using data aggregated at monthly frequency and at the bond issuance. Standard errors are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Monthly data.

Table B.6: Fixed effects analysis using alternative country of assignment for the firm: country of incorporation

	(1) EA spread	(2) EA spread	(3) EA ε_i, j, c, t	(4) EA firm default risk
N	2,721,730	2,709,321	2,721,730	2722052
R^2 adjusted	0.0614	0.1208	0.4048	0.0417
Fixed effects	Country	Country-Time	Firm	Country
Additional controls	No	No	No	No

Table B.7: EA corporate bond spreads vs OIS responses to monetary policy surprises

	(1) Average effect All ECB surprises	(2) Lower rated EA country All ECB surprises	(3) Average effect Largest ECB surprises	(4) Lower rated EA country Largest ECB surprises	(5) Average effect Fed spillovers	(6) Average effect Horse race ECB and Fed surprises	(7) Lower rated EA country Fed spillovers
ECB surprise	1.0119	0.9681	5.0354***	4.9825***		0.8247	
	(0.8266)	(0.7335)	(1.5378)	(1.4809)		(0.7803)	
ECB surprise x Perif_Country		0.1935		0.2733			
		(0.5950)		(0.8146)			
Fed surprise					0.2625	0.2173	0.2654
					(0.1949)	(0.1943)	(0.1865)
Fed surprise x Perif_Country							-0.0145
							(0.1842)
N	85206	85206	4521	4521	60298	160265	60298
R^2 adjusted	0.0120	0.0120	0.2754	0.2752	0.0507	0.0093	0.0506
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	No	No	No
Double clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	169	169	10	10	110	280	110

Table B.8: EA corporate bond spreads vs Bund responses to monetary policy surprises

	(1) Average effect All ECB surprises	(2) Lower rated EA country All ECB surprises	(3) Average effect Largest ECB surprises	(4) Lower rated EA country Largest ECB surprises	(5) Average effect Fed spillovers	(6) Average effect Horse race ECB and Fed surprises	(7) Lower rated EA country Fed spillovers
ECB surprise	0.5865	0.5358	4.6013***	4.5906***		0.5836	
	(0.6739)	(0.6136)	(1.3524)	(1.3040)		(0.6693)	
ECB surprise x Perif_Country		0.2269		0.0549			
		(0.4977)		(0.7628)			
Fed surprise					0.1322	0.0868	0.1333
					(0.1890)	(0.1857)	(0.1810)
Fed surprise x Perif_Country							-0.0053
							(0.1856)
N	99063	99063	4497	4497	58937	158021	58937
^{2}	0.0024	0.0025	0.5396	0.5396	0.0678	0.0216	0.0678
^{2} adjusted	0.0024	0.0025	0.2639	0.2636	0.0337	0.0059	0.0337
Fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes	No	No	No
Double clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	170	170	10	10	109	279	109

Table B.9: EA corporate bond spreads responses to alternative monetary policy surprises

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. controls	(4) Lower rated EA country, incl. controls
Timing	-1.3630*	-1.3829**	-1.5564*	-1.5502**
	(0.7411)	(0.6565)	(0.8525)	(0.7660)
Timing x Perif_Country		0.0959		-0.0289
		(0.5283)		(0.5025)
N	99752	99752	86689	86689
R^2 adjusted	0.0181	0.0181	0.0257	0.0257
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	168	168	167	167

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. FE and controls	(4) Lower rated EA country, incl. FE
Target	1.7049	1.7837	1.7067	1.8032
	(1.7791)	(1.6355)	(1.8180)	(1.6655)
Target x Perif_Country		-0.3383		-0.4156
		(0.6610)		(0.6734)
N	94,438	94,438	81,425	81,425
R^2	0.0136	0.0138	0.0635	0.0637
R^2 adjusted	0.0136	0.0138	0.0343	0.0344
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	155	155	155	155

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. FE and controls	(4) Lower rated EA country, incl. FE
FG	-0.3423	-0.3092	-0.3890	-0.3316
	(0.3493)	(0.2992)	(0.4660)	(0.4043)
FG x Perif_Country		-0.1592		-0.2740
		(0.3422)		(0.4050)
N	94,220	94,220	81,353	81,353
R^2	0.0008	0.0010	0.0478	0.0478
R^2 adjusted	0.0008	0.0009	0.0180	0.0180
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	Yes
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	154	154	154	154

Notes: The table reports the results from estimating specification (1) and shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise using Altavilla et al. (2019) surprises. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

Table B.10: Role of country fixed effects for corporate bond spreads - without netting out for time fixed effects

