External Finance Premium: Market Finance versus Bank Finance*

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January 15, 2025

Abstract

This paper is the first to investigate simultaneously the behavior of corporate bond markets in the United States and the euro area and contrast firms' market-based external finance premium with their bank-based premium. We use a unique micro-level dataset and show that the euro area and US market finance premia, measured with corporate bond spreads, are very similar in terms of how little they depend on the issuer's state or country of origin. In both economies, the transmission of monetary policy to corporate bond spreads is homogeneous across bond issuers. Delving deeper, we also find that the state or country of origin of the bond-issuing firms explains almost none of the variance in the level of corporate bond spreads. The euro area corporate bond market is thus as integrated as the US one, contrary to conventional beliefs. In the euro area, this stands in contrast with the bank-finance premium, measured with bank loan spreads, which is strongly determined at the country level for the same sample of bond-issuing firms. The premium paid by firms to access external funds depends on whether funds are sourced from banks or from financial markets. Bank finance premium depends on country factors, but market finance premium does not. From a policy perspective, our findings lend support to initiatives aimed at creating a Capital Markets Union in the euro area.

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

*The views expressed here are those of the authors and do not necessarily reflect those of the ECB or the Eurosystem. We are grateful to Klaus Adam, Carlo Altavilla, Ursel Baumann, Florin Bilbiie, Matteo Benetton, Valentin Burban, Giacomo Carboni, Ambrogio Cesa-Bianchi, Roland Chai, Jens Christensen, Alexander Düring, Carlo Favero, Massimo Ferrari Minesso, Andrea Ferrero, Georgios Georgiadis, Florian Heider, Christophe Kamps, Marek Jarocinski, Urban Jermann, Philip Lane, Wolfgang Lemke, Arnaud Mehl, Monika Piazzesi, Giorgio Primiceri, Vincenzo Quadrini, Rogier Quaedvlieg, Andreas Rapp, Morten Ravn, Hélène Rey, Massimo Rostagno, Silvana Tenreyro, Isabel Vansteenkiste, Frank Warnock as well as to participants at various ECB internal seminars, the Research Network on Challenges for Monetary Policy Transmission in a Changing World (ChaMP), the EUI Pierre Werner Chair-Banque de France Conference on International Macro in a Changing World and the 1st CEPR Frankfurt Hub International Conference for helpful discussions and suggestions.

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1 Introduction

One might study firms' external finance premium in the United States 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. It shows 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.

We are the first ones to simultaneously investigate the behaviour of corporate bond markets in the two major monetary unions, the United States and the euro area, and to contrast for the first time in the empirical literature the market-based with the bank-based external finance premium, i.e. 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 a number 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 effect. The transmission of monetary policy to corporate bond spreads is homogeneous across bond issuers both in the Unites States and in the euro area. 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. This first set of findings speak to the nascent literature on the role of heterogeneity and financial frictions in the transmission of monetary policy, but also to the long-standing debate on challenges to monetary policy posed by asymmetric shocks in currency unions, as in the seminal contribution by Mundell (1961), revisited by Krugman (2013), Silva and Tenreyro (2010) or more recently by Fornaro and Grosse-Steffen (2024).

Delving deeper, we study whether our findings can be more generally applied to corporate bond markets over and beyond monetary policy transmission. Leveraging on the granularity of our dataset, we exploit rather than absorb fixed effects at various levels. In both economies, the country or state of the issuers explain a negligible share of the unconditional variance of corporate bond spreads levels. The country or country-time fixed effects explain less than 10% of the bond spreads level 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 local, 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, as captured by their bank loan spreads. Are these firms' bank loan spreads also independent of their countries of origin? To this end, we further expand our dataset in two ways. First, we add information on the bank loans interest spreads of these same firms using proprietary data from the European credit registry AnaCredit. This is a dataset containing detailed information on individual bank loans in the euro area, harmonised across all Member States. Second, we add bond-level data on the investor ownership composition, the type and nationality of investors, 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 suggests 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. This in turn suggests that 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, contrary to conventional wisdom. In both monetary unions, monetary policy transmits homogeneously across bond issuers independently of their country or state of origin. We 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, these results lend support to the need to deepen the euro area capital markets to facilitate bond issuance. They speak to the European policy initiative to complete the capital markets union and by so doing to scale up firm innovation and regain competitiveness.[1]

[1]See the European Commission report on the future of European competitiveness (2024) and Allen and Yago (2010).

Related literature. Our paper relates to several strands of literature. It relates closely to the nascent literature on the role that heterogeneity and financial frictions play in the transmission of monetary policy. These recent studies show that heterogeneity in firm fundamentals and financial frictions play an important role in the transmission of monetary policy (e.g. 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. Several key aspects of transmission also remain under-researched. One such aspect is the role of country heterogeneity in a monetary union for the transmission of common monetary policy surprises. We tackle this question in this project. We use the US and the EA as laboratories which enables us to contrast a mature monetary union with a more recent one to study the role that country or state heterogeneity within a monetary union may play in the transmission of monetary policy to corporate bond spreads.

We focus first 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 the understanding of the bond lending channel of monetary policy (see Darmouni, Giesecke, and Rodnyansky (2022)).[3] As 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.[4] Investigating the bond lending channel of monetary policy is warranted not only in light of the rapid rise in corporate bond financing, particularly in the post-Global Financial Crisis period, but also given the peculiarities of corporate bond markets, as stressed out in recent papers on demand-system asset pricing, as pioneered by Koijen and Yogo (2019).[5] Corporate bonds are characterized by lower liquidity than

[2]More specifically, recent 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]With corporate bond markets being a growing source of funding for companies throughout the world, Darmouni et al. (2022) inspect the so-called bond lending channel of monetary policy. More precisely, they look into the responses of stock prices to monetary policy shocks conditional on firms' debt structure. They find that monetary policy disproportionately impacts bond-financed firms and argue that this is because bonds have higher costs of financial distress relative to bank loans.

[4]More generally, 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.

[5]See e.g. Cappiello et al. (2021); Darmouni and Papoutsi (2022) for evidence on the rapid rise in corporate bond financing.

government bonds. Recent studies also show that the investor base of US corporate bonds is dominated by institutional investors, particularly insurance companies and pension funds that are typically buy-and-hold, which may in turn have an impact on bond pricing.[6]

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. From this perspective, 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 e.g. 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 (e.g. Friedman (1997); Krugman (2013)) and financial fragmentation (e.g. Fornaro and Grosse-Steffen (2024)). At the same time, according to predictions of the optimal currency areas theory, a common currency should increase trade, including trade in assets, and thereby foster financial integration and deeper and more liquid financial markets (e.g. 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 the specific segment of corporate bonds.

As one of our main variable of interest is the corporate bond spread, i.e. 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. The value of a firm equity is priced as a call on its assets with a strike price equal to the value of its debt.[7] Merton (1974)

[6] Coppola (2021) for instance shows that the investor base composition is an important determinant of bond price dynamics providing causal evidence that the distribution of ownership of financial assets across heterogeneous institutional investors is an important determinant of the magnitude of fire sales over the credit cycle. He shows that, during crises, firms whose bonds are owned by investors less prone to fire sales face relatively better credit conditions, and discusses implications for macro-prudential regulation. Koijen and Yogo (2023) study the ownership structure of US corporate bonds with a focus on the central role of insurers showing that insurers take credit risk and incur risk charges by allocating a larger share of their portfolio to corporate bonds than Treasury bonds.

[7] 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 (e.g. 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 bond prices.

introduced the *distance-to-default* model which indicates 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 model, 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, net of country or country-time fixed effects, 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.

Importantly, our unique dataset enables us to contrast for the first time in the empirical literature the market-based with the bank-based external finance premium of firms, where the focus is on country heterogeneity within monetary unions. This in turn relates our paper also to the literature on the external finance premium, i.e. 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 observed (e.g. 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.[8]

The remainder of the paper is structured as follows. Section 2 presents the data and descriptive statistics. Section 3 outlines the potential mechanisms and presents the empirical approach. Section 4 reports the baseline results, section 5 details the robustness checks and extensions and section 6 concludes.

