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Volume IV



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Volume IV

Please address correspondence to
Banco de Portugal, Economics and Research Department
Av. Almirante Reis 71, 1150-012 Lisboa, Portugal
T +351 213 130 000 | estudos@bportugal.pt



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Editorial

July 2018

The third issue of Banco de Portugal Economic Studies for 2018 contains four essays with a common theme: using individual level data to examine in depth the behavior, financial environmental conditions and performance of Portuguese firms. One essay looks at firms' exports (and imports) of non-tourism services while others look at the financing of firms: how age, size and industry matter and what happens to the financing of firms and firm dynamics in distress situations.

The first essay, by João Amador, Sónia Cabral and Birgitte Ringstad, is titled "A portrait of Portuguese international traders of non-tourism services". As in other parts of the world, Portugal has been experiencing an increase in the importance of trade in non-tourism services. In 2015, Portuguese trade in non-tourism services represented around 13 percent of GDP, compared to 9.5 percent in the world economy. In addition, since the 2000s, Portugal has been recording surpluses in the non-tourism services account. In 2015, the Portuguese non-tourism services account showed a surplus of 2.5 percent of GDP, with exports and imports representing 7.7 and 5.2 percent of GDP, respectively. This essay uses detailed firm-level data on Portuguese exporters and importers of non-tourism services to establish a few facts concerning the service and geographical portfolios of Portuguese traders and sketch a profile these Portuguese exporters and importers in dimensions like sector of activity, age, size, productivity and profitability.

The analysis relies on firm-year-service-country data on Portuguese international trade of non-tourism services at a disaggregated level merged with firms' balance-sheet information. Non-tourism services are classified according to the Extended Balance of Payments Services 2010 nomenclature. The firms included in the analysis were engaged in international trade of non-tourism services in 2014 or 2015, and they were mostly from non-financial sectors. The sample includes 9,903 unique firms and 16,177 firms-year (fy). The paper makes the distinction between firms that only export (4,506 fy), that only import (4,430 fy) and two-way traders (7,181 fy).

The descriptive analysis presented is very rich and multidimensional. The distributions of the numbers of exporters and importers and values of trade by firm type (one way vs. two way) are examined and connected with the number of non-tourism services and countries in the portfolio of each firm. The distribution of these characteristics by economic sector is also examined along with the joint distribution with variables such as the firm's age, size, productivity and profitability. All in all, there is a very large number of facts in the paper that are hard to summarize. However, a few facts stand out.

Most exporters and importers trade only one type of service, representing around three-quarters of total exporters and half of total importers, and have

only one partner country. Two-way traders represent around 45 percent of total traders and account for around 90 percent of total trade values. Two-way traders tend to have higher productivity and higher profitability levels than other traders. The average one-way exporter ships 1.1 non-tourism services to 4.1 countries and receives about 530 thousand euros, while the average two-way trader exports 1.6 non-tourism services to 6 countries for 2,725 thousand euros.

Trade value is very concentrated: the top 1 percent exporters account for 59 percent of the total export value, while the top 10 percent exporters represent 86 percent of total exports. The figures are similar for imports.

Portuguese international trade in non-tourism services is dominated by three main categories: "Other business services", "Transport" and "Telecommunications, computer and information". In the last two of these sectors, two-way traders are responsible for 99 percent of the imports of the respective sector and for more than 90 per cent of its exports.

Finally, probably the most interesting specific result of the analysis is that manufacturing firms represent a significant part of total international traders of non-tourism services. The fact that more than 14 percent of firms exporting non-tourism services belong to the manufacturing industry (23 percent for importers) is consistent with recent evidence on the relevance of servitisation of manufacturing, where the term refers to the increase of purchases, production, sales and exports of services by manufacturing firms. This suggests a shift from selling only goods to the supply of an integrated combination of goods and services, presumably adding value and contributing to product differentiation. Is this where the future is heading? The authors do not cross that threshold in their essay, but it is plain to see that further analysis, looking at the eventual association between exports of goods and exports of services, may shed more light on the matter.

The second essay, by Joana Pimentel and Sujiao (Emma) Zhao has the title "The Maturity Rat Race and Short-termism". In a world with perfect capital markets it should be mostly irrelevant what kind of financing firms use. The real world has enough information imperfections and rigidities for us to know better. In the Economics and Finance literatures it has been found that we can observe a correlation between reliance on short-term debt and the probability of firms defaulting. One explanation for this fact is that as firms in deteriorating circumstances tend to generate negative information in the future, they have incentives to shorten the maturity of an individual creditor's new loan. This decreases the default risk on this new loan but at the cost of diminishing the relative claim and the payoffs of the remaining creditors. In anticipating this problem, the remaining creditors may only accept to offer debt with shorter maturities, the so-called "maturity rat race". This equilibrium is borne out of a lack of coordination between the lenders of each firm and it is inefficient because the excessive reliance on short-term funding leads to an undesirable asset-debt maturity mismatch and intensified

rollover risk. In the limit “maturity rat race” may even threaten otherwise perfectly solvent firms, in particular during economic crises that raise the volatility of fundamentals.

Do maturity rat race occurs in Portugal, where small and medium-sized enterprises (SMEs) account for a significant share of the private sector? The authors’ answer is yes. Their analysis looks at non-financial corporations and uses information from several data sets: the Portuguese Credit Register, the New Credit Operations Database, the Central Balance Sheet Database and the Monetary Financial Institutions Balance Sheet Database. The first part of the paper investigates the maturity race issue in an event study framework by tracking the evolution of debt maturity structure around the time of a firm’s default. A second part examines whether the excessive reliance on short-term financing leads firms to engage in myopic behaviors.

The analysis focuses on the first default of a firm, defined as the firm’s failure to fulfil debt obligation amounting to 2.5 percent or more of its total debt outstanding for more than three months. A firm’s exposure to a maturity race is captured by the evolution of the ratio of a firm’s short-term debt to total debt. The paper tracks the evolution of the short-term debt ratio in each defaulting firm, using a 24-month window. Overall, the pattern revealed does imply the existence of maturity race in firms facing financial distress. Notably, the curves of the short-term debt ratio increase substantially before default. The mean/median short-term debt ratio increases from 0.49/0.46 24 months before default to 0.57/0.63 when default occurs. The short-term debt ratio continues to increase even after the default.

In the second part of the paper the authors explore whether excessive short-term debt leads firms to take more short-term oriented decisions. Their results suggest a negative role of excessive short-term debt in investment and employment decisions. There is also evidence suggesting that excessive short-term debt is related to short-termism as the affected firms’ assets and employment compositions show an increasing investment in short-term assets and an increased role for unpaid and part-time workers.

The authors do not venture deeply into policy recommendations but it is clear that improving coordination and information sharing among lenders might mitigate the problem. However, this may not be easily acceptable as this type of solutions could be seen as anticompetitive. There is probably an acceptable solution where the right balance between the competing concerns of competition and coordination is to be found but we may need more research before establishing what the optimal policies might be.

The following paper, “Financial situation indicators of Portuguese firms: Do size, age and sector matter?” is authored by Fábio Albuquerque, Paulo Soares Esteves and Cloé Magalhães. In the paper three ratios were chosen to summarize the financial situation of firms: the capital ratio (equity over total assets), the bank loans over liabilities ratio, and the commercial gap (ratio of debt to suppliers over debt from customers). The capital ratio is an

indicator meant to assess the firms' leverage and dependency on external funding as higher levels of indebtedness increase the firms' vulnerability. The bank loans over liabilities ratio is relevant for SMEs that, in general, have little access to financial markets. Low levels of the bank loans to liabilities ratio may be evidence of restrictions in the access to bank credit but they can also signal firms' preferences for other sources of funding. The commercial gap is an indicator of the firms' financial situation as trade credits are a source of funding used by all firms, in contrast to bank loans. A low commercial gap may pressure short-term liquidity requirements and increase the dependence of firms on other sources of funding.

The paper establishes three types of empirical results. It shows the annual evolution of the three ratios for Portuguese non-financial firms, using information from the Central Balance Sheet Database for the period from 2010 to 2016. The percentage of assets financed by equity decreased from 2010 to 2012, growing after 2014. This more recent evolution reflects a growth of equity in line with the savings increase by non-financial corporations documented elsewhere. The bank loans to liabilities ratio, decreased over the sampling period, reflecting a reduction of the loans granted to firms. Finally, the commercial gap remained stable during this period, with values around 84 percent meaning that, on average, trade credits give a negative contribution to the short-term funding of firms.

The second type of results come from an international comparison of the Portuguese ratios with their counterparts in nine European countries using aggregate data for 2015 from the Bank for the Accounts of Companies Harmonized database. Despite the recovery registered in recent years, Portugal has the lowest capital ratio of all the countries studied. Portuguese firms are in the middle of the pack when it comes to dependence on banks as source of external funding. Finally, commercial credit contributes more significantly to negative net short-term funding in Portugal than in the majority of the countries studied.

The third set of results comes from an econometric analysis of firm level panel data. The estimates show how some structural characteristics, more specifically age, size and economic activity sector, affect the financing of firms by impacting on the aforementioned financial ratios. The capital ratio is increasing in age and decreasing in size. In both cases there is a concave (log) relationship. There are significant differences across industries, with a higher proportion of equity in "transportation and storage" firms when compared to firms in the remaining economic activity sectors. In contrast, firms operating in "real estate" and in "electricity and water" resort more to external debt for funding. The commercial gap ratio is decreasing in age and increasing in size, the opposite of the capital ratio, suggesting a higher market power of larger firms when dealing with suppliers and customers. The ratio tends to be higher in "accommodation and food services" and lower in the sectors "transportation and storage", "electricity and water" and

manufacturing. Finally, the bank loans over total liabilities ratio behaves in a quadratic fashion with respect to age and size of the firms, increasing up to a level of age or size and decreasing after that threshold. The ratio tends to be lower in manufacturing and higher in real estate and in transportation and storage.

The results suggest that as firms age, equity increases (mainly due to retained earnings), as well as the use of financial debt. In the intermediate age classes, firms rely more on bank loans for external funding, while more mature firms have other alternatives of funding, such as debt securities. Also, capital ratios tend to be higher for smaller firms, as these rely less on banks for external funding and present a smaller commercial gap. As firm size increases, firms resort more to external debt.

The fourth and last paper, by Sónia Félix is titled “Borrowing constraints and firm dynamics”. The essay investigates the impact of borrowing constraints on the firm’s investment and survival. The motivation for the analysis is clear since it is well known that difficulties in the access to credit have important implications for firm dynamics as firms may be forced to lower their output, lose investment opportunities and may become vulnerable to temporary liquidity shortfalls, in particular in the presence of negative aggregate shocks.

The analysis proceeds in two steps. In the first step, the credit demand and credit supply estimates of the credit disequilibrium model estimated in Farinha and Félix (2015) are used to determine the probability of credit rationing and to identify which firms were partially credit constrained in the period between 2010 and 2012. Farinha and Félix estimated that approximately 15 percent of Portuguese SMEs were partially credit constrained in this period. In the second step, the paper estimates how the firm’s investment and exit responded to credit conditions.

The data used in the analysis was taken from the Portuguese dataset Simplified Corporate Information - which consists of detailed balance sheet data for Portuguese nonfinancial corporations. A firm exit in year t is defined by its absence from the IES in that year. The investment rate is defined as a ratio with the change from year $t-1$ to year t in net fixed assets in the numerator and total assets in $t-1$ in the denominator.

Using over 51 thousand observations from more than 25 thousand firms the author estimates a linear regression explaining the investment rate as a function of year, sector and firm fixed effects, two (alternative) measures of credit rationing and a categorical variable accounting for size. The results suggest that the investment rate of SMEs that were estimated to have been partially credit constrained is on average 2.7 percentage points lower than that of non credit-constrained firms.

A complementary log-log regression was used to explain the probability of a firm exit as a function of a set of variables similar to those used for the investment regression, with the variable time added to account for

duration dependence. Firms that were estimated to have been partially credit constrained in the period between 2010 and 2012 were on average less likely to survive by 1.61 percentage points, a large effect considering that the average exit rate for the firms in the sample in this period was 2.5 percent.

These results suggest that financial-market frictions are important to explain the firm's investment and probability of survival. Overall, the results support that financing constraints played a role in explaining firm dynamics in this period.

A portrait of Portuguese international traders of non-tourism services

João Amador
Banco de Portugal
Nova SBE

Sónia Cabral
Banco de Portugal

Birgitte Ringstad
Nova SBE

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Abstract

The role of services international trade on firms' activities has been growing in the recent decades and its study is an active topic of research. This article uses firm-level data on Portuguese international traders of non-tourism services, combined with detailed balance-sheet information, and offers two types of insights. Firstly, we draw a detailed profile of Portuguese exporters and importers of services in dimensions like sector of activity, age, size, productivity and profitability. Secondly, we explore the firm-year-service-country detail of the data to examine the service and geographical portfolios of Portuguese traders. We confirm most of the evidence observed for other countries, namely the high degree of firm-level heterogeneity in services trade and the concentration of trade flows both between and within-firms. We also show that two-way traders play a prominent role in Portuguese international trade of non-tourism services. (JEL: F1, F14, L25)

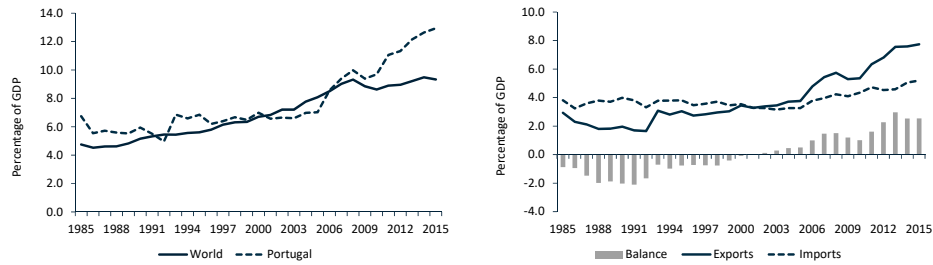
Introduction

In recent decades, international trade in services has been growing strongly, leading to higher shares of this sector in total gross output, employment and trade. Portugal has also been experiencing a progressive increase in its trade openness and there has been a growing importance of trade in services. Even if tourism remains the largest sector in Portuguese trade in services, accounting for around 45 percent of total exports of services and

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E-mail: jamador@bportugal.pt; scabral@bportugal.pt; biringstad@gmail.com

28 percent of total imports of services, trade in non-tourism services has been gaining importance since the 2000s (Figure 1). In 2015, total Portuguese trade in non-tourism services represented around 13 percent of GDP, which compares to around 9.5 percent in the world economy. In addition, since the 2000s, Portugal has been recording surpluses in the non-tourism services account, which contrasts with the systematic deficits registered previously. In 2015, the Portuguese services account, excluding tourism, showed a surplus of 2.5 percent of GDP, with exports and imports representing 7.7 and 5.2 percent of GDP, respectively.



(A) International trade in non-tourism services (B) Portuguese exports and imports of non-tourism services

FIGURE 1: International trade of non-tourism services as a percentage of GDP

Source: CEPII-Chelem database.

Notes: Nominal Balance of Payments transactions and nominal GDP are denominated in current US dollars. Exports and imports of services exclude transactions of the travel account.

The literature on international trade in services using firm-level data has been growing recently but it is still limited when compared with the large number of studies on firm-level international trade in goods. This article contributes to this literature by reporting a set of stylised facts using detailed firm-level data on Portuguese exporters and importers of services. Portugal is an interesting case-study as its export performance stands out as a key variable in the economic recovery initiated after the latest sudden stop in external financing, triggered by the sovereign debt crisis in the euro area.

Our analysis relies on firm-year-service-country data on Portuguese international trade in non-tourism services at a disaggregated breakdown level, as collected by the Statistics Department of Banco de Portugal, merged with firms' balance-sheet information for 2014 and 2015. We distinguish between firms that only export, that only import, and those that engage in both international flows of services (two-way traders).

Most of the facts shown in this article are in line with and reinforce the conclusions of the still relatively scarce literature on firm-level international

trade in services. As found for other countries and for trade in goods, firm-level heterogeneity is a key feature of Portuguese services trade. We show that Portuguese international trade in non-tourism services is highly concentrated in some firms: two-way traders represent around 45 percent of total traders and account for around 90 percent of total trade values.

Taking into account the service and geographical portfolios of traders, we find that most exporters and importers trade only one type of service, representing around three-quarters of total exporters and half of total importers, and have only one partner country (around 40 percent for both traders). However, these firms are responsible for much smaller percentages of total exports and imports. In fact, as identified for other countries, the values of Portuguese services trade are concentrated in the group of multi-service and multi-country traders. Nevertheless, even for firms with diversified portfolios, the main service type/partner country still represents a high percentage of a firm's total trade.

The article is organized as follows. Section 2 briefly discusses the specificities related with the measurement of international trade flows of services, describes the main features of the two databases used and provides some basic descriptive statistics of the sample. Our findings are reported along two blocks. Firstly, section 3 analyses some basic attributes of the three types of service traders in terms of sector of activity, age, size, productivity and profitability. Secondly, section 4 examines the portfolios of trading firms at a detailed level, with regard to the number of services and partner countries. Finally, section 5 offers some concluding remarks.

Concepts, measurement and data

Concepts and measurement

Part of the explanation for the relatively limited number of firm-level studies on international trade in services relates with the difficulties in compiling and interpreting the data. In fact, the services sector has several specificities that lead to fundamental differences relatively to trade in goods.

Firstly, services are intangible and hence their international trade does not involve shipping. As a consequence, services are inherently harder to monitor, measure and tax. Secondly, services are non-storable, so their production and consumption tend to occur simultaneously. Thirdly, services are highly differentiated, as they are sometimes tailored to the needs of customers. Fourthly, all services require some form of interaction between producer and user, the so-called joint production. It can be a direct person-to-person contact (e.g., haircut), a telecommunication (e.g., internet banking) or an exchange of written documents. Some services may require the consumer to move to the location where the services are supplied (e.g., tourism), while

others may require the producer to move his location (e.g., maintenance engineering). As a result, even with the strong improvements in information and communication technologies, services are still less tradable than goods.

Since services are intangible, in general, tariffs cannot be levied directly on their transactions, except for a few activities like transportation and tourism. Therefore, barriers to trade in services are mostly non-tariff barriers, like quotas, prohibitions and government regulations. These restrictions can take the form of limits on the market shares of foreign providers of services or on the scope of their activities. Moreover, regulations may include provisions on licensing and certification, technical and environmental standards or government procurement and sourcing policies. As discussed in OECD (2014), even though regulatory barriers to product market competition have been reduced since the mid-nineties, there is scope for further reforms, especially in professional services. In fact, services are the sectors in which most economic regulation is concentrated and where it is most relevant for economic activity. Nordås and Rouzet (2017) use a recent OECD regulatory database on services trade restrictions and highlight the large potential costs of regulations that restrict trade and investment in these sectors.

The intangible nature of trade in services also makes these flows difficult to measure. As such, finding efficient ways of collecting data on services international transactions is a statistical challenge. There are several studies devoted to the measurement of trade in services (see, for instance, Lipsey (2009) and Sturgeon *et al.* (2006)) and most country studies on trade in services also discuss this issue in detail. In line with the classical approach, Balance of Payments (BoP) data is still the main source used to measure international trade in services. Nevertheless, there is a broad consensus that the growth of services trade is significantly underestimated, as we will discuss in detail below.

In order to understand the consequences on the analysis arising from alternative definitions of trade in services, it is useful to provide additional details and examples. The United Nations Manual on Statistics of International Trade in Services (UN 2010) describes in depth the four modes through which services may be traded internationally, according to the General Agreement on Trade in Services (GATS), taking into account the location of both suppliers and consumers.

Mode 1 (cross-border supply) applies when suppliers in one country provide services to consumers in another country, without either of them moving into the territory of the other. This mode is similar to the traditional notion of trade in goods, where both the consumer and the supplier remain in their respective territory. Freight transport services, correspondence courses and telediagnosis are examples of cross-border supply of services.

Mode 2 (consumption abroad) comprises the cases when a consumer resident in one country moves to another country to obtain a service. Tourism services and related activities are typical examples of consumption abroad.