	(1) US: Spread OAS	(2) US: Spread OAS	(3) EA: Spread vs OIS	(4) EA: Spread vs OIS
N	16,934,103	16,924,574	2,693,918	2,690,761
R^2 adjusted	0.0424	0.2071	0.0530	0.2466
Fixed effects	State	State-Time	Country	Country-Time
Additional controls	No	No	No	No
Double clustering	Firm, time	Firm, time	Firm, time	Firm, time

Notes: Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

Table B.11: Role of country fixed effects for bank bond spreads

	(1) US: Spread OAS	(2) US: Spread OAS	(3) EA: Spread vs OIS	(4) EA: Spread vs OIS
N	905,485	890,737	701,749	696,449
R^2 adjusted	0.0733	0.3508	0.2263	0.7339
Fixed effects	State	State-Time	Country	Country-Time
Additional controls	No	No	No	No
Double clustering	Bank, time	Bank, time	Bank, time	Bank, time

Notes: Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006 - Sep 2023. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

Table B.12: Role of country fixed effects for bank loan spreads in the euro area

	(1) Bank loan spread	(2) Bank loan spread
N	16431	16431
R^2	0.736	0.740
R^2 adjusted	0.7361	0.7403
Fixed effects	Bank country*Time	Firm country*Time
Cluster	Bank country, time	Firm country, time

Notes: Each observation is weighted by the aggregated loan size at the country-time level. Standard errors clustered at country and time level. Sample period: January 2019 - October 2024. Monthly data.

Table B.13: Role of country fixed effects for bank loan spreads in the euro area, for firms and banks located in different countries

	(1) Bank loan spread	(2) Bank loan spread
N	3899	3899
R^2	0.699	0.697
R^2 adjusted	0.6981	0.6959
Fixed effects	Bank country*Time	Firm country*Time
Cluster	Bank country, time	Firm country, time

Notes: The sample is restricted to firms and banks located in different countries. Each observation is weighted by the aggregated loan size at the country-time level. Standard errors clustered at country and time level. Sample period: January 2019 - October 2024. Monthly data.

Table B.14: Loans and bond characteristics at the firm-month-year level, for firms with both bonds and loans

Bonds	N	Mean	Median	SD	Min	Max
Number of bonds	7853	7.18	4.00	10.36	1.00	153.00
Outstanding amount (mln EUR)	7853	4805.60	1926.71	7836.16	2.21	101014.55
Yield to maturity	5237	2.16	1.19	2.47	-0.31	18.01
Maturity at issuance (years)	7853	8.23	8.00	2.71	3.00	30.02
Loans	N	Mean	Median	SD	Min	Max
Number of loans	7853	19.84	7.00	45.12	1.00	1181.00
Outstanding amount (mln EUR)	7853	298.41	113.22	530.18	0.00	7065.59
Interest rate	6869	1.96	1.51	1.58	0.01	14.72
Maturity at issuance (years)	7832	4.88	4.81	4.05	0.00	126.86

Sources: Anacredit, ICE BofA, CreditEdge, CSDB.
Notes: Bonds and loans are aggregated at the firm level. For each firm, we calculate at the end of each month the number of bonds (loans), their total outstanding amount, their median yield to maturity (interest rate), their median maturity at issuance. Bonds' yield to maturity and loans' interest rate are trimmed at the 1st and 99th percentile before getting aggregated at the firm-level. Sample period: January 2019 - September 2023. Monthly data.

Table B.15: The investor base composition of euro area corporate bonds by country

	Bond holdings by domestic investors (in % of total EA holdings as reported in SHSS)	*of which:*	Banks	MMFs	IFs	IC	PF	Other
Country								
AT	24.0		9.6	0.0	4.4	3.9	0.0	6.0
BE	9.6		0.8	0.0	0.8	5.3	0.1	2.7
DE	48.9		11.4	0.0	16.4	3.3	0.5	17.1
ES	16.5		2.9	0.0	3.9	5.4	2.5	1.8
FI	32.8		5.4	0.0	7.6	4.9	0.3	14.3
FR	49.4		5.7	0.2	7.2	33.8	0.0	2.5
GR	41.1		19.6	0.0	6.0	3.1	0.9	11.5
IE	7.7		1.0	0.0	5.8	0.7	0.0	0.1
IT	33.0		4.0	0.0	4.6	14.0	0.5	9.8
LU	16.7		1.1	0.0	11.0	0.4	0.0	4.4
NL	7.6		0.2	0.0	1.7	2.9	2.1	0.8
PT	32.8		8.6	0.0	2.1	13.6	3.4	4.8

Sources: ECB Securities Holdings Securities Statistics (SHSS) and authors calculations.