2 Data and descriptive statistics

Our data comes from several sources, including proprietary datasets. This 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. Our dataset maps bond-level characteristics such as maturities, issuance size and daily prices with (i) balance-sheet information of the issuer firm and the firm's country or state of residence, (ii) the types and domiciles of the bond holders and (iii) the bank loan spreads over the overnight indexed swap (OIS) for euro area firms, if

[8] There are also studies investigating potential differences in the arm-length versus bank lending relationships and on firms decision to borrow from markets versus banks (e.g. Rajan (1992)).

the firm also has bank loans. The baseline dataset focuses on non-financial corporations. In addition, for robustness tests, we also construct a database for financials, including banks, comparing their bond spreads behavior to those of non-financial corporations.

2.1 Data

We begin by constructing a detailed, granular dataset for the US and the euro area 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 origin. To do so, we first select corporate bonds using the Intercontinental Exchange - Bank of America Merrill Lynch (ICE-BofAML) Global Index System. Our focus in 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.[9] 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 yearly 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 using Anacredit, the credit registry of the European System of Central Banks, providing information at a monthly frequency on individual bank loans above €25,000.

We focus on senior unsecured bonds issued in domestic currency 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 1,600 US and 300 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 often behave more like financial firms.[10] 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).

We use option adjusted spreads for both the euro area and the US. 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-to-maturity either the overnight index swap (OIS)

[9]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. Please refer to the ICE Bond Index Methodologies (2023) for further details.

[10]For instance, 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.

of matching maturity, 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.[11] 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 residence of the bond *issuer*. This is a crucial element for our question studied here and which we also allows us to circumvent potential issues related to the so-called Onshore Offshore Financial Centers (OOFC) countries, as we discuss in more detail below. We use Orbis to apply a similar definition when assigning a US state for 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 a few bonds that are assigned to a different country in CSDB compared to the ICE BofAML. This is related to what 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.[12] Reassuringly for our case, the ICE-BofAML country classification overcomes this issue, since, as explained above, bonds are assigned according to the issuer's operating headquarters and are not assigned to the country where the bond was issued.[13]

Overall, after filtering and matching bond-level data with balance sheet information of their issuers, our baseline dataset is comprised of 15,314 USD-denominated bonds issued by 1,603 US non-financial

[11]For more details, see ICE Bond Index Methodologies, 2023.

[12]The results of 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 OOFCs 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 (see e.g. Euroclear White Paper, 2024). Netherlands, for instance, is home to one of Euroclear local CSDs, which may artificially overstate its role as OOFC. There is however little research on the role of custodians in facilitating financial integration.

[13]Many bonds that may potentially pose this problem are bonds issued by auto loan companies and REITs, which we anyway drop in our baseline data, as explained above. We also show robustness to dropping all bonds for which ICE-BofAML and CSDB country assignments differ.

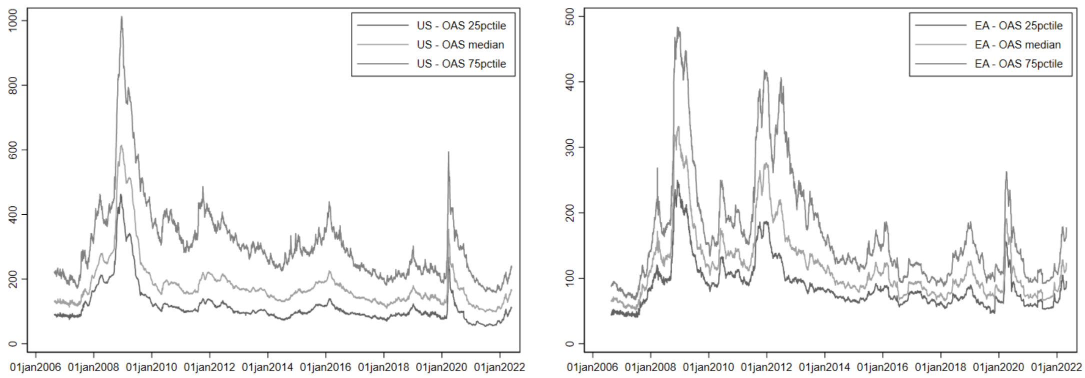
corporations and of 2,527 EUR-denominated bonds issued by 295 EA non-financial corporations.[14] We take precaution that the sample size differences do not drive our results, as we detail further below in one of our robustness tests where we apply a firm matching algorithm.

2.2 A first look at the data

Figure 1 below plots the median spreads in the US and the EA together with the 25th and 75th percentiles from our dataset. Heterogeneity at both time series and cross-sectional dimensions are evident. Global Financial Crisis and Covid are visible as spikes in bond spreads of both economies, and the EA figure also shows 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 high-end of the distribution in crisis times. We will return to this observation below.

Figure 1: Option adjusted spreads

(a) US **(b)** EA

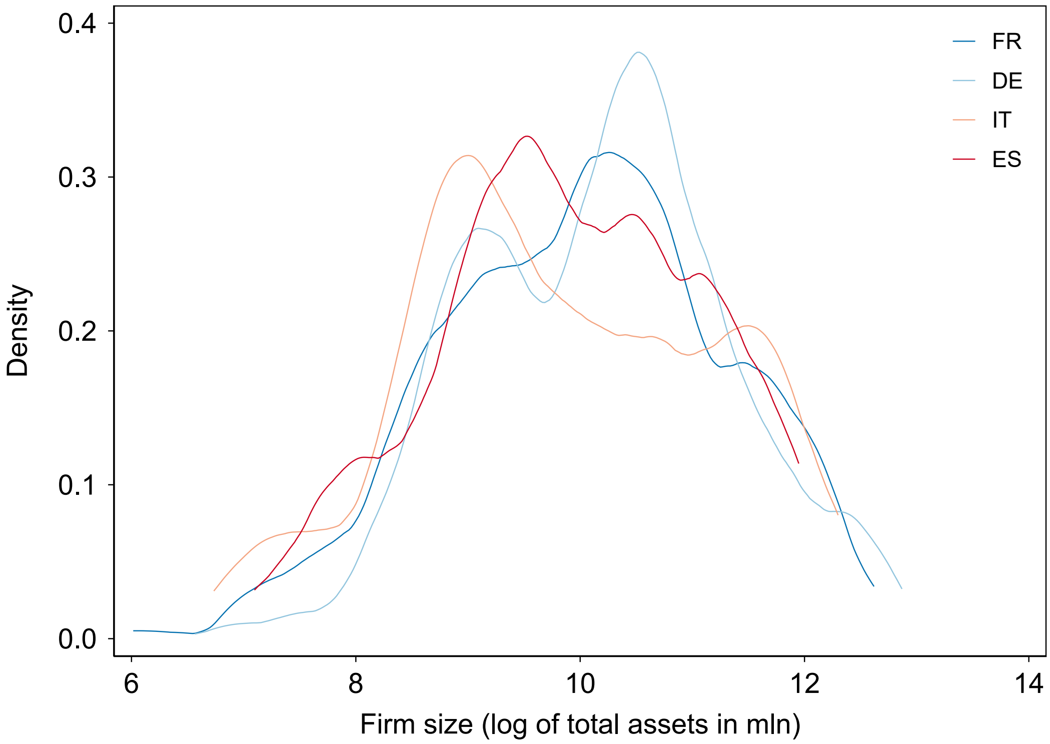


Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations. *Notes*: The figures plots the panel of daily corporate bonds spreads in basis points for the US (panel a) and the EA (panel b) over 2006 to 2022.

Figure 2 shows that, in the euro area, the distributions of bond issuing firms by size are generally similar across euro area countries. Importantly, the figure shows that, contrary to what one would expect, Italian or Spanish firms do not have to be larger than German ones to be able to issue bonds.

[14]In line with 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 headquarters or whose country of risk are 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.

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.

In the euro area, the median bond across major EA countries has a volume between EUR 600-750 mln, between 7- to 10-year maturity, a BBB credit rating and trades between a 90 to 140 basis point spread. The median firm across major EA countries has a low probability to default over the one-year horizon, has assets between EUR 7 and 35 mln, has between 6 to 14 bonds outstanding in an average day with some firms in the largest countries trading more than 40 bonds in 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.[15] In the US, the median bond has a volume of about 400 USD mln, but there are also bonds of

[15]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.

more than 15 USD bln (the so-called jumbo bonds).[16] The median US bond has 10-year maturity and a spread of 160 basis points. The median US firm has about 7 USD mln 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 between 0.04 to 0.10 percent.[17] The median US firm has 10 bonds outstanding in an average day, with some firms trading more than 100 bonds in a given day. Further information on bonds and issuing firms are in Tables A.1 and A.2 in the Appendix.

