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Natural Bank Reliance

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Natural Bank Reliance
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ABSTRACT: The higher aggregate prevalence of loan over bond funding in Europe is not only driven by the well-documented differences in financial market settings but also strongly shaped by different firm characteristics. The European economy is more fragmented than the U.S. economy, and thus features a different firm distribution in terms of size and collateral availability. I estimate that if all European firms had access to a financial market like the U.S. market, their aggregate bond funding share would remain significantly smaller. This counterfactual suggests a limited potential for European corporate bond markets in the short and medium term.

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WORKING PAPERS

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Prepared by Hannah Winterberg*

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Contents

Introduction **3**

Data **8**

Debt choice and a heterogeneous cross-section **12**
Firm characteristics 14
Modeling choice 21

Counterfactual analysis **21**
Model description 21
Equilibrium with bond and bank debt 24
Equilibrium with bank debt only 25
Calibration and estimation 26
Counterfactual scenarios 27

Conclusion **30**

Appendix **31**
Appendix I: Data Cleaning 31
Appendix II: Summary Satistics 32
Appendix III: Firm coverage 34
Appendix IV: Firm distribution 37
Appendix V: Information on the distribution of bond funding in the economy 38

References **43**

Introduction

European firms' debt funding is dominated by bank funding, whereas firms in the United States choose to issue more bonds. Why do European firms seem to reach such different conclusions regarding their best debt choice? If European firms were facing a financial market akin to the U.S. market, would the aggregate debt funding choice be the same?

This paper analyzes the cross-sectional dimensions of firm debt choice in the euro area in comparison to the United States. For this, I compile a unique, extensive data set and show that firm size and collateral availability are significant predictors of a firm's debt choice. I use a theoretical model to estimate the extent to which the aggregate debt choice is driven by similar firms using different funding sources in the two areas, as opposed to being driven by fundamentally different firms operating in those regions. Based on these estimates, I discuss counterfactual scenarios for the aggregate funding choice of European firms if they were relocated to the United States. I find that the use of bond funding among them would remain significantly lower due to different firm fundamentals in the segmented common market.

Nonfinancial corporations' debt funding is split between bank loans and corporate bonds; in Europe, those shares are around 85%/15% in the aggregate[1], while in the United States, there is a greater balance, tilting towards corporate bonds with shares of 45%/55%, respectively[2].

The distribution of funding choices across firms of different characteristics follows similar patterns in both regions. First, large firms, which are frequently public entities, carry a higher share of market debt (bond debt) on their balance sheets. In the United States, the bond debt share in this group is almost 70% (Caglio, Darst, and Kalemli-Özcan, 2021). In the euro area, larger firms also employ more bond debt, but the bond funding share remains below 50% even for the largest quartile of public firms (largest in terms of total assets, Darmouni and Papoutsi, 2020). Second, firms at the bottom of the firm size distribution almost exclusively use bank loans to fund themselves. Among small and mid-size enterprises (SMEs) in the United States, bank loans make up more than 90% of all debt, implying a share of market debt below 10% (Caglio et al., 2021).[3]

Larger European firms not only issue fewer bonds than their American counterparts, but they also make up a smaller share of the total economy since the distribution of firm sizes differs between the two regions. The European common market is much more fragmented than the U.S. market. While in the United States, 6 out of 10 employees work in a firm with at least 300 employees, only a third of European

[1] Statistical Data Warehouse, time series "Debt Securities And Loans" and "Total Debt Securities".

[2] Federal Reserve Economic Data, time series NCBLL and NCBDBIQ027S.

[3] In the United States, 'SMEs' are defined as firms with less than 500 employees, Caglio et al. (2021) employ the OECD definition under which 'SMEs' are firms with less than 250 employees and/or assets below $10 million and/or revenues below $50 million.

employees do.[4] Correspondingly, small firms play a more prominent role in the euro area than in the United States.

The finding that bond funding makes up a smaller percentage of their debt for large European firms compared to their US counterparts indicates that bank loans remain popular even among those European firms with access to the bond market. This points to a difference in the two financial markets. Several differences have been highlighted (Langfield and Pagano, 2016): First, the European financial structure is dominated by large, systemically important banks that enjoy an implicit government guarantee resulting in significantly lower funding costs (Lambert, Ueda, Deb, Gray, and Grippa, 2014) and thus a cost advantage over market debt. Second, the European institutional framework differs from the U.S. framework along several dimensions. On the one hand, the corporate bond market in Europe is strongly fragmented with low trading volume spread across several exchanges (consider, for example, Bleaney, Mizen, and Veleanu, 2016). Such fragmentation entails inefficiently high bond issuance cost (Foucault, Pagano, Roell, and Röell, 2013). On the other hand, differences in the efficiency of firm resolution procedures impact banks and bond investors differently (Becker and Josephson, 2016; Hackbarth, Hennessy, and Leland, 2007). Bankruptcy resolution procedures are typically rated more efficient in the United States than in the euro area (Kornejew, Lian, Ma, Ottonello, and Perez, 2024). Becker and Josephson (2016) highlight that a higher efficiency of bankruptcy procedures is associated with more bond funding.

A dominance of bank funding has been found to create a misallocation of resources due to excessive fluctuations in credit and has thus been called a *bank bias* (Langfield and Pagano, 2016). These negative consequences arise from two sources: First, banks' lending ability is procyclical (Behn, Haselmann, and Wachtel, 2016), implying that in a boom, less productive projects are funded in excess, whereas in a recession, more productive projects cannot secure funding, which is inefficient. Second, banks tend to continue to fund firms even though they might not be profitable anymore;[5] this is less often the case for debt sources with a large number of investors such as bonds. A bank bias has also been confirmed for the United States, where highly leveraged SMEs borrow more when monetary policy is expansionary (Caglio et al., 2021). In a cross-country comparison, the aggregate systemic risk associated with these bank biases is more pronounced in the euro area (Langfield and Pagano, 2016). In line with this observation, Jiménez, Ongena, Peydró, and Saurina (2014) find that banks take excessive risks under expansionary monetary policy in a Spanish sample, while Caglio et al. (2021) do not observe such risk-taking in a U.S. sample.

For this analysis, this paper considers firm size as a firm characteristic that stems from market fragmentation and impacts firms' debt choice. The paper interprets firm size as a characteristic of the firm that determines funding choices and is not driven by them. However, a firm's size could also be seen as the outcome of funding choice and constraints. In the aggregate, prior research has shown that the

[4] According to the statistics of U.S. businesses (SUSB) of the U.S. Census Bureau and the statistics on small and medium-sized enterprises from Eurostat. No restrictions on assets or revenues were applied.

[5] This has been referred to as "zombie lending"; see Keuschnigg and Kogler (2020).

firm size distribution (FSD) is not affected by financial constraints in developed economies. Angelini and Generale (2008) conclude that funding constraints are not a main driver of the FSD across developed economies because in their sample, the FSD of nonconstrained firms is similar to the entire sample for OECD countries. The literature also highlights several nonfinancial factors that shape the firm size distribution among developed economies. These are size-based regulation (Garicano, Lelarge, and Van Reenen, 2016), antitrust laws (Covarrubias, Gutiérrez, and Philippon, 2020; Grullon, Larkin, and Michaely, 2019; Philippon and Gutierrez, 2018), and the prevalence of certain industries (Beck, Demirguc-Kunt, Laeven, and Levine, 2008).

A second firm characteristic that has been shown to impact a firm's choice of debt type relates to a firm's liquidation value. A primary determinant of the liquidation value is the availability of collateral, or the fixed asset share, also referred to as a firms' asset tangibility. The direction of the impact of the liquidation value on debt choice depends on the frictions being considered. Theoretical models motivating funding choices through asymmetric information and improved monitoring by a bank (such as Diamond, 1984, 1991; Leland and Pyle, 1977) typically conclude that tangible assets reduce the information asymmetry and thus benefit bond issuances (Hoshi, Kashyap, and Scharfstein, 1993). By contrast, models that are based on a more efficient liquidation (or threat of liquidation) achieved through banks conclude that a large share of tangible assets benefits choosing bank loans (Park, 2000; Repullo and Suarez, 1998). In U.S. data, the collateral impacts not only the level of bank credit extended to SMEs, but it is also an important determinant of the impact of monetary policy on lending outcomes (Caglio et al., 2021). The assets of a firm, and thus its collateral, vary along the lines of industries, which can be assumed to be exogenous to the firm's funding decision (Beck et al., 2008).

Estimating counterfactual scenarios based on firm characteristics requires data on the distribution of those characteristics among the firms in both regions. By combining two data sources (bond issuances from Thomson Reuters / Refinitiv and firm data from Bureau van Dijk's Orbis database), this paper considers a more diverse picture of bond vs. bank loan choices among different types of firms than in the samples available via the commonly used Compustat and Capital IQ databases (consider, e.g., Darmouni, Giesecke, and Rodnyansky, 2019; Darmouni and Papoutsi, 2020). After data cleaning, the data starts in 2012 and ends just before Covid. It includes private and public nonfinancial firms in the euro area and the United States. For example, for the euro area, the sample represents about 60% of aggregate revenues and 59% of total employment. For the United States, the counterfactual analysis relies on the characteristics of bond-issuing firms, which are well covered, as is indicated by the total covered bond debt outstanding, which represents more than two-thirds of the aggregate in both regions. The share of bond funding (over total debt funding) is well represented by the micro-level data and amounts to 17% in the euro area and 53% in the United States in 2018 (in the aggregate, those shares are 13% and 62%, respectively).

This paper discusses how prevalent bond funding is in the cross-section of firms with different characteristics. My data confirms the patterns that (i) firm size is an essential predictor of bond issuance and that (ii) among the group of very large entities, European firms have a smaller share of bond debt. I observe two additional stylized facts: (iii) the observation that European firms hold smaller shares of bond debt also holds in smaller size categories and (iv) that the cut-off firm size to begin issuing bonds is higher in Europe than it is in the United States. The smallest American firms issuing bonds employ between 100 and 250 employees, while in Europe, bond issuance is almost exclusively seen among firms with at least 5,000 employees. Moreover, I consider the availability of collateral and observe that firms with more such assets tend to issue more bonds in both regions. In this context, I refer to collateral as fixed assets or redeployable assets available to the firm, which does not necessarily imply that these assets are indeed pledged as collateral.[6] Considering the aggregate firm distributions, I observe that European firms tend to be smaller than their American counterparts with no visible trend of the gap closing.

The second part of the paper employs a theoretical model of debt choice from the literature that incorporates heterogeneity along two dimensions: firm size and fixed asset share. A slightly adapted version of the model presented in Becker and Josephson (2016), this model illustrates the interaction between heterogeneous firms and a large set of bond investors, as well as banks. I assume that a firm's business model, the project undertaken, has a specific size and fixed asset requirement that is structural (i.e., exogenous to the debt choice). The agents in the model interact in a Cournot competition that leads to an equilibrium that closely resembles the situation observed in the data: only firms beyond a certain size threshold issue bonds, and this threshold increases with a firm's fixed asset share. In particular, conditional on their size, firms with a higher share of redeployable assets should have a higher share of bond funding. This mechanism results from a bankruptcy consideration. If a firm becomes insolvent, banks are more efficient in recovering their investment since they can engage in an out-of-court restructuring. By contrast, bond holders need to rely on formal bankruptcy procedures. If a firm has few redeployable assets, formal bankruptcy procedures destroy a lot of value. Thus bond investors consider the investment more risky and offer less bond funding. These firms use more bank loans due to equilibrium effects, not necessarily due to pledging of collateral in a specific contract.

I then estimate two sets of model parameters to best represent the empirically observed patterns on debt choice: one for the euro area and one for the United States. Based on these estimates and the aggregate firm distributions, I present counterfactual scenarios of debt choice on the intensive and extensive margin. These results are depicted in Figure 1.

If European firms were to face a financial market like their American counterparts, their aggregate bond funding share would on average be about 18 percentage points higher, closing less than half of the gap between the two countries. This is driven by existing bond issuers issuing more bonds ("counterfactual constant set" [of issuers]); the additional entry of smaller firms beginning to issue bonds ("counterfactual additional issuers") increases the aggregate share only slightly.

[6] Finally, I also consider the profitability and leverage of the firms in the cross-section and find that both characteristics are less predictive of firms' debt choices.

Overall, my results show that the difference in the bond funding share between the two regions mainly results from different firm fundamentals, this explains two-thirds of the modeled variation. Differences in the financial market structure explain the remaining one-third of the variation.

Figure 1: euro area counterfactual scenarios

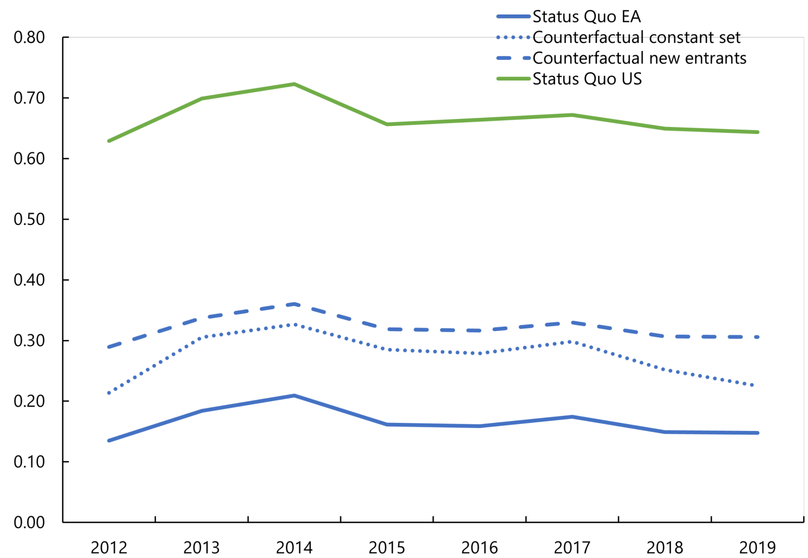


Figure 1 shows the results of the counterfactual analysis estimated in this paper. It includes two scenarios, the first only incorporates existing bond issuers issuing more bond debt, while the second also allows new entrants into the bond market.