Medical treatment of non-resident persons and language courses taken abroad are other examples.

Mode 3 (commercial presence) includes the situations when firms supply services internationally through the activities of their foreign affiliates. Medical services provided by a foreign-owned hospital and services supplied by a domestic branch of a foreign bank are examples of supplies through commercial presence. Most mode 3 services concern domestic sales of foreign affiliates that are not included in the BoP services data, as they are considered transactions between residents. Statistics on foreign affiliates trade in services (FATS) are the main sources of data on international trade in services through mode 3. The main exception refers to short-term construction projects done by unincorporated site offices, which are recorded in the BoP under construction services.

Finally, mode 4 (presence of natural persons) describes the process by which an individual moves temporarily to the country of the consumer in order to provide a service. This mode of supply includes trade in services in the BoP sense, like auditing services by a foreign auditor or entertainment services by a foreign artist on tour in the host country. In addition, mode 4 also includes non-permanent employment in the country of the consumer, which is recorded in the BoP as labour income.

From the discussion above it results that the BoP trade in services broadly covers modes 1, 2, a significant part of mode 4 and a small part of mode 3. Therefore, the international trade in services is being underestimating when it is measured as BoP transactions in services. This underestimation can be significant since foreign direct investment (FDI) is an important channel for the international provision of services. Rueda-Cantuche *et al.* (2016) provide recent evidence on the high relevance of mode 3, showing that it was the largest mode of supply of European exports of services in 2013.

Moreover, recent evidence shows that services are increasingly incorporated in exports of goods. Francois *et al.* (2015) examine in detail the value-added linkages between services and goods and find that most of the services exports on a value-added basis are embodied in exports of goods. In that context, Cernat and Dimitrova (2014) go beyond the four modes of services supply and suggest the so-called "mode 5" to account for services embodied in exports of manufacturing goods. Mode 5 services are a subset of servitisation and include the domestic intermediate services inputs that are incorporated in a country's goods exports.¹ Given its nature, mode 5 services are not included in the traditional BoP data for services and trade policy issues may arise as they become an important part of cross-border exchanges of services. In this context, Rueda-Cantuche *et al.* (2018) provide evidence that mode 5

1. See Baines *et al.* (2009) for a detailed discussion of servitisation, i.e., the rise of the participation of manufacturing firms in service activities.

services trade may have contributed to sustain the European manufacturing employment base.

Databases

This article uses detailed data on Portuguese firms exporting and importing services from the Banco de Portugal's official Portuguese BoP services account, combined with detailed balance-sheet and income statement information from the Simplified Corporate Information (*Informação Empresarial Simplificada*, Portuguese acronym: IES). We merge the databases by using a common and unique firm identifier. Our period of analysis corresponds to the years of 2014 and 2015, for which both databases are available.

The services account of the BoP measures transactions of services between residents and non-residents according to the guidelines of the IMF (2016) Balance of Payments Manual (6th edition). As described in the previous section, this definition of international trade in services is narrower than the one of GATS, which has broadened the statistical concept of trade in services, moving it beyond a subset of the BoP and reflecting the modes by which services are supplied.

Banco de Portugal collects monthly detailed data on international trade in services to compile the services account of the Portuguese BoP. However, there is no firm-level data for travel and tourism flows. The survey sets a non-reporting yearly threshold of 100 thousand euros on the total value of a firm's economic and financial operations with non-residents. Therefore, no specific threshold is imposed on the reporting of international transactions of services. The firm-level data covers more than 90 percent of total exports and around 80 percent of imports of non-tourism services as published in the official Portuguese BoP. In this article, the data is aggregated at the annual level and values are expressed in current euros. For each record, the database reports the firm identifier, partner country, type of service and time period. Services are classified according to the Extended Balance of Payments Services (EBOPS) 2010 nomenclature, including 29 types of services as described in Appendix A.

The balance-sheet data bases on annual information for Portuguese firms reported under Simplified Corporate Information (*Informação Empresarial Simplificada*, IES), which results from a partnership between the Ministry of Finance, the Ministry of Justice, Statistics Portugal and Banco de Portugal. The IES follows the new accounting standards system from 2010 to 2015, and it covers almost the universe of non-financial corporations in Portugal.²

2. More precisely, it does not include firms of sections O - Public administration and defence, compulsory social security (division 84); T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use (division 97

The nearly universal coverage of IES results from the fact that it is the system through which corporations report mandatory information to the tax administration and statistical authorities, including detailed annual balance-sheet, profit and loss accounts. IES also includes information on firms' characteristics such as age, number of employees and sector of activity under the Portuguese industrial classification Rev 3 – *Classificação Portuguesa das Actividades Económicas* (CAE).

In order to remove erroneous, inconsistent or missing observations, some filters were imposed on the data. Firstly, the sample was restricted to firms with information on key variables, like age and sector of activity. Secondly, the database was limited to firms with positive gross value-added, turnover labour costs, employment and total assets.

In this article, the sample contains only firms that are present in both the BoP and IES databases. Hence, it only comprises firms that are active in international trade of non-tourism services in 2014 and/or 2015. The final sample includes 9,903 unique firms. Taking into consideration the two years, there are 16,177 firms-year, of which 4,430 only import, 4,506 only export, and 7,181 both export and import. Hence, 11,687 firms-year report positive exports and 11,611 firms-year positive imports.

Due to the merge with IES, some service traders were excluded from the sample resulting in a final coverage of around 85 percent for exports and 65 percent for imports. In particular, most of the insurance and banking sectors are not included in the final sample, leading to a reduced coverage of these type of services.³ Nevertheless, the sample still includes data on international transactions of financial services of non-bank institutions.

Finally, it should be noted that the EBOPS classification of types of services is distinct and independent from the CAE classification of sector of activity. Firms are officially assigned to a sector of CAE according to their main reported activity, while international trade in non-tourism services is classified along the 29 service types of the EBOPS nomenclature.

Descriptive aggregate statistics

We classify international traders of services in three groups in line with their trading status: only export (one-way exporters), only import (one-way importers) or engaging in both activities (two-way traders). The general

– 98); U - Activities of extraterritorial organisations and bodies (division 99) of the Portuguese statistical classification of economic activities Rev 3 – *Classificação Portuguesa das Actividades Económicas* (CAE). In addition, most corporations in section K - Financial and insurance activities (divisions 64 – 66), like banks and insurance companies, are also excluded. However, other financial and insurance intermediaries and auxiliaries are present in the database.

3. For insurance services, the sample covers around 37 percent and 17 percent of total exports and imports of these services in 2014-2015, respectively. For financial services, the sample coverage is around 15 percent for exports and 13 percent for imports.

term importers (exporters) refers to firms importing (exporting) services irrespective of the export (import) dimension. Throughout the analysis, statistics are computed using firm-year observations, meaning that a firm active in services trade in both years is counted as a new observation in each year. For simplicity, the term *firm* is used for *firm-year* and non-tourism services are referred to as services in the remaining of the article. Finally, the tables and graphs represent pooled results for 2014 and 2015.

Table 1 shows the representation of firms and trade flows according to 10 broad categories of services at the 2-digit level of EBOPS classification, based on the 29 types of services considered in the database. In terms of number of firms, "Other business services" is the largest category for both exporters and importers, followed by "Transport" on the export side and "Telecommunications, computer and information" on the import side. The two latter service categories are third in the ranking of number of importers and exporters. In terms of values traded, "Transports" accounts for almost half of the value exported (48.2 percent), followed by "Other business services" (30.6 percent). On the import side, "Other business services" rank first (35.7 percent) and "Transports" second (27.5 percent). "Telecommunications, computer and information" accounts for the third highest share in exports and imports (10.6 and 15.6 percent, respectively). Hence, Portuguese international trade in non-tourism services is dominated by three main categories of services: "Other business services", "Transports" and "Telecommunications, computer and information". Within these broad categories, the most important types of services are "Air transport", "Telecommunications", "Computer services", "Scientific and other technical services", "Trade-related services" and "Other business services n.i.e", both on the export and import sides.⁴

To examine the geographical composition of Portuguese international trade in services, Table 2 reports the ten largest export and import partner countries in terms of their percentage share in the respective trade flows and number of firms. The main trade partners are almost identical on the export and import side, where countries of the European Union (EU) and Portuguese speaking countries dominate. UK, Spain and France are the top export destinations, while Spain, UK and Germany are the top import origins. Interestingly, Spain represents a larger share of Portugal's imports than exports (17.7 versus 11.1 percent). In addition, Spain is also the country that accounts for the largest number of both exporters and importers. Regarding non-European countries, Angola and Brazil are more relevant in terms of exports than imports, while USA has a higher importance in imports than exports.

4. A detailed breakdown of service types exported and imported according to the 29 service types of the EBOPS classification, comprising the trade values, number of firms-year, partner countries and transactions of each service is included in Tables A.1 and A.2 of the Appendix.

Code	Description	Exports	Exporters	Imports	Importers
SB	Maintenance and repairs	3.4	5.1	4.9	7.9
SC	Transports	48.2	19.1	27.5	11.6
SE	Construction	4.4	6.7	1.5	2.8
SF	Insurance	0.4	3.4	1.0	4.6
SG	Financial services	0.5	2.2	1.1	5.3
SH	Charges for the use of intellectual property	0.5	1.4	9.1	2.9
SI	Telecommunications, computer, and information	10.6	8.3	15.6	17.9
SJ	Other business services	30.6	50.0	35.7	41.0
SK	Personal, cultural, and recreational services	1.3	3.7	3.5	5.8
SL	Government goods and services	0.00	0.02	0.00	0.16
	Total	100.0	100.0	100.0	100.0

TABLE 1. Shares in total trade and firms by broad service categories, 2014-2015

Notes: The 29 types of services are aggregated in 10 broad categories at the 2-digit level of EBOPS 2010 for presentation purposes. Firms are counted each time they export/import a specific service type at the disaggregated breakdown level of 29 service types in the current year, implying that a firm-year can appear more than once across the broad categories of services listed. The share of each aggregate service category represents its percentage fraction in total exports or imports in both years.

Countries	Exports	Exporters	Countries	Imports	Importers
UK	12.1	5.9	Spain	17.7	14.2
Spain	11.1	10.5	UK	13.4	8.8
France	10.3	7.6	Germany	10.2	7.5
Germany	7.9	6.8	USA	9.0	5.0
Angola	7.2	2.9	France	8.4	8.0
Brazil	5.7	1.6	Netherlands	6.2	5.3
USA	5.5	3.2	Switzerland	4.1	2.9
Switzerland	4.8	3.2	Belgium	3.9	3.8
Netherlands	3.7	4.7	Ireland	3.3	3.6
Italy	3.3	3.4	Brazil	3.3	1.7
Other	28.4	50.1	Other	20.6	39.1
Total	100.0	100.0	Total	100.0	100.0

TABLE 2. Main partner countries - shares in total trade and firms, 2014-2015

Notes: Firms are counted each time they export or import with a different partner country in the current year, implying that a firm-year can appear more than once across the listed countries. The share of each country represents its percentage fraction in total exports or imports in both years.

Characteristics of Portuguese international traders of services

We start by examining the frequency and trade representativity of the different types of traders by their main sectors of economic activity. Table 3 illustrates the sectoral distribution of trading firms, while Table 4 reports the same information for the values of exports and imports.

For the sample as a whole, Table 3 shows that a substantial share of Portuguese firms that participate in international trade of services are active in both flows: two-way traders represent 44.6 percent of trading firms. In addition, the proportions of one-way exporters and importers are very similar: 28.0 and 27.5 percent of total traders, respectively. However, the distribution of firms within sectors of activity reveals that there is a high heterogeneity

between sectors regarding the shares of one-way and two-way traders. Trading firms in the wholesale sector are equally distributed among the three firm types, while in the manufacturing industry almost half of the firms only import services. In contrast, the sectors of transportation, and professional, scientific and technical activities are dominated by only exporters and two-way traders, while the latter type represents almost 80 percent of trading firms in the sector of information and communication.

Sector of activity	No. firms	Shares in total firms, exporters or importers				
		Within sectors			By sector	
		Exp Only	Imp Only	Exp & Imp	Exporters	Importers
Primary	331	11.2	64.4	24.5	1.0	2.5
Manufacturing	3,285	18.7	49.6	31.7	14.2	23.0
Electricity, gas, water	211	9.0	55.9	35.1	0.8	1.7
Construction	1,230	33.2	15.2	51.6	8.9	7.1
Wholesale and retail trade	3,917	30.8	36.3	33.0	21.4	23.4
Transportation and storage	1,993	41.6	4.1	54.3	16.4	10.0
Hotels and restaurants	439	23.5	45.1	31.4	2.1	2.9
Information and communication	1,016	14.9	7.0	78.1	8.1	7.4
Financial and insurance activities	234	17.1	21.8	61.1	1.6	1.7
Real estate activities	182	34.6	23.6	41.8	1.2	1.0
Professional, scientific and technical activities	1,862	28.5	9.1	62.4	14.5	11.5
Administrative activities	963	45.1	12.8	42.2	7.2	4.6
Others	454	15.9	27.3	56.8	2.8	3.3
Total (column) and % share in total	16,177	28.0	27.5	44.6	100.0	100.0

TABLE 3. International traders of services by firm type and sector of activity, 2014-2015

Notes: Values are based on firm-year observations, implying that a firm can appear more than once and change firm type category in the two years. The sample contains 16,177 firms-year, in which 4,506 only export, 4,430 only import and 7,181 engage in both activities. In the two last columns, an exporter (importer) is defined as a firm-year exporting (importing) services regardless of the import (export) dimension of the firm.

The last two columns of Table 3 show that wholesale is the largest sector in terms of the number of trading firms, accounting for more than 20 percent of both exporters and importers. As found for other countries, manufacturing firms represent a significant part of total international traders of services. The fact that more than 14 percent of firms exporting services belong to the manufacturing industry (23 percent for importers) links with recent evidence on the relevance of servitisation of manufacturing. Servitisation (or servicification) refers to the increase of purchases, production, sales and exports of services by manufacturing firms and can be considered as a shift from selling only goods to the supply of an integrated combination of goods and services that add value and contribute to product differentiation (see Baines *et al.* (2009) for a discussion). Other relevant sectors in terms of the number of traders of services are transportation, professional, scientific and technical activities, and information and communication.

The representativity of sectors and firm types differs when assessed in terms of export and import values, rather than in the number of firms (Table 4). For the sample as a whole, international trade flows of services are extremely

(A) Exports

Sector of activity	Exports	Shares in total exports		
	Total	Within sectors		By sector
		Exp Only	Exp & Imp	Exports
Primary	51,988	15.7	84.3	0.2
Manufacturing	1,306,592	9.0	91.0	5.9
Electricity, gas, water	23,832	13.0	87.0	0.1
Construction	1,164,858	12.3	87.7	5.3
Wholesale and retail trade	1,359,003	13.9	86.1	6.2
Transportation and storage	10,801,095	7.9	92.1	49.2
Hotels and restaurants	36,283	30.5	69.5	0.2
Information and communication	2,445,279	1.7	98.3	11.1
Financial and insurance activities	161,383	5.7	94.3	0.7
Real estate activities	72,712	29.6	70.4	0.3
Professional, scientific and technical activities	3,515,690	23.4	76.6	16.0
Administrative activities	818,762	15.5	84.5	3.7
Others	202,825	19.7	80.3	0.9
Total (column) & % share in total	21,960,303	10.9	89.1	100.0

(B) Imports

Sector of activity	Imports	Shares in total imports		
	Total	Within sectors		By sector
		Imp Only	Exp & Imp	Imports
Primary	56,922	25.7	74.3	0.5
Manufacturing	1,502,506	16.1	83.9	13.0
Electricity, gas, water	113,364	18.4	81.6	1.0
Construction	385,898	7.3	92.7	3.3
Wholesale and retail trade	1,542,319	12.8	87.2	13.3
Transportation and storage	4,239,237	0.8	99.2	36.6
Hotels and restaurants	125,885	22.8	77.2	1.1
Information and communication	2,388,423	1.0	99.0	20.6
Financial and insurance activities	204,187	24.8	75.2	1.8
Real estate activities	48,964	42.6	57.4	0.4
Professional, scientific and technical activities	598,366	5.3	94.7	5.2
Administrative activities	197,202	13.9	86.1	1.7
Others	183,876	9.7	90.3	1.6
Total (column) & % share in total	11,587,146	6.4	93.6	100.0

TABLE 4. Trade values of services by firm type and sector of activity, 2014-2015

Notes: Trade values are in thousand euros. The table gives total exports or imports per sector, the percentage share of firm types in exports or imports per sector, and the percentage share of each sector in total exports or imports.

concentrated in two-way traders: these firms account for 89.1 percent of total exports and 93.6 percent of total imports. This concentration of exports and imports of services in two-way traders is common to most sectors of activity. In two of the main sectors in Portuguese services trade – transportation, and information and communication – two-way traders are responsible for 99 percent of the imports of the respective sector and for more than 90 per cent of its exports. One-way traders have an above average importance in exports of professional, scientific and technical activities, accounting for more than 23 percent of the flows.

On the export side, the relevance of wholesalers in terms of the value of transactions is smaller than their share in the number of firms, as they represent 21.4 percent of exporters but only 6.2 percent of overall exports. The same is visible for the manufacturing industry, which accounts for 14.2 percent of total exporters of services and 5.9 percent of total exports. On the import side, there is also a difference in the importance of both wholesalers and manufacturers, as each of them accounts for about 23 percent of importers and 13 percent of imports. Thus, firms in the wholesale and manufacturing sectors are more relevant on the import than on the export side, suggesting that the international sourcing of services inputs is important in these sectors. The opposite applies to transportation, which is the largest sector in terms of trade values, representing around half of total exports and more than one third of imports. Firms in information and communication activities account for around 20 percent of total imports, while their share in exports is smaller (11.1 percent). The contrary happens with professional, scientific and technical activities, which have a stronger relevance in exports than in imports (16.0 percent and 5.2 percent, respectively).

Table 5 presents the joint distribution of traded values and traders by their type and size categories. The four size categories are defined according to the EU official classification, which combines number of employees, turnover and balance-sheet total.⁵ Large firms account for the majority of international trade flows of services in Portugal, representing 63 percent of exports and 67 percent of imports. However, most international traders of services are micro and small firms. In particular, around half of one-way exporters are micro firms, while more than 40 percent of one-way importers are small firms. The proportion of large firms is higher in two-way traders, representing more than 11 percent of the total. The distribution of firms and international trade flows of services along size classes is in line with that identified for Portuguese international trade in goods (Amador and Opromolla 2013).

The joint distributions of Portuguese international trade of services on the age and firm type dimensions are shown in Table 6. Older firms are responsible for a substantial proportion of trade in services. Firms with more than 20 years represent 37.3 percent of total exporters and 43.3 percent of importers and account for around 60 percent of both trade flows. On average,

5. The criterion for the classification by size categories was taken from the "Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises". According to this definition, the category of micro, small and medium-sized enterprises (SMEs) is made up of firms which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance-sheet total not exceeding EUR 43 million. Within the SME category, a small firm is defined as employing fewer than 50 persons and whose annual turnover and/or annual balance-sheet total does not exceed EUR 10 million. Within the SME category, a micro-firm is defined as employing fewer than 10 persons and whose annual turnover and/or annual balance-sheet total does not exceed EUR 2 million. All other firms not classified as SMEs are considered as large firms.