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 these distributions on three dates and pooled across time. 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.[18] At the other end of the distribution, there are no EA firms with comparable sizes to US superstars like Amazon, hence the US distribution continues to have a slightly longer right tail.[19]

To show that our results are not due purely to firm size distribution differences between the US and the EA, we will perform robustness checks on samples where the size distributions are the same. 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 firms by size, as long as the best match is within EUR 5 million by assets. We drop the unmatched firms in both economies. The resulting firm size distributions are shown in Figure 4. Clearly, 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 (more precisely we have 4,974 US bonds vs. 1,552 EA bonds). We will show below that our results are essentially the same if we condition on this sample. Firm size differences do not drive our results.

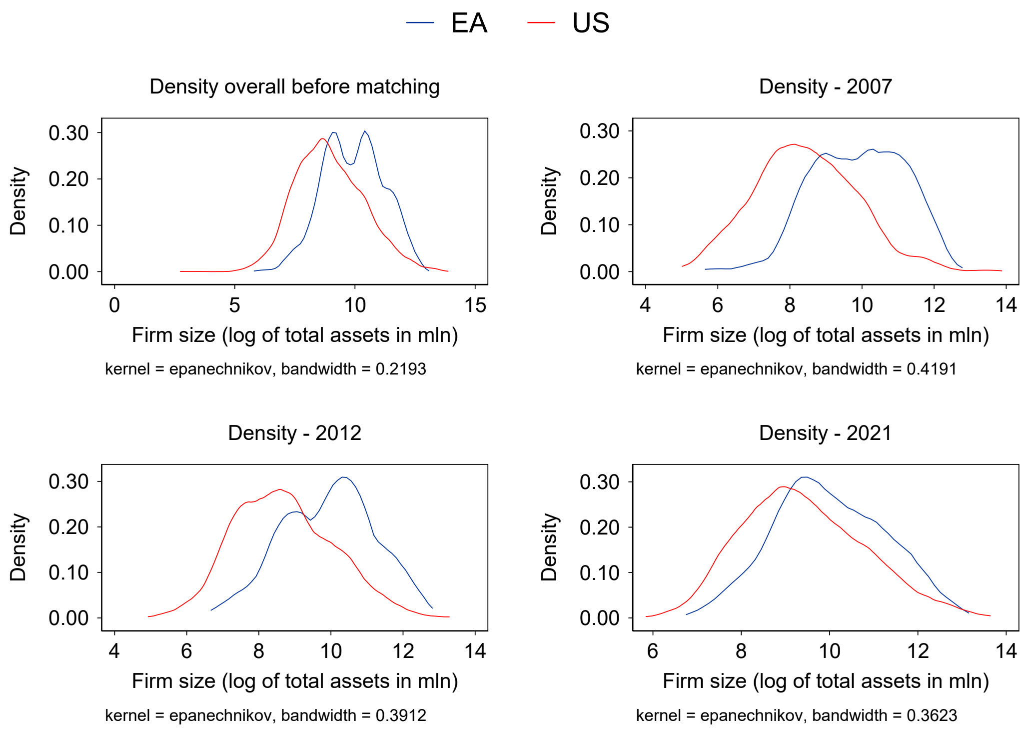
[16] Indeed, many US firms, particularly well known blue-chips, have engaged since 2015 in bond mega deals.

[17] The maximum total assets of a firm can however also reach more than 400 USD bln.

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

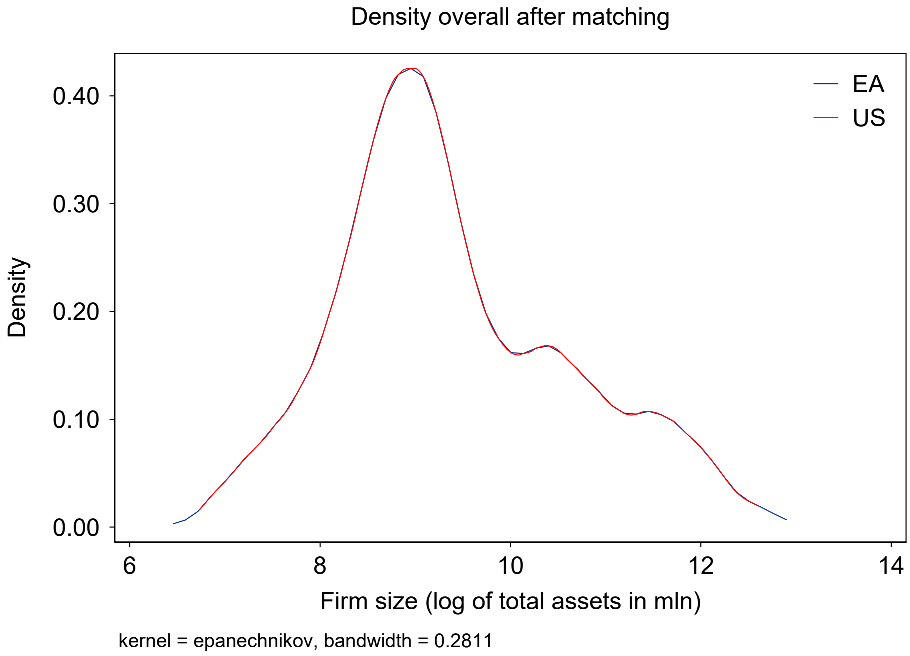
[19] Many US companies, particularly well known blue−chips, have engaged since 2015 in bond mega deals of at least USD10bn, the so-called jumbo bonds.

Figure 3: Distributions of US and EA firms by size



Sources: ICE BofA Merrill Lynch, LSEG and authors calculations.
Notes: The figure shows the kernel density of firms by their size proxied by the log of total assets (expressed in millions of EUR) in the EA and the US at the beginning of the sample in 2007, during the EA crisis in 2012, towards the end of the sample in 2021 and pooled over time.

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.

3 Mechanisms and empirical framework

Mechanisms. 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 bank loan level variance in bank loan interest rate spreads over OIS 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 the bank loan spreads. Here, we focus on corporate bond spreads and use the US as a baseline where, inside the monetary union (the US, in this case), firms' domicile differences do not matter. We will compare the country-level differences for corporate bond spreads in the EA to state-level differences in the US. We will 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, in line with evidence in Palazzo and Yamarthy (2022), for instance. In our sample of US and euro area firms, the location of the firm matters particularly. One would expect that the state of origin of a bond-issuing firm in the US does not matter for transmission of the Fed's monetary policy. However, one would expect the country of origin of a euro area bond-issuing firm to matter for transmission of the ECB's monetary policy across the euro area for various reasons. The euro area is conventionally regarded as not as optimal a currency area as the US given the absence of a fiscal union and limited capital and labor mobility across EA countries. And various frictions, such as heterogeneity in corporate tax regimes, legal systems, trading and post-trading infrastructures, contribute to fragment euro area financial markets along national lines. All this may encourage investors to demand higher compensation for the risk of holding corporate bonds of firms located in EA countries with less favorable tax regimes, legal systems or that are simply harder to trade across national borders. Importantly, compensation is tightly linked to benchmark risk-free assets, which are diverse in the EA, unlike in the US.[20]

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

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

where changes in spreads of bond i issued by the firm j belonging to sector s in country or state c over a one-week window, t, 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.[21] We also add a vector of control variables, $\boldsymbol{Z}_{ij,t}$, including firm default risk, as captured by Moody's Expected Default Frequency measure, and bond ratings. We leverage on the granularity of our dataset to control for unobserved heterogeneity with bond, firm and sector-level fixed effects. We are mainly 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.

Similarly 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) or Gilchrist, Wei,

[20]US corporate bonds are priced over US government bonds, while corporate bonds of EA firms are priced over bonds of their respective governments, whose 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). US states also have different ratings, but the reference for US corporate bonds is the US Treasury bonds' yield curve.