To my knowledge, this is the first paper using aggregate micro-level data to present counterfactual debt scenarios for the euro area. The paper thereby contributes to two strands of the literature: first, to the macro-financial literature on debt markets and, second, to the empirical literature on debt choices among heterogeneous firms. From a macro-financial point of view, the papers closest to this work are De Fiore and Uhlig (2011) and Allen, Bartiloro, Gu, and Kowalewski (2018). The first presents a model of firm financing that incorporates the composition of corporate debt in order to explain different debt choices in the United States and Europe. The model does not incorporate effects of scale, a firm characteristic that I observe to be the main determinant of funding choice. The second paper, Allen et al. (2018), argues that on a macroeconomic level, real economic structure predicts financial structure. The authors present evidence based on aggregate data for a large cross-section of countries and consider exogenous events, such as the collapse of the Soviet Union, as a shock to the financial structure. From an empirical viewpoint, the paper presents a novel combination of micro-level funding data from both private and public firms to evaluate the funding decision across heterogeneous firms. A distinction between bank and bond funding has so far been drawn mainly based on data from Capital IQ (e.g. Darmouni et al., 2019; Darmouni and Papoutsi, 2020), which, with very few exceptions, only covers public firms. A different perspective on funding choice is achieved by considering supervisory loan-level data (e.g. Caglio et al., 2021; Chodorow-Reich, Darmouni, Luck, and Plosser, 2021).

My results are also relevant for the policy discussion surrounding the European Union's capital markets union project. This project aims to promote more efficient funding choices by firms to improve the integration and resilience of financial marketHs. In related studies, the euro area is frequently compared to the United States as a more integrated market union with an advanced financial market (consider, for example, Langfield and Pagano, 2016; Organisation for Economic Cooperation and Development, 2016). I highlight in this context that the difference in aggregate funding choices between the United States and Europe and its negative implications for systemic risk in the euro area are not exclusively a result of the different financial systems but are in part also caused by structurally different firm characteristics in a segmented market. My results thus provide an insight into the required nature of potential, targeted policies. In particular, they suggest that interventions focusing on the negative implications of the prevalence of bank funding should balance measures designed to foster debt market access for small firms as well as measures designed to disincentivize banks' amplifying behavior, since a reliance on bank debt appears to be unavoidable in the light of the European firm distribution. In the long-term, less market fragmentation could change the firm distribution and thereby impact the aggregate funding choice more strongly.

Data

The research question requires data on firms' bank and bond debt, individual firm balance sheets, as well as additional aggregate information.

I access detailed information on bond issuances in the United States and Europe from Refinitiv, formerly Thomson Reuters. In particular, I extract data on all historic bond issues by nonbank corporates from their debt deals database. This data set contains information on bond characteristics and details on the issuing firm at the time of issuance for a wide set of countries and securities. It not only covers different types of bonds, but also includes notes and certain types of commercial paper.[7] I download information on more than 300,000 bond issuances by nonfinancial issuers. For each firm, I deduce the volume of outstanding bond debt at a given balance sheet date from a firm's outstanding bonds. In this process, I take events such as buybacks or reopenings into account.[8]

For firm balance sheet data, I use Bureau van Dijk's Orbis database, which is a common choice in the literature on the euro area (for a detailed review on the database's representativeness, see Ba-

[7]The exact definition of each security type differs according to the laws and standards of the jurisdiction under which the debt instrument is issued. The more frequently occurring instrument types are: Bonds, Notes, Debentures, Commercial Paper, Negotiable European Commercial Paper (Short-Term or Medium Term) as defined under French law, and Inhaberschuldverschreibungen, a specific bond under German law. I remove all instruments with equity- or option-like features (such as convertible bonds or warrants).

[8]In particular, I determine the remaining outstanding amount for each given bond at each balance sheet cut-off date.

jgar, Berlingieri, Calligaris, Criscuolo, and Timmis, 2020; Kalemli-Özcan, Sørensen, Villegas-Sanchez, Volosovych, and Yesiltas, 2019).

In the existing literature, a distinction between bank and bond funding has been drawn mainly based on data from Capital IQ (e.g. Darmouni et al., 2019; Darmouni and Papoutsi, 2020). Capital IQ provides very detailed data but only covers public firms and a few very large private firms. By combining bond issuance data from Refinitiv with firm balance sheet data from Orbis, I compile a cross-country database covering a history of 9 years for 1.2 million firms (after data cleaning), which also covers private firms. Private firms are smaller than public firms and make up a large share of the total economy, it is therefore essential to include them when making aggregate statements. My data set thereby improves upon the coverage of small firms in the euro area in Capital IQ (as used in Darmouni and Papoutsi, 2020[9]). By considering data for a large international sample including a substantial share of private firms, I am able to include new perspectives on this topic[10].

To identify the representativeness of my sample, I compare the covered micro-level data to aggregate data. This aggregate data is typically provided for nonfinancial corporates. I apply a very strict definition of 'nonfinancial' to be conservative in this comparison. This is necessary since the definition of financial corporates differs across aggregate data sources in some respects. For aggregate measures, the U.S. Flow of Funds data explicitly mentions not only chartered commercial banks, bank holding companies, credit and savings institutions as financial corporates, but also life insurances and pension funds (Board of Governors of the Federal Reserve System, 2000, Vol.1, p. 20). These definitions are based on a classification with 30 sectors. For European data from the ECB's Statistical Data Warehouse, the definition is based on the European System of Accounts 2010 (ESA 2010) which can additionally include non–life insurance companies (Eurostat, 2013, p. 42).[11]

Firms in both databases can be matched using the Legal Entity Identifier (LEI) or, if unavailable, by matching the bond ticker to the BvD-ID using the firm name and industry. The resulting data set is cleaned to ensure that balance sheet items are in appropriate relation to each other (a detailed description of this process is provided in the appendix).

I also account for the common practice of issuing bonds through a subsidiary. Consider the example of automotive manufacturer Volkswagen AG. Volkswagen AG as the group head rarely issues bonds itself, while its fully owned subsidiaries such as Volkswagen International Finance NV issue a variety of bonds that are guaranteed by Volkswagen AG.

[9] The authors use a sample of 3,336 public firms. The average observation on total firm debt is €1,246 Mio. In an extension, they consider 47 private firms with rating downgrades of unknown size.

[10] Aggregate supervisory statistics, while providing universal coverage, cannot be used for this analysis since they lack the granularity required.

[11] The attribution of micro-level data to these aggregate measures is further complicated by the occurrence of inconsistencies between the industries reported in Refinitiv and Orbis data, which use slightly different classification systems. To be conservative, I drop all firms that may be seen as a financial firm or an insurance firm based on either the Statistical Classification of Economic Activities in the European Community (NACE) or on the field "Entity Type" reported in Orbis. More detail on this can be found in Section in the appendix

To appropriately capture the funding situation of corporate groups, I focus on consolidated accounts, if available. To avoid any double-counting, I drop the accounts of all majority-owned subsidiaries of those consolidated groups on a yearly basis (this approach has also been suggested in Bajgar et al. (2020, p.52) and a similar approach is taken in Caglio et al. (2021, p.12) for bank loans issued to firm subsidiaries).[12] The yearly information on firm ownership can be retrieved from the Orbis Webinterface and provides information on the corporate group structure.[13]

The basic, cleaned full sample for the euro area used in this paper contains information on 41.069 firms from Austria, 64.858 firms from Belgium, 136.199 firms from Finland, 734.663 firms from France, 242.772 firms from Germany and 15.792 firms from the Netherlands. I focus on the countries less affected by the sovereign debt crisis (also referred to as *Non-GIIPS* countries) to ensure that the results are not driven by this crisis. The dataset is also cut in 2019 to avoid any confounding effects of the Covid pandemic. The cleaned dataset on bond issuers contains information on 885 bond issuers in the euro area and 1.511 bond issuers in the United States. Among the European bond issuers, 48% are listed firms, compared to 63% in the United States. A detailed summary statistic of listing status and legal form can be found in the appendix in Table 1.

To ensure the representativeness of the firm data in Orbis, I consider different aggregate measures. A first measure to consider is total revenue, in this case of nonfinancial corporates. I observe that the coverage for the euro area is high with, on average, 60% of revenue covered. A second measure is the total number of employees in the nonfinancial corporate sector. On this measure, the average coverage in covered countries of the euro area is 59%[14]. Figure 3 in the appendix illustrates the coverage in terms of aggregate total operating surplus, for which the Orbis data covers about 69% of the aggregate. [15] A set of summary statistics for all firms and for bond issuers in each country can be found in the appendix in Table 2.

Figure 2 compares the total volume of outstanding bond debt across the cleaned micro-level data employed in this paper to aggregate data for the two covered regions. The aggregate outstanding volumes of debt securities are depicted in blue, while the micro-level data is depicted in orange (raw bond data, according to the borrower country reported by Refinitiv) and yellow (firm-matched data, by the firm's

[12]In order to avoid double-counting firms, it is also common to use nonconsolidated accounts when working with Orbis data (Kalemli-Özcan et al., 2019, p. 69) in comparison to aggregate, macroeconomic measures. This approach is difficult in the case of the bond debt attribution for two reasons. First, in non-consolidated accounts of the group head Volkswagen AG, the subsidiary's bond debt is not included in long-term debt, but provisions are included to account for the guarantees provided. These provisions cannot be distinguished from provisions for other contingent liabilities. Second, the bond-issuing subsidiary often only publishes very limited accounts or does not publish any accounts at all.

[13]Consolidated annual reports typically include this information in an appendix, for example, for the case of Volkswagen AG the "Shareholdings of Volkswagen AG and the Volkswagen Group [...] and presentation of the companies included in Volkswagen's consolidated financial statements" confirms the data from the Orbis database and shows that all bond issuing subsidiaries are fully consolidated entities.

[14]The aggregate data for turnover refers to the time series "Turnover or gross premiums written" from the "Annual enterprise statistics for special aggregates of activities (NACE Rev. 2)" for the total business economy except financial and insurance activities. The aggregate data for employment refers to the time series "Employees - number" from the same data set. If in the micro-level data corporate groups report worldwide employment, this is broken down to the domestic level by the share of local revenue in worldwide revenue.

[15]This measure was suggested in Crouzet and Eberly (2021).

domicile in Orbis). I observe that my micro-level data set, on average, covers more than two-thirds of the aggregate bond debt.

Figure 2: Bond data vs. aggregate debt securities

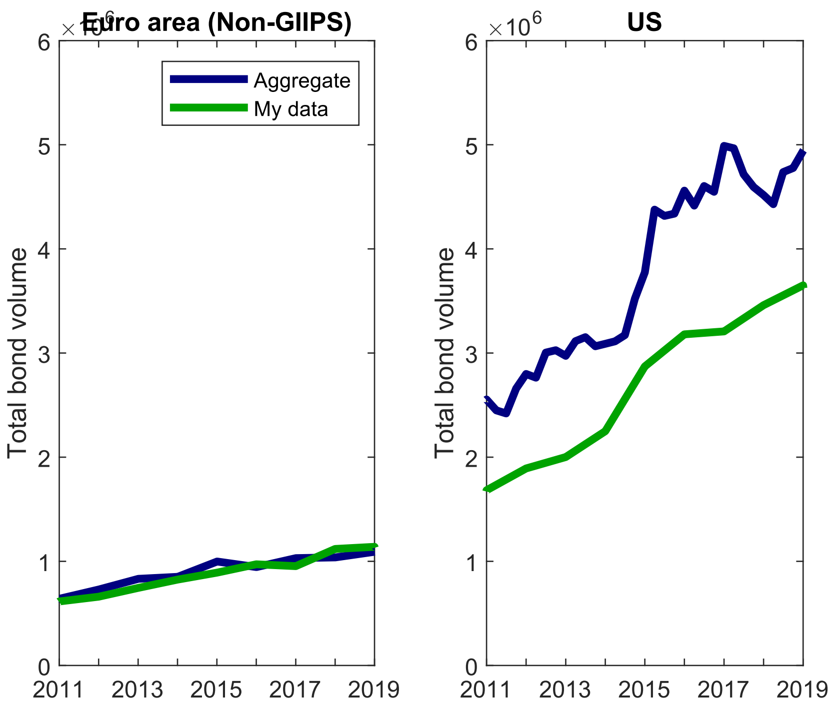


Figure 2 compares the total volume of outstanding bond debt across the micro-level data employed in this paper to aggregate data for the two regions: the euro area (Non-GIIPS) and the United States. The aggregate data for the euro area was derived using the time series Total Debt Securities for all core European countries from the quarterly financial and nonfinancial sector accounts available in the ECB Statistical Data Warehouse. The aggregate data for the United States was derived from the time series Nonfinancial Corporate Bonds (CBLBSNNCB) obtained from Federal Reserve Economic Data. Nuanced differences in the definition of domicile explain the minor overshooting in the EA coverage.

I use the combined data set to compute the bond funding share as the share of outstanding bond debt in financial debt as follows:

$$\text{Bond Funding Share} = \frac{\text{Bond Debt Outstanding}}{\text{Total Debt} - \text{Nonfinancial Debt}} \tag{1}$$

The bond funding share refers to the share of bond funding in external financial funding. This differentiates financial funding from other forms of debt that do not necessarily result from a firm's financing decisions, such as accounts payable. I therefore compute the volume of outstanding financial debt as the difference between total debt and other nonfinancial debt items.[16]

[16]These are, in particular, other current liabilities (creditors) and other non-current liabilities (provisions).