(A) Exports								
Firm size	Exports			Exporters			By firm type	
	Only Exp	Exp & Imp	Total	Only Exp	Exp & Imp	Total	Only Exp	Exp & Imp
Micro	1.7	2.5	4.1	19.2	14.4	33.6	49.7	23.4
Small	3.1	10.2	13.2	14.2	24.1	38.2	36.7	39.2
Medium	2.3	17.4	19.6	4.5	16.0	20.5	11.7	26.0
Large	3.9	59.1	63.0	0.7	7.0	7.7	1.9	11.4
Total	10.9	89.1	100.0	38.6	61.4	100.0	100.0	100.0

(B) Imports								
Firm size	Imports			Importers			By firm type	
	Only Imp	Exp & Imp	Total	Only Imp	Exp & Imp	Total	Only Imp	Exp & Imp
Micro	0.3	2.3	2.6	8.9	14.5	23.4	23.4	23.4
Small	1.4	8.3	9.8	16.6	24.2	40.8	43.5	39.2
Medium	1.8	18.6	20.4	10.2	16.1	26.2	26.6	26.0
Large	2.8	64.4	67.2	2.5	7.0	9.5	6.5	11.4
Total	6.4	93.6	100.0	38.2	61.8	100.0	100.0	100.0

TABLE 5. Joint distribution of trade values and traders by firm type and size category

Notes: Each cell represents the percentage of total exporters (importers) or exports (imports) associated with firms-year belonging to a certain size class (row category) and firm type (column category) in 2014-2015. The four size classes are defined according to the EU official classification (for more details, see footnote 5 of the main text).

(A) Exports								
Firm age	Exports			Exporters			By firm type	
	Only Exp	Exp & Imp	Total	Only Exp	Exp & Imp	Total	Only Exp	Exp & Imp
1-5	0.7	3.7	4.4	5.2	6.2	11.5	13.6	10.1
6-10	1.3	9.7	11.0	7.7	11.4	19.1	20.0	18.5
11-20	2.3	21.6	23.9	12.7	19.4	32.1	32.9	31.6
>20	6.6	54.1	60.7	12.9	24.4	37.3	33.5	39.7
Total	10.9	89.1	100.0	38.6	61.4	100.0	100.0	100.0

(B) Imports								
Firm age	Imports			Importers			By firm type	
	Only Imp	Exp & Imp	Total	Only Imp	Exp & Imp	Total	Only Imp	Exp & Imp
1-5	0.5	5.0	5.4	2.8	6.3	9.1	7.3	10.1
6-10	1.1	8.0	9.1	5.8	11.4	17.2	15.1	18.5
11-20	1.8	23.1	24.9	10.9	19.6	30.5	28.5	31.6
>20	3.0	57.6	60.6	18.7	24.6	43.3	49.1	39.7
Total	6.4	93.6	100.0	38.2	61.8	100.0	100.0	100.0

TABLE 6. Joint distribution of trade values and traders by firm type and age group

Notes: Each cell represents the percentage of total exporters (importers) or exports (imports) associated with firms-year belonging to a certain age group (row category) and firm type (column category) in 2014-2015.

one-way importers tend to be older than the other two types of trading firms, with almost half of them having more than 20 years.

Figure 2 illustrates the distribution of values traded by one-way exporters, one-way importers and two-way traders. The main message is that the majority of firms export and/or import values below 250 thousand euros. This pattern is particularly pronounced on the import side, where more than 90 percent of one-way importers and more than 70 percent of two-way traders

are located in the first bin of the respective histograms. The percentage of firms exporting less than 250 thousand euros amounts to 73.8 percent for one-way exporters and to 52.1 percent for two-way traders. The spikes on the last bin of the histograms of two-way traders indicate that some of these firms have very high trade flows. This feature is more important on the export than on the import side: the percentage of two-way traders exporting more than EUR 3 million reaches 10.5 percent, while the corresponding share for imports is 6.7 percent.

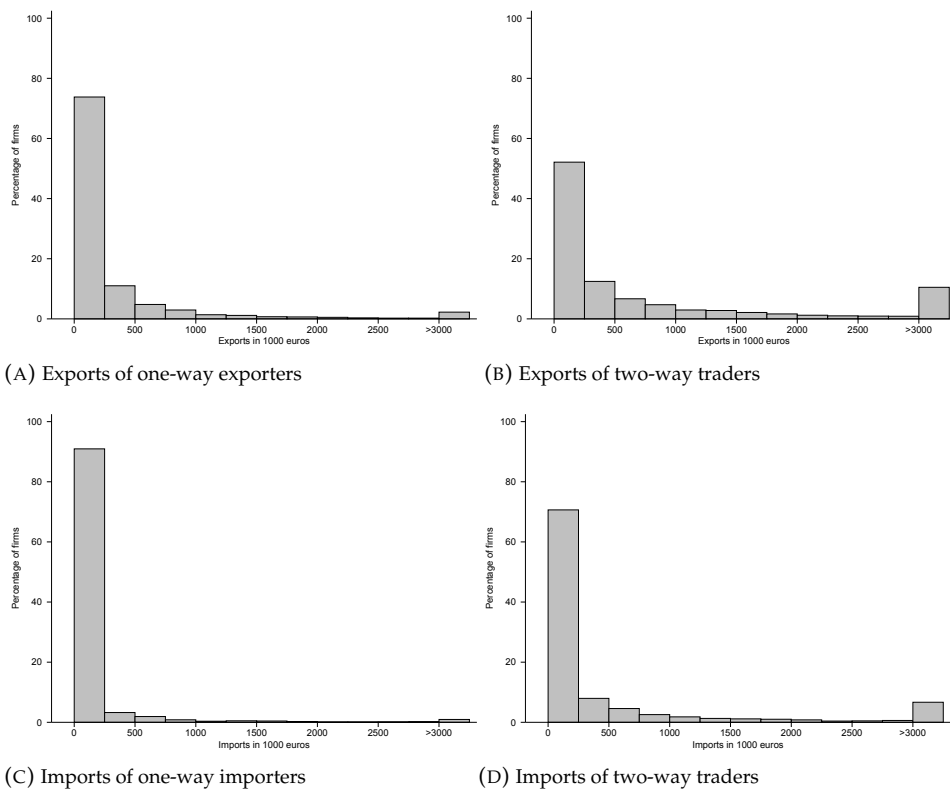


FIGURE 2: Distribution of trade values by firm type, 2014-2015

Notes: Exports and imports are in thousand euros. Distributions are based on firm-year observations in 2014-2015.

The two panels of Figure 3 depict the distributions of productivity and profitability of the three types of Portuguese international traders of services. Labour productivity is defined as gross value added per worker and profitability is defined as the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over total assets, which is an approximate measure of operating cash flow based on income statement data. This is an indicator commonly used for profitability assessment and usable

for small and large firms. We tested alternative measures like earnings before taxes over total assets or simple price-cost margins and the results were very similar. All distributions of labour productivity are markedly right-skewed, but two-way traders tend to have higher productivity levels. In addition, firms that only import services appear to be somewhat more productive than those that just export. The profitability distributions are closer to a normal distribution, but that for two-way traders presents less density at lower profit rates. Therefore, this set of firms tends to be not only more productive but also more profitable than one-way traders of services.

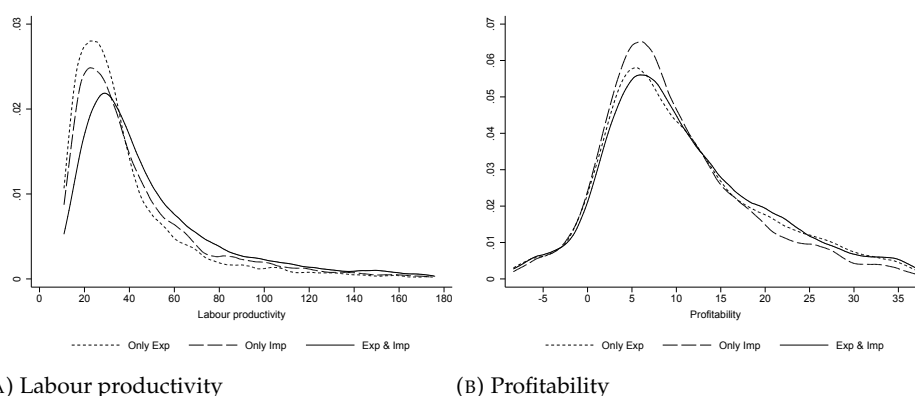


FIGURE 3: Distribution of labour productivity and profitability, 2014-2015

Notes: Labour productivity is in thousand euros and it is defined as a firm's gross value added divided by the number of employees. Profitability is defined as the percentage share of a firm's earnings before interest, taxes, depreciation and amortization (EBITDA) in total assets. Firms-year with values in the lower 5th and upper 95th percentiles are excluded.

Trade portfolios of Portuguese international traders of services

This section builds on the availability of firm-year-service-country data for Portuguese international trade in services to examine trade portfolios along several dimensions, differentiating between the three types of traders.

Table 7 presents some basic descriptive statistics on the service and geographical portfolios of international traders of services. Two-way traders not only have higher levels of exports and imports than one-way traders, but they also have broader portfolios of partner countries and service types for both flows. For instance, the average one-way exporter ships 1.1 services to 4.1 countries and receives about 530 thousand euros, while the average two-way trader exports 1.6 services to 6 countries for 2,725 thousand euros. The median one-way trader exports 1 service to 1 country for 78 thousand euros, and the median two-way trader exports 1 service to 3 countries for

217 thousand euros. Considering the 25th and 75th percentiles, the number of partner countries ranges between 1 and 7 for two-way exporters and between 1 and 3 for one-way exporters. The 25th/75th percentile dispersions are always higher in the case of the number of partner countries than in the case of the number of service types traded, which should be related to lower disaggregation of the services classification. Overall, these simple statistics illustrate the high variance and skewness in the underlying distributions of the number of services, and especially, the number of partner countries and firms' traded values.

(A) Exports						
Firm-level	Only Export			Exp & Imp		
	No. services	No. countries	Exports	No. services	No. countries	Exports
Mean	1.1	4.1	530	1.6	6.0	2,725
Median	1	1	78	1	3	217
1st quartile	1	1	10	1	1	27
3rd quartile	1	3	264	2	7	939
Standard deviation	0.4	8.4	10,102	1.2	9.9	41,469

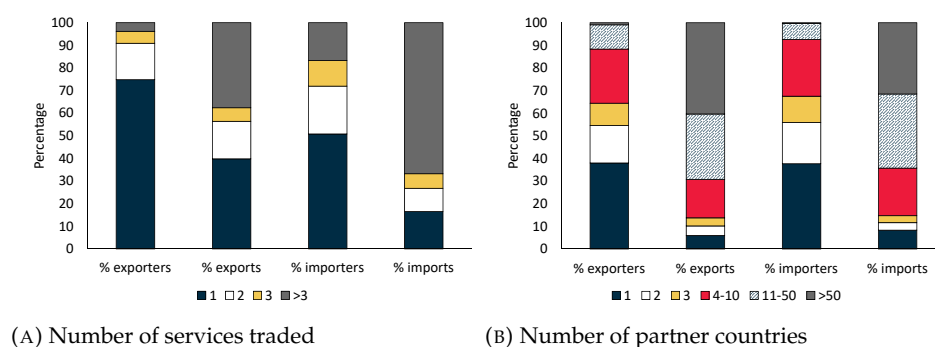
(B) Imports						
Firm-level	Only Import			Exp & Imp		
	No. services	No. countries	Imports	No. services	No. countries	Imports
Mean	1.8	2.2	166	2.5	5.3	1,511
Median	1	1	5	2	3	53
1st quartile	1	1	1	1	1	6
3rd quartile	2	3	36	3	6	370
Standard deviation	1.3	2.7	1,075	2.1	8.5	17,321

TABLE 7. Summary statistics of the trade portfolios of Portuguese international service traders, 2014-2015

Notes: Values of exports and imports are in thousand euros. The firm-level statistics are based on firm-year observations in 2014-2015.

Figure 4 depicts the marginal distributions of service traders and trade values along the service and geographical dimensions. Most Portuguese firms trade only one service type abroad: around three-quarters of total Portuguese exporters sell only one service type and around half of importers buy only one service. However, these firms are responsible for much smaller proportions of total trade, 39.8 percent for exports and 16.5 percent for imports. The diversification is higher in terms of partner countries than in terms of service types traded. Firms that have only one destination country are 38.0 percent of total exporters and represent 5.9 percent of total Portuguese exports of services. The proportions are similar on the import side, with traders with only one source country accounting for 37.6 percent of total importers and 8.3 percent of total imports. Considering both dimensions together, firms that only export one service to one country represent 34.5 percent of total exporters but only 4.2 percent of total exports. On the import side, firms with a single service and source country represent 30.8 percent of importers and account for 5.1 percent of total imports.

Conversely, firms that trade multiple services are responsible for disproportionate large shares of total values traded. Firms that export more than 3 service types represent 3.8 percent of exporters and 37.6 percent of exports (16.7 percent and 66.8 percent for importers and imports, respectively). This feature is particularly evident on the geographical dimension: firms that export to more than 50 destination countries represent only 0.9 percent of exporters but 40.3 percent of exports, while firms that import from more than 50 source countries represent 0.4 percent of total importers and 31.5 percent of total imports. When the service and geographical dimensions are taken together, firms that export more than 3 services to more than 50 countries represent just 0.3 percent of total exporters but account for 27.9 percent of total exports. Values are similar for imports as firms that buy more than 3 services from more than 50 source countries represent 0.2 percent of importers and 31.1 percent of imports.



(A) Number of services traded

(B) Number of partner countries

FIGURE 4: Distribution of trade values and traders by number of services and partner countries, 2014-2015

Notes: For the number of services, the values represent the percentage of total exporters (importers) and exports (imports) associated with firms-year exporting (importing) a certain number of service types in 2014-2015. For the number of partner countries, the values represent the percentage of total exporters (importers) and exports (imports) associated with firms-year exporting (importing) to (from) a certain number of partner countries in 2014-2015.

Evidence on the concentration of traded values in a small group of firms is corroborated by the fact that the top 1 percent exporters account for 59 percent of the total export value, while the top 10 percent exporters represent 86 percent of total exports. These percentages are similar to those reported by Minondo (2016) for Spain. The values are very similar for imports, with the top 1 percent and 10 percent importers accounting for 60 and 91 percent of total import value, respectively. Moreover, the vast majority of these top exporters and importers are two-way traders.

We proceed by analysing how international flows of services are concentrated within a firm. Figure 5 shows the average share of a firm's

exports and imports accounted for by its top four service types and partner countries. The main service type exported by a firm represents a sizeable share of its exports even for firms exporting more than 3 different services (73.6 percent of total). The same holds in terms of imports, as the top service accounts for 68.1 percent of total imports for firms importing more than 3 service types. When partner countries are considered, instead of services types, a similar pattern for average shares emerges in exports and imports, though the role played by the top partner is less dominant, in particular as the geographical scope broadens. Nevertheless, even for firms trading with more than 50 countries, the major partner accounts for almost 30 per cent of its exports and imports.

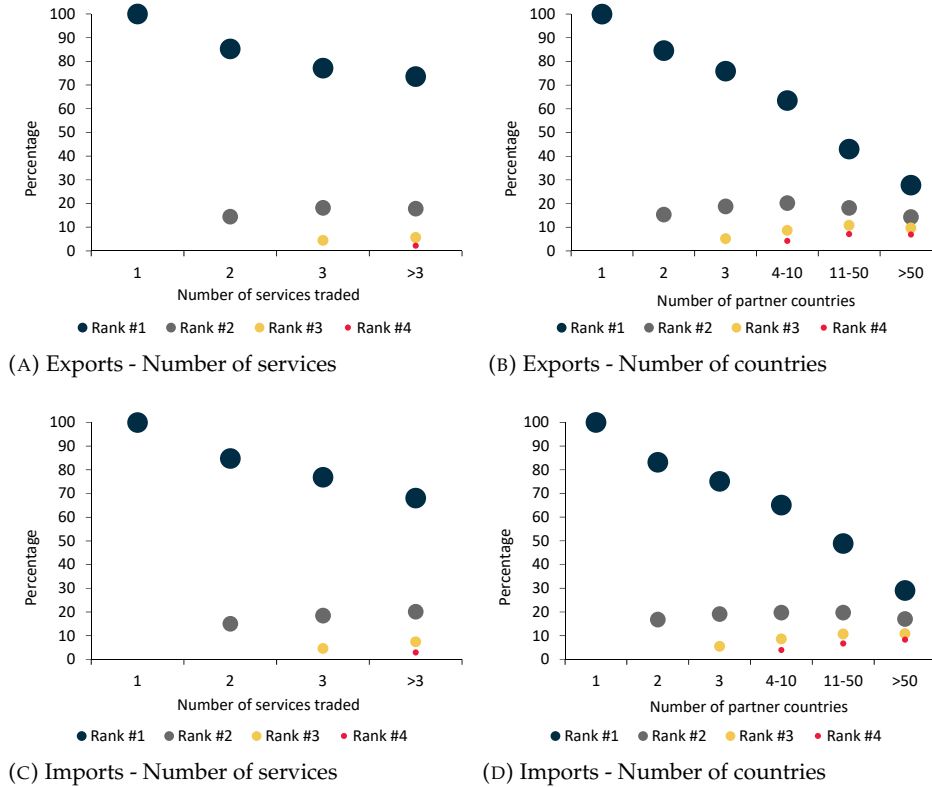


FIGURE 5: Concentration of firms' exports and imports by service type and partner country, 2014-2015

Notes: For the services rank, the values report the average share of a firm's exports (imports) accounted for by its four most important service types exported (imported) for firms-year exporting (importing) 1, 2, 3 or >3 service types. For the countries rank, the values report the average share of a firm's exports (imports) accounted for by its four most important export (import) partner countries for firms-year exporting (importing) to (from) 1, 2, 3, 4-10, 11-50 or >50 countries. Service types and partner countries are ranked within each firm according to their share in total exports (imports) of that firm in 2014-2015.

The concentration of Portuguese international trade flows of services both between and within firms is in line with the results observed for other countries, like the UK (Breinlich and Criscuolo 2011), Italy (Federico and Tosti 2017) and Spain (Minondo 2016). Our findings on the service and geographical portfolios of international traders of services are also consistent with the behaviour of Portuguese firms in export markets of goods (Amador and Opromolla 2013).

Concluding remarks

Exports and imports of non-tourism services are an important component of Portuguese international trade of goods and services. The purpose of this article is to improve the understanding of firm-level international trade of this type of services. Using a new firm-level database for international trade in non-tourism services merged with balance-sheet data for the years 2014 and 2015, we describe the main characteristics of Portuguese international services traders in dimensions like sector of activity, age, size, productivity and profitability. Moreover, we explore the detailed data to examine the service and geographical portfolios of Portuguese services traders.

We find that most Portuguese international traders of services are micro and small firms but that large firms account for the majority of trade flows of services. Older firms are responsible for a significant share of services trade, both in terms of the number of traders and of the value traded for both exports and imports.

A substantial share of Portuguese traders is active in both flows (45 percent). Furthermore, there is a high concentration of both exports and imports of services in these firms: two-way traders account for 90 percent of total international trade in non-tourism services. Compared with firms that only export and that only import, two-way traders of services tend to be more productive and more profitable.

Another conclusion is that a significant proportion of Portuguese firms trades only one service type or with one partner country, but the importance of these firms in total traded values is smaller. In fact, as found for international trade in goods, we show that multi-service and multi-country firms are crucial in explaining the level of Portuguese international trade in services. However, even for traders with broad service and geographical portfolios, the main service type and partner country represent an important share of a firm's total exports and imports.

The increase in the share of exports in Portuguese GDP has been one positive development of the latest years. This path signals a reorientation of resources towards the tradables sector, thus consolidating the correction of Portuguese external imbalances. Non-tourism services are becoming increasingly tradable and contributing to this structural transformation of

the Portuguese economy. This article provides detailed information on firms engaging in international trade of non-tourism services, thus contributing to better inform policy-decisions in this area.