[21]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 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 (i.e. Germany, Luxembourg and the Netherlands), with the remaining countries constituting the periphery group. This classification would arguably minimize composition effects arising from changes in ratings in euro area sovereigns during the euro area debt crisis, which would bias the estimates of the effects of monetary policy shocks upwards on AAA countries against downwards on non-AAA countries.

Yue, and Zakrajšek (2024). 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. They 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.[22] 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.

4 Results

Monetary policy transmission across US states. We first analyze transmission in a mature monetary union such as the US. Table 1 reports the baseline estimates. The estimated coefficient reported in column (1) of Table 1 capture the average response of corporate bond spreads to a monetary policy tightening surprise. 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. The estimated coefficient is significant at the 1% level of significance and is of the same order of magnitude of the point estimate of 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. Column (3) of Table 1 shows that the coefficient is slightly lower although of same statistical significance in the specification adding multidimensional fixed effects at the bond, firm and sector level, and further control variables such as firm specific expected default frequency or bond-level ratings.

Importantly for our question, if one differentiates borrowers by their state of origin, monetary policy surprises have similar effects on spreads irrespective of whether the issuing firms are from lower-rated US States or not. 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 in the US and the corporate bond market is highly integrated, as one would have expected.

Monetary policy transmission across euro area countries. Contrary to what one would expect, things are similar for the euro area as well, to which we now turn. Table 2 reports the estimates for the baseline specification (1) for the euro area. As shown in the descriptive part above,

[22] Their focus is on separating the pure monetary policy shock from central bank information shock, without differentiating between conventional and unconventional monetary policy measures. They state that central bank information shocks are central bank announcements that convey private information about the central bank's assessment of the economic outlook. Ignoring the central bank information shocks biases the inference on monetary policy non-neutrality.

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

	Overall	Lower rated US State	Overall, incl. FE and controls	Lower rated US State, incl. FE and controls
	(1)	(2)	(3)	(4)
MP surprise	0.959***	0.911***	0.718***	0.706***
	(0.251)	(0.252)	(0.256)	(0.240)
MP surprise x Perif_State		0.081		0.020
		(0.081)		(0.075)
Observations	398,836	398,836	335,352	335,352
R^2	0.01	0.01	0.05	0.05
Adjusted R^2	0.01	0.01	0.02	0.02
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. Standard errors (reported in parentheses) are clustered two-way, at the firm and time level. Sample period: Aug 2006-Dec 2021. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

the distribution of euro area firms, in contrast to the US one, is overall skewed towards larger firms that might better weather shocks stemming from average monetary policy surprises. We hence focus here on large monetary policy surprises defined as one and a half standard deviation above their mean. This corresponds to the 10 largest surprises, which are above 6 basis points in our dataset.[23] Chart A.3 in the Appendix illustrates these 10 largest surprises together with the dates of the ECB Governing Council meetings when they occurred. Similarly to the US, on average, spreads widen after a large tightening surprise. Again, similarly to the US, on average, ECB monetary policy transmits homogeneously across EA countries. Indeed, if one differentiates simultaneously borrowers by their country of origin, monetary policy shocks have similar effects on spreads irrespective of whether the issuers are domiciled in high rated sovereigns or not. There is no segmentation in the EA either.

Next we contrast the responses of euro area corporate bond spreads to all monetary policy surprises, not only the largest ones, both domestic surprises (i.e. ECB surprises) and international ones (Fed

[23]The maximum pure monetary policy surprise was about 18 basis points.

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

	Overall	Lower rated EA country	Overall, incl controls	Lower rated EA country, incl. controls	Overall, Fed response	Overall, Fed and ECB horse race	Lower rated EA, Fed reponse
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MP surprise	3.159*	3.036*	3.876**	3.863**		0.580	
	(1.528)	(1.510)	(1.271)	(1.196)		(0.718)	
MP surprise x Perif_Country		0.620		0.066			
		(1.106)		(0.872)			
Fed surprise					0.425**	0.823***	0.403**
					(0.176)	(0.224)	(0.159)
Fed surprise x Perif_Country							0.106
							(0.180)
Observations	5,311	5,311	4,413	4,413	62,534	563,201	62,534
R-squared	0.422	0.422	0.545	0.545	0.051	0.041	0.051
Adjusted R^2	0.110	0.110	0.270	0.270	0.0192	0.0130	0.0192
Fixed effects	Yes	Yes	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	10	10	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) to (4) report estimated 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-Dec 2021. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

surprises). Columns (5) to (7) in Table 2 show that, on average, corporate bond spreads of EA firms also respond to US monetary policy surprises (see column 5) and that Federal Reserve monetary surprises dominate the ECB ones both in terms of statistical significance and magnitude, when we conduct a horse race between the two (see column 6). These results echo the findings of Ca' Zorzi et al. (2020) showing that the Federal Reserve monetary policy strongly affects financing conditions in the euro area. However, most importantly for our main question, the effect is here again not differentiated across lower or higher rated countries, as the interaction coefficient remains insignificant (see column 7 of Table 2 below).

The lack of heterogeneity conditional on monetary policy surprises in the euro area is perhaps surprising, given the voluminous literature on the differential effects of monetary policy on countries with different characteristics. Why are corporate bonds different? Is this invariance only with respect to monetary policy surprises?

Role of country or state of origin of the bond-issuing firms for corporate bond spreads levels. We now turn to understand to what extent corporate bond spreads (in levels) are determined at the level of the state or country of residence of the issuer. We thus analyse whether country (of residence) of the bond-issuing firm matters for explaining variations in the levels of corporate bond spreads in the EA and the US, applying a similar methodology as Altavilla et al. (2024). Leveraging on the granularity of our dataset, we now explore rather than absorb the fixed effects, by sequentially extracting fixed effects that aggregate information at country or state level first and then at the firm and bond level. 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 level at time t of bond i belonging to firm j in country c and μ_c are the country fixed effects.

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

where $y_{i,j,c,t}$ is the spread level at time t of bond i belonging to firm j in country c and $\mu_{c,t}$ are the country-time 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.

In addition, we also look at whether country-time fixed effects may have a role in explaining the variance of firms' default risk:

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

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

Table 3 below shows that country/state or country/state-time fixed effects explain only single-digits 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, i.e. $\varepsilon_{i,j,c,t}$.[24] Overall, we find that corporate bonds spreads levels do not depend on country/state of the bond-issuing

[24] After accounting for firm specific default risk, country fixed effects explain even less of the variance of the default-free spread (the so-called excess bond premium as coined by Gilchrist and Zakrajšek (2012), with an adjusted R^2 in the range of 2% to 5% for both the EA and the US, depending on the specifications considered. When regressing spreads jointly on EDF, VIX, bond liquidity and controlling for bond, firm and sector fixed effects, the R^2 reaches more than 76%. We also tried to understand whether sovereign spreads have explanatory power for firm specific default prospects. They explain less than 0.2% of the variance of firm default probability.

firm at all. This is polar opposite to *bank loan spreads*, which are very strongly determined at the country level (Altavilla et al. (2024)).

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

	US				EA			
	(1) OAS	(2) OAS	(3) $\varepsilon_{i,j,c,t}$	(4) Default risk	(1) OAS	(2) OAS	(3) $\varepsilon_{i,j,c,t}$	(4) Default risk
Fixed effects	Country	Country-Time	Firm-Time	Country-Time	Country	Country-Time	Firm-Time	Country-Time
Observations	14,993,069	14,993,069	14,993,069	14,968,703	2,708,938	2,708,938	2,708,938	2,651,022
Adjusted R^2	0.042	0.074	0.385	0.023	0.030	0.058	0.400	0.027

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 2021. Daily data.

Is the corporate bond market special or the bond-issuing firms? 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, i.e. their bank loans.