Figure 3 plots the aggregate bond funding share across all covered firms over time. It compares the observation in my micro-level data set to macroeconomic observations describing the aggregate bond funding share, as reported by Eurostat and the Federal Reserve. In the United States, the bond share has increased slightly from around 55% in 2011 to more than 60% in 2018. In the covered countries of the euro area, the bond funding share has also increased slightly from approximately 11% to around 13%. I find that my sample slightly overestimates the bond funding share in the euro area, while it modestly underestimates it in the United States.

The counterfactual analysis presented in this paper requires detailed coverage for the euro area, while for the United States only good coverage among the bond-issuing firms is necessary, since no conclusions are to be drawn about nonissuers in the United States and these are not incorporated into the analysis. The total coverage of U.S. firms in Orbis is smaller than for Europe, as is illustrated in Figures 1 to 3 in the appendix. Nonetheless, the coverage of bond-issuing firms is very good in both regions (according to Figure 2).

Debt choice and a heterogeneous cross-section

The debt choice between bonds and loans has received attention in different strands of the literature. The corporate finance literature focuses on the microeconomic choice of the individual firm[17], while the macroeconomic literature looks at the aggregate volumes of debt and the role of institutional and political factors (consider, for example, Allen et al., 2018; Becker and Josephson, 2016; Qian and Strahan, 2007). The literature has stressed several institutional factors that may impact the choice of debt funding. Such institutional factors are, among others, the efficiency of bankruptcy procedures (Becker and Josephson, 2016), the power of majority shareholders (Lin et al., 2013) and the financial reporting quality (Florou and Kosi, 2015). I draw a connection between those two strands of the literature by estimating to what extent the aggregate (macroeconomic) differences in debt choice between the euro area and the United States result from the regions featuring firms with different microeconomic characteristics. If firms with similar characteristics make different funding choices in the euro area compared to the United States, and the U.S. financial market is deemed a more efficient, developed financial market, this could be interpreted as inefficient or a bias. By contrast, if the differences in the aggregate debt choice result from structurally different firms making different decisions, negative implications have more structural underpinnings.

[17] It has highlighted that an individual firms' choice between bank loans and bonds is influenced by factors such as credit ratings, life cycle stage, growth opportunities, financial reporting quality, shareholder power, and bargaining dynamics, with higher-rated and public firms preferring bonds, while new, overvalued, or weak firms often opt for bank loans (Denis and Mihov, 2003; Diamond, 1991; Florou and Kosi, 2015; Hackbarth et al., 2007; Hadlock and James, 2002; Lin, Ma, Malatesta, and Xuan, 2013).

Figure 3: Micro vs. macro firm data

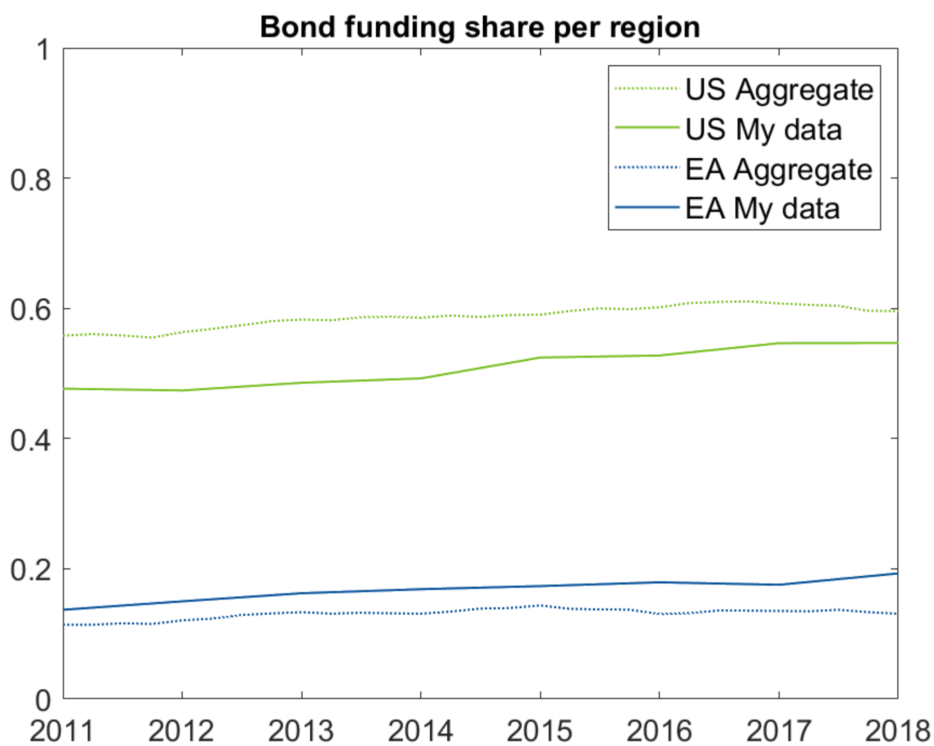


Figure 3 compares the average bond share observed across the micro-level data employed in this paper to aggregate data for the two regions: the euro area and the United States. The aggregate data for the euro area was derived using the time series "Total Debt Securities And Loans" as well as "Total Debt Securities" for all core European countries from the quarterly financial and nonfinancial sector accounts available in the ECB Statistical Data Warehouse. The aggregate data for the U.S. was derived from the time series "Nonfinancial Corporate Debt Securities Total Liabilities" (NCBDBIQ027S) as well as "Nonfinancial Corporate Business Loans" (NCBLL) obtained from Federal Reserve Economic Data. The micro-level data depicts aggregate values from the micro-level data set compiled using the approach discussed in Section .

The corporate finance literature has suggested a number of underlying factors for the choice between bond and bank debt. My data set covers a variety of heterogeneous firms. These firms differ along several dimensions. In the following, I explore how the debt choice differs with these characteristics and how these characteristics are distributed in the economy.

Firm characteristics

Firm size

The first factor is **firm size**. The size of a firm is related to its funding needs and can be measured in different ways, for example, by the number of employees. The empirical literature suggests that larger firms are more likely to issue bonds (Denis and Mihov, 2003). This can be rationalized by fixed certification costs associated with bond issuances and minimum issue sizes.[18]

Figure 4: Employment share of small firms

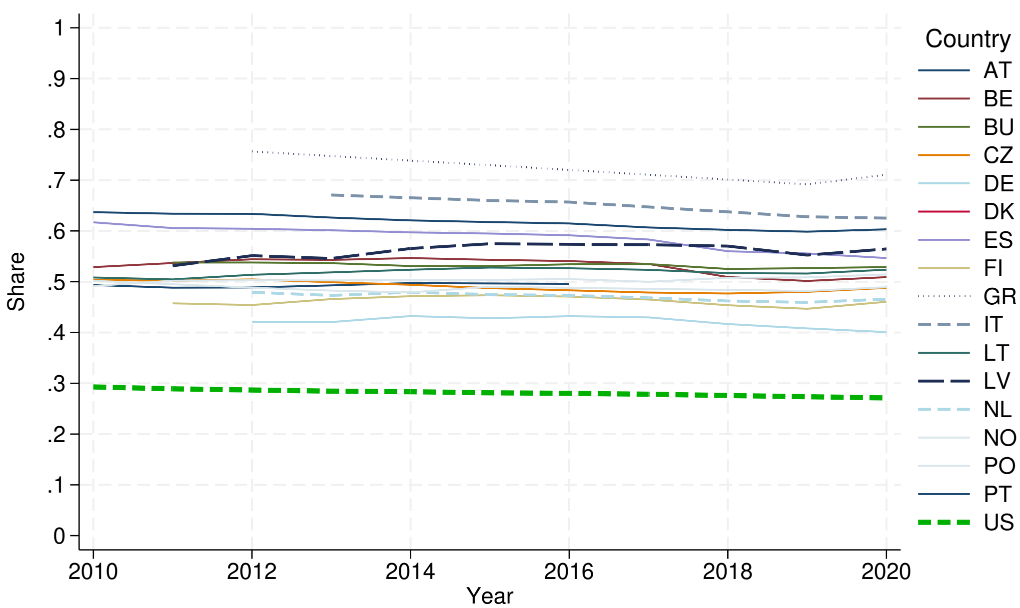


Figure 4 depicts the share of employment in small firms (employing less than 50 employees) over time for selected euro area countries as well as the United States.

The share of employment in small firms (less than 50 employees) is depicted over time in Figure 4, and the cumulative distribution of firm size is depicted in Figure 4 in the appendix. I observe significant differences in the firm size distribution. For example, in Europe between 45% and 50% of employees work in firms with less than 49 co-workers. In the United States, only about a quarter of employees

[18]In the theoretical literature, firm size rarely plays a role, since most models are set up in a scale-invariant manner. An interesting exception is Becker and Josephson (2016) which is discussed in more detailed in the second part of this paper.

do. Small firms play a larger role in the European market as measured by the sample of six countries analysed in this paper and even more so when considering all 27 members. As depicted in Figure 4, these regional differences did not converge during the last decade.

The role of firm size in the cross-sectional distribution of funding choice in the euro area compared to the United States is depicted in Figure 5a. In this graph, firm size refers to the number of employees, as in Cabral and Mata (2003), a choice that allows for a comparison to census data.[19] In particular, the diameter of each circle depicted in Figure 5a refers to the share of employees in firms of the respective size group in each region.

First, I observe that the importance of bond funding is increasing with firm size. However, the cut-off point from which bond funding becomes more prevalent differs between the two regions. In the United States, the cut-off is at around 300 employees, while in the euro area, the smallest bond-issuing firms tend to have more than 5,000 employees. Considering the largest firms, the share of bond funding grows to above 50% in the United States, while in the euro area it remains below 30%. Comparing the firm size distribution in the two regions leads to the identification of the first two drivers of the low prevalence of bond funding in the euro area: firms with less than 300 employees rarely issue bonds in any of the two regions. However, in the euro area these small firms make up a larger share of the total economy, as they account for 62% of total employment (compared to 43% in the United States). Second, for a given firm size, U.S. firms tend to have a higher bond funding share.

Sample coverage

The bigger role of very large corporates in the U.S. boosts the size of the corporate bond market, as the following derivation illustrates. The aggregate bond funding BS_{agg} share can be broken down into

$$BS_{agg,r} = \xi_{agg,r} \sum_{g} \kappa_{g,r} \epsilon_{g,r} BS_{g,r} \tag{2}$$

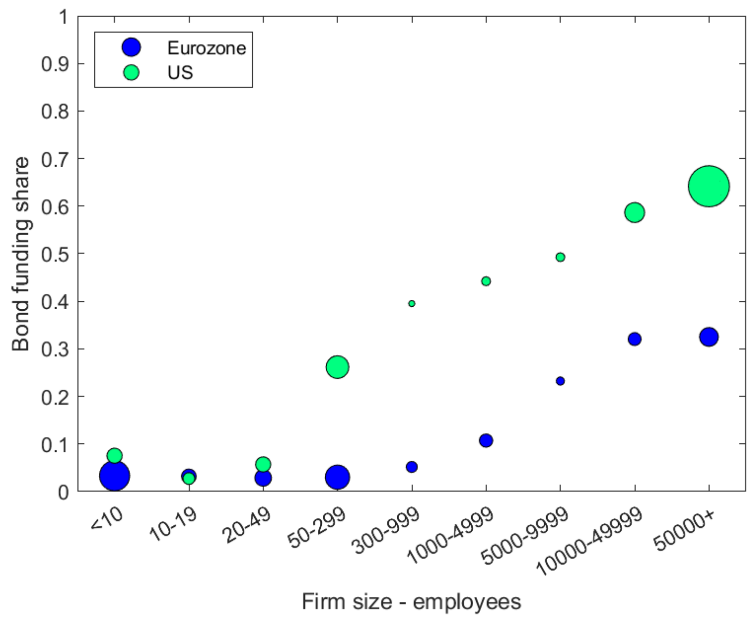
where $r = EA, US$ denotes the region and g denotes each firm size in the groupings illustrated also in Fig. 5a. $\epsilon_{g,r}$ denotes the employment share of category g in region r, $\kappa_{g,r}$ denotes the debt-to-employee ratio in that category and $\xi = \frac{Emp_{agg}}{Debt_{agg}}$ refers to the region's aggregate employment to debt ratio. The components of equation 2 can be measured or estimated for an initial impact estimate of the different firm size distributions. If the euro area had the same firm size distribution as the United States, and all else remained equal, its bond funding share would be:

$$BS_{EA} = \xi_{EA} \sum_{g} \kappa_{g,EA} \epsilon_{g,US} BS_{g,EA} \tag{3}$$

[19] The comparison to census data is an important step since my data set, despite its wide scope, underestimates the number of very small firms, as is the case for most financial data sets. Matching the data set with information about the firm size distribution from census data, which can be assumed to perfectly cover each country, allows to still draw conclusions about the importance of firms of different sizes.