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Appendix: Detailed breakdown of services traded

Code	Description	Exports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SB	Maintenance and repair services n.i.e.	750,845	3.4	853	5.1	104	3.3	2,357	3.3
SC1	Sea transport	1,278,382	5.8	606	3.6	179	5.6	6,919	9.8
SC2	Air transport	7,238,084	33.0	528	3.2	198	6.2	4,632	6.5
SC3	Other modes of transport	1,871,417	8.5	1,947	11.7	156	4.9	9,263	13.1
SC4	Postal and courier services	204,204	0.9	100	0.6	123	3.9	571	0.8
SE	Construction	975,247	4.4	1,118	6.7	90	2.8	2,148	3.0
SF	Insurance and pension services	80,207	0.4	566	3.4	87	2.7	1,340	1.9
SG	Financial services	99,430	0.5	359	2.2	84	2.6	820	1.2
SH1	Franchises and trademarks licensing fees	53,349	0.2	85	0.5	40	1.3	145	0.2
SH3	Licenses to reproduce or distribute computer software	5,250	0.0	43	0.3	47	1.5	166	0.2
SH4	Licenses to reproduce or distribute audio-visual	60,574	0.3	100	0.6	74	2.3	462	0.7
SI1	Telecommunications services	1,037,562	4.7	212	1.3	191	6.0	1,560	2.2
SI2	Computer services	1,261,934	5.7	1,026	6.2	156	4.9	4,402	6.2
SI3	Information services	29,770	0.1	149	0.9	70	2.2	613	0.9
SJ1	Research and development services	168,137	0.8	166	1.0	56	1.8	468	0.7
SJ211	Legal services	283,157	1.3	248	1.5	140	4.4	2,659	3.8
SJ212	Accounting, auditing, bookkeeping, and tax consulting	223,073	1.0	266	1.6	118	3.7	1,714	2.4
SJ213	Business and management consulting and public relations	542,116	2.5	673	4.0	110	3.5	2,129	3.0
SJ22	Advertising, market research, and public opinion polling	540,719	2.5	819	4.9	102	3.2	2,783	3.9
SJ311	Architectural services	92,774	0.4	268	1.6	88	2.8	851	1.2
SJ312	Engineering services	457,938	2.1	394	2.4	110	3.5	1,325	1.9
SJ313	Scientific and other technical services	750,156	3.4	1,546	9.3	131	4.1	4,018	5.7
SJ32	Waste treatment and de-pollution, agricultural and mining	34,678	0.2	166	1.0	37	1.2	266	0.4
SJ33	Operating leasing services	216,728	1.0	448	2.7	103	3.2	1,506	2.1
SJ34	Trade-related services	531,173	2.4	1,881	11.3	196	6.2	8,956	12.7
SJ35	Other business services n.i.e.	2,883,445	13.1	1,453	8.7	139	4.4	5,285	7.5
SK1	Audio-visual and related services	114,485	0.5	148	0.9	115	3.6	775	1.1
SK2	Other personal, cultural, and recreational services	175,293	0.8	470	2.8	133	4.2	2,645	3.7
SL	Government goods and services n.i.e.	177	0.0	4	0.0	2	0.1	4	0.0
Total		21,960,303	100.0	16,642	100.0	3,179	100.0	70,782	100.0

TABLE A.1. Service types exported: Values, firms, countries and transactions, 2014-15

Notes: The table reports the 29 service types considered and the corresponding code according to the Extended Balance of Payments Services (EBOPS) 2010 classification. The breakdown used is a combination of 2, 3 and 5 digit levels of the EBOPS 2010 classification. Exports are in thousand euros. Values are pooled for 2014 and 2015. Firms are counted each time they export a particular service type at the disaggregated breakdown level in the current year, implying that a firm-year can appear more than once across the listed services types. For that reason the total number of firms-year differs from the one reported in the main text where no service breakdown is used in the count. Countries are counted within the respective service type (service-country combination), thus independent of firm and year. A transaction is defined as firm-year-service-country in the database, i.e., an observation in the sample.

Code	Description	Imports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SB	Maintenance and repair services n.i.e.	567,084	4.9	2,038	7.9	104	3.5	4,258	6.4
SC1	Sea transport	183,295	1.6	522	2.0	145	4.9	2,945	4.5
SC2	Air transport	2,704,447	23.3	936	3.6	175	5.9	3,968	6.0
SC3	Other modes of transport	155,889	1.3	1,312	5.1	103	3.5	3,406	5.2
SC4	Postal and courier services	143,842	1.2	218	0.8	135	4.5	744	1.1
SE	Construction	172,660	1.5	715	2.8	109	3.7	1,670	2.5
SF	Insurance and pension services	119,101	1.0	1,187	4.6	79	2.7	1,773	2.7
SG	Financial services	130,646	1.1	1,366	5.3	152	5.1	2,939	4.4
SH1	Franchises and trademarks licensing fees	671,716	5.8	388	1.5	54	1.8	583	0.9
SH3	Licenses to reproduce or distribute computer software	109,629	0.9	135	0.5	30	1.0	253	0.4
SH4	Licenses to reproduce or distribute audio-visual	277,265	2.4	227	0.9	75	2.5	916	1.4
SI1	Telecommunications services	950,790	8.2	1,001	3.9	198	6.7	2,689	4.1
SI2	Computer services	836,546	7.2	2,783	10.8	118	4.0	7,056	10.7
SI3	Information services	25,721	0.2	808	3.1	63	2.1	1,610	2.4
SJ1	Research and development services	255,436	2.2	423	1.6	60	2.0	913	1.4
SJ211	Legal services	72,105	0.6	1,140	4.4	142	4.8	2,775	4.2
SJ212	Accounting, auditing, bookkeeping, and tax consulting	86,996	0.8	670	2.6	112	3.8	1,427	2.2
SJ213	Business and management consulting and public relations	382,631	3.3	1,398	5.4	110	3.7	3,139	4.7
SJ22	Advertising, market research, and public opinion polling	374,203	3.2	2,635	10.3	120	4.0	6,971	10.5
SJ311	Architectural services	48,517	0.4	320	1.2	91	3.1	849	1.3
SJ312	Engineering services	120,851	1.0	373	1.5	79	2.7	886	1.3
SJ313	Scientific and other technical services	652,998	5.6	490	1.9	118	4.0	2,072	3.1
SJ32	Waste treatment and de-pollution, agricultural and mining	36,362	0.3	401	1.6	53	1.8	749	1.1
SJ33	Operating leasing services	451,107	3.9	1,645	6.4	115	3.9	2,815	4.3
SJ34	Trade-related services	490,265	4.2	418	1.6	102	3.4	2,041	3.1
SJ35	Other business services n.i.e.	1,166,330	10.1	609	2.4	122	4.1	2,346	3.5
SK1	Audio-visual and related services	249,962	2.2	246	1.0	82	2.8	816	1.2
SK2	Other personal, cultural, and recreational services	150,535	1.3	1,241	4.8	110	3.7	3,451	5.2
SL	Government goods and services n.i.e.	218	0.0	41	0.2	21	0.7	51	0.1
	Total	11,587,146	100.0	25,686	100.0	2,977	100.0	66,111	100.0

TABLE A.2. Service types imported: Values, firms, countries and transactions, 2014-15

Notes: The table reports the 29 service types considered and the corresponding code according to the Extended Balance of Payments Services (EBOPS) 2010 classification. The breakdown used is a combination of 2, 3 and 5 digit levels of the EBOPS 2010 classification. Imports are in thousand euros. Values are pooled for 2014 and 2015. Firms are counted each time they import a particular service type at the disaggregated breakdown level in the current year, implying that a firm-year can appear more than once across the listed services types. For that reason the total number of firms-year differs from the one reported in the main text where no service breakdown is used in the count. Countries are counted within the respective service type (service-country combination), thus independent of firm and year. A transaction is defined as firm-year-service-country in the database, i.e., an observation in the sample.

The Maturity Rat Race and Short-Termism

Joana F. Pimentel
Banco de Portugal

Sujiao (Emma) Zhao
Banco de Portugal

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Abstract

The global economic financial crisis has rekindled great public interest in one of the oldest questions in finance. That is, what's the connection between firms' value and their financial policies? The rationality of debt maturity shortening and managerial short-termism has been at the forefront of the debate. This paper examines the "maturity rat race" proposition in a group of financially distressed firms during the recent crisis in Portugal. We find significant debt maturity shortening before firm default - a finding robust to various empirical specifications. Furthermore, we show that short-term debt overhang leads to managerial myopic behaviors (i.e., short-termism) and the pattern is even more prominent in financially distressed firms. Firms who hold a larger proportion of short-term debt are more prone to invest in short-term assets and engage in earnings management. (JEL: G3, G20, G21, G32, G33)

Introduction

The global economic financial crisis has rekindled great public interest in one of the oldest questions in finance: what's the connection between firms' value and their financial policies? The rationality of an excessively short debt maturity structure of firms and managerial short-termism, was at the forefront of the debate. Specifically, researchers find that firms financing a great portion of their assets with short-term debt during the crises diminish debt capacity (Acharya *et al.* (2011)) and tend to default at a higher fundamental threshold due to the fact that they are exposed to higher rollover risk (e.g., He and Wei (2012b)). There is also evidence that short-termism, i.e., managerial incentive to inflate short-term results at the expense of long-term interests, played a crucial part in the 2007-2009 subprime crisis in US. Bank CEOs with myopic incentives allowed their firms to engage in mortgage-related fraud during the subprime boom while cashing out of their stock and option holdings earlier during the crisis (see Bebchuk *et al.* (2010), Bhagat and Bolton (2014), Kolasinski and Yang (2018)). Especially, managerial

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E-mail: jmpimentel@bportugal.pt; szhao@bportugal.pt

myopic behaviors are likely influenced by capital market short-termism (e.g., Attig *et al.* (2012), Milbradt and Oehmke (2015), Jordan *et al.* (2016)). Despite abundant evidence in debt maturity shortening and short-termism, the link between the two, reflecting correlated short-term horizons from two related parties, creditors and firms, is rarely explored.

The most widely used frameworks in analyzing the debt maturity decision are Leland (1994, 1998) and Leland and Toft (1996). It is a static analytical framework by its nature in which firms decide the maturity structure of their debt by making cost-reward tradeoffs. This is, however, at odds with the empirical evidence holding that firms manage their debt maturity actively (Graham and Harvey (2001), Krishnamurthy (2010), Mian and Santos (2018), Chen *et al.* (2013)). A recent line of research highlights that the coordination problems among creditors can exacerbate when credit conditions deteriorate, causing excessive short-term debt usage. Especially, the “maturity rat race” proposition by Brunnermeier and Oehmke (2013) points to an inefficient equilibrium of short-term debt financing. They argue that if the interim information coming out at the rollover dates is negative, a borrower may have an incentive to shorten the maturity of an individual creditor’s debt for it diminishes the relative claim of the remaining creditors. In anticipating this problem, the remaining creditors will choose an even shorter maturity for their contacts, causing a “maturity rat race”. Analogously, He and Wei (2012a) discuss debt run risk in a dynamic setting and their results suggest that in fear of future runs by other creditors, all creditors will end up raising the rollover threshold on the borrower. In their model, a firm’s fundamental varies over time and the rollover decision of a specific creditor is made based on his/her anticipation of the future maturing creditors’ rollover decisions. If the creditor anticipate that the next creditors are likely to run (i.e., using a higher rollover threshold for the firm’s fundamental value), he will have a higher incentive to run now in order to protect himself against the increase in firm’s future rollover risk. He and Milbradt (2016) extend Leland’s framework by modelling joint determination of endogenous default, endogenous dynamic maturity and bond prices. They show that when firm fundamentals and economic conditions deteriorate, debt maturity shortening will occur together with earlier default. In a framework of information asymmetry, König and Pothier (2016) model the situation when solvency risk is not observable or uncertain. They conclude that the equilibrium debt maturity structure tends to be inefficiently short, given the “excess elasticity” of long-term interest rates plus the redistribution of refinancing gain from bad to good firms.

Although the existing theoretical models are more ready to apply to financial institutions, they also have important implications for non-financial firms. Brunnermeier and Oehmke (2013) mention that, unlike financial institutions, firms do not need to tap capital market very frequently and they can prevent the maturity rat race by employing covenants or creditor protective provisions. However, covenants and provisions are not

a free lunch, as the subsequent monitoring may be undesirable, especially during the crises. In particular, when credit conditions and information environment deteriorated, firms would naturally prefer to maintain more financial flexibility (e.g., Duchin *et al.* (2010), He and Wei (2012b), Gopalan *et al.* (2014)). Moreover, despite the fact that the fundamentals of non-financial corporations do not vary substantially in “good times”, this may not hold true in “bad times”, which corroborates the two main assumptions in the model of He and Wei (2012b), i.e., illiquid asset and time-varying fundamentals.

Understanding the potential mechanisms of firms using excessively short-term debt and its potential consequences, notably short-termism, is of particular interest in the aftermath of the recent crisis. The Portuguese banking system and the private sector provide an interesting setting to analyze this issue. Firstly, small and medium-sized enterprises (SMEs) account for a significant share of the private sector and are essential to economic activities in Portugal. However, under information asymmetry short-term debt is often used as a sorting device by creditors. Although a short debt maturity exerts a valuable role in mitigating firm’s risk shifting behaviors and allows creditors to sort out low-quality firms in normal times, it may not be desirable in bad times, especially for SMEs. Higher fundamental volatility during crises tends to exacerbate the coordination problem, leading to “maturity rat race” even when the firm is still solvent. The noticeable increase in the occurrence of default events during the recent crisis, as shown in Figure 1, may have been partly driven by the “maturity rat race”. Secondly, corporate governance practices may not have been given equal importance to performance pressures by the shareholders of SMEs and this may further foster managerial myopic behaviors. In particular, the recent global crisis was characterized not only by high refinancing risk but also by the prevalence of managerial risk sharing behaviors, such as underinvestment and employment reduction (Almeida *et al.* (2012), Martins (2016)).

This paper investigates the maturity race issue by first tracking the evolution of debt maturity structure around firm default and then examining whether the excessive reliance on short-term financing leads firms to engage in myopic behaviors.

The rest of the paper is organized as follows. Firstly, we review the related literature. Secondly, we describe the data and discuss the variables of interest. Thirdly, we present the econometric model and discuss the empirical results. Finally, we conclude.

Literature

Debt maturity has been an active research area in finance. In a perfect capital market implied by Modigliani and Miller (1958) and Stiglitz (1974), debt maturity choice is irrelevant to the valuation of a firm. The subsequent

literature stresses the relevance of debt maturity decisions by accounting for a variety of financial frictions faced by firms such as agency conflicts, asymmetric information, credit risk and taxation. In general, researchers contend that the appeal of short-term debt originates from firm's concerns of synchronizing investment demand, disciplining managers, and refinancing at more favorable terms while waiting for credit upgrades (e.g., Myers (1977), Barnea *et al.* (1980), Harris and Haviv (1991), Aivazian. *et al.* (2005), Diamond (1991)). Conversely, long-term debt is more desirable when firms are exposed to high refinancing risk (e.g., Diamond (1991, 1993), Jun and Jen (2003)). Some frictions may be more important for some type of firms in certain circumstances, but of little relevance to others. Closely related to this paper are the models pointing to short-term debt favoritism and its outcomes.

The first type of debt maturity model emphasizes the role of short-term debt in disciplining managerial risk taking behaviors such as underinvestment (i.e., renouncing profitable investment projects) and asset substitution (i.e., investing in very risky projects). Myers (1977) shows that with a long-term debt overhang at the moment of exercising growth options, firms possibly forgo profitable projects, for otherwise the future benefits of growth options will go partly to the creditors. This is known as the debt overhang problem and a solution proposed by Myers (1977) is to finance the asset-in-place with debt that matures before the growth option will be exercised, that is, short-term debt. Equity holders also have incentives to increase their wealth at the expense of debt holders by investing in very risky projects. Barnea *et al.* (1980) and Jensen (1986) elucidate the role of short-term debt in supervising managerial over-investment behaviors and aligning the interests of shareholders and those of managers. Specifically, by shortening the maturity structure of debt, creditors are provided with an option to monitor frequently their borrowers.

The second type takes into account the role of private information in affecting the manner in which firms raise funds. The key to this line of literature lies in the "adverse selection" issue, characterized by the undervaluation of high quality firms and the overvaluation of low quality ones under information asymmetry. Short-term debt is less sensitive to mispricing as it provides lenders with the possibility of updating a firm's credit information at high frequency. Consider a situation when the creditworthiness of borrowers is private information. As creditors cannot tell high quality borrowers from the low quality ones, an industry-average risk rating will be assigned to both types of firms. Before favorable private information is disclosed to the market, high quality firms have no choice but to borrow at the same cost as low quality firms. As a result, high quality firms will prefer short-term debt in order to wait for a better moment to tap the market, while low quality firms will prefer to issue long-term debt to benefit from market overvaluation. As soon as low quality firms realize that long-term debt issuance signals bad image, they will imitate high quality firms to

issue short-term debt. This leads to a “pooling equilibrium”, as defined by Flannery (1986), where all firms choose to issue short-term debt.

However, in the presence of high refinancing costs, only high quality firms can afford to signal the real state through refinancing short-term debt, resulting in a “separating equilibrium” where high quality firms issue short-term debt and low quality firms issue long-term debt. In a sequential games framework, Kale and Noe (1990) show that a “separating equilibrium” exists even without transaction costs. Diamond (1991) highlights the liquidity risk induced by rolling over short-term debt at the time when refinancing is expensive or unavailable. In his model, low quality firms are screened out of the long-term debt market because creditors are not willing to offer long-term debt given the high asset substitution risk. Meanwhile, most creditworthy firms will continue to issue short-term debt in order to signal favorable private information. In equilibrium, only medium-quality firms who are more sensitive to credit downgrading and refinancing unavailability will use long-term debt, while both high and low-quality ones will continue to issue short-term debt.

Another strand of the literature discusses how coordination problems among creditors drive short-term debt usage, based on equilibrium models of bank runs (i.e., the dynamic coordination among multiple creditors concerning the decisions of debt rollovers and liquidations). He and Wei (2012a) discuss debt run risk in a dynamic setting, accounting for time-varying fundamentals and staggered debt structures. They show that each creditor will raise the rollover threshold in fear of future runs by other creditors, leading to runs by all creditors on a firm. Brunnermeier and Oehmke (2013) derive that short debt maturity is a result of maturity race among multiple banks. A borrower who cannot commit to an aggregate maturity structure has an incentive to shorten the maturity of an individual creditor’s debt for it diminishes the relative claim of the remaining creditors and dilutes their payoffs. In anticipating this problem, the remaining creditors will choose a shorter maturity for their contacts, so that in equilibrium all the creditors only accept to offer debt with very short maturities, so-called “maturity rat race”.

Besides the mechanisms that drive debt maturity shortening, the consequences of using very short-term debt have also been discussed recently. Brunnermeier and Oehmke (2013) argue that the maturity rat race is actually inefficient because the excessive reliance on short-term funding leads to undesirable asset-debt maturity mismatch and intensified rollover risk. Besides the role of debt maturity in intensifying credit risk, exacerbating information asymmetry and agency problems, other researchers examine how short-term debt outstanding can affect firm’s investment decisions. Diamond and He (2014) provide a formal test showing that short debt maturity can in fact exert more severe debt overhang than long-term debt if firms’ fundamentals decrease after the short-term debt is issued. Milbradt and Oehmke (2015) examine the feedback from financial frictions to asset maturity.

Their results suggest that credit rationing leads firms to invest inefficiently in short-term projects instead of choosing the first-best investment project. This is consistent with the perception of asset maturity shortening during downturns (e.g., Dew-Becker (2012)) and the criticisms of firms being overly short-term oriented. For example, firms tend to focus on projects that can bring immediate “return” to shareholders, engage in earnings management and stock buybacks, while underinvest in projects that maximize profit in the long run, for example, innovation and employment training (e.g., Graham *et al.* (2005)). Notably, existing research has shed light on how short-term market pressure from institutional investors, financial analysts has shaped managerial myopic behaviors (e.g., Attig *et al.* (2012), He and Tian (2013), Jordan *et al.* (2016)). If so, firms who face refinancing pressure induced by the maturity race will also have incentives to adopt short-term horizons. To make frequent payments for the maturing debt, it is likely they invest more in short-term oriented projects which normally require less money and bring fast cash. While short-termism is not a novel topic, this is the first paper that empirically examines how a special channel, i.e., debt maturity shortening, can lead to distorted incentives in corporate investment, namely myopic behaviors or short-termism.