We therefore extend the dataset to include firm-level information on bank loan spreads from the European credit registry AnaCredit whenever a bond-issuing firm also contracts bank loans.[25] The bank loan spread is computed as the interest rate on the bank loan (at the issuance of the loan) minus the maturity-matched risk free (OIS) rate. We apply a similar methodology as Altavilla et al. (2024) and consider the set of all new, senior unsecured loans denominated in EUR issued by a bank in the euro area to firms in our sample of bond-issuing firms each month.[26]

In terms of empirical framework, we investigate the role of country or country-time fixed effects in explaining the variance of firms' *bank loan spreads*. Here, 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:

$$y_{l,j,b,c,t} = \mu_{c,t} + \varepsilon_{l,j,b,c,t} \tag{6}$$

This is the measure of bank-based external finance premium for firms borrowing from banks, with the spread defined relative to a maturity-matched OIS rate. In other words, this is the mirror measure of our main variable of interest, the corporate bond spread, i.e. the market-based external finance premium of

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

[26] 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 April 2024. This set contains about 34,490 loans, together with information on a wide variety of loan level characteristics.

firms. We conjecture that if bank loan spreads of the bond-issuing firms are determined at the firm level, expecting therefore a low R^2 for country-time fixed effects, that would suggest that bond-issuing firms are special. Conversely, if bank loan spreads are determined at the country level, expecting therefore a high R^2 for country-time fixed effects, that would suggest that the corporate bond market is special.

Table 4: Relevance of country fixed effects for bank loan spreads

	(1) Bank loan spreads	(2) Bank loan spreads	(3) Bank loan spreads
Fixed effects	Country	Country-Time	Country-Time
Controls	No	No	Yes
Adjusted R^2	0.29	0.71	0.74

Note: The table provides the R^2 of the WLS estimates of country (column 1), country-time fixed effects (column 2) and country-time fixed effects controlling for sovereign spreads (column 3) 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 - April 2024. Monthly data.

Table 4 above 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.[27] Country fixed effects and in particular country-time fixed effects explain more than half of the variation of bank loan spreads for our sample of bond-issuing firms. This suggests that it is the corporate bond market which 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.

Here two stylised facts are interesting to note. First, more than 90% of the bank loans are made by euro area banks and only 10% of the loans are contracted from foreign banks. Second, about 60% of the loans are with domestic banks and just 40% of loans are cross-border. This again stresses the local nature of the European banking system. It also raises the question of whether it is the country of the bank, the country of the firms or the overall euro area conditions that dominate the bank loan spread. We therefore investigate further the bank and market external finance premium when the country of residence of the bond-issuing firm differs from the country of residence of the bank, taking into account sequentially or simultaneously the sovereign spreads and/or the country or the country-time fixed effects pertaining to the firm or the bank, also netting out the EA overall sovereign spread in some specifications.

[27] As a result, the fixed effects are effectively value-weighted indices of bank loan spreads at the country level.

When the bank and the firm are located in different EA countries, it is the EA overall spreads that explains most of the variation of bank loan spreads, not only in terms of explanatory power but its coefficient is statistically significant and sizeable in terms of magnitude, trumping the one of either sovereign spreads of the country of the bank or those of the country of the firm (see column 6 in Table A.5); without controlling for EA sovereign spreads, it is the sovereign spread of the bank that trumps the one of the firm, not only in terms of explanatory power but also in terms of size and statistical significance of the coefficients (see columns 1, 2 and 5 in Table A.5). Net of EA overall sovereign spreads, the sovereign spreads are statistically insignificant and hardly explain loan spreads variation (see columns 3-5 in Table A.6) and their explanatory power is similar after accounting also for country fixed effects (columns 3-5 in Table A.7). Table A.8 shows the regressions of the bank loan spread on the sovereign spreads of the country of the bank and those of the country of the firm, controlling also for country or country-time fixed effects. Again, also here the explanatory power is similar, but the sovereign spreads of the country of the bank appears of larger magnitude than the sovereign spreads of the country of the firm (column 1 of Table A.8). Overall, when the bank and the firm are located in different euro area countries, we find a more important role for the country of the bank than for the country of the firm, but these are dwarfed in prominence by the euro area overall conditions in explaining bank loans spreads variance

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 with the loans spreads, suggesting that banks 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
R2 adj.	0.0274	0.7658
Fixed effects	Country bank	Country bank-time
Cluster	Country bank, time	Country bank, time

Note: 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 2022 - April 2024. Monthly data.

One potential explanation of why corporate bond market might be special could be related to the composition of their investor base. We investigate this further for the euro area using proprietary data on security-by-security holdings from the ECB Securities Holdings Statistics by Sector (SHSS). This database provides information on securities held by selected categories of euro area investors, broken down by instrument type, but most relevant for us, by type of holders and also by nationality of the holders. Table A.4 shows that domestic investors generally account for a small fraction of domestic corporate bonds and that investors are geographically diversified. Home bias hence does not appear to be very pronounced, since the largest share of domestic corporate bonds are held by other euro-area investors, which in turn may affect the bond pricing. 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.[28] The role of custodians and payment infrastructures in facilitating financial markets integration remains a topic under-researched but which may warrant attention in future research.

5 Further results and extensions

Robustness tests. Our results remain robust to a battery of sensitivity checks. They are robust to alternative definitions of corporate bond spread, country/state classification or alternative sample periods (e.g. pre-CSPP sample). The results for the euro area are further robust to alternative monetary policy surprises. Instead of the pure monetary policy surprise of Jarociński and Karadi (2020), we also used the timing, target and forward guidance surprises from Altavilla et al. (2019). These results are shown in Appendix Table A.3.

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 by considering a coarse definition. In this case, higher rated countries are considered only those that maintained their AAA rating throughout the sample, including during crises. This definition would allow to minimize concerns over composition effects arising from changes in ratings in euro area sovereigns during the euro area 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

[28]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 serve as a gateway to the international market. For details, see Euroclear, 2024

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 detail some of these robustness below and relegate others to the Appendix.

Our baseline sample consists of investment grade bonds and 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 however robust also to the inclusion of all tranches of high yield bonds or when considering only the lowest tranches of high yield bonds, i.e. bonds rated below BB. Our results do not change from the baseline ones neither for the US nor for the EA. The transmission of monetary policy remains homogeneous across bond issuers. Also, the country fixed effects analysis yields similar results to the baseline ones, as the R squared continues to remain in single-digits numbers. However, the R squared changes considerably when restricting the analysis to the EA sovereign debt crisis period. Here, it almost triples from around 7% to about 21% when considering the universe of all bonds. When we leave out the EA sovereign crisis, the R squared is reduced to barely 1%.

In addition to these robustness tests, we also investigated whether bonds or firms may be better rated than their own sovereign and find that this is indeed the case. In some instances, more than half of the bonds or firms in Italy, Spain, Portugal or Ireland are better rated than their own sovereign, but not or less so in France. This runs against the conventional wisdom that firm ratings are generally below those of their own sovereign.

We also looked into balance tables to test the statistical difference between bond- and firm-characteristics depending on whether firms are located in core or periphery regions of the monetary union (controlling for sector fixed effects and clustering by EA country/US state). We do not find statistically significant and economically sizeable differences between core vs periphery firms. This holds for both the EA and the US: once a firm is able to issue bonds, its state or country of location does not matter anymore.

Matching EA and US distributions of firms by size. From the distributions shown in the descriptive statistics section above, we have seen that the distributions of firms by size are not similar, especially at the beginning of our sample (see more details under Section 2 above). We therefore apply a matching algorithm where EA firms are matched with their closest US firm peer in terms of size. We run our baseline estimates on the resulting sample and find essentially similar results, as shown in the two tables below.

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

Table 6: Corporate bond spreads responses to monetary policy surprises in the US - After matching

	(1) Overall	(2) Lower rated US State	(3) Overall, incl. FE and controls	(4) Lower rated US State, incl. FE
MP surprise	0.9182***	0.9827***	0.6396**	0.9703***
	(0.2587)	(0.2878)	(0.2455)	(0.2871)
MP surprise x Perif_State		-0.1077		-0.1049
		(0.1468)		(0.1508)
Observations	146,184	146,184	122,291	146,067
R^2	0.007	0.007	0.050	0.044
Adjusted R^2	0.0070	0.0070	0.0192	0.0156
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	No
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	110	110	110	110

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-Dec 2021. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

average in the US (see column 1 of Table 6) 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 6). 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 of bonds issued by firms located in lower or higher rated states in the United States. The same holds also for the euro area (see Table 7). 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.