Figure 5: Bond funding share across the firm size distribution

(a) Bond funding share



(b) Distribution of employment

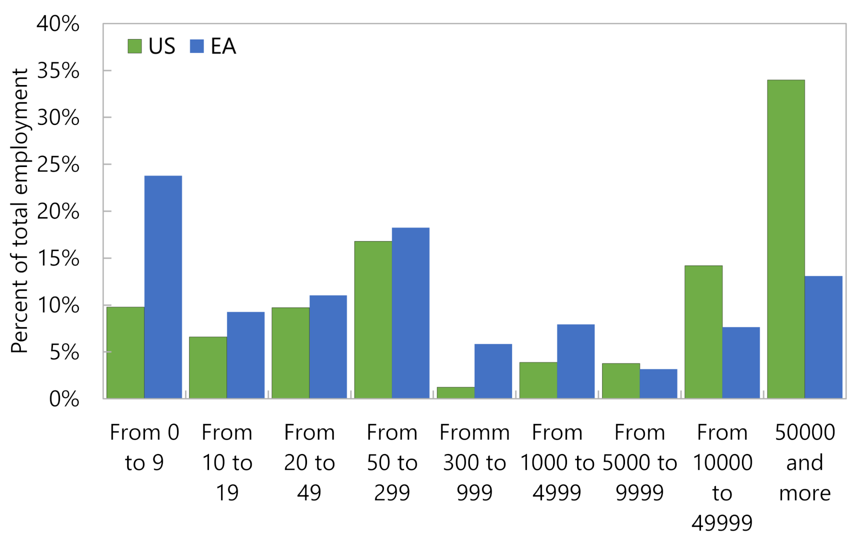


Figure 5a details the distribution of the bond funding share across the distribution of firms. The diameter of each circle represents the importance of firms in this size category in terms of total employment, which is also illustrated in 5b. This importance is derived from the Statistics of U.S. Businesses (SUSB) of the U.S. Census Bureau and the statistics on small and medium-sized enterprises from Eurostat (Eurostat's structural business statistics).

A back-of-the-envelope calibration of these statistics suggests that the share of bond funding in the euro are would increase from 13 percent to 25 percent if the firm size distribution would be similar to the United States. Vice versa, if the United States had the firm distribution of the euro area, its bond funding share would be 31 instead of 55 percent.

For the modeling exercise, this paper assumes that firm size is an exogenous characteristic of the firm. In the long-run, this relationship could be exogenous. In particular, the differences in firm size between the United States and the euro area could be endogenously related to funding decisions or constraints. This would be the case if small and medium-sized firms in the euro area were so financially constrained that they were unable to grow despite sufficient growth opportunities. That being said, in a survey, the ECB semiannually asks SMEs located in the region to report their major business obstacle. In 2010, 15.4% of these firms reported access to finance as their major obstacle, a share that decreased to below 8% in 2019.[20] Firms more often struggle to find customers (27.8% in 2010, 20.9% in 2019) or skilled employees (12.4%/24.2%), indicating that the firm size distribution (FSD) is more strongly shaped by nonfinancial underlying factors. Similarly, the EIB Investment Survey specifically asks SME's about their financial constraints, which are experienced by 7.19 percent of EU SME's in 2023.

The aggregate impact of financial constraints on the FSD is estimated in Angelini and Generale (2008). The authors conclude that the FSD of nonconstrained firms is similar to the entire sample for OECD countries, which suggests that the impact of funding constraints on the FSD is small in these countries. By contrast, the authors find a stronger impact of financial constraints on the FSD in non-OECD countries. The authors therefore conclude that funding constraints are not a main driver of the FSD across developed economies. Correspondingly, Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006) find that while for firms in emerging economies firm size and financial constrainedness are strongly related, firm size is not significantly related to financial constrainedness in developed economies (where firm age is the main driver).

The literature highlights several nonfinancial factors that shape the firm size distribution among developed economies. A first aspect that has been highlighted in the literature is regulation. In several European countries, larger firms are strongly regulated and face higher labor costs. This effect is estimated in Garicano et al. (2016) by comparing French and U.S. firms. The authors find that the French FSD contains a disproportionate number of firms with less than 50 employees, due to a requirement for a workers' council and other committees setting in at this firm size cut-off. The estimated welfare loss is sizeable (3.5% of GDP) and involves a jump in labor cost at the cut-off of more than 2%. Another regulatory factor shaping the FSD relates to antitrust laws. Covarrubias et al. (2020); Philippon and Gutierrez (2018) and Grullon et al. (2019) observe an increase in market concentration in several U.S. industries, while more rigorous antitrust laws in the single market of the European Union have limited concentration and thus the prevalence of very large firms.

A second determinant of a country's FSD is the prevalence of certain industries. Beck et al. (2008)

[20] Survey on the access to finance of enterprises (SAFE), series H.U2.SME.A.0.0.0.Q0.ZZZZ.P3.AL.WP.

highlight that an industry has a technological firm size distribution that results from the required production processes, as well as the capital intensity and associated economies of scale.[21] This is in line with the findings of Poschke (2018), who attributes a large part of the variation in the international FSD to occupational choice and technological progress. Similarly, Gomes and Kuehn (2017) argue that the FSD is a representation of education and public employment; in particular, a more educated work force and a larger share of public servants raises firm size[22].

Building on the aforementioned literature this paper assumes that the aggregate FSD is predominantly shaped by nonfinancial factors and that it can be interpreted as an exogenous characteristic in shaping the decision between bond vs. bank debt funding. In a long-run perspective, the FSD may change and may affect the results.

Liquidation value/fixed assets

A second set of firm characteristics that the literature has identified as a driver of the debt choice relates to a firm's liquidation value (see Qian and Strahan, 2007). A main determinant of the **liquidation value** is the fixed asset share, also referred to as a firm's **asset tangibility**. The direction of the impact of the liquidation value on debt choice depends on the frictions being considered. Theoretical models motivating funding choices through asymmetric information and improved monitoring by a bank (such as Diamond, 1984, 1991; Leland and Pyle, 1977) typically arrive at the conclusion that tangible assets reduce the information asymmetry and thus benefit bond issuance (Hoshi et al., 1993). By contrast, models that are based on a more efficient liquidation (or threat of liquidation) achieved through banks arrive at the conclusion that a large share of tangible assets benefits choosing bank loans (Park, 2000; Repullo and Suarez, 1998). In the data, I observe that firms with small fixed asset shares play a much larger role in this sample of European countries than they do in the United States.

Figure 6 plots the share of bond funding in the euro area and the United States according to the share of fixed assets in a firm's total assets. In both regions, the use of bond funding increases with the prevalence of fixed assets. In the United States, bonds amount to about 20% of financial funding for firms with a small fixed asset share (less than a quarter of total assets) and increases to more than 50% for firms with large fixed assets shares (two-thirds of total assets and above). In the euro area, the pattern is also increasing in the fixed asset share but on a smaller scale and with a lower slope (not reaching more than 20% of bond funding for firms with a large amount of fixed assets). Considering the theoretical literature, this speaks to models with a risk-reducing or adverse-selection-mitigating role of collateral. On a different note, Rauh and Sufi (2010) have associated asset tangibility with higher levels

[21] For example, the authors find that oil refineries employ less than 20 employees only in 0.21% of the cases, while 12.26% of firms manufacturing nonelectric machinery fall in that size category. When a country produces more oil and less machinery (e.g. the United States vs. Germany) this shapes each country's FSD.

[22] Better educated workers earn higher wages and are therefore less inclined to become self-employed. As more high-skilled workers are absorbed by the public sector, a smaller pool of potential entrepreneurs remains. Compared to the euro area, the United States have a higher share of workers with a university degree (Barro and Lee, 2013) and a similar level of public employment(Organization for Economic Cooperation and Development, 2015).

of total debt.[23]

Figure 6: Bond funding share and fixed assets

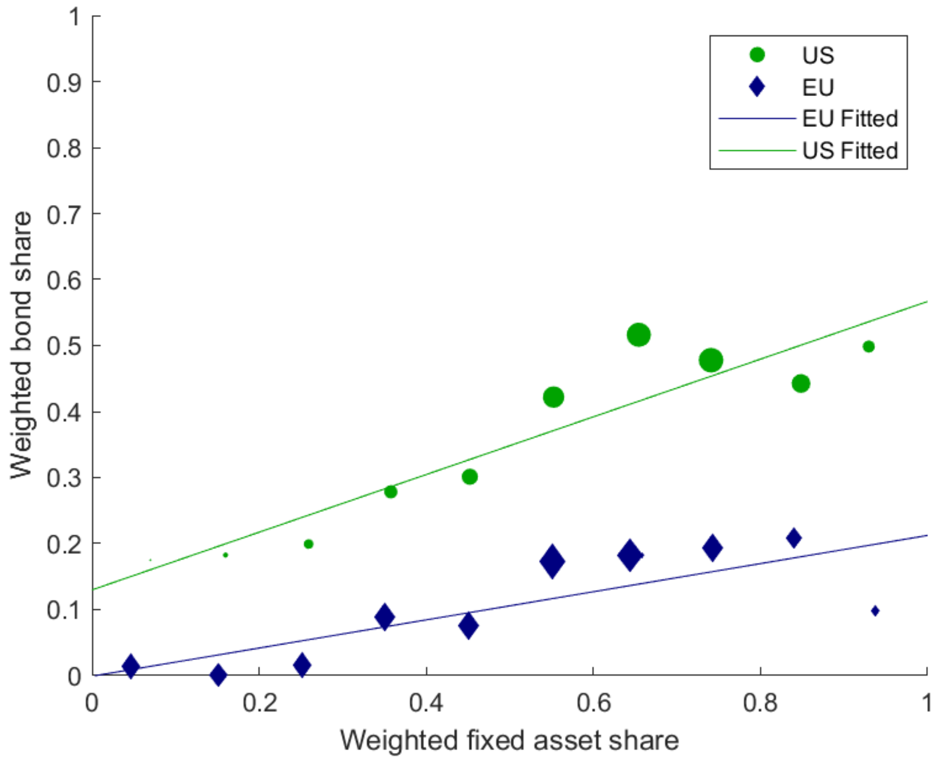


Figure 6 details the distribution of the bond funding share among firms of different fixed asset shares. The size of the marker depicts the relative importance of the covered firms in terms of total employees.

For the modelling exercise, it is again relevant to determine whether asset tangibility is an exogenous characteristic of the firm with regard to the firm's debt choice. In my data set, asset tangibility strongly differs according to a firm's industry (see Figure 6 in the appendix). Also, firms rarely change their industry. I therefore assume that asset tangibility can be interpreted as a firm characteristic that is exogenous to the choice of debt type.

[23]Based on their findings, one could assume that firms with a high share of fixed assets are highly leveraged and therefore resort to bond issuance when looking for additional funding sources. I depict the distribution of tangible assets and equity funding by firm size categories in Figure 9 in the appendix. For the United States, firms with a higher share of tangible assets indeed have less equity across the firm size distribution. For the euro area, by contrast, firms with a higher share of tangible assets even tend to have more equity. These differences speak against indebtedness being the main driver behind the higher prevalence of bond funding among firms with a large amount of tangible assets in both regions.

Leverage

A third characteristic that has been associated with a firm's debt choice is **leverage**. Holmstrom and Tirole (1997) highlight the monitoring capabilities of banks and argue that they are able to mitigate moral hazard. This implies that well-capitalized firms choose bonds while less capitalized firms choose loans. Since leverage directly results from the firm's funding decisions, it is endogenous to the choice of debt type.

I depict the bond funding share by leverage levels in Figure 7 in the appendix. The graph does not speak to leverage being the main driver of debt choice in the sample.

Profitability

A fourth characteristic that has been suggested as a microeconomic driver of debt choice is the **profitability** of a project. In a modelling exercise for Europe, De Fiore and Uhlig (2011, 2015) argue that an entrepreneur's funding choice depends on her expectation of the project's payout. Entrepreneurs with an intermediate expectation of productivity value a bank's opinion about the project's potential, while firms with a high expectation do not rely on the bank's expertise. In conclusion, their model implies that firms with a high expected profitability choose bond funding while those with an intermediate expectation choose bank funding.

The last firm characteristic to be considered is profitability. The prevalence of bond funding across firms of different profitability is depicted in Figure 8 in the appendix. I measure the profitability of a firm in terms of its return on total assets (ROA), where return for comparability is measured by the earnings before interest and taxes (EBIT). Across the two regions, no clear relation between bond funding and profitability emerges.

The four aforementioned firm characteristics, firm size, liquidation value, leverage, and profitability, are not the only characteristics suggested in the literature as drivers of debt choice. Additional drivers that have been suggested include a firm's valuation (Hadlock and James, 2002), life cycle (Diamond, 1991; Hackbarth et al., 2007), credit rating (Rauh and Sufi, 2010), or shareholder concentration (Lin et al., 2013). Nonetheless, the four discussed characteristics are the most frequently suggested drivers and apply to all firms, while factors such as shareholder concentration or formal credit ratings only apply to a small subset of the firms considered in this analysis. In order for my data to have the highest possible representativeness including the coverage of small firms, I therefore focus on the four mentioned firm characteristics applying to all of them.

Modeling choice

The funding decision is a complex problem that needs to be reduced to its most important considerations for the modeling exercise. I decide which factors to include in the model based on the evidence discussed in the last section and a motivational regression analyses reported in the appendix, in Table 3.

In the regression analyses, I consider a firm's size as measured by either the number of employees or total assets as well as the firm's profitability and leverage. Table 3 considers each firm characteristic as a single driver of the bond share in a univariate regression. The regressions suggest that firm size, either measured by total assets or by the number of employees, is an important driver of the bond share (with R^2s of 12.9 % and 6.7%, respectively). By contrast, profitability is on its own not significantly correlated with the bond share. Profitability and leverage carry R^2s of negligible size.