Data and sample selection

Data source

The objective of this paper is to examine whether maturity race exist in the Portuguese economy and, if yes, what could be the outcomes. To achieve this purpose, we confine our sample to a group of non-financial corporations in this study and employed various datasets, including the Portuguese Credit Register (Central de Responsabilidades de Crédito), the New Credit Operations Database (Informação Individual de Taxas de Juro), the Central Balance Sheet Database (Central de Balanços), and the Monetary Financial Institutions Balance Sheet Database (Balanço das Instituições Monetárias e Financeiras), all managed by Banco de Portugal.

The Portuguese Credit Register reports monthly information on credit exposures by all credit-granting institutions resident in Portugal. The dataset is organized on a borrower-by-borrower basis and provides detailed information on the breakdown of credit exposure, such as credit situation and maturity structure. This allows us to construct the aggregate debt maturity measure for each firm (defined as the proportion of debt with a remaining maturity of more than one year), the overdue intensity (the proportion of overdue credit to a firm’s total credit outstanding), and bank-firm relationship variables (the size and dispersion of firm’s lender pool).

The New Credit Operations Database provides information on the amount, the maturity dates, and the interest rates of new and renegotiated loans to firms.¹ We use this dataset mainly to provide additional checks. Further, to obtain additional controls (i.e., firm and bank characteristics) and to estimate ex post outcome variables (investment, employment, and managerial short-termism), we retrieved firms' financial statement data and banks' balance sheet data from the annual dataset of Central Balance Sheet and the monthly dataset of Monetary Financial Institutions Balance Sheet, respectively.²

As the maturity race is more likely to occur around great asset fluctuations (He and Wei (2012b), He and Milbradt (2016)), we examine an extreme corporate event when firms significantly default vis-à-vis the banking system. Following Antunes *et al.* (2016), we define default event as firm's failure to fulfil debt obligation that amounts to 2.5% or more of its total debt outstanding for more than three months. To eliminate confounding effects caused by further defaults, we focus on firm's first default which is likely the most relevant screening information for creditors. Default events are also computed using information from the Credit Register. We use the full period from January, 1980 to December, 2016 to identify firm's first default. But in order to analyze the evolution of firm's maturity structure around default applying a window of two years, we are only focusing on events that occurred between January, 2011 and December, 2014.³ The final sample comprises 33 318 non-financial corporations which defaulted between 2011 and 2014. Furthermore, we eliminate extreme values by winsorizing the firm characteristic variables at the 1st and 99th percentiles. The variables used in this study are defined in Table 1.

Descriptive statistics

Figure 1 depicts the incidence of default events for non-financial Portuguese firm from January, 2011 to December, 2014. To illustrate the prevalence of firm default in the whole economy, we consider all defaulted firms, meaning that firms that have already defaulted in a previous period continue to be counted in this graph. The left axis plots the number of defaulted and non-defaulted firms in the blue and red bars. The black solid line, plotted on the right axis is the month-by-month percentage of defaulted firms, with default event defined using the parameters suggested in Antunes *et al.* (2016). The black dash line and the red solid line apply higher thresholds in order to

1. The data in the New Credit Operations Database only started to be reported in June, 2012.

2. Variables are defined in Table 1.

3. To construct the aggregate debt maturity structure of a firm, we used the variable of "residual maturity" from the Portuguese Credit Register (Central de Responsabilidades de Crédito) database. This variable is only available from 2009 on.

show the importance of heavily defaulted firms in the economy.⁴ What we can immediately see from the graph is the increasing importance of defaulted firms in Portugal, confirming the relevance of using firm default as a relevant research setting for maturity race.

Table 2 illustrates the main characteristics of defaulted firms and non-defaulted firms by year. At first glance, it seems that defaulted firms are not very different from non-defaulted firms in terms of size and age, but they do show lower financial performance and growth rates. They also tend to use more debt and hold less cash in their account. In terms of bank relationships, they have a larger and more dispersed lender pool, which meets well the initial conditions in the maturity race proposition. More interestingly, their short-term debt ratio is not higher than non-defaulted firms on average, which makes it even more interesting to examine the issue in a dynamic setting. Note that not all these variables are included for multivariate analyses due to potential multicollinearity issues.⁵

Empirical analysis

The maturity race around firm default

In this section, we analyze in an event study framework whether there exists the phenomenon of maturity race around firm default in the Portuguese economy. The principal measure of firm's exposure to maturity race is the ratio of the firm's short-term debt amount to total debt amount, using information from the Portuguese Credit Register. An alternative measure is the time-to-maturity of new or renegotiated debt extracted from the New Credit Operations Database. As this information is only available after June, 2012, we use it for robustness checks.

The evolution of debt maturity. To explore the underlying patterns of the maturity race, we start by tracing the evolution of the short-term debt ratio around corporate default, as illustrated in Figure 2. We track the evolution

4. Specifically, the black solid line considers as a default event if a firm fails to fulfil debt obligation that amounts to 2.5% or more of its total debt outstanding for at least three months consecutively. The black dash line considers as a default event when a firm fails to fulfil debt obligation that amounts to 5% or more of its total debt outstanding for at least six months consecutively. The red line considers as a default event when a firm fails to fulfil debt obligation that amounts to 25% or more of its total debt outstanding for at least twelve months consecutively.

5. The firm-specific variables used in our multivariate analyses include firm size (the log value of total assets), profitability (earnings before interest and tax divided by turnover), leverage (total liabilities divided by total assets), cash (cash and bank deposits divided by total assets), employment growth (annual change in number of employees), loss (dummy for negative operating income) and current asset ratio (total current assets divided by total assets).

of firm's exposure to maturity race, i.e., the short-term debt ratio, using a 24-month window. We define default month as event time 0 and s month subsequent (prior) to the default month as event time s ($-s$). The blue line plots the mean value of the short-term debt ratio in event month, while the red line plots the median value.

Overall, the pattern revealed in the figure does imply the existence of maturity race in firms who are facing financial distresses. Notably, the curves of the short-term debt ratio increase substantially before default. For a typical firm, the short-term debt ratio continues to increase after default and the value peaks at the end of the curves. The mean/median short-term debt ratio increases from 0.49/0.46 at month -24 to 0.57/0.63 at month 0.

For robustness, we further check the evolution of debt maturity in new loans for distressed firms.⁶ To do this, we first collapse loans with short and long maturities (defined using the one-year cutoff) for each firm-month and calculate the proportion of loans that matures in one year. We then trace the mean value of the short-maturity debt ratio around event time in Figure 3. As observed in the first panel of Figure 3, short-maturity debt extended to a typical "distressed" firm accounts for a significant portion of total debt and increases dramatically before its default. The caveat is that different from credit outstanding, the issuance of new loans is occasional. Therefore, it may not be straightforward to track the event-time evolution for new debt in low frequencies. In the second panel of Figure 3, we study the issue on a yearly basis and the same pattern remains. Notably, a similar pattern is observed when the average time-to-maturity is tracked, as illustrated in Figure 4. The time-to-maturity of new debt obtained by the average firm in our sample decreases from 170 days to less than 120 days in a two-year period before it went into default. Additionally, we find that the maturity shortening is concentrated in the loans that have a maturity of less than five years (see the separate analysis on the loans with different maturity categories in Figure 5).

Although intuitive, the event study results could be contaminated by the latent factors that affect debt maturity choices of distressed firms universally. To address this concern, the following section examines the maturity race issue in a multivariate analysis framework.

Multivariate regression analysis. To formally test the maturity race around firm default, we estimate the following specification,

$$ST_{i,m} = \varpi_k W_{i,k} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_m + \varepsilon_{i,m} \quad (1)$$

where $ST_{i,m}$ is the short-term debt ratio of firm i in month m , $W_{i,k}$ is a dummy variable that accounts for the default window for firm i , in the default window k , $X_{i,t-1}$ is a set of one-year lagged firm-specific variables, F_i , $S_{(i)}$, and T_m are

6. This information is extracted from the New Credit Operations Database.

vectors of firm, industry, and month fixed effects, and $\varepsilon_{i,m}$ stands for the error term. Due to the presence of both firm and industry fixed effects, we estimate the coefficients and standard errors using the high-dimensional fixed-effects linear model (Guimarães and Portugal (2010)).

To gauge the course of maturity race, we are particularly interested in estimating the coefficients for the default window dummies. The default windows are tracked at a monthly frequency. Figure 6 plots the regression coefficients for these dummy variables based on a two-year window (i.e., 24 months before and 24 months after a default event). We use the month -24 as the benchmark period. This means that the coefficients estimated on the other default periods should always be interpreted comparing with this specific period. As the Figure shows, there is strong evidence of maturity race in financially distressed firms. The estimates for the default window dummies are significantly positive, except for the window [-14, -3] – about one year before firm's first default. Note that we have defined default event using a 3-month lag, i.e., a firm needs to have overdue credit present for more than 3 months to be considered as in default. This means that the firm's default information is likely to be already available to other creditors at month $t-3$ and this could explain the peak in the coefficients before default.

Nevertheless, the increase in short-term debt ratio may be induced either by an increase in short-term debt or by a decrease in long-term debt. To understand the issue better, we further examine changes in total credit, short-term credit and long-term credit (measured using log amount) in Figure 7, Figure 8, and Figure 9, separately. An interesting pattern, in support of the maturity race hypothesis, again unfolds. There is a higher ex ante probability for these firms to obtain credit beforehand and the funds that they received are generally short-term rather than long-term. To provide further evidence, we split the sample into two groups: firms with single bank relationships and firms with multiple bank relationships. For the latter, we further divide it into two subsamples based on the concentration index of bank-firm relationships. This exercise forms three groups of firms: firms with single bank relationships, firms with a concentrated lender pool and firms with a dispersed lender pool. We then repeat the same analysis as in Figure 6 for each subsample. The estimates for the default window dummies are plotted in Figure 10, showing a more prominent maturity race in firms with multiple relationships and dispersed lender pools for which the coordination problems are likely more severe. The coefficients in firms with single bank relationships are mostly negative.

Given these results, a natural follow-up question to ask is: what are the key features of credit contracts around firm default? If the maturity race proposition holds, they should have shorter time-to-maturity in general. We address this question by estimating the following econometric model,

$$M_{i,j,m} = \varpi_k W_{i,k} + \alpha X_{i,t-1} + \beta Y_{j,t-1} + \gamma L_{i,j,m} + \delta R_{i,j,t-1} + F_i + S_{(i)} + B_j + T_m + \varepsilon_{i,j,m} \quad (2)$$

where $M_{i,j,m}$ measures the time-to-maturity of a loan that firm i obtains from bank j in month m . Besides the variables specified in equation (1), we include a set of one-year lagged bank-specific variables $Y_{j,t-1}$, a set of loan-specific variables $L_{i,j,m}$, a set of one-year lagged bank-firm relationship variables $R_{i,j,t-1}$, and a vector of bank fixed effects B_j . $\varepsilon_{i,j,m}$ is the error term.

Indeed, credit contracts that were entered into or renegotiated right before a firm's first default event have significantly shorter time-to-maturity (Figure 11). The effect is more prominent in new issued debt (see Figure 12 and Figure 13). For those who continue to obtain new debt after default, time-to-maturity actually lengthens although statistically insignificant. In unreported robustness checks, we investigate other contractual dimensions, that is, tranche amount and the pricing of the loan. We find decreasing amount and increasing interest rate around default, consistent with the view that debt capacity diminishes for distressed firms. However, we would like to draw readers' attention to the fact that one-shot debt issuance does not necessarily reflect a firm's unalloyed financing intent. One should therefore interpret the findings from individual loan with more caution.

Short-term debt overhang and short-termism

In this section, we explore whether short-term debt overhang leads firms to take more short-term oriented decisions. The specification to estimate is as follows:

$$D_{i,t} = \beta ST_{i,t-1} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_t + \varepsilon_{i,t} \quad (3)$$

where $D_{i,t}$ is the specific decision of firm i in year t , $ST_{i,t-1}$ is the short-term debt overhang measure for firm i at year $t-1$, $X_{i,t-1}$ is a set of firm-specific variables at year $t-1$, F_i , $S_{(i)}$, and T_t represent firm, industry, and year fixed effects. $\varepsilon_{i,t}$ is the error term.

To generalize the results, we start by including all firms with available information on all the regression variables. We control for financial distress of firms by incorporating *Overdue Intensity*, measured by total overdue credit divided by total credit. For firms with no credit present in the Portuguese Credit Register, we assign the value of zero to this variable.

In general, the regression results, reported in Table 3, suggest a negative role of short-term debt overhang in corporate investment decisions, measured as firm's investment in tangible and intangible assets scaled by total assets. The estimated coefficients of the short-term debt ratio is negative and statistically significant in the regressions of general investment (column (1))

and employment (column (3)). There is also evidence suggesting that short-term debt overhang is related to firm short-termism. A closer look at firm's asset and employment compositions shows an increasing investment of short-term assets and increased unpaid and part-time workers in firms with higher short-term debt overhang (see columns (2), (4), and (5)). Previous research indicates that myopic managers have an inclination to manipulate accruals and distort their firms' reported financial performance (e.g., Efendi *et al.* (2007), Burns and Kedia (2006), Fang *et al.* (2016)). We focus on the conflict of interest between firms and creditors by asking whether the pressure of paying down maturing debt at higher frequencies gives managers incentives to manage their earnings.

Following existing work such as Fang *et al.* (2016), we measure earnings management of firms using discretionary accruals and the performance-matched discretionary accruals in columns (6) and column (7). The results are again consistent with our expectation: the higher the short-term debt overhang, the higher the discretionary accruals, that is, the greater the likelihood that earnings quality is low.

Table 4 runs a similar exercise for firms in the default sample. But instead of including merely the short-term debt ratio, we interact the short-term debt overhang variable with the dummy variables for the default window ($W_{i,k}$), as shown in equation (4). The purpose is to examine the effect of short-term debt overhang for different default windows.

$$D_{i,t} = \varpi_k W_{i,k} \times ST_{i,t-1} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_t + \varepsilon_{i,t} \quad (4)$$

The effect of short-term debt on investment and short-term asset investment is significant in all years, but the effect is more prominent in default year -3 and default year -2 . To visualize, we plot the regression coefficients of the default window for discretionary accruals and the performance-matched discretionary accruals in Figure 14. As the pattern found in investment and earnings management are also highest at default year -2 and at default year -3 , suggesting a more severe short-term debt overhang before default. The reversion in earnings managements at default year -1 and default year -2 is somehow expected as the delayed reporting of the unreported accruals need to be fulfilled eventually, which may have induced a closer scrutiny by firm's creditors and caused the firms to default earlier. These results, taken together, testify that business being too fixated on the short-term could be related with short-term debt overhang.

Concluding remarks

In addition to its conventional role in sorting firms, short-maturity debt can also arise from the maturity rat race among creditors, a form of coordination problem defined by Brunnermeier and Oehmke (2013). When facing financial

distress, a borrower has an incentive to use more short-term debt from an individual creditor because it dilutes the claims and payoffs of the remaining creditors. This eventually causes all the creditors to run into a shorter maturity structure. The presence of a large number of short maturity debt users can be dangerous for an economy, especially when the economy is in its downturn, accompanied with debt market liquidity deterioration (e.g., Almeida *et al.* (2012), Duchin *et al.* (2010), Gopalan *et al.* (2014), Chen *et al.* (2013)).

This paper examines the relevance of maturity race based on a group of financially distressed Portuguese firms which fail to comply with their credit obligations for the first time. Our results suggest important maturity shortening before firm default. This finding remains robust using various specifications. The study also sheds some light on how excessive short-term debt drives firm's myopic behaviors. In particular, we find that short-term debt overhang encourages firms to be overly short-term oriented in their investment and operation decisions. To meet short-term targets imposed by repaying short-term debt, they continue to invest in short-term assets and engage in earnings management. To mitigate the concern that myopic behaviors and excessive short term debt might be driven by common factors, we used an event-study approach in this paper. Our rationale is that as the default events spreaded out across time, it is less likely that the results will be driven by a specific shock. However, firm default is also more likely to occur during the financial crisis period. Future research might consider a cleaner design to address this issue.

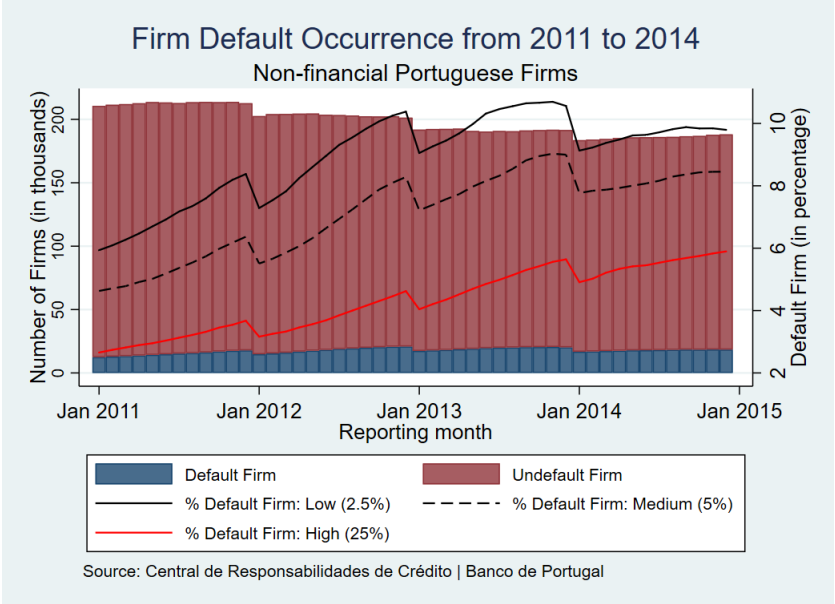


FIGURE 1: The occurrence of firm default from 2011 to 2014.

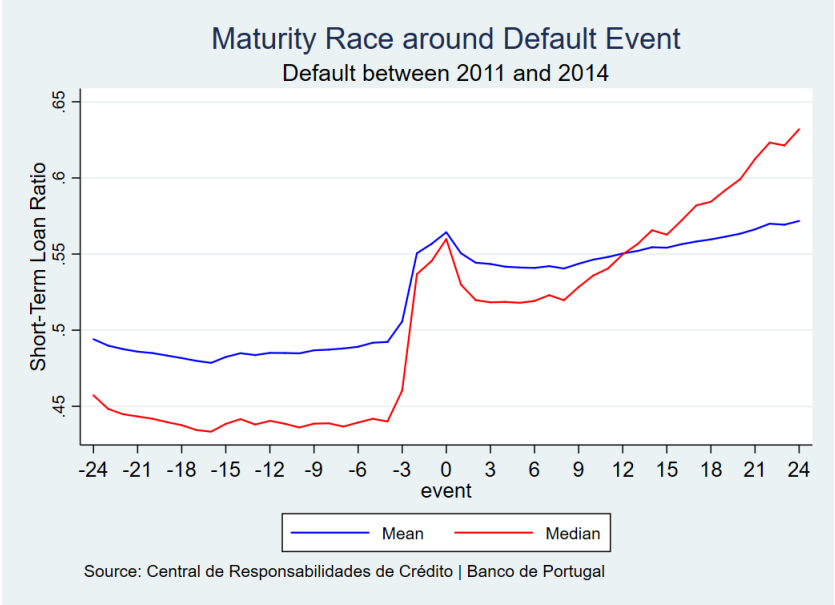


FIGURE 2: The evolution of short-term debt ratio around default.

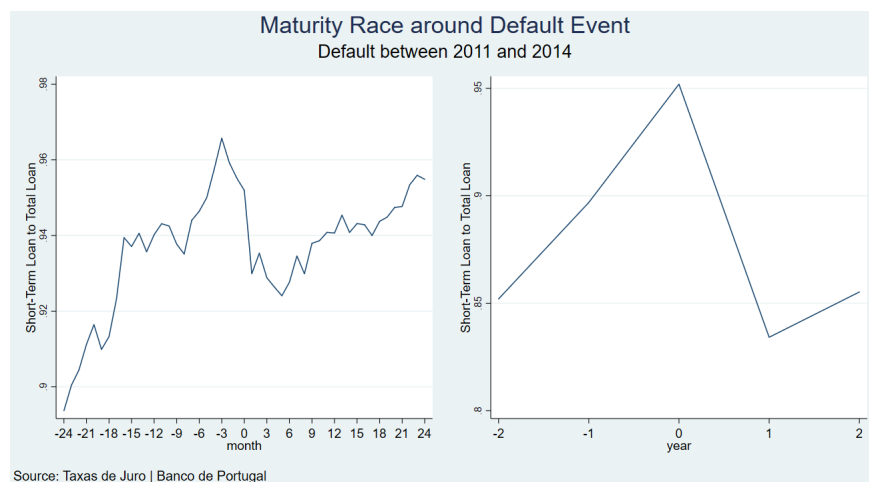


FIGURE 3: The evolution of short-term debt ratio for new loans around default.