Correlations with sovereign bond spreads. We have also investigated the correlation between corporate bond spreads and sovereign spreads, as well as that between bank bond spreads and sovereign spreads. To that end, we have extended our baseline dataset to include bonds issued by banks, not only by non-financial corporations. The correlation coefficient is low for the former but higher for the latter, as shown in the Figure 5. This provides suggestive evidence that, in contrast to the banking system which remains essentially dependent to local and sovereign conditions, the corporate bond market

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

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. FE and controls	(4) Lower rated EA country, incl. FE
MP surprise	1.3259	1.3174	1.3138	1.2768
	(1.1144)	(1.1683)	(1.1768)	(1.1357)
MP surprise x Perif_Country		0.0329		0.0696
		(0.4244)		(0.4081)
Observations	58,115	58,115	49,980	58,079
R^2	0.015	0.015	0.067	0.069
Adjusted R^2	0.0153	0.0153	0.0368	0.0412
Fixed effects	No	No	Yes	Yes
Additional controls	No	No	Yes	No
Double clustering	Yes	Yes	Yes	Yes
Number of clusters	156	156	156	156

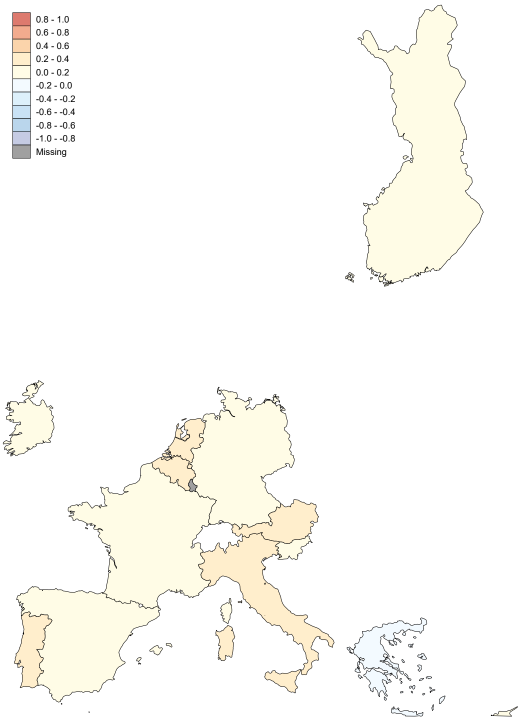
Notes: The table reports the results from estimating specification (1) after matching the US and EA firms by size. It shows the estimates of bond spreads responses following one basis point contractionary monetary policy surprise. The MP surprise is the pure monetary policy surprise from Jarociński and 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-Dec 2021. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

appears more integrated and less dependent on sovereign conditions.

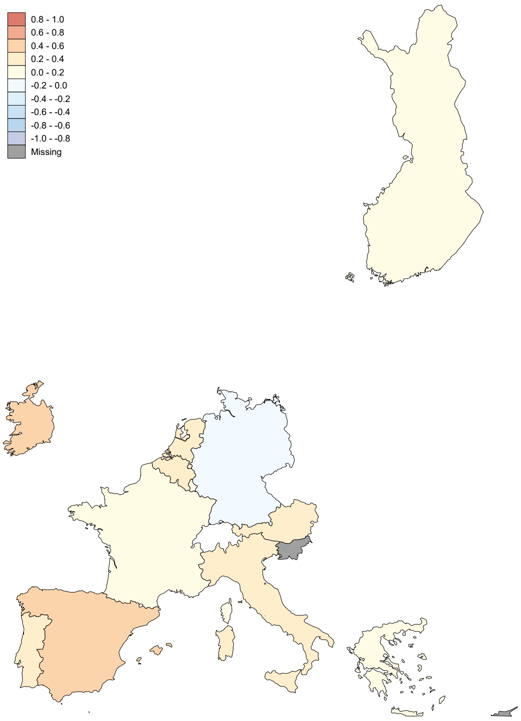
These results should, however, be taken with caution, since correlations between asset prices are prone to the so-called Forbes-Rigobon bias. Forbes and Rigobon (2002) show that correlation coefficients are conditional on market volatility. Therefore, during crises when markets are more volatile, estimates of correlation coefficients tend to increase and be biased upward. Under certain assumptions such as no endogeneity or omitted variables, it is possible to specify the magnitude of this bias and correct for it. Given that our sample period includes the great financial crisis as well as the euro area sovereign debt crisis, we corrected for this bias in three ways: (i) we applied the Forbes and Rigobon correction (note, however, the two assumptions that are needed, i.e. no endogeneity and omitted variable bias); (ii) we calculated the correlation coefficients of the residuals from a regression controlling for time (i.e. day) fixed effects as well as for the VIX or the VSTOXX, for the US and the EA, respectively. Both methods reduced indeed the correlation coefficients, although more for the US and less so for the EA; and (iii) we also computed the correlation coefficients excluding sovereign stress periods i.e. periods where the dispersion of changes in individual 10-year sovereign yields relative to the EA GDP-weighted 10-year yield is one standard deviation above the mean.

Figure 5: Correlation with sovereign bond spreads, excluding stress times

(a) Corporate bond spreads



(b) Bank bond spreads



Sources: ICE BofA Merrill Lynch, Moody's CreditEdge, Bloomberg, LSEG and authors' calculations.
Notes: The chart displays the correlation coefficients country by country of corporate bond spreads with sovereign bond spreads, matched by bond time to maturity (panel (a)), and bank bond spreads with sovereign bond spreads, matched by bond time to maturity (panel (b)). To correct for the Forbes and Rigobon (2002) bias, the calculations exclude periods of sovereign stress, i.e. periods where the dispersion of changes in individual 10-year sovereign yields relative to the EA GDP-weighted 10-year yield is one standard deviation above the mean.

6 Conclusion

Using a unique micro-level dataset combining several proprietary databases, we are the first ones to simultaneously investigate the behaviour of corporate bond markets in the two major monetary unions, the United States and the euro area, and contrast firms' market-based external finance premium versus their bank-based premium. The questions we pose here 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 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 a monetary union. We contrasted the impact of domestic monetary policy surprises on US and euro area corporate bond spreads. Our focus was to examine whether the location of bond issuers in core or periphery regions of a monetary union matters for monetary policy transmission. Our estimates suggest that the transmission of monetary policy surprises to corporate bond markets is homogeneous across borrowers of similar risk profile and is independent of their location within the monetary union. This is the case for US bond issuers but, 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. Here we tried to understand whether variations in the level of corporate bond spreads in a monetary union may be explained by the location of the bond issuing firm in a core or periphery region and explored the explanatory power of country and country-time fixed effects. We find that this is not the case. Country and country-time fixed effects hardly explain variations in the level of corporate bond spreads in the US and the euro area.

We further studied whether this is a property of the bond market itself or of the bond issuing firms, by investigating firms' bank-based external finance premium as captured by the bank loan spreads. In stark contrast to corporate bond spreads, country-time fixed effects explain a large portion of the variation of bank loans spreads of firms. The bank loan spreads of the bond issuing firms are similarly determined as those of other firms: at the country level. This in turn suggests that our findings are primarily due to properties of the corporate bond market rather than to bond-issuing firms' specific characteristics.

Overall, we find that, contrary to conventional beliefs, the euro area corporate bond market is as integrated as that of the United States. 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, these results lend support to the need to deepen the euro area capital market to facilitate bond issuance, speaking to initiatives aimed at creating a Capital Markets Union in the euro area.