Based on the distribution of bond funding across firms with different attributes I come to the conclusion that firm size and fixed assets (asset tangibility) are the most important drivers of debt choice, while profitability and leverage seem to be less important. Therefore, a modeling exercise should take those two factors into account. In this context, I argue that firm size and asset tangibility are characteristics that can be interpreted as being exogenous to the choice of debt type and therefore enter into a partial equilibrium model of the firm debt decision as characteristics of heterogeneous firms. Finally, the efficiency of insolvency procedures is an important institutional feature for the debt choice and should therefore be incorporated into the model as well.

Counterfactual analysis

To accommodate these features and compute a counterfactual, I present a slightly adapted version of the model discussed in Becker and Josephson (2016).

Model description

The original version encompasses firms of different size, while this adapted version accommodates an additional source of heterogeneity: firms that differ in their share of fixed assets. In particular, the model features a partial equilibrium of funding choice that depends on a firm's characteristics and on the characteristics of the market environment. The market environments in the euro area and the United States are allowed to differ in terms of restructuring efficiency and the determinants of balance sheet costs. This is in line with La Porta, Lopez-de Silanes, Shleifer, and Vishny (2000, p. 3), who describe the legal corporate governance framework as a more important driver of market developments than the "conventional distinction between bank-centered and market-centered" economic systems.

In the following, I first describe the model environment in its original form and then add the second form of heterogeneity through a variation in parameter specification. [24] The environment features a continuum of firms that differ in their project size and in the share of fixed assets involved in the project (θ). A firm demands capital K as a function of the offered interest rate $K(r) = A - Br$. If the firm were able to receive funding without interest cost, the maximum project size A would be attained. The project size decreases in the cost of capital r. The inverse capital demand function is thus $R(K) = \frac{A-K}{B}$. The firm's project is successful with a probability of $1 - q$, implying that, with a probability of q, the debt is not repaid in full.

Firm funding is provided by a mass of atomistic bond investors and n banks; both types of investors are assumed to be risk-neutral. In the main specification, both types of debt claim rank pari-passu. This is a simplification; in reality banks tend to be senior claimants (Hackbarth et al., 2007), Becker and Josephson (2016) show that assuming bank seniority in the model leads to similar conclusions about bond choice. Funding is provided by the different investors in a Cournot competition. The differing abilities of banks and bond holders to react in case of default creates the friction that differentiates bond and bank funding. In general, both out-of-court restructurings and formal in-court bankruptcy procedures are available if a firm's project is not successful. Out-of-court restructurings are more efficient than lengthy in-court bankruptcy procedures; therefore, the firm value in restructurings is given by $(1 - \beta)K(r)$, while in formal bankruptcy procedures it is $(1 - \beta - \sigma)K(r)$ under the assumptions that $\beta, \sigma > 0$ and $(1 - \beta - \sigma) > 0$. Atomistic bond holders never choose to engage in out-of-court restructurings and fully rely on in-court procedures[25].

The difference in the efficiency of the two resolution procedures (the welfare loss σ) depends on a firm's business model as well as on the efficiency of the local legal system. This assumption is different from that in the model presented in Becker and Josephson (2016), in which the welfare loss does not depend on firm characteristics. I assume that

$$\sigma = \alpha - \tau \cdot \theta, \tag{4}$$

i.e., the welfare loss decreases with the share of fixed assets owned by the firm. This is warranted since fixed assets such as real estate or materials are easily redeployed, while intangibles such as patents can be harder to liquidate. This mechanism is empirically supported by Gilson, John, and Lang (1990), who find that firms with many intangible assets are more likely to engage in out-of-court restructuring since bankruptcy procedures are more detrimental to their value. Using different values for the parameters τ and α, the model is able to incorporate different sensitivities associated with the differing legal systems.

[24] I am very grateful for the additional supplementary material on the derivations in Becker and Josephson (2016) provided by the authors in private communication.

[25] This is mainly motivated by two factors: First, fixed costs involved with out-of-court procedures are prohibitively high compared to the small sums invested per bond holder (for the coordination problem, see Bolton and Scharfstein, 1996). For expositional simplicity, the fixed cost in the model is assumed to be zero. See Becker and Josephson (2016) who demonstrate that this does not materially change the model. Second, banks obtain additional information on the firm during the banking relationship that is valuable in out-of-court negotiations (Hotchkiss, John, Mooradian, and Thorburn, 2008, p.249).

The varying degrees of bankruptcy efficiency across different legal systems are evaluated in Djankov, Hart, McLiesh, and Shleifer (2008). The authors consider the procedures involved in representative bankruptcies and find that such procedures in common law countries such as the United States often resemble reorganizations, while in civil law countries such as Austria, Germany, or the Netherlands liquidations are more prevalent. This is in line with the more detrimental outcomes of in-court bankruptcy procedures for the recovered values of firms with many intangible assets that are more difficult to re-deploy.

The large group of potential bond investors requires a return r^*. The investment is assumed to be a small part of each bond investor's portfolio and there is a sufficiently large number of investors such that there are always those willing to lend at r^*. Atomistic competition, a risk-free rate of zero, and risk-neutrality imply that $r^* = q(\beta + \sigma)/(1 - q)$. To put it differently, the inverse funding supply function of bond investors is flat (perfectly elastic) at r^*.

Banks provide bank loans, they are regulated and subject to capital requirements that induce a convex cost function:

$$C(L_i) = c\frac{L_i^2}{2}; \tag{5}$$

the cost of capital C for each individual loan increases in the total loan sum L_i provided by bank i to that individual firm. Supplying very large loans exposes the bank to idiosyncratic counterparty risks. Issuing smaller loans is therefore beneficial in terms of risk, as the "firm-size adjustment for small or medium-sized entities" incorporated into CRE31.9 of the Basel framework also suggests.[26]

The equilibrium in the funding market is determined under Cournot competition. As long as the market interest rate is below r^*, all n banks provide an equal share of funding to the firms and no bond funding is used. Once the market interest rate reaches r^*, bond investors provide an infinite amount of funding at this break-even rate. I denote the amount of capital demanded by firms at this rate by D. Note that, due to the welfare loss involved with in-court bankruptcy procedures, it is always rational for the banks to offer bond holders the same return they would receive under an in-court bankruptcy procedure and engage in an out-of-court restructuring. This allows banks to distribute the welfare gain of $\sigma \cdot K$ among themselves.

Two interesting equilibria, one for small and one for large firms, can be perceived under the aforementioned scenario and reasonable parameter values.[27] Which equilibrium materializes depends mainly on the firm size:

1. Large firms: both banks and bond holders provide funding. Bond holders are the marginal investors and the interest rate is r^*; the equilibrium quantity of debt demanded by those firms at the margin is D.

[26] https://www.bis.org/basel_framework/chapter/CRE/31.htm
[27] Becker and Josephson (2016) provide detailed conditions under which these equilibria occur and also discuss corner solutions.

2. Smaller firms: banks can provide sufficient funding with a low cost of capital at rates below r^{*}[28]. The equilibrium quantity is smaller than D. Bond holders do not lend to firms in this size category.

In the following, I first discuss scenario (1), under which both types of funding occur. From this result, I derive the cut-off firm size below which a firm solely relies on bank loans (scenario 2).

Equilibrium with bond and bank debt

In the symmetric equilibrium, n identical banks engage in lending and follow the same symmetric decision problem. The loan sum provided by all other banks is taken into account by the individual bank and is denoted by L_{-i}. The profit-maximization problem of that individual bank reads as follows:

$$U(L_i, L_{-i}) = (1-q) * R(K) * L_i + q * [\sigma * K * \frac{L_i}{L} - (\beta + \sigma)L_i] - c\frac{L_i^2}{2}. \tag{6}$$

In the case of the good outcome, the loan amount L_i is fully repaid with interest. In the case of the bad outcome, banks engage in out-of-court restructuring. The return is equal to the in-court bankruptcy payout plus the welfare gain σ, which is split among the banks. Regardless of the outcome, the bank has to bear capital costs $c\frac{L_i^2}{2}$.

I first consider equilibria in which at least some bond funding is provided. In this scenario, we know that $R(K) = r^* = q(\beta+\sigma)/(1-q)$. The total funding demanded at this rate is $D = K(r^*)$. An individual bank's first-order condition in this case reads:

$$\frac{\partial U(L_i, L_{-i})}{\partial L_i} = qK\sigma\frac{L - L_i}{L^2} - cL_i = 0. \tag{7}$$

Optimal total bank loan supply reads:

$$L = \sqrt{\frac{q * \sigma * D * (n-1)}{c}}. \tag{8}$$

The optimal bond share of a firm follows as:

$$\text{Bond Share(BS)} = 1 - \frac{L}{D} = 1 - \sqrt{\frac{q * (n-1) * (\alpha - \tau \cdot \theta)}{D * c}}. \tag{9}$$

A firm's bond share increases in firm size (D) and in the share of fixed assets owned (θ). Structurally, the bond share increases in the bank's cost of capital (c) and it decreases in the probability of bad project outcomes (q) as well as the competition in the banking sector (n).

[28]Note that r^* differs across firms of different sizes and depends on the individual firm's default probability. As prob. of default is higher for small firms, it does not imply that smaller firms pay smaller interest rates.

Equilibrium with bank debt only

The definition of the cut-off below which no bond funding is provided immediately follows from the optimal bank loan supply derived above. If the optimal loan supply at the cut-off rate is at least as large as the funding demanded by the firm at this rate, bank loans will be sufficient.

$$L = \sqrt{\frac{q * (n-1) * (\alpha - \tau \cdot \theta) * D}{c}} \geq D. \tag{10}$$

This translates into a critical threshold at which firms begin to receive bond funding. This threshold depends on each firm's size and fixed asset situation. In this case, size relates to the total amount of funding demanded and is defined by:

$$D^{CutOff} = L^{CutOff} = \frac{q * (n-1) * (\alpha - \tau \cdot \theta)}{c}. \tag{11}$$

The cut-off below which a firm does not demand bond funding (i.e., the bond funding share is zero) increases with the probability of a bad project outcome (q) and with the competition in the banking sector (n). It decreases with the firm's fixed asset share (θ) as well as with the bank's cost of capital (c).

The size threshold decreases with the share of fixed assets the firm can provide:

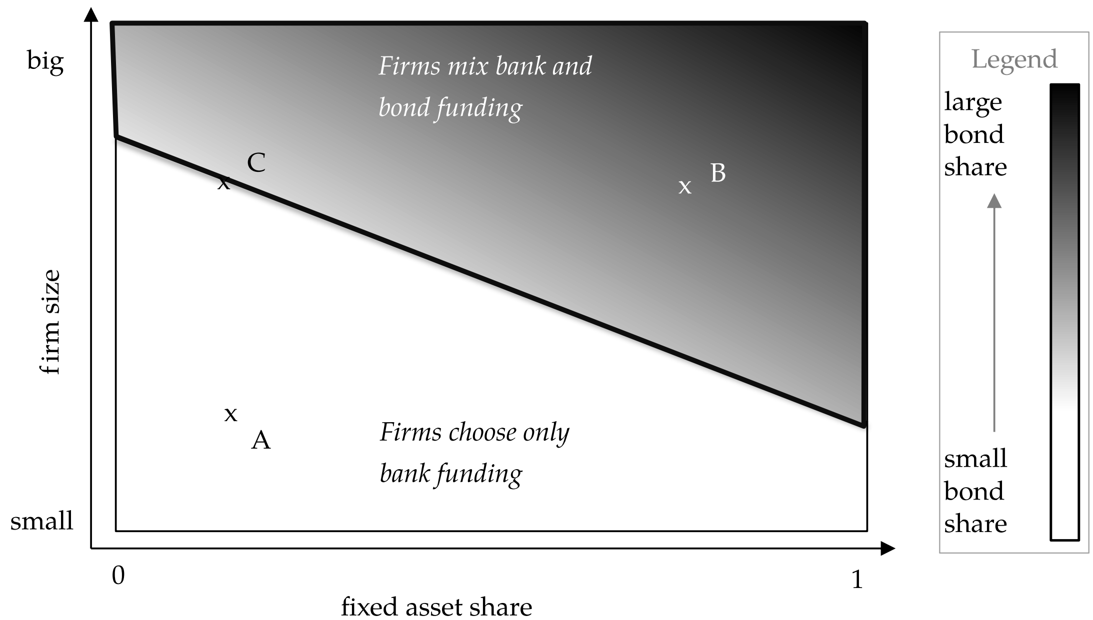
$$\frac{\partial L^{CutOff}}{\partial \theta} = -\frac{q\tau(n-1)}{c}. \tag{12}$$

The economic rationale behind this decreasing cut-off is the smaller welfare losses incurred by bond holders. For firms with a larger share of fixed assets, in-court bankruptcy procedures are comparatively more efficient since the value of fixed assets tends to be more easily recovered and depends less on continued business operations than for intangible assets. For firms with many fixed assets, bond holders therefore face a more level playing field and thus a more attractive investment.

The optimal funding choice for firms of different characteristics is illustrated in Figure 7. Small firms and firms with a lower fixed asset share - those in the lower left corner of the graph - choose to use bank funding only, as does firm A. The bigger the firm, the costlier the loan is for the bank due to concentration risk. Hence, for a bigger firm (such as Firm C) bond funding becomes more attractive so that the firm begins to issue some bonds once the threshold size is crossed. All else equal, bond holders are able to offer better rates to firms with higher fixed asset shares, which is why the bond funding share for a firm such as firm B is higher.

This partial equilibrium model based on Becker and Josephson (2016) is able to accommodate a set of stylized facts observed in the data. First, it accommodates a mixed debt choice, which is in contrast

Figure 7: Optimal funding choice



to the model presented in De Fiore and Uhlig (2011), among others, in which firms only use a single funding source. Second, the firm characteristics that determine the cut-off for the decision to enter the bond market are fixed assets (also referred to as "asset tangibility") and firm size, not leverage (as in Repullo and Suarez, 1998 and Crouzet, 2017), risk (as in Darmouni et al., 2019), or profitability (as in De Fiore and Uhlig, 2011).