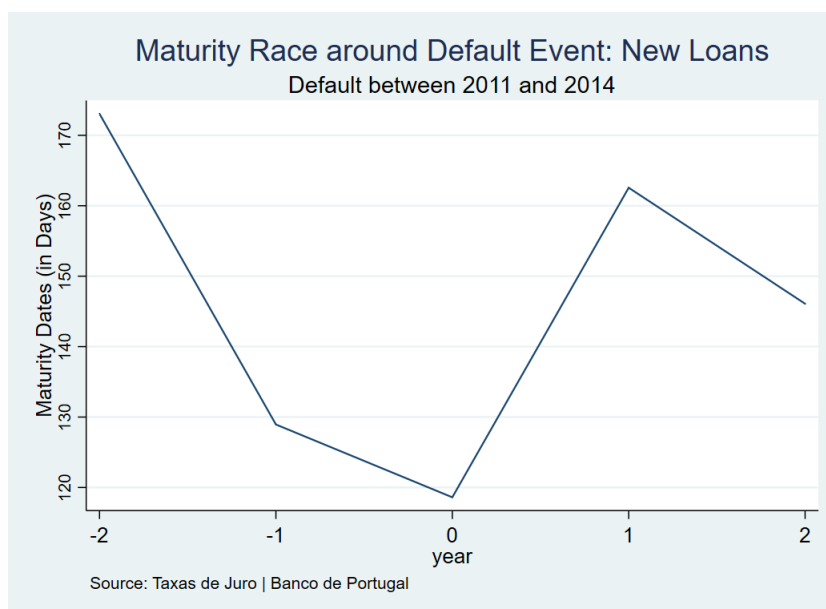


FIGURE 4: The evolution of time-to-maturity for new loans around default.

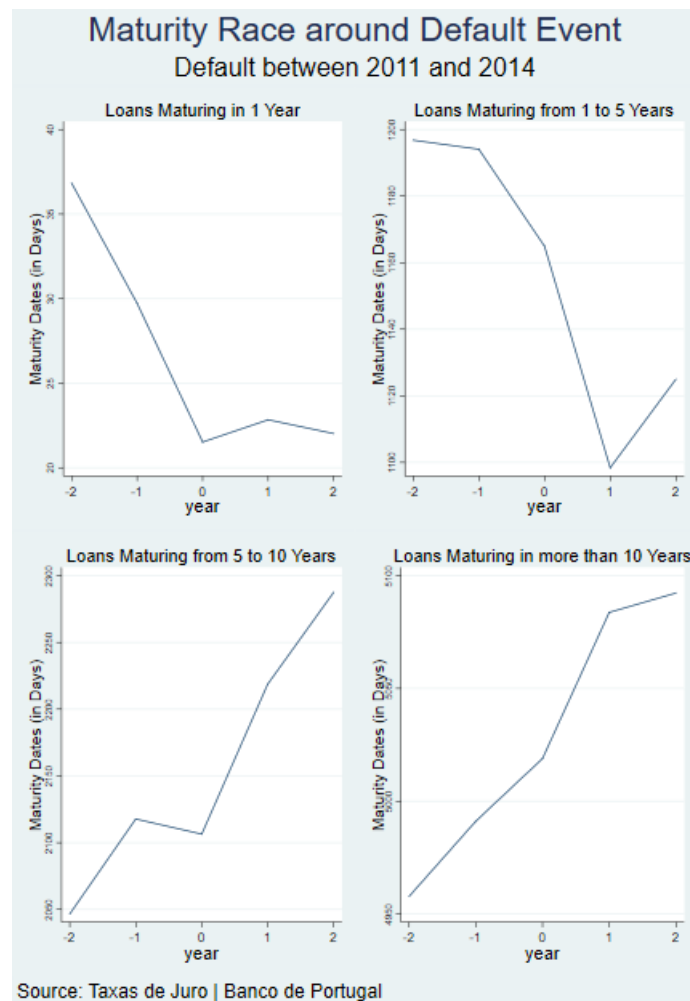


FIGURE 5: The evolution of time-to-maturity for new debt around default: subsample analyses by maturity class.

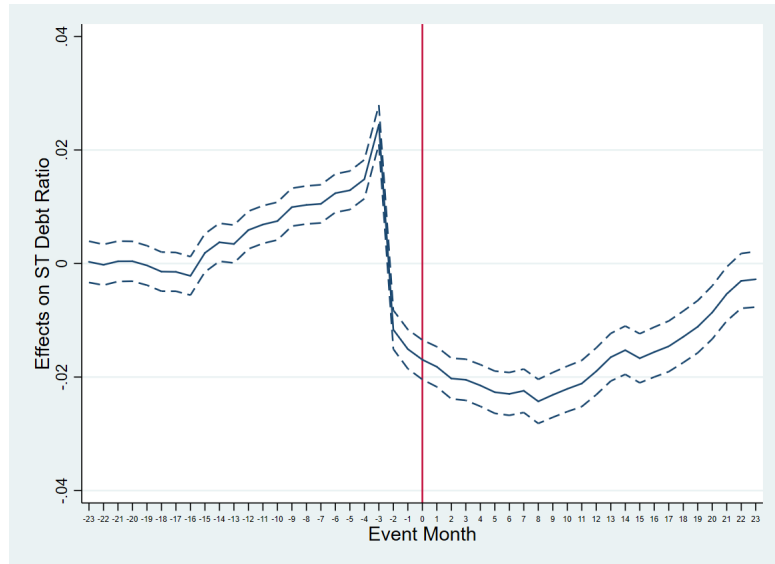


FIGURE 6: Estimated coefficients of ϖ_k , with the short-term debt ratio as the dependent variable.

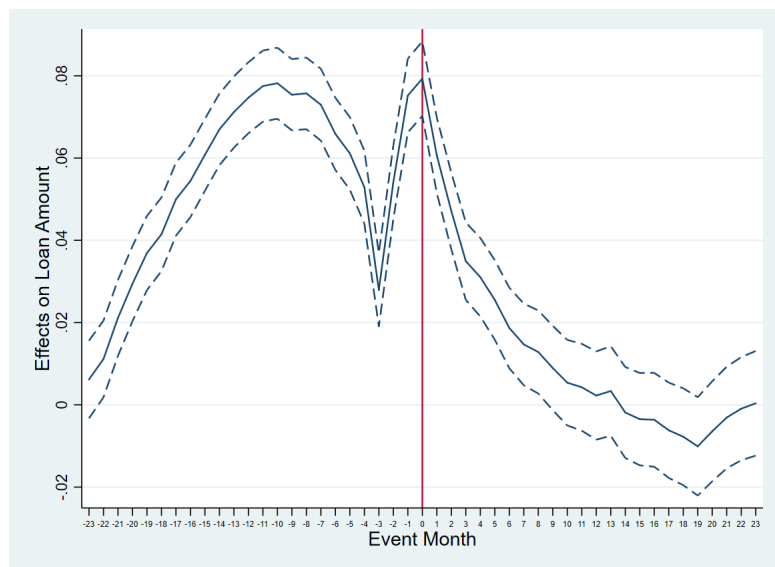


FIGURE 7: Estimated coefficients of ϖ_k , with the log amount of total credit as the dependent variable.

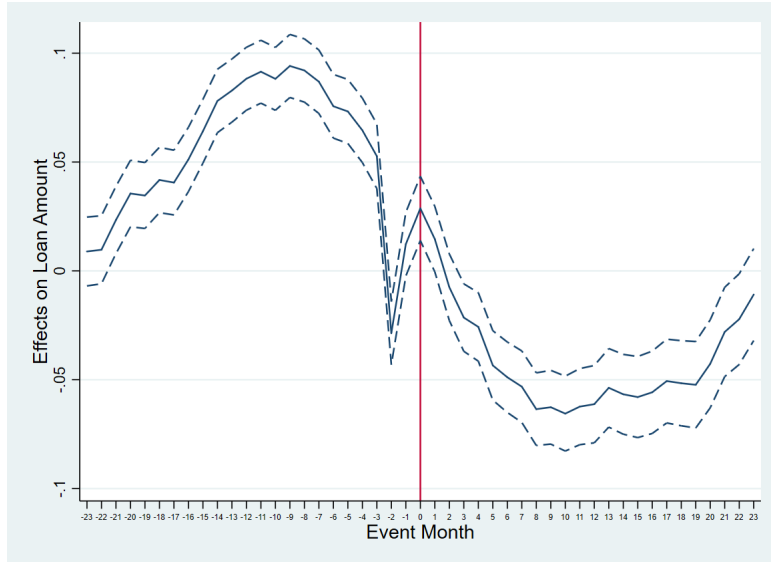


FIGURE 8: Estimated coefficients of ϖ_k , with the log amount of total short-term credit as the dependent variable.

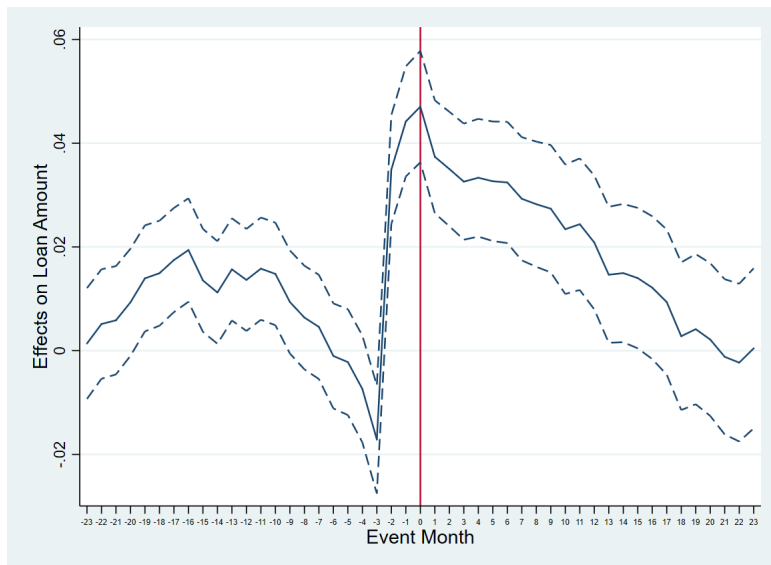


FIGURE 9: Estimated coefficients of ϖ_k , with the log amount of total long-term credit as the dependent variable.

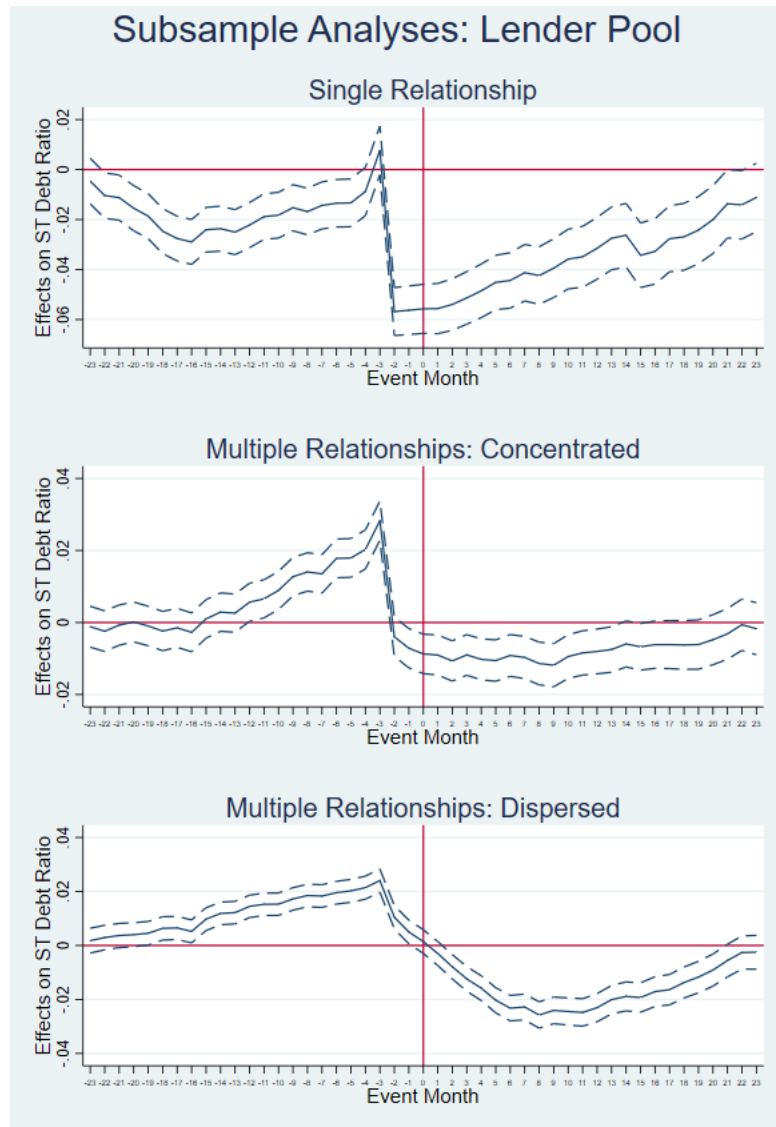


FIGURE 10: Subsample analyses of the estimates for ϖ_k by lender pool type, with the short-term debt ratio as the dependent variable.

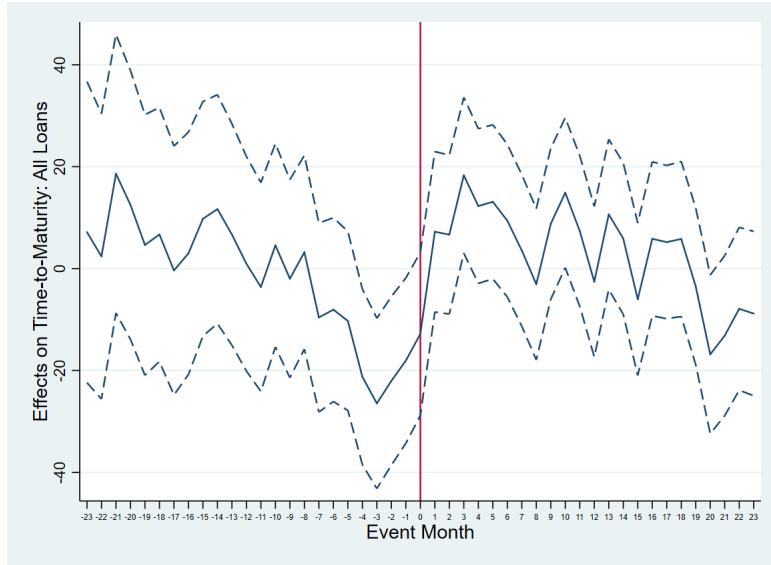


FIGURE 11: Estimated coefficients of ϖ_k for all loans, with time-to-maturity as the dependent variable.

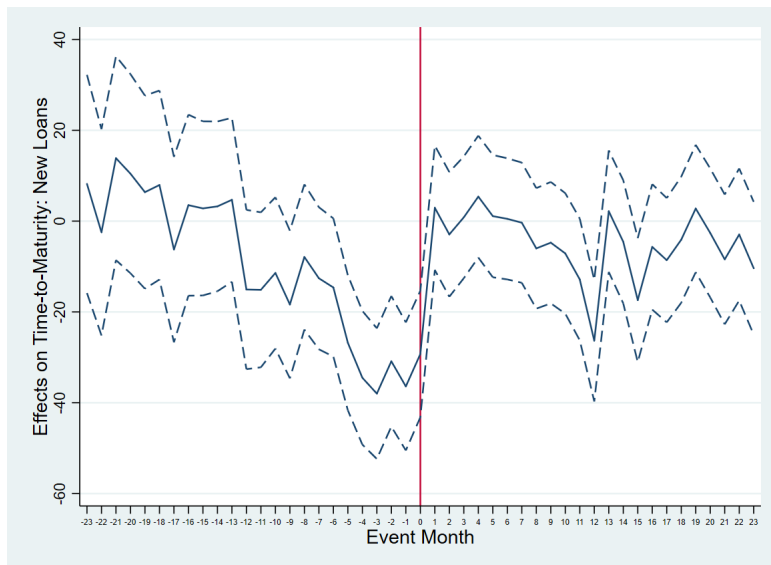


FIGURE 12: Estimated coefficients of ϖ_k for new loans, with time-to-maturity as the dependent variable.

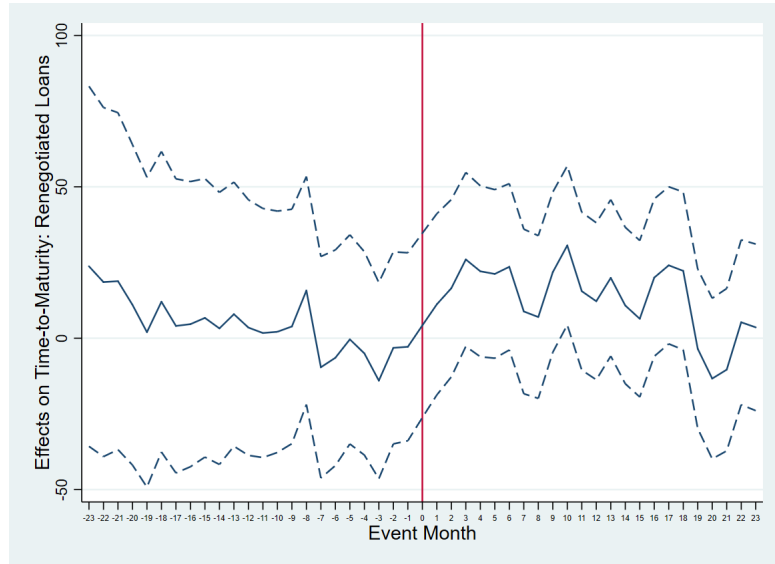


FIGURE 13: Estimated coefficients of ϖ_k for renegotiated loans, with time-to-maturity as the dependent variable.

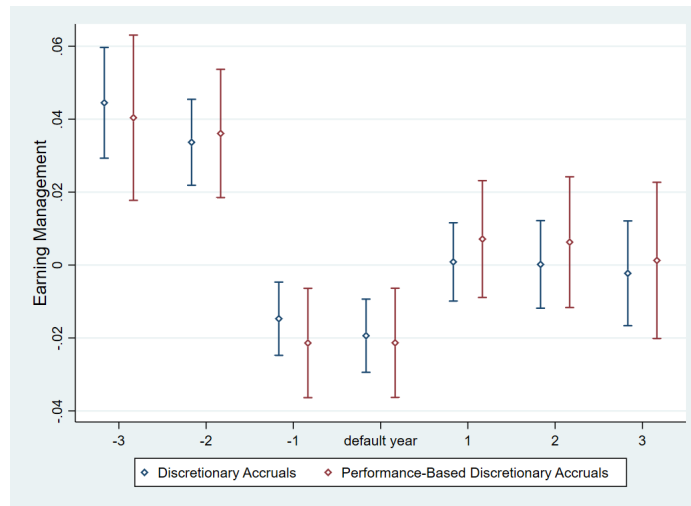


FIGURE 14: Estimated coefficients of ϖ_k , with the discretionary accruals and the performance-based discretionary accruals as the dependent variable.

TABLE 1. Variable definitions

Variables		Measurement
Firm-Specific Variables		
Age		The number of years elapsed since a firm's foundation year.
Size		The log value of a firm's total assets.
Profitability		The ratio of a firm's earnings before interest and tax to total turnover.
Leverage		The ratio of a firm's total liabilities to total assets.
Growth		The relative change in a firm's total number of employees.
Cash		The ratio of a firm's cash and bank deposits to total assets.
Current ratio	asset	The ratio of a firm's total current assets to total assets.
Loss		A dummy variable which takes a value of 1 if a firm's net operating income is negative and 0 otherwise.
ST debt ratio		The ratio of a firm's total short-term credit to total credit outstanding. Short-term credit is defined as bank credit with a residual maturity of less than one year.
Overdue intensity		The ratio of a firm's total overdue credit to total credit.
Investment		The ratio of a firm's fixed tangible and intangible assets to total assets.
Investment: assets	ST	The ratio of a firm's total current assets to the firm's fixed tangible and intangible assets.
Employment		The log value of a firm's number of employees.
Employment: unpaid		The ratio of a firm's unpaid employees to the firm's total number of employees.
Employment: part-time		The ratio of a firm's part-time employees to the firm's total number of employees.
Discretionary accruals		The difference between a firm's total accruals and the fitted normal accruals derived from a modified Jones model as in Fang et al. (2016).
Performance based discretionary accruals		A firm's discretionary accruals minus the corresponding discretionary accruals of a matched firm from the same fiscal year and CAE3 industry with the closest profitability (measured as a firm's earnings before interest and tax divided by the firm's total turnover).

Table 1 – continued

Variables	Measurement
Bank-Firm Relationship Variables	
Lender pool	The number of active bank relationships in a specific year.
Lender concentration	The concentration of bank relationships, calculated as the sum of the squares of the bank lending share in the spirit of the Herfindahl–Hirschman Index.
Relation duration	The number of months elapsed since the establishment of a bank-firm relationship.
New client	A dummy variable which takes a value of 1 if a loan is extended by a bank who just establishes the relationship with the borrower in the current year and 0 otherwise.
Bank-Specific Variables	
Bank size	The log value of a bank's total assets.
Market power	The share of a bank's credit extension to the credit extension by all the financial institutions.
Loan-to-deposit	The ratio of a bank's credit to deposits.
Credit growth	The annual change in a bank's total credit extension.
Bank current ratio	The ratio of a bank's current assets to current liabilities.
Domestic bank	A dummy variable which takes a value of 1 if the credit extension institution is located in Portugal and 0 otherwise.
Sovereign debt	The ratio of a bank's Sovereign credit to the bank's total assets.
Non-performing debt	The ratio of a bank's non-performing credit to total credit.
Loan-Specific Variables	
Renegotiation	A dummy variable which takes a value of 1 if a reported loan in the <i>New Credit Operations Database</i> corresponds to a renegotiated loan and 0 otherwise.
Collateral	A dummy variable which takes a value of 1 if a loan is secured by a collateral and 0 otherwise.
Past default	A dummy variable which takes a value of 1 if a loan is extended to a firm who has defaulted on the lending bank in the past three years and 0 otherwise.

	# Firms		Age		Size		Profitability		Leverage		Cash	
Default	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2011	156 107	26 919	15.11	13.20	12.32	12.44	-0.11	-0.29	0.96	1.29	0.15	0.11
2012	152 346	22 294	15.52	13.86	12.28	12.35	-0.13	-0.44	1.00	1.51	0.15	0.11
2013	148 067	17 146	15.88	14.97	12.31	12.37	-0.10	-0.43	1.01	1.63	0.16	0.11
2014	148 124	13 289	15.92	16.34	12.30	12.44	-0.08	-0.42	1.05	1.72	0.16	0.11
	# Firms		Growth		Current ratio		ST debt ratio		Lender pool		Lender concentration	
Default	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2011	156 107	26 919	0.04	0.00	0.70	0.70	0.58	0.52	2.47	3.73	0.73	0.60
2012	152 346	22 294	0.00	-0.08	0.70	0.69	0.57	0.50	2.34	3.47	0.75	0.63
2013	148 067	17 146	0.03	-0.06	0.71	0.69	0.57	0.52	2.32	3.35	0.76	0.65
2014	148 124	13 289	0.07	-0.01	0.70	0.68	0.55	0.52	2.35	3.23	0.75	0.67

TABLE 2. Characteristics of defaulted firms and non-defaulted firms

	Investment	Investment: ST asset	Employment	Employment: unpaid	Employment: part-time	Discretionary Accruals	Performance Based Discretionary Accruals
ST debt ratio	-0.036*** (-76.20)	0.034*** (67.31)	-0.032*** (-31.90)	0.003*** (9.66)	-0.033 (-0.58)	0.005*** (5.06)	0.005*** (3.79)
Size	0.016*** (37.06)	-0.019*** (-43.78)	0.222*** (255.36)	-0.015*** (-57.06)	0.385*** (7.70)	-0.042*** (-46.72)	-0.049*** (-35.51)
Profitability	-0.000 (-0.94)	-0.000 (-0.52)	0.040*** (77.01)	-0.006*** (-34.97)	-0.030 (-0.97)	0.001 (1.38)	-0.012*** (-15.33)
Leverage	-0.005*** (-30.88)	0.004*** (27.12)	0.003*** (9.88)	0.001*** (13.60)	0.034* (1.87)	0.020*** (31.19)	0.022*** (22.13)
Growth	0.005*** (14.14)	-0.004*** (-10.30)	0.177*** (225.26)	-0.006*** (-25.54)	0.269*** (5.97)	0.000 (0.33)	0.001 (0.96)
Cash	0.015*** (11.67)	-0.014*** (-10.37)	-0.003 (-1.20)	0.006*** (8.02)	-0.075 (-0.49)	0.173*** (59.31)	0.145*** (32.49)
Loss	0.007*** (15.17)	-0.006*** (-13.47)	-0.037*** (-40.28)	-0.003*** (-10.55)	-0.097* (-1.86)	-0.007*** (-9.06)	0.049*** (38.45)
Current Ratio	-0.355*** (-283.38)	0.411*** (311.82)	-0.012*** (-4.50)	0.002** (2.10)	0.255* (1.71)	-0.051*** (-19.97)	-0.059*** (-15.01)
Observations	1 301 308	1 315 541	1 318 938	1 269 878	952 602	416 163	416 163
Adjusted R^2	0.754	0.742	0.907	0.658	0.859	0.268	0.093

t statistics in parentheses

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

TABLE 3. The effect of short-term debt overhang: full sample

	Investment	Investment: short-term asset	Employment	Employment: unpaid	Employment: part-time	Discretionary Accruals	Performance Based Discretionary Accruals
ST debt ratio x [default year - 3]	-0.037*** (-6.05)	0.037*** (6.03)	0.015* (1.69)	0.003 (1.07)	-0.001 (-0.14)	0.042*** (5.44)	0.038*** (3.26)
ST debt ratio x [default year - 2]	-0.033*** (-6.47)	0.033*** (6.40)	0.059*** (8.25)	-0.002 (-0.78)	0.002 (0.64)	0.034*** (5.61)	0.036*** (4.05)
ST debt ratio x [default year - 1]	-0.022*** (-4.81)	0.020*** (4.51)	0.028*** (4.45)	-0.002 (-1.01)	0.002 (0.83)	-0.013** (-2.48)	-0.019** (-2.45)
ST debt ratio x default year	-0.017*** (-4.00)	0.013*** (2.94)	-0.103*** (-16.96)	0.009*** (5.25)	0.006** (2.40)	-0.017*** (-3.73)	-0.018*** (-2.60)
ST debt ratio x [default year + 1]	-0.026*** (-5.72)	0.022*** (4.68)	-0.192*** (-29.54)	0.018*** (9.57)	0.009*** (3.30)	0.004 (0.93)	0.012* (1.75)
ST debt ratio x [default year + 2]	-0.026*** (-4.97)	0.019*** (3.62)	-0.165*** (-22.31)	0.018*** (8.45)	0.016*** (5.12)	0.005 (1.00)	0.014* (1.70)
ST debt ratio x [default year + 3]	-0.019*** (-3.07)	0.010 (1.59)	-0.147*** (-16.35)	0.020*** (7.68)	0.017*** (4.41)	0.005 (0.73)	0.011 (1.12)
Size	0.015*** (5.48)	-0.018*** (-6.91)	0.208*** (56.20)	-0.018*** (-16.14)	-0.017*** (-10.54)	-0.042*** (-12.47)	-0.042*** (-8.30)
Profitability	-0.001 (-0.74)	-0.000 (-0.08)	0.047*** (31.62)	-0.007*** (-14.82)	-0.007*** (-8.64)	-0.004*** (-3.59)	-0.011*** (-6.70)
Leverage	-0.008*** (-11.46)	0.008*** (10.89)	0.008*** (7.84)	0.001*** (3.68)	0.001** (1.97)	0.010*** (6.19)	0.013*** (5.40)
Growth	0.006*** (2.71)	-0.004** (-2.04)	0.200*** (68.02)	-0.008*** (-8.87)	-0.002 (-1.53)	0.003 (1.21)	-0.001 (-0.20)
Cash	-0.008 (-0.89)	0.012 (1.37)	-0.098*** (-8.21)	0.012*** (3.39)	0.016*** (3.09)	0.167*** (13.58)	0.143*** (7.82)
Loss	0.012*** (5.02)	-0.012*** (-4.93)	-0.063*** (-18.67)	-0.003*** (-3.02)	-0.002 (-1.06)	-0.003 (-1.25)	0.059*** (15.88)
Current ratio	-0.297*** (-39.44)	0.345*** (45.55)	-0.003 (-0.24)	0.016*** (4.93)	0.002 (0.32)	-0.055*** (-6.29)	-0.076*** (-5.77)
Observations	130 752	132 548	132 830	123 458	88 200	39 906	39 906
Adjusted R^2	0.500	0.505	0.853	0.504	0.509	0.248	0.095

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 4. The effect of short-term debt overhang: default sample

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Financial situation indicators of Portuguese firms: Do size, age and sector matter?

Fábio Albuquerque
Banco de Portugal

Paulo Soares Esteves
Banco de Portugal

Cloé Magalhães
Banco de Portugal

July 2018)

Abstract

The Great Recession raised a more uncertain, complex and dynamic environment explaining why firms are increasing attention to their financial situation. However, the evaluation of this situation is complex, and a large number of indicators can be found in the literature. This paper considers three indicators to assess the Portuguese firms' financial situation: the capital ratio; the bank loans to liabilities ratio, and the commercial gap ratio. The objective is to understand how these indicators are related to firms' age, size and economic activity sector. This may help to understand the firm financial situation and also to identify some structural effects underlying the overall aggregates evolution. (JEL: D22, G30, G33)

Introduction

The assessment of firms' financial situation is crucial both at an individual and at a macroeconomic level. The analysis at the firm level allows us to understand the heterogeneity underlying their operating, financing and liquidity position. At a macroeconomic level, this assessment may help policy makers to conduct and implement suitable policies in order to strengthen the economy against adverse shocks. This issue became even more relevant during the recent years. From the Great Recession emerged an environment more uncertain, complex and dynamic, explaining the increasing attention to firms' vulnerability to future macroeconomic shocks, as well as to changes in firms' decisions concerning savings and dividends policy in order

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E-mail: fhalbuquerque@bportugal.pt; pmesteves@bportugal.pt; clmagalhaes@bportugal.pt

to improve their financial stance [on this issue see Banco de Portugal (2017a) and Chen et al. (2017)].

The analysis of firms' financial situation is complex, and a large number of indicators can be found in the literature in order to assess it. In this paper, we consider three indicators to assess the Portuguese firms' financial situation: the capital ratio; the bank loans to liabilities ratio, and the commercial gap ratio.

The analysis performed in this paper relates these indicators to the firms' age, size, and economic activity sector, in order to understand the structural characteristics that should be taken into consideration when analyzing the firms' financial situation indicators. Portuguese firms are substantially heterogeneous in what concerns size and age. These two variables are frequently used as a proxy to measure asymmetric and opaque information and, therefore, are key determinants of the corporate funding structure. New firms are usually smaller, but are an important driver of innovation¹, income, and job creation. However, they fail at a significant rate, even though larger new firms have higher survival probabilities.² Also, the funding structure depends on the sector of economic activity in which the firm is operating in, reflecting differences on the investment horizon, the degree of economies of scale, or the required amount of sunk costs. Therefore, knowing the effects of the composition of Portuguese firms concerning age, size and economic activity sector is important not only to understand the macroeconomic indicators concerning firms' situation, but also their evolution.

The paper is organised as follows. In the next section we present the motivation underlying the choice of these financial indicators. Section 3 evaluates how these indicators are related to the firms' age, size and economic activity sector.³ This analysis is performed in two steps. In section 3.1, we use the Central Balance Sheet Database of Banco de Portugal to describe the evolution of these indicators for the Portuguese economy. Additionally, we use aggregate data from the Bank for the Accounts of Companies Harmonized (BACH) database⁴, to provide a comparison with other European countries. Finally, using more detailed information for the last available year of the Central Balance Sheet Database, we analyze the heterogeneity underlying these indicators at the size, age and economic activity sector level. Section

1. See Acemoglu et al. (2013).

2. See Félix (2017) for a recent analysis of firm creation and survival in Portugal.

3. Banco de Portugal (2017b) presents very detailed information concerning the structure of Portuguese non-financial corporations (NFC).

4. BACH is a database of aggregated and harmonized accounting data of non-financial incorporated enterprises of 10 European countries (plus three in a near future), based on national accounting standards (individual annual accounts). Information on the methodology and the coverage of national samples may be obtained on the BACH website (<https://www.bach.banque-france.fr/?lang=en>).

3.2 presents an econometric framework to estimate the effect of age, size and economic activity sector on the financial indicators. Section 4 summarizes the main conclusions.

Assessing firms' financial situation

How to assess the financial situation of firms is not straightforward. The financial indicators are frequently chosen from the perspective of assessing the robustness of firms to future shocks. Since Altman's (1968) seminal contribution, the concept of financial vulnerability is linked to the research on models predicting firms' bankruptcy. However, the choice of indicators is subjective in these rating evaluation models, and both iterative algorithms [e.g. Imbens and Rubin (2015)] and expert analysis are frequently used to find the set of indicators that best predict the firms' default [Antunes et al (2016)]⁵. The three financial indicators considered in this paper are some of those often used in these models, allowing a perspective on the firms' use of own funds, the firms' recurrence to banks for external funding and the liquidity needs that arise from the firms' operational activity. We do not claim that these indicators are more suitable than others to assess the financial situation of Portuguese firms. Moreover, the objective is not to explain the evolution of these indicators or to address any special theory concerning the reasons why these indicators are frequently used. Even though these three indicators may provide an incomplete picture of the firms' financial situation, they comprise the financing through equity, bank loans and trade credits, which are the issues that analysts frequently focus on when evaluating the firms' situation.

The capital ratio indicates the percentage of total assets that is financed by equity. This is a common indicator to assess the firms' leverage and dependency on external funding. It is widely accepted that higher levels of indebtedness increase the firms' vulnerability, particularly for less profitable companies. The capital ratio may be also understood as a proxy for the firms' savings and dividends policy. Altman (1968) identified the ratio between retained earnings and total assets as a relevant factor to predict firms' bankruptcy. Additionally, according to the pecking order theory (Myers, 1984), firms prefer to resort to their own funds rather than to other sources of funding. Based on this, it is expected that firms retain profits throughout their lifecycle, in order to accumulate equity and be less dependent on external funds. This process also allows firms to reduce costs and maintain the control of the firm by the current shareholders.

The bank loans to liabilities ratio measures the firms' recourse to banks for external funding. Even though 45% of Portuguese firms do not resort

5. The authors present a review of the recent academic literature on this topic as well as applications for other countries.

to financial debt, banks are the most relevant creditors for firms that use financial debt. This is particularly relevant for micro, small and medium-sized enterprises (SMEs) that, in general, have no access to the financial markets [Banco de Portugal (2017b and 2018)]. Low levels of the bank loans to liabilities ratio can be understood as evidence of restrictions in the access to bank credit, limiting the capacity of firms to invest and grow. However, it can also signal the firms' preference for other sources of funding, such as equity or debt securities. This means that the interpretation of this indicator is not straightforward and its analysis should be complemented with information on other funding sources. Instead, high levels of this ratio imply that companies rely heavily on the banking system as source of external funding, which may increase their vulnerability in a context of credit constraints or increasing interest rates. In Portugal, the financial crisis affected the access of younger and smaller firms to bank loans significantly more [Antunes and Martinho (2012) and Farinha and Félix (2015)].

The commercial gap ratio is the ratio between trade credits and trade debts. It is an important indicator of the firms' financial situation as trade credits are a source of funding that is in general used by all firms, in contrast to bank loans. When credit from suppliers is insufficient to cover the credit granted to customers, leading to a commercial gap ratio under 100%, firms must resort to other funding sources to finance their operational activity. The commercial gap ratio may pressure short-term liquidity requirements and the dependence of firms on other sources of funding. This effect is expected to be stronger for smaller firms, which are expected to have lower market power, and to be dependent on the sector of economic activity [Ng et al. (1999)].

Several authors have analyzed the substitution effect between trade credit and bank credit, especially during a crisis period. In fact, Nielsen (2002) and Petersen and Rajan (1997) find evidence that firms resort more to trade credit when bank loans are not accessible, which is more likely to occur in the case of smaller firms [Bias and Gollier (1997)]. Love et al. (2007) argue that the financial vulnerability of firms may affect the trade credit granted to their customers, in particular during crisis periods, and McGuinness and Hogan (2016) point out that the financially vulnerable Irish SMEs increased trade credits from suppliers and reduced trade credit to customers during the recent crisis. Additionally, there is evidence that larger and financially robust firms, and firms with higher levels of liquidity are able to redistribute credit to financially constrained SMEs. Petersen and Rajan (1997) and Rodríguez-Rodríguez (2008) show that firms with access to bank loans grant more trade credits than others, acting as an intermediate between banks and firms with limited access to bank loans.

Data and descriptive analysis

The Central Balance Sheet Database (CBSD) of Banco de Portugal collects accounting data on enterprises. We consider the information underlying the Sector Tables, which is available since 2010⁶. This information is comprised of a comprehensive set of economic and financial indicators by sector of economic activity and size class, including also an international comparison based on the BACH database.

Descriptive analysis

This subsection presents a descriptive analysis of the evolution of the financial ratios under analysis over the period between 2010 and 2016 using information from the CBSD of Banco de Portugal. Additionally, it is presented an international comparison based on the BACH database for 2015.

Evolution over the recent years. Figure 1 presents the evolution from 2010 to 2016 for the capital ratio, the bank loans to liabilities ratio and the commercial gap ratio based on weighted means.

Since 2014 the percentage of assets that is financed by equity increased, reflecting an effective growth of equity during this period. This is in line with the increasing savings by non-financial corporations documented in Banco de Portugal (2017a)⁷. In what concerns the bank loans to liabilities ratio, it decreased over the sampling period, reflecting an effective reduction of loans granted to firms as a result of the strong banking deleveraging. Nevertheless, the reduction of loans granted to companies reflects the contribution of the intensive margin, since the extensive margin - i.e. firms starting to borrow from the banking sector - provided a positive contribute in the most recent period [(Banco de Portugal (2017c)]. Finally, the commercial gap ratio remained stable during this period. It is important to highlight that this indicator is always below 100%, meaning that trade credits give a negative contribution to the firm's short-term funding.

6. The Sector Tables are targeted at the general public and available in BPStat | Statistics online [see Banco de Portugal (2014)]. In 2010, the accounting standards were changed, as the Official Chart of Accounts (Plano Oficial de Contabilidade, in Portuguese) was replaced by the Accounting Standards System (Sistema de Normalização Contabilística, in Portuguese). This change had an impact on the basic information of the Central Balance Sheet Database, as underlying accounting concepts were redesigned.

7. More details on equity developments, namely at the sectoral level, is available in Banco de Portugal (2017b) and in the Sector Tables.