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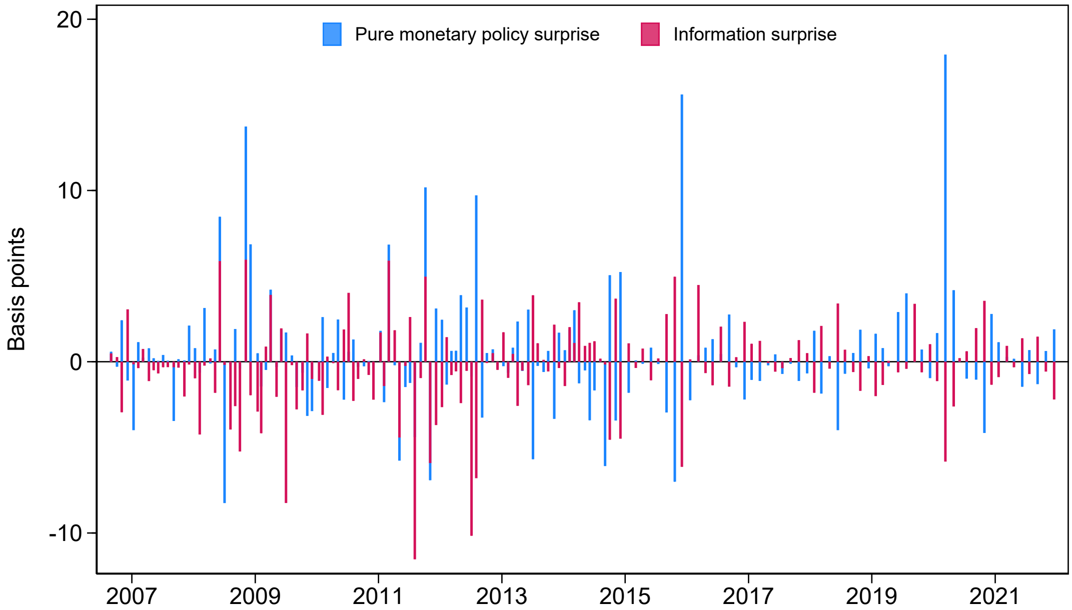
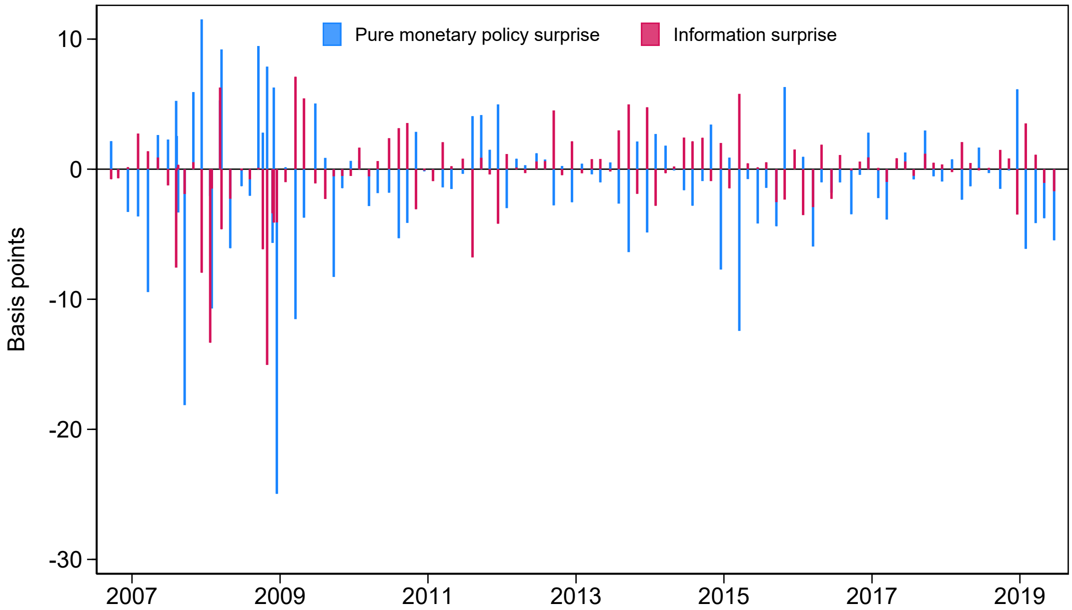
A Appendix

Figure A.1: ECB pure monetary and information surprises



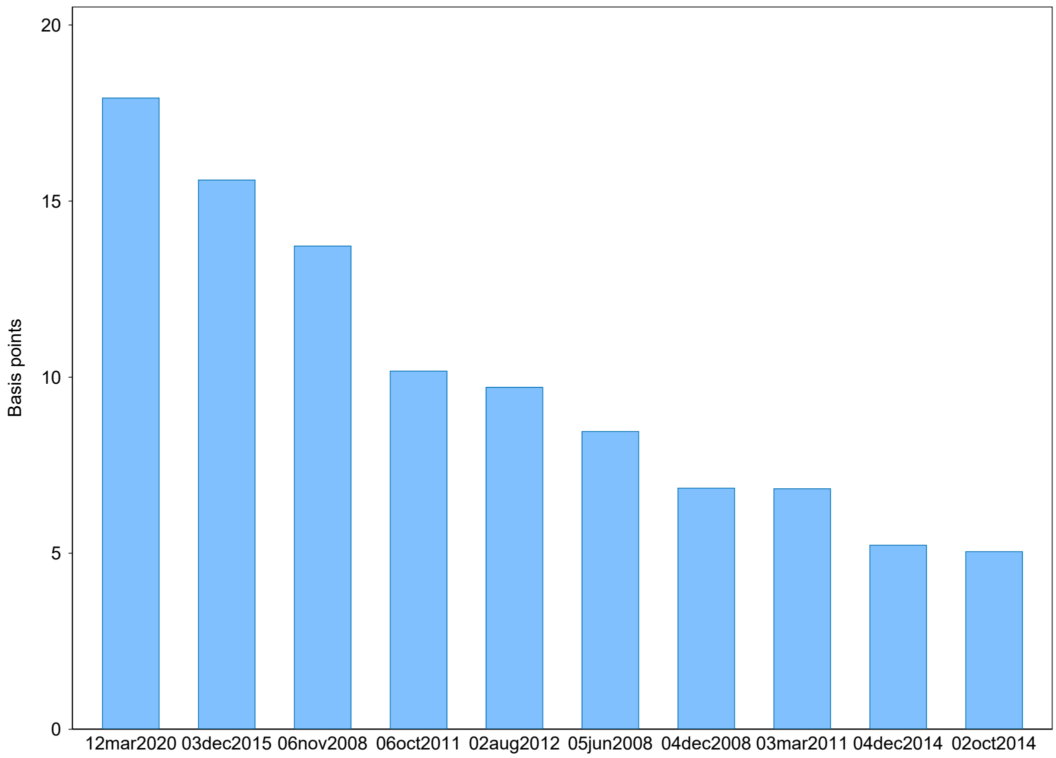
Sources: Jarociński and Karadi (2020).
Notes: The chart shows the ECB pure monetary and information surprises following the decomposition proposed by Jarociński and Karadi (2020).

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 and the date of the ECB Governing Council following the decomposition proposed by Jarociński and Karadi (2020) and the dates of the ECB Governing Council meetings when these surprises occurred.

Table A.1: Bond characteristics

DE	Mean	SD	Min	Median	Max
No. of bonds per firm/day	13.2	11.0	1	10	48
Bond volume (mil EUR)	777	381	30	750	2500
Maturity at issue (years)	8.1	3.9	1.5	7.0	30.0
Remaining maturity (years)	5.4	3.8	1.0	5.0	30.0
Bond Rating	BBB1		B3	BBB1	AA3
OAS spread (bp)	127	120	5	96	3498
Coupon rate (pct)	2.7	2.0	0.0	2.1	9.6
ES	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	10.3	7.1	1	10	39
Bond volume (mil EUR)	763	361	73	700	2250
Maturity at issue (years)	8.0	2.4	2.0	8.0	20.0
Remaining maturity (years)	5.1	2.8	1.0	5.0	20.0
Bond Rating	BBB2		B3	BBB2	A1
OAS spread (bp)	174	218	5	111	3494
Coupon rate (pct)	3.2	1.8	0.0	2.9	9.6
FR	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	8.7	5.8	1	8	39
Bond volume (mil EUR)	687	300		635	3500
Maturity at issue (years)	9.0	3.8	1.5	8.1	30.0
Remaining maturity (years)	5.7	3.7	1.0	5.0	30.0
Bond Rating	BBB1		B3	BBB1	AA1
OAS spread (bp)	131	126	5	95	3488
Coupon rate (pct)	3.1	1.9	0.0	2.9	9.4
IT	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	9.9	6.7	1	9	39
Bond volume (mil EUR)	786	373	42	750	2750
Maturity at issue (years)	9.2	3.8	3.0	8.0	23.0
Remaining maturity (years)	5.5	3.3	1.0	5.0	21.0
Bond Rating	BBB2		B3	BBB2	AA2
OAS spread (bp)	176	153	5	127	3495
Coupon rate (pct)	3.7	1.9	0.0	4.0	11.8
US	**Mean**	**SD**	**Min**	**Median**	**Max**
No. of bonds per firm/day	15.6	16.2	1	10	116
Bond volume (mil USD)	565	550	0	441	15000
Maturity at issue (years)	14.6	9.6	1.5	10.0	31.0
Remaining maturity (years)	14.3	9.5	1.0	10.0	30.0
OAS spread (bsp)	238	268	5	160	3500
Coupon rate (pct)	5.3	1.9	0.0	5.4	15.0