Calibration and estimation

The model calibration follows two steps. First, I set a subset of parameters to predetermined values known from the literature. Second, I determine the remaining parameters by minimizing the squared deviation of the model predictions on the predicted cut-off size and the predicted bond shares (equations 9 and 11) from their empirical counterparts.

To calibrate the probability of a negative project outcome q, the literature suggests a decrease of the probability of default with firm size (due to diversification) and different values, depending on a firm's industry (see, for example, Lopez, 2004). To match these observations, I model the default probability as $q_i(D_i, \theta_i) = q_0 + \tau_D D_i + \tau_\theta \theta_i$. To determine precise values for τ_D and τ_θ, I collect information on the probability of default of 812 firms based on credit default swaps. From these spreads each firm's probability of default can be computed under the assumption of a recovery rate 68.1 Cts/$ for the euro area and 67.5 Cts/$ for the United States [29] Table 1 depicts the result of this regression, including time

[29] Data from EBA. There is a strand of literature on the legal origins of differences in the efficiency of debt collection and associated creditor rights; for a detailed summary see (La Porta, Lopez-de Silanes, and Shleifer, 2013, p. 438).

fixed effects. Based on these results, I set $\tau_D = -0.003$ and $\tau_\theta = -0.022$.

To estimate the remaining parameters, I first summarize the observed micro-level data by the yearly distribution of the bond funding share across firms of different size and fixed asset share in 9, respectively 10, categories each. This results in a data set containing average observations for firm size $D_{i,r}$, fixed share $\theta_{i,r}$ and bond funding share $BS_{i,r}$ of 90 data points per year per region, $r = US/EZ$. I define the cut-off size and cut-off fixed share via the aggregate distribution; in particular, I use a cut-off value of a bond share of 1%.[30]

I calibrate the model parameters c and τ for the euro area and the United States to minimize the squared deviations of the model predictions for the cut-off size and the bond share (equations 9 and 11) from their empirical counterparts. The estimated values for the United States are $c = 0.077^{***}$, and $\tau = 0.395^{***}$; as well as $c = 0.083^{***}$, and $\tau = -0.058$ for the euro area. Note that a higher cost of capital parameter for Europe in the model is in line with higher funding costs of European banks observed in reality (Vito, Leite, and Fuentes, 2023). The scaling parameters are set to $n = 10$ and $\alpha = .5$ in both regions. The fitted values using the estimated parameters are depicted in Figure 8. The model matches the observed empirical data reasonably well considering that all parameters are time-constant. This implies that all observed time variation in the fitted values results from variation in the underlying firm distribution and the probabilities of default.

Table 1: Probability of default

	Prob(default)
Constant	0.111***
	(7.958)
Fixed Assets θ	-0.022***
	(-2.661)
Firm Size D	-0.003***
	(-4.313)
Fixed Effects	Year
Observations	1,344
Within R^2	0.018

t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Counterfactual scenarios

I present two sets of counterfactual results. First, I compute how large the European bond share would be if all existing bond issuers were facing the same financial market conditions as in the United States (intensive margin). Formally, this result stems from the model prediction of the firm bond share presented in equation 9, while holding the set of bond issuers (i.e., the firm cut-off described by equation 11) constant. The evolution of this counterfactual bond funding share is depicted in Figure 9 with the blue, dotted line:

If European bond issuers were faced with the market conditions that are prevalent in the U.S. funding market, they would issue 10.5 percentage points more bonds than they do currently. These different funding conditions explain around a quarter of the observed difference in the bond funding share between the two regions.

[30]That implies that if, for a certain combination of firm size and fixed share, the aggregate bond funding share in the category is below 1%, this observation point is deemed to be below the cut-off. All data points with a larger fixed asset share or a larger firm size are deemed to be above the cut-off.

Figure 8: Model fit

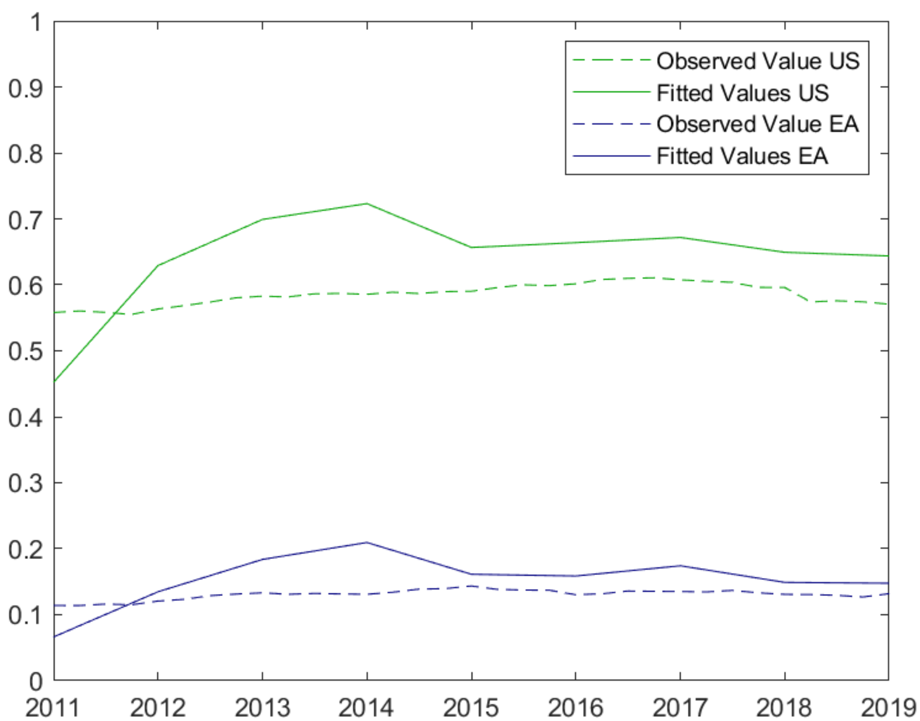


Figure 8 displays the model prediction for the firm funding share in each region over time. The model predicts the bond share by firm size decile and per fixed asset category. The plotted lines result from weighting each observation by the number of employees.

Figure 9: euro area counterfactual scenarios

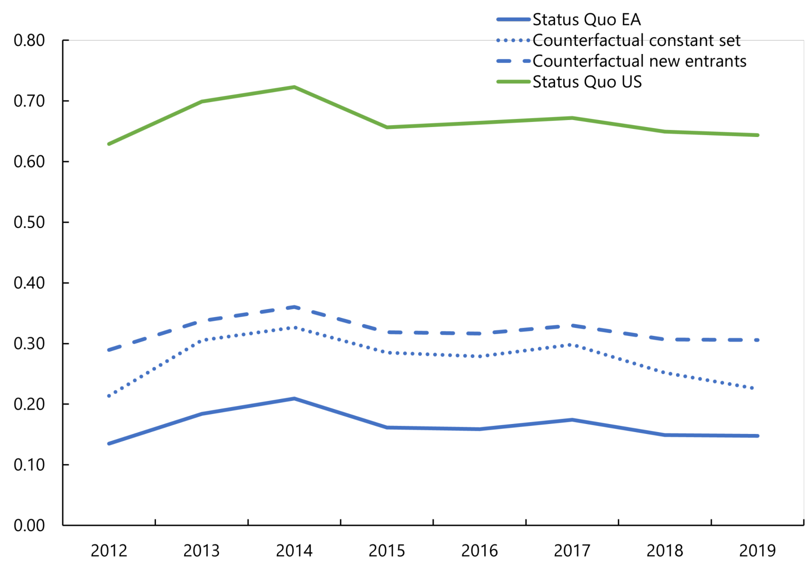


Figure 9 shows the results of the counterfactual analysis estimated in this paper. It includes two scenarios, the first only incorporates existing bond issuers issuing more bond debt, while the second also allows new entrants into the bond market.

In a second step, I consider the increase in the bond funding share resulting from additional firms beginning to issue bonds (extensive margin). In the framework of the model, this refers to the increase in bond funding that results from a shift in the cut-off level. The resulting aggregate bond share is depicted with a blue, dashed line in Figure 9. I observe that the changes in the extensive margin only lead to a smaller increase in the aggregate bond funding share of, on average, less than 5 percentage points. This implies that, in the counterfactual scenario of European firms facing the market conditions of their American counterparts, only a small number of nonissuers would begin to issue bonds.

The counterfactual scenario leaves a difference of 32.6 percentage points in bond funding shares between the observed firms in the United States and the euro area that is attributed to fundamental differences.[31] This implies, that more than two-thirds of the observed funding difference (of the average bond share across time, which is 58.4% in the United States and 13.1% in the euro area, resulting in an average difference of 45.3%) can be attributed to different firm characteristics, while the remaining one-third is associated with different market conditions. This finding underlines the importance of small firms in the euro area, as depicted in the census firm size distribution in Figure (5a). This implies that, even if the European financial landscape were reshaped to resemble the United States', the level of bond funding would still be significantly smaller.

[31] The average bond share in the United States over the time period 2011 to 2019 is 58.4%, while the average share for the euro area counterfactual analysis (intensive + extensive margin) is 25.8%.

Conclusion

The reliance of European firms on bank funding has been described as excessive in comparison to their American counterparts. I provide the first counterfactual analysis of how much the European market would rely on bank funding if its financial structure resembled the United States. I find that the funding differences can be largely explained market fragmentation, in particular by different types of firms operating in the two areas: (i) European firms tend to be smaller, on average, than their U.S. counterparts, and small firms tend to rely more on bank funding. (ii) The size cut-off at which firms begin to consider bond funding is considerably higher in the United States, and (iii), European firms with large fixed asset shares tend to rely more on bank debt than U.S. firms with comparable fixed asset shares. These differences imply that two-thirds of the observed funding difference can be attributed to different firm characteristics, while the remaining one-third is related to different financial market conditions.

A prevalence of bank funding has been shown to increase systemic risk and has therefore been referred to as a bank bias. This bank bias can be observed in both regions, while it has been found to lead to a more substantial increase in systemic risk in the euro area. The European Union's capital markets union project aims to promote more efficient funding choices by firms to improve the integration and resilience of financial markets. My results highlight that the reliance on bank funding is partially rooted in the distribution of firms and that in the short- to medium-term this limits the usage of bond funding among corporates. Long term, the composition of the corporate bond market is endogenous to the capital market structure and effects such as a reduction in market segmentation can impact the aggregate funding choice via the firm distribution, leading to potentially different outcomes. My findings suggest that policy decisions should factor in Europe's natural reliance on bank funding as it has a sizable impact on the financial market structure and likely also affects the speed of adoption.

Appendix

Appendix I: Data Cleaning

1. Dropping data points that either point to incomplete data or inactive firms:
   - All data points with unknown or negative equity (field 'Shareholders Funds').
   - All data points with unknown or zero operating revenue (field 'Operating Revenue / Turnover').
2. Dropping data points with observations in unreasonable size relations:
   - All data points reporting a fixed asset share of below zero or above one.
   - All data points reporting a bond funding share of below zero or above one.
   - All data points reporting revenues of more than 500 million and less than 5 employees.
3. Ensuring coverage of only domestic non-financial corporates by cleaning the following observations from the dataset:
   - All firms with Entity type = 'Financial company'.
   - All firms with Entity type = 'Insurance company'.
   - All firms with unknown NACE (Rev.2) main section.
   - All firms with Nace (Rev.2) core code starting with 64.
   - All firms with NACE (Rev.2) main section = 'U - Activities of extraterritorial organisations and bodies'.
   - All firms with NACE (Rev.2) main section = 'T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use'.