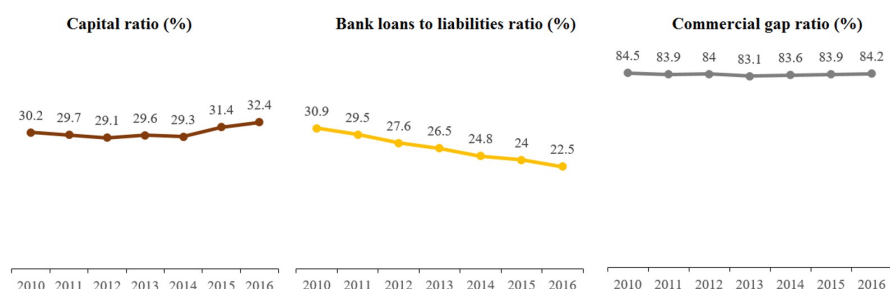


FIGURE 1: Financial situation indicators of Portuguese NFC

Source: Banco de Portugal.

International comparison. Figure 2 presents an international comparison for these three indicators using the weighted means from BACH data for 2015⁸. In what concerns the capital ratio, Portugal has the lowest figure, despite the recovery registered in the most recent years. Banco de Portugal (2017d) emphasizes that this difference does not arise from differences in the cross-country samples of firms.

On the other hand, despite the decrease observed since 2010, Portuguese firms still show some dependence on banks as source of external funding - bank loans account for 24% of the firms' liabilities. The bank loans to liabilities ratio for Germany and France is slightly above 16%.

In what concerns the commercial gap ratio, in most countries of the sample, including Spain, Portugal and Italy, the commercial credit contributes more significantly to a negative net short-term funding. Portugal shows a relative worse position when compared to other countries, namely Poland, Czech Republic and Slovakia.

Information disaggregated by firms' age, size, and sector of economic activity. Using micro data from the CBSD of Banco de Portugal it is possible to compute a large set of financial indicators for non-financial corporations and analyze the underlying heterogeneity according to the firm's age, size and economic activity sector. This allows us to shed light on the observable differences in the financial structure of firms according to these dimensions⁹. In this analysis, we

8. Final data for 2016 are not available to all countries under assessment yet. In this case, 2015 was used instead (2014 for CZ; 2013 for SK). Further, using the average values for the period from 2010 to 2015 leads to the same main conclusions. Because countries have different levels of coverage, some composition effects might be verified, in particular in what concerns the smaller firms. However, the results are robust to the exclusion of the smaller firms.

9. An analysis exploring the influence of age and size characteristics on funding structure is presented in Antão e Bonfim (2008) for the period from 1990 to 2017 and in Barbosa e de Pinho (2016) covering the period from 2006 to 2012.

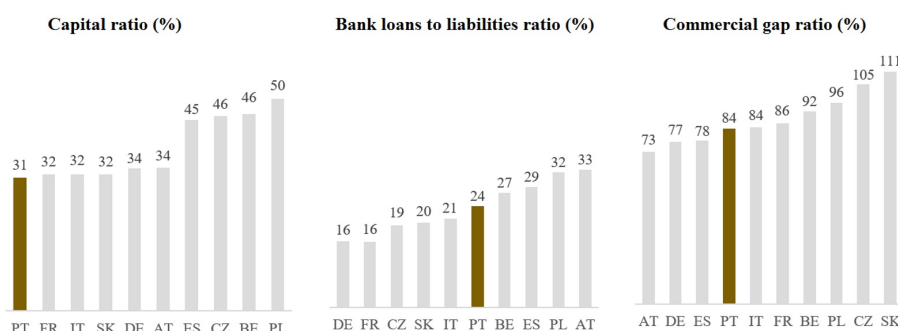


FIGURE 2: Financial situation indicators: International comparison - 2015

Source: BACH database.

define firm's age as the difference between the current year and the founding year and classify it into four categories: up to 5 years old; from 6 to 10 years old; from 11 to 25 years old; over 25 years old. The classification of firms into size categories follows the EC Recommendation of 6 May 2003¹⁰. Companies were classified into four groups: micro-companies; small companies; medium-sized companies; large companies. The classification is based on the number of employees, turnover and total assets of each enterprise. In this paper, the sector of economic activity classification follows the Portuguese classification of economic activities (CAE-Rev.3), which corresponds to the Eurostat classification (NACE Rev2).

The distribution of the financial ratios under analysis by quartiles is provided in Figures 3, 4, and 6, as these measures are more robust to the presence of outliers in comparison with the average values. Figure 3 presents the quartile distribution of the capital ratio. The first result to highlight is the number of firms with negative equity (28%). This situation is concentrated in younger and, especially, in micro firms. Moreover, the universe of micro firms encompasses two different patterns: more than 30% of firms have negative equity, while 25% of firms have a capital ratio above 67%. This strong heterogeneity should be taken into consideration when estimating the determinants of the capital ratio.

10. According to this Recommendation, microenterprises are defined as enterprises that employ fewer than ten employees and has annual turnover and/or balance sheet total does not exceed €2 million. A small enterprise is defined as an enterprise which employs fewer than 50 employees and has annual turnover and/or annual balance sheet total does not exceed €10 million. A medium-sized enterprise have less than 250 employees and has an annual turnover below €50 million or an annual balance sheet total below €43 million. A large enterprise are the remaining ones.

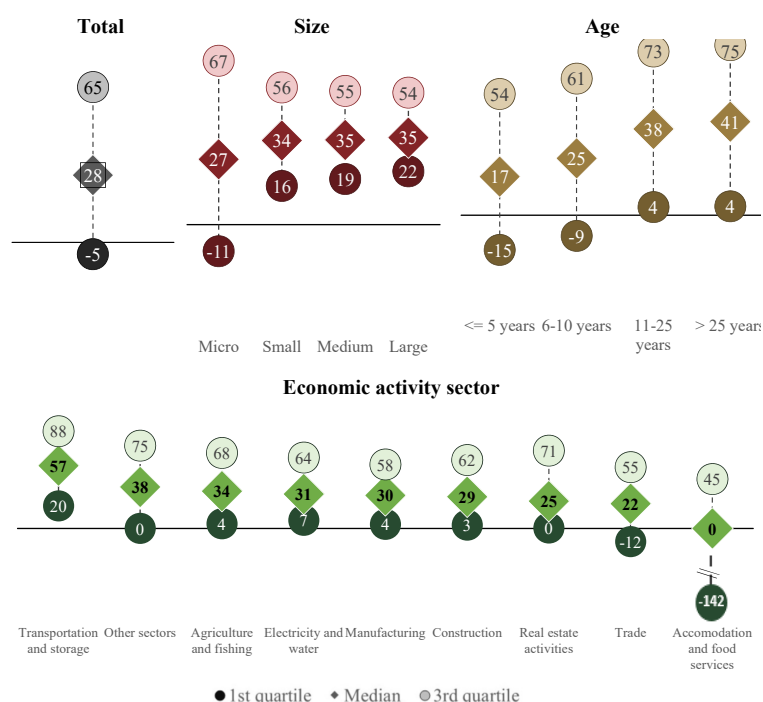


FIGURE 3: Capital ratio: quartile analysis - 2016

Source: Banco de Portugal.

Note: Capital ratio = equity / total assets.

The capital ratio exhibits a positive correlation with firm's age, while the relation with firm's size is not obvious, in particular when the micro firms are excluded from the analysis. These results are in line with the ones presented in Barbosa and de Pinho (2016). The analysis by sector of activity shows considerable heterogeneity. On one hand, transportation and storage is the sector where assets are more funded by equity, as the ratio is comparatively higher in all quartiles. On the other hand, half of the firms (based on the median) have negative equity in the accommodation and food service activities.

Figure 4 reproduces this analysis for the bank loans to liabilities ratio. The first message to retain is that more than half of the Portuguese non-financial firms do not resort to bank loans, as the median is zero for this ratio. This is transversal to the micro and the large firms. In what concerns age, Figure 4 suggests a non-linear relation at the third quartile. Considering the startups (less than 5 years old), bank loans represent less than 7% of the firms' liabilities for 75% of these firms.

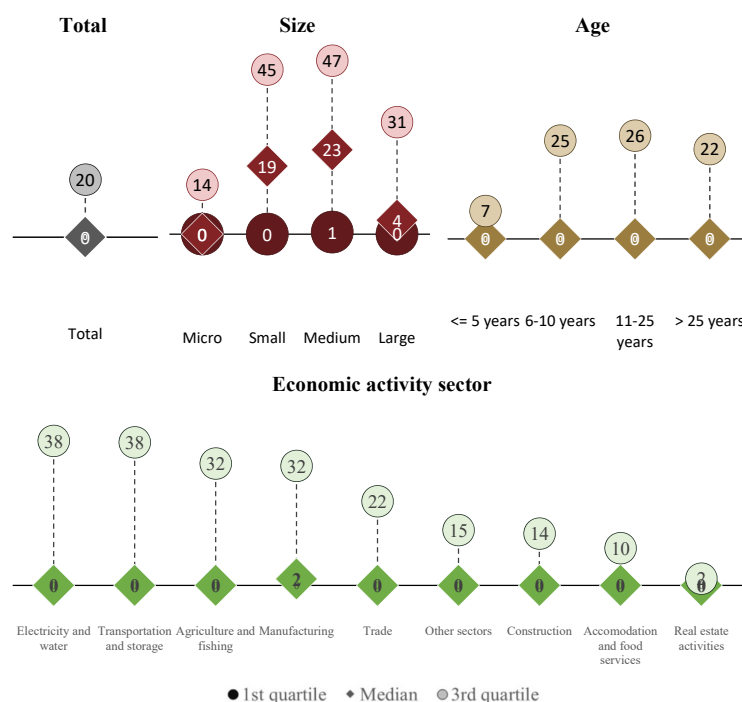


FIGURE 4: Bank loans to liabilities ratio: quartile analysis - 2016

Source: Banco de Portugal.

Note: Bank loans to liabilities ratio = bank loans / liabilities. The liabilities include all funding sources except equity.

Regarding the economic activity sector, the first highlight is that more than half of the firms do not borrow from banks, with the exception of the manufacturing sector. Nevertheless, despite this common characteristic, some important differences emerge at the third quartile. For instance, in the electricity and water and in the transportation and storage sectors, bank loans represent more than 38% of total liabilities for 2% of the firms. In contrast, bank financing is less important in real estate activities, in which bank loans represent less than 2% of firms' liabilities for 75% of the firms.

As previously mentioned, the interpretation of the bank loans to liabilities ratio is not straightforward and therefore should be complemented with information on other funding sources. Figure 5 provides a more in-depth analysis of the firm's funding sources (in percentage of the total liabilities). In comparison with small and medium firms, micro firms rely more on

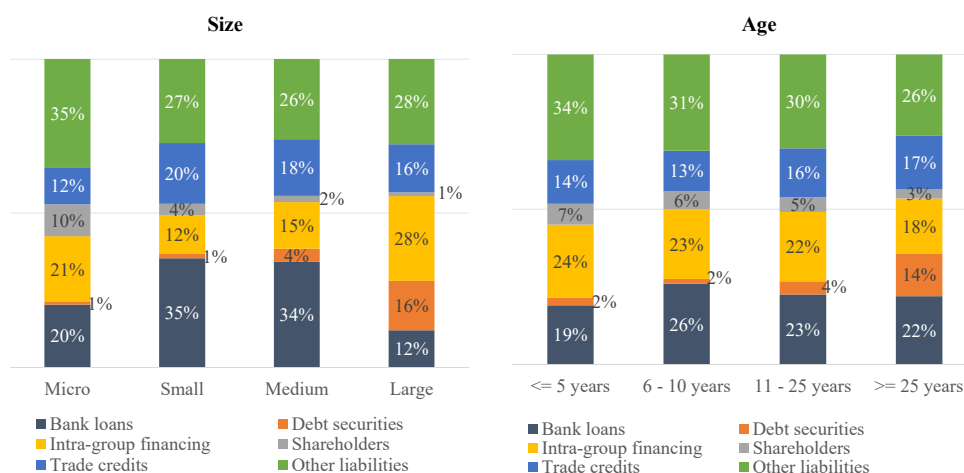


FIGURE 5: Funding sources - 2016 (% of liabilities)

Source: Banco de Portugal.

shareholders and intra-group financing¹¹, while large enterprises resort more to debt securities and intra-group financing. Therefore, the lower weight of bank loans in micro and large firms embodies a difference between the importance of shareholders funding for microenterprises and the relevance of debt securities for large companies. Additionally, micro firms resort less to trade credits in comparison with the remaining size classes.

The analysis of the funding structure according to the firms' age classes suggests that bank loans are less important to young firms (less than 5 years old). Furthermore, shareholders and intragroup financing tend to decrease for older firms.

It is worthwhile to stress the relevance of the financial markets as a source of funding for the largest and oldest enterprises – representing 16% and 14% of the liabilities, respectively - while debt securities show a residual weight in the remaining size and age classes.

Figure 6 presents the quartile distribution of the commercial gap ratio. Although credits granted by suppliers represent an important share of the firms' liabilities, the commercial gap ratio is not, in general, a source of net short-run funding. The median value of this ratio is around 45%, which is substantially below the aggregate value (84%). This difference can be explained by the fact that larger firms tend to have higher values of this ratio. In what concerns the quartile distribution of the commercial gap ratio

11. Intra-group financing is part of the firm's financial debt and therefore it is a liability with associated costs, in contrast to shareholders' debt.

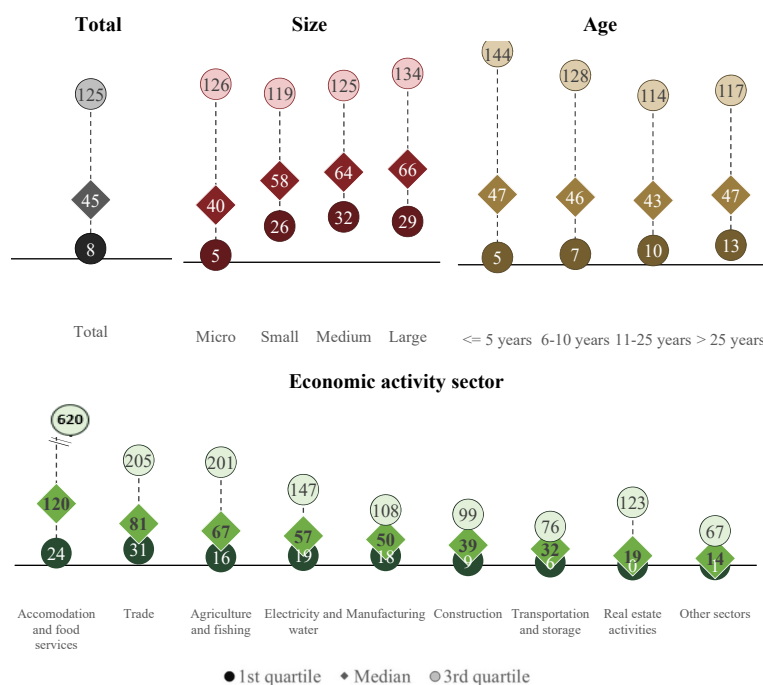


FIGURE 6: Commercial gap ratio: quartile analysis - 2016

Source: Banco de Portugal.

Note: BCommercial gap ratio = trade credits / trade debts.

according to the firms' age, the median value is similar across the different age classes, although there is a clear reduction of the interquartile range as firms get older.

The analysis of the sectorial differences raise some remarkable findings. Only in the accommodation and food services trade credits represent a net source of funding for most of the firms, and this might be related to the particular characteristics of this economic activity sector, suggesting that for a relevant set of firms a part of the turnover is received mostly instantly: for the median firm, trade credits are 20% higher than trade debts. The trade sector has the second highest figures for the median firm, which indicates that some firms within this sector also present a similar pattern. This may be related to the fact that those firms sell more directly to final consumers, while firms more in early stages of the value chain benefits less from trade credit. In contrast, in the real estate activities sector, 25% of firms do not have credit granted by suppliers, while for the median firm it corresponds only to 19% of the credit granted to customers.

Econometric analysis

Econometric framework. The previous section pointed out that the distribution of firms' capital ratio, bank loans to liabilities ratio and the commercial gap ratio differs across size and age classes, as well as across economic activity sectors. However, these firms' characteristics may be correlated. In this section, the effect of the firms' size, age and economic activity sector on the financial ratios under analysis is estimated simultaneously, allowing to control for the correlation between these effects.

The data underlying this analysis corresponds to the annual Central Balance Sheet Database for the 2010-16 period. The analysis excludes the extreme 1 per cent observations (in both sides of the distribution) to limit the impact of outliers in the results. Firms with negative equity were also excluded, as the factors underlying this situation are outside the scope of this analysis. The sample corresponds to an unbalanced panel comprised of 938,513 observations and 208,370 firms. The model for the bank loans to liabilities ratio also excludes firms with no bank loans, resulting in an unbalanced panel with 866,344 observations and 192,372 firms.

The purpose of this formulation is to capture the correlation between the three ratios under analysis and firms' age, size and economic activity sector; we do not intend to infer causal relations from the present analysis. As the firms' age, size, and economic activity sector are rarely changing variables¹², in the sense that their variance is mostly between firms, rather than changes in the same firm across time, a two-step approach was used to estimate the effect of those characteristics on the firms' structural level of the financial ratios under analysis.

In the first step, we obtain the firm fixed effects θ_i which capture the heterogeneity of the ratios under analysis arising from the firms' permanent characteristics, using a fixed effects model, as presented in equation (1):

$$y_{it} = \alpha + \sum_{m=1}^M \beta_m x_{m,it} + \theta_i + \delta_t + u_{it} \quad (1)$$

The dependent variable y_{it} assumes three different outcomes: the capital ratio, the bank loans to liabilities ratio, and the commercial gap ratio of firm i in year t . We include a set of regressors X to control for the firms' financial situation, accounting for the firms' economic activity, profitability, liquidity, operating cycle, cost of debt, and financial pressure. In equation (1), $x_{m,it}$ is the regressor m for firm i in year t , and β_m is the corresponding coefficient. As

12. A variable is rarely changing if the within variance is very low, compared to the between and overall variance. Table 1, presented in the Appendix, provides the between, within, and overall standard deviations for all the variables considered in the analysis.

the component $\sum_{m=1}^M \beta_m x_{m,it}$ is included for control purposes only, we will not analyze the estimates of these coefficients¹³. We also include time fixed effects δ_t to capture the effect of the macroeconomic environment on these ratios.

In the second step, an OLS estimator is used to decompose δ_i into the part explained by age, size and economic activity sector, and the unobserved component. As these variables are not strictly time-invariant, this estimation was performed using a representative value for each firm. Therefore, S_{ki} is the mode of the sector dummy for firm i , age_i and $size_i$ are, respectively, the average values for age and total assets for firm i over the sampling period.

In this step, two alternative formulations were considered: the linear-log model presented in equation (2) and the quadratic model presented in equation (3)¹⁴:

$$\hat{\theta}_i = \gamma_0 + \sum_{k=1}^9 \gamma_{ki} S_{ki} + \gamma_{10} \ln(age_i) + \gamma_{11} \ln(size_i) + \varepsilon_i \quad (2)$$

$$\hat{\theta}_i = \gamma_0 + \sum_{k=1}^9 \gamma_{ki} S_{ki} + \gamma_{10} age_i + \gamma_{11} age_i^2 + \gamma_{12} size_i + \gamma_{13} size_i^2 + \varepsilon_i \quad (3)$$

The purpose of these alternatives is to test the monotonicity of the effect of size and age on the firm fixed effects. The first specification includes the logarithms of age and total assets, assuming that the effect of these variables is always positive or negative, even though marginally decreasing when age or size increases. The second specification considers a quadratic relationship between age or total assets and the ratios under analysis; this corresponds to the hypothesis that as age or size increases, the relation between these variables and the dependent variable reverts at some point. The AIC was used to choose one of the formulations.

Empirical results and discussion. The detailed estimation outputs are presented in Tables 2, 3 and 4 in the Appendix. In each one of those tables, column (1) provides the results for equation (1), column (2) provides the results for the second step presented in equations (2) or (3), and column (3) presents the results of the pooled OLS estimator.

The estimates are overall statistically significant at 1% significance level. The results point to a linear-log relation in the case of the capital ratio and

13. All of the models were also estimated excluding these additional regressors. The results are virtually the same.

14. As the objective is to have a continuous relationship with age and size, the previous classes were replaced by continuous variables.