Table A.2: Firm characteristics

DE	Mean	SD	Min	Median	Max
EDF 1-Year (%)	0.23	0.54	0.01	0.06	14.33
EDF 5-Year (%)	0.55	0.57	0.03	0.37	6.83
EDF 10-Year (%)	0.77	0.56	0.03	0.63	4.96
Leverage ratio	0.29	0.14	0.05	0.27	1.24
Total assets (EUR mln)	47	80	0	19	515
ES	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.28	0.99	0.01	0.04	19.94
EDF 5-Year (%)	0.56	0.95	0.05	0.26	9.85
EDF 10-Year (%)	0.78	0.76	0.05	0.52	6.82
Leverage ratio	0.45	0.11	0.13	0.45	0.71
Total assets (EUR mln)	34	41	1	15	352
FR	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.26	0.72	0.01	0.06	16.90
EDF 5-Year (%)	0.57	0.73	0.01	0.31	11.74
EDF 10-Year (%)	0.79	0.67	0.01	0.57	7.90
Leverage ratio	0.33	0.15	0.01	0.30	1.02
Total assets (EUR mln)	39	50	1	24	359
IT	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	0.31	0.81	0.01	0.05	18.29
EDF 5-Year (%)	0.56	0.76	0.01	0.29	11.40
EDF 10-Year (%)	0.73	0.66	0.01	0.53	7.30
Leverage ratio	0.38	0.13	0.04	0.40	1.34
Total assets (EUR mln)	36	47	1	12	196
US	**Mean**	**SD**	**Min**	**Median**	**Max**
EDF 1-Year (%)	1.34	4.81	0.01	0.13	50.00
EDF 5-Year (%)	1.25	2.74	0.01	0.45	47.02
EDF 10-Year (%)	1.26	1.89	0.01	0.72	47.02
Leverage ratio	0.39	0.21	0.00	0.36	7.03
Total assets (USD mln)	425	8,955	0	7	422,360

Table A.3: EA corporate bond spreads responses to alternative monetary policy surprises

	(1) Overall	(2) Lower rated EA country	(3) Overall, incl. FE and controls	(4) Lower rated EA country, incl. FE
Timing	-1.3235*	-1.2812*	-1.5251*	-1.4833*
	(0.7572)	(0.6784)	(0.8764)	(0.8092)
Timing x Perif_Country		-0.1943		-0.1930
		(0.4423)		(0.3398)
N	94,220	94,220	81,353	81,353
R^2	0.0061	0.0062	0.0551	0.0551
R^2 adjusted	0.0061	0.0061	0.0255	0.0255
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

	(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. The MP surprises are the surprises from Altavilla et al. (2019), 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-Dec 2021. Daily data. The asterisks denote statistical significance (*** for $p < 0.01$, ** for $p < 0.05$, * for $p < 0.1$).

Table A.4: 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.

Table A.5: Loan spreads regressed on sovereign spreads, with or without country fixed effects

	(1) Loan spread	(2) Loan spread	(3) Loan spread	(4) Loan spread	(5) Loan spread	(6) Loan spread
Bank sov. spread	2.1752**		0.6177		1.8662*	-1.0676
	(0.9309)		(0.4462)		(0.8287)	(0.6582)
Firm sov. spread		1.1829		0.1427	0.9476***	-0.2092
		(0.6997)		(0.6369)	(0.1506)	(0.1957)
EA sov. spread						5.6592***
						(0.5414)
N	22929	22169	22929	22169	19646	19618
R^2 adj.	0.1404	0.0718	0.7958	0.7842	0.1801	0.5687
Fixed effects	No	No	Bank country*time	Firm country*time	No	No
Cluster	Bank country, time	Firm country, time	Bank country, time	Firm country, time	Bank country, time	Bank country, time

Sources: Anacredit, CreditEdge, LSEG and authors calculations. All spreads are calculated versus the OIS curve. Sovereign spreads 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 2019 - April 2024.

Table A.6: Loan spreads regressed on sovereign spreads, netted out of euro area sovereign spread

	(1) Firm sov. spread	(2) Bank sov. spread	(3) Loan spread	(4) Loan spread	(5) Loan spread
EA sov. spread	0.5843***	0.7194***			
	(0.1666)	(0.1085)			
Firm sov. spread net of EA			-0.1571		-0.1537
			(0.3240)		(0.2422)
Bank sov. spread net of EA				-1.0438	-1.0231
				(1.1778)	(0.8636)
N	23184	24133	22131	22901	19618
R^2	0.152	0.431	0.001	0.019	0.019
R^2 adj.	0.1520	0.4310	0.0010	0.0185	0.0184
Fixed effects	No	No	No	No	No
Cluster	Firm country, time	Bank country, time	Firm country, time	Bank country, time	Firm country, time

Sources: Anacredit, CreditEdge, LSEG and authors calculations. All spreads are calculated versus the OIS curve. Sovereign spreads 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 2019 - April 2024.

Table A.7: Loan spreads regressed on sovereign spreads netted out of euro area sovereign spreads, with country fixed effects

	(1) Firm sov. spread	(2) Bank sov. spread	(3) Loan spread	(4) Loan spread	(5) Loan spread	(6) Loan spread
Sov. spread EA	0.5843***	0.7194***				
	(0.1666)	(0.1085)				
Firm sov. spread net of EA			0.4003		0.5133	0.2151
			(0.6744)		(0.7240)	(0.1523)
Bank sov. spread net of EA				-2.5019	-1.2287	-2.4987
				(1.9144)	(0.8063)	(1.9255)
N	23184	24133	22131	22901	19618	19618
R^2	0.152	0.431	0.188	0.236	0.205	0.241
R^2 adj.	0.1520	0.4310	0.1882	0.2361	0.2051	0.2403
Fixed effects	No	No	Country firm	Country bank	Country firm	Country bank
Cluster	Country firm, time	Country bank, time	Country firm, time	Country bank, time	Country firm, time	Country bank, time

Sources: Anacredit, CreditEdge, LSEG and authors calculations. All spreads are calculated versus the OIS curve. Sovereign spreads 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 2019 - April 2024.

Table A.8: Loan spreads regressed on sovereign spreads, controlling also for country or country-time fixed effects

	(1) Bank loan spread	(2) Residual	(3) Bank loan spread	(4) Residual
Bank sov. spread	2.0848***	0.6842	0.6200	0.3104
	(0.5033)	(0.5562)	(0.4877)	(0.3001)
Firm sov. spread	0.8123***	2.2947	-0.0198	0.0724
	(0.1795)	(1.3793)	(0.1549)	(0.6892)
N	19647	19647	19647	19647
R^2	0.319	0.328	0.798	0.796
R^2 adj.	0.3191	0.3274	0.7983	0.7955
Fixed effects	Country bank	Country firm	Country bank*time	Country firm*time
Cluster	Country bank, time	Country firm, time	Country bank, time	Country firm, time

Sources: Anacredit, CreditEdge, LSEG and authors calculations. All spreads are calculated versus the OIS curve. Sovereign spreads 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 2019 - April 2024.

Table A.9: Relevance of sovereign spreads and debtor's spreads for bank loan spreads, for firms and banks located in different countries, from 2022

	(1) Bank loan spread	(2) Residual	(3) Residual
Corp. spread vs. OIS	-0.0279		
	(0.0162)		
Sov. spread bank		-0.1559	-1.4747**
		(0.7937)	(0.5787)
Sov. spread firm		0.5845	0.2497
		(0.3952)	(0.3787)
Sov. spread EA			3.0635***
			(0.6095)
N	5964	5040	5020
R^2	0.062	0.016	0.133
R2 adj.	0.0616	0.0159	0.1322
Fixed effects	No	No	No
Cluster	Country bank, time	Country bank, time	Country bank, time

Note: 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 2022 - April 2024. Monthly data.