Appendix II: Summary Satistics

Table 1: Summary Statistics by Listing Status and Legal Type

		Listing Status			Standardized Legal Form			
		Total	Listed	Listed Share	Private lim. companies	Public lim. companies	Partnerships	Other
Full Sample	AT	41069	63	0.15%	98.01%	1.17%	0.33%	0.49%
	BE	64858	102	0.16%	53.23%	33.74%	3.36%	9.67%
	DE	242772	627	0.26%	96.28%	1.75%	1.15%	0.82%
	FR	734663	617	0.08%	88.34%	10.49%	0.85%	0.32%
	FI	136199	152	0.11%	98.41%	0.17%	1.21%	0.22%
	NL	15792	112	0.71%	86.05%	2.86%	2.87%	8.23%
Bond Issuers	AT	95	30	31.58%	38.95%	61.05%	0.00%	0.00%
	BE	74	35	47.30%	1.35%	78.38%	0.00%	20.27%
	DE	360	155	43.06%	33.06%	65.28%	1.39%	0.28%
	FR	237	142	59.92%	13.92%	85.23%	0.84%	0.00%
	FI	63	37	58.73%	23.81%	74.60%	1.59%	0.00%
	NL	56	27	48.21%	26.79%	69.64%	1.79%	1.79%

Table 2: Summary Statistics by Country

Country	**Statistic**	**Full Sample**		**Bond Issuers**	
		Mean	Standard deviation	Mean	Standard deviation
Austria	Domestic Employment	94.6	1,013.7	3,439.3	6,546.3
	Domestic Revenue	5,767.0	44,189.9	53,123.6	126,568.7
	Total Assets	39,140.3	555,990.0	2,611,075.5	5,122,009.9
	Outside Funding	16,660.6	265,687.2	1,052,683.0	1,706,541.4
Belgium	Domestic Employment	79.1	1,622.8	5,593.3	21,871.3
	Domestic Revenue	1,216.2	62,262.2	185,144.6	1,275,339.1
	Total Assets	39,493.9	1,037,018.1	5,454,930.3	19,767,302.9
	Outside Funding	15,598.7	506,996.1	2,446,706.0	10,009,477.3
Germany	Domestic Employment	206.9	2,497.9	10,234.0	26,327.1
	Domestic Revenue	7,641.2	87,099.2	183,108.6	562,585.6
	Total Assets	74,215.8	2,225,597.7	10,206,503.2	34,455,576.6
	Outside Funding	25,929.9	920,959.8	3,944,565.7	14,356,861.5
Finland	Domestic Employment	26.1	409.5	3,776.4	8,438.5
	Domestic Revenue	367.9	9,137.7	67,833.6	176,115.0
	Total Assets	7,887.9	218,773.2	3,178,303.1	5,904,648.0
	Outside Funding	2,499.7	71,911.5	1,142,966.6	1,883,141.5
France	Domestic Employment	40.4	1,469.7	16,245.5	44,795.0
	Domestic Revenue	482.7	23,616.0	262,228.6	766,962.7
	Total Assets	16,630.6	1,023,999.6	12,909,037.5	34,521,407.7
	Outside Funding	6,789.0	570,351.8	5,796,161.0	19,739,446.8
Netherlands	Domestic Employment	536.8	4,454.7	17,052.7	41,311.1
	Domestic Revenue	14,622.3	135,127.7	373,456.4	819,114.8
	Total Assets	330,614.5	2,813,911.9	14,190,151.0	22,349,638.5
	Outside Funding	139,649.8	1,285,133.4	6,014,715.1	9,601,494.9

Appendix III: Firm coverage

Figure 1: Coverage: Total Revenue of Nonfinancial Corporates

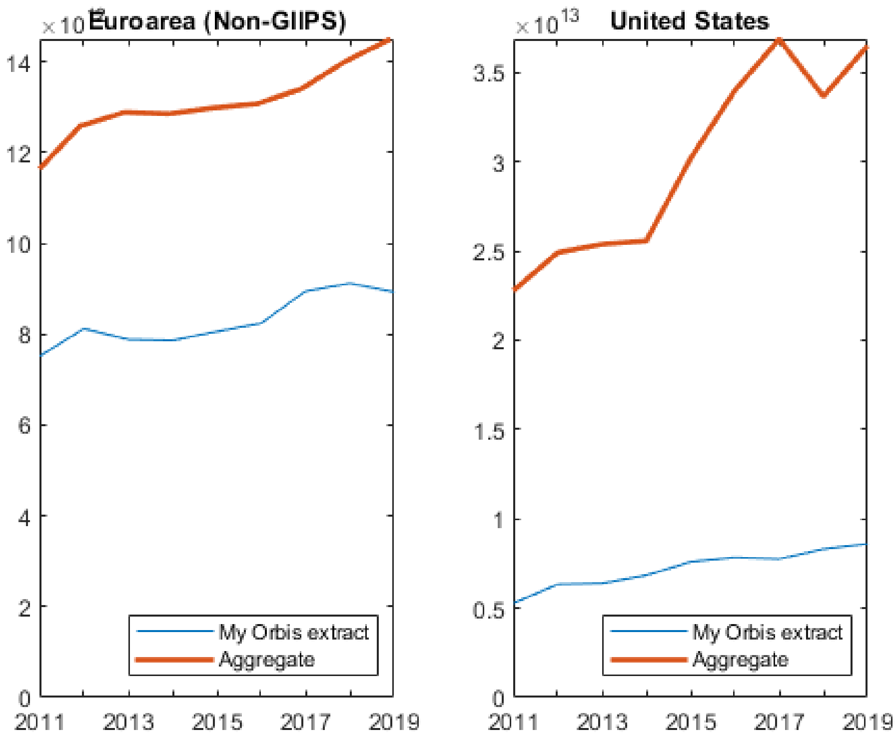


Fig. 1 compares the aggregate total revenue of nonfinancial firms to the total revenue across the micro-level data employed in this paper for the two regions: the Euroarea and the United States. The aggregate data for the Euroarea refers to the time series 'Turnover or gross premiums written' from the 'Annual enterprise statistics for special aggregates of activities (NACE Rev. 2)' for the total business economy except financial and insurance activities. The aggregate data for the U.S. depicts the time series 'Nonfinancial Corporate Business; Revenue from Sales of Goods and Services, Excluding Indirect Sales Taxes' (labeled BOGZ1FA106030005Q in the FRED database). Unfortunately, the consistency of this time series has been questioned, because "This series is identical to the gross value added for the non-financial corporate sector reported in NIPA table 1.14 (FRED series A455RC1Q027SBEA), indicating that the Flow of Funds series likely measures value added, not gross revenue, despite its name (Crouzet and Eberly, 2021, p.A59, footnote 37).

Figure 2: Coverage: Total Employment of Nonfinancial Corporates

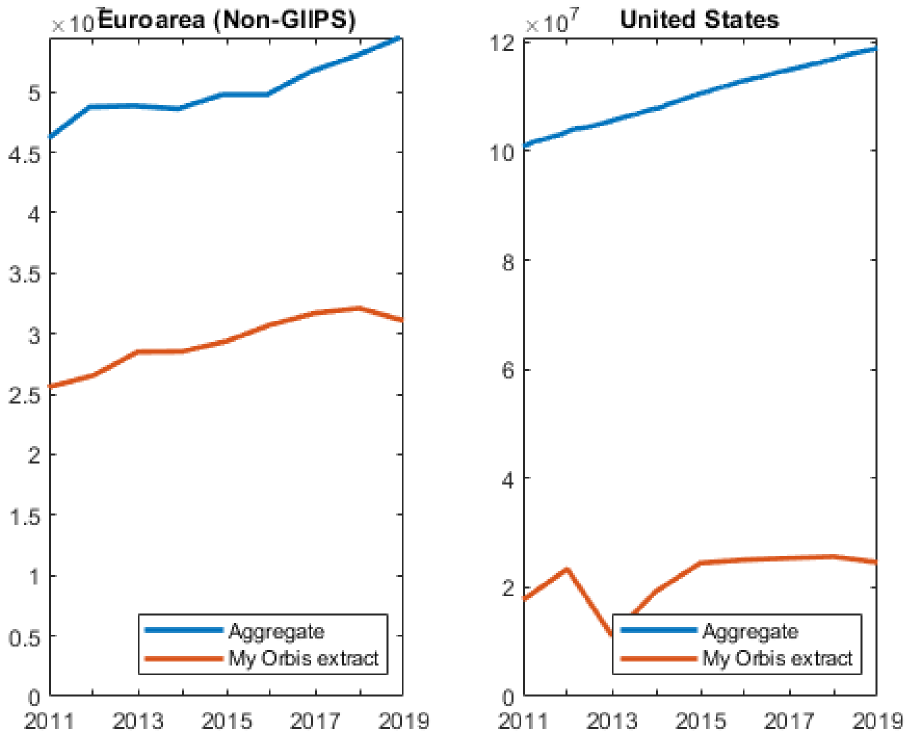


Fig. 2 compares the aggregate total employment of nonfinancial firms to the total employment across the micro-level data employed in this paper for the two regions: the Euroarea and the United States. The aggregate data for the Euroarea countries refers to the time series 'Employees - number' from the 'Annual enterprise statistics for special aggregates of activities (NACE Rev. 2)' for the total business economy except financial and insurance activities. The data for the United States stems from the Bureau of Labor Statistics and were retrieved from FRED. The times series is calculated as the difference of the series 'All Employees, Total Private [USPRIV]' and the series 'All Employees, Financial Activities [USFIRE]'. If on the micro-level data corporate groups report worldwide employment, this is broken down to the domestic level by the share of local revenue in worldwide revenue.

Figure 3: Coverage: Domestic Aggregate Operating Surplus

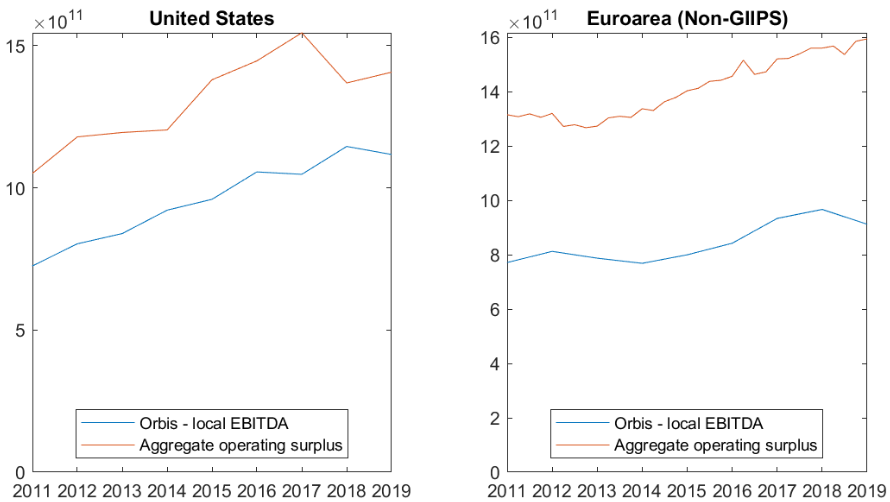
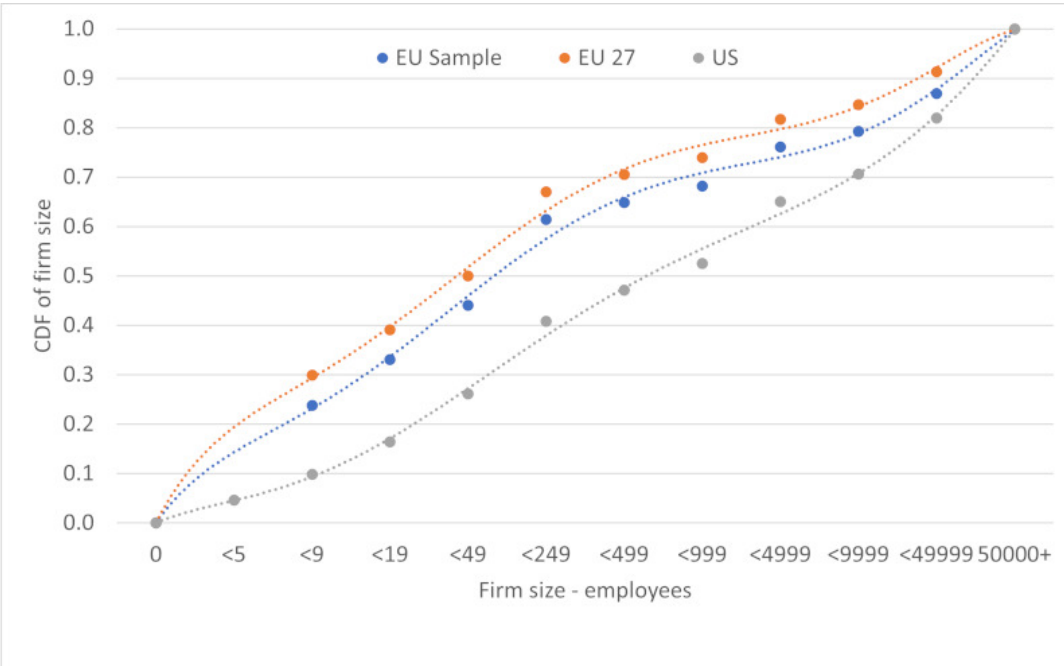


Fig. 3 compares the aggregate total operating surplus of nonfinancial firms to the total operating profit across the micro-level data employed in this paper for the two regions: the Euroarea and the United States. The aggregate data for the Euroarea countries refers to the time series 'Gross operating surplus and mixed income of Non financial corporations' from the ECB's Statistical Data Warehouse. The data for the United States were retrieved from FRED (time series NCBOSNA027N). If on the micro-level data corporate groups report worldwide operating profit, this is broken down to the domestic level by the share of local revenue in worldwide revenue. If gross operating profit is not reported by a firm, the measure EBITDA or EBIT are used instead, which are smaller measures.

Appendix IV: Firm distribution

Figure 4: Cumulative firm size distribution



The Figure weights firms by the number of employees, therefore, the interpretation of an observations is how many employees work in firms smaller than a certain cut-off. The majority of data points in this Figure draw on census data[a] and are therefore not prone to selection bias.

[a]This is derived from the Statistics of U.S. Businesses (SUSB) of the U.S. Census Bureau and the statistics on small and medium-sized enterprises from Eurostat (Eurostat's structural business statistics). Since the U.S. and the European census on firm size do not use consistent bucket sizes, I use the distribution of firms in Orbis in order to adjust buckets. In particular, the European census focuses on small firms and thus groups all firms of at least 250 employees in one bucket, representing 38.55% of all employees. In order to deduce the share of firms in, for example, the group 50-299 in Europe (this metric is available in the U.S. census data), I compute the share of the size group 250-299 in terms of all firms of at least 250 employees across nonfinancial Euroarea firms in Orbis (using Orbis Pivot analysis tool), which is 2.212%. I deduce that 0.85% (0.02212*0.3855=0.0085) of employees work in firms of the size category 250-299 employees. The census data already includes the share of all employees in the size group 50-249 employees, which is 17.39%. This results in the weight for the size category 50-299 employees as depicted in the graph of 0.1739+0.0085=0.1824, or 18.2%. Orbis data has been found to be representative in terms of employment for firms of at least 250 employees; see (Bajgar et al., 2020, p. 22). Note that the three smallest size categories (<10,10-19,20-49) which are most prone to selection biases are available as is in both census publications.

Appendix V: Information on the distribution of bond funding in the economy

Figure 5: Bond funding share across industries

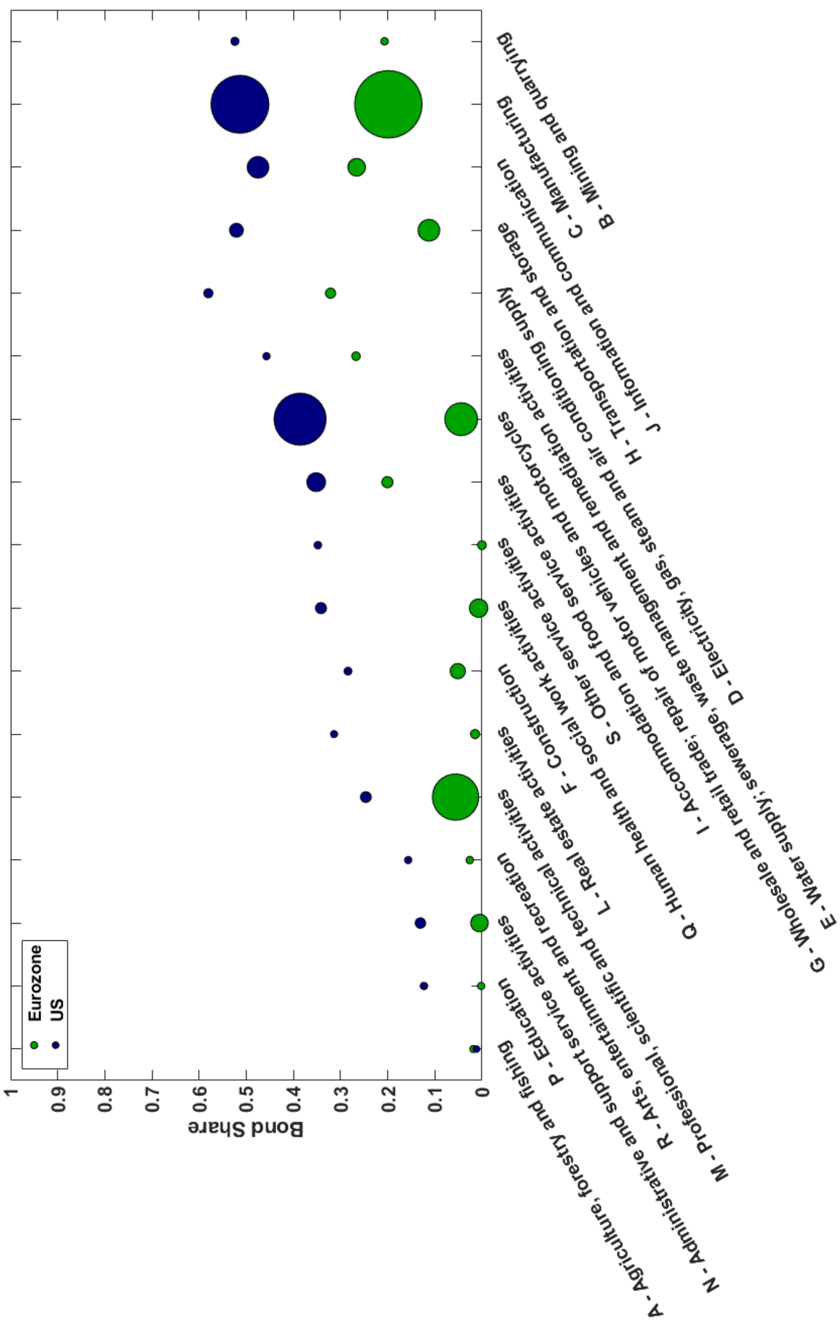
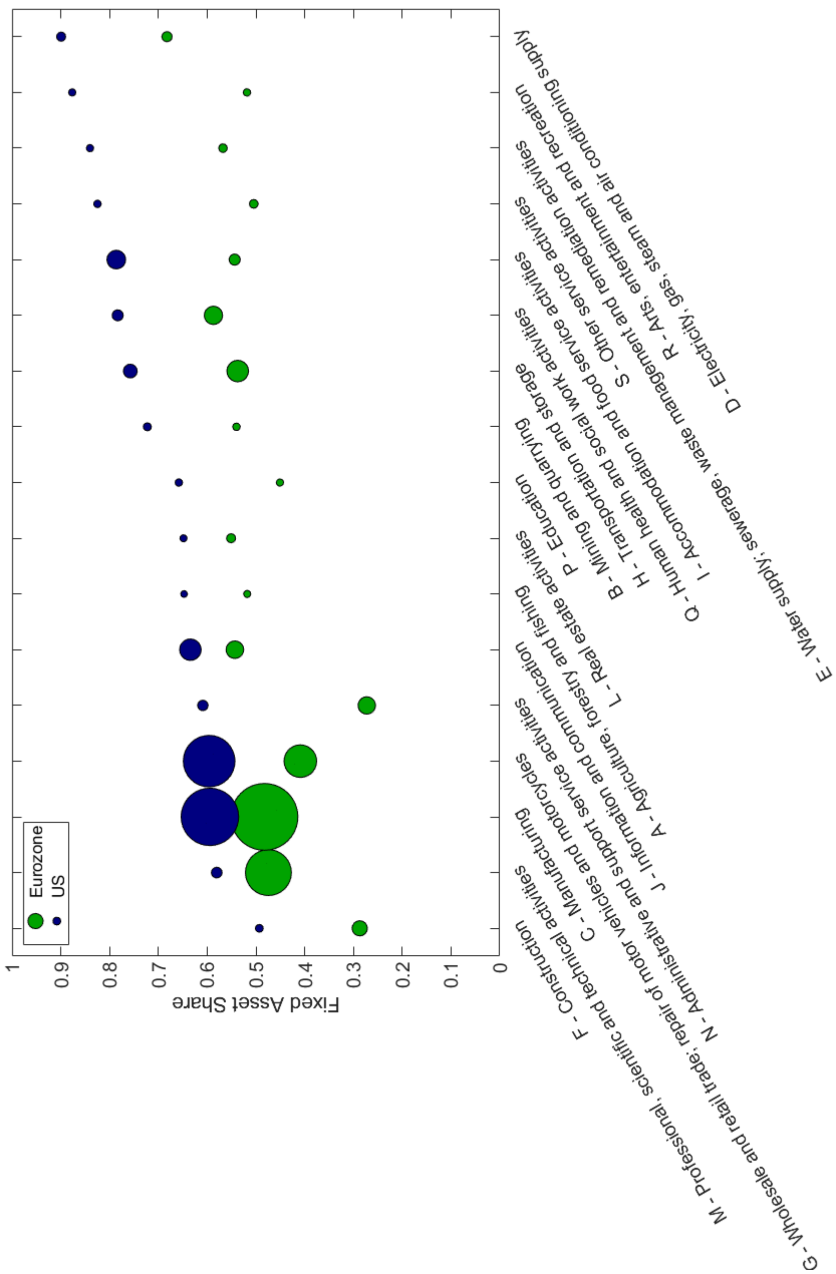


Figure 6: Fixed asset share across industries



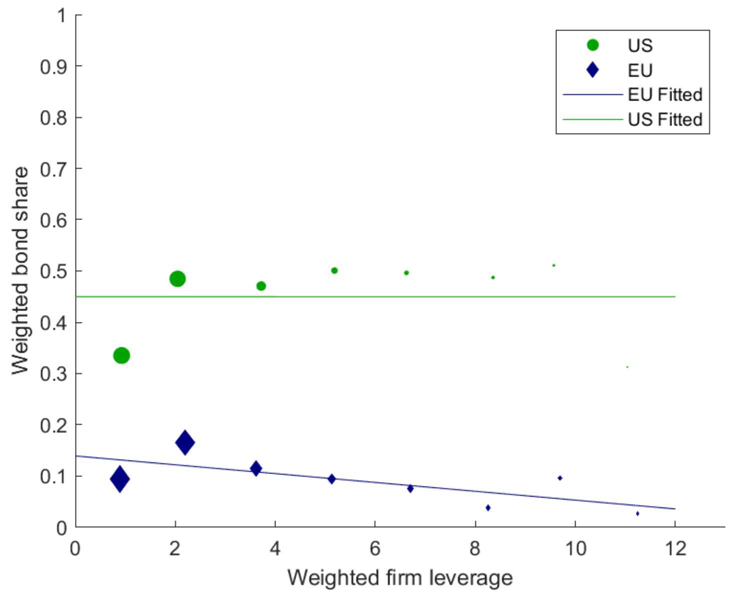


Figure 7: Bond funding sharing and leverage

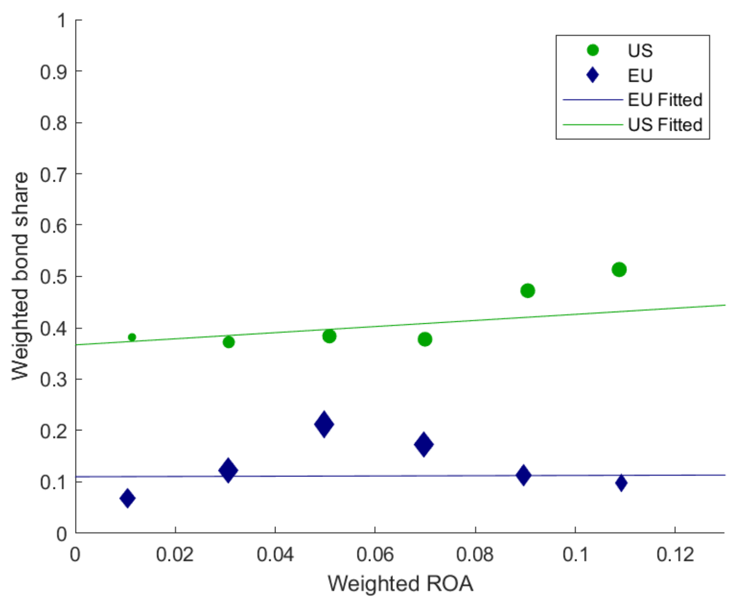


Figure 8: Bond funding sharing and profitability

Table 3: Univariate regressions

	(1) Bond share	(2) Bond share	(3) Bond share	(4) Bond share	(5) Bond share
Size (Total assets)	0.000006***				
	(20.251374)				
Size (Employees)		0.001637***			
		(7.798685)			
Fixed assets			0.006093***		
			(89.360984)		
Profitability				0.000000	
				(1.040017)	
Leverage					$5.6 \cdot 10^{-11}$***
					(2.669920)
Observations	3,643,746	3,643,746	3,629,437	3,134,386	3,635,937
R^2	0.067372	0.129583	0.006139	0.000000	0.000000

***, **, and * represent significance at a 1, 5, and 10% level, respectively. *t*-statistics are in parentheses. Regressions include heteroscedasticity-robust standard errors. Fixed assets refers to the share of fixed assets in total assets, shown as a percentage. Total assets is measured in euro millions. Employees is measured in thousands. Profitability refers to return on equity, shown in percentage. Leverage refers to debt/equity, shown in percentage.

Figure 9: Leverage by Fixed Assets and Firm Size

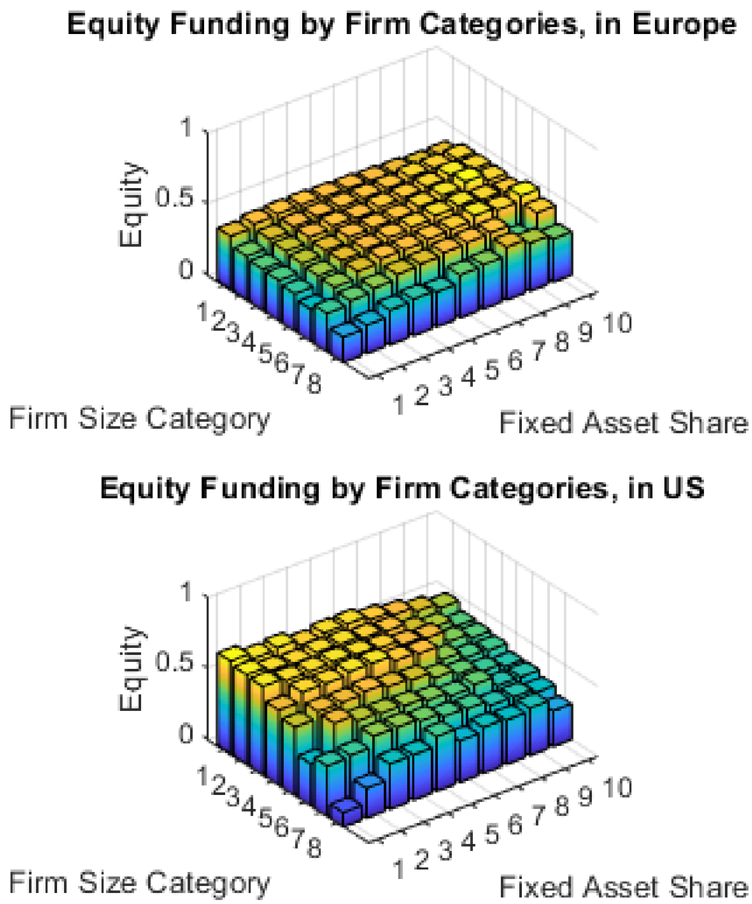


Fig. 9 depicts the distribution of leverage among firms of different sizes and fixed asset shares. The firm size categories translate into the number of employees as follows: (1) - less than 100, (2) from 100 to 249, (3) from 250 to 499, (4) from 500 to 999, (5) from 1000 to 4999, (6) from 5000 to 9999, (7) from 10000 to 49999, (8) at least 50000. The fixed asset share refers to the fixed asset categories as defined per the deciles of the distribution.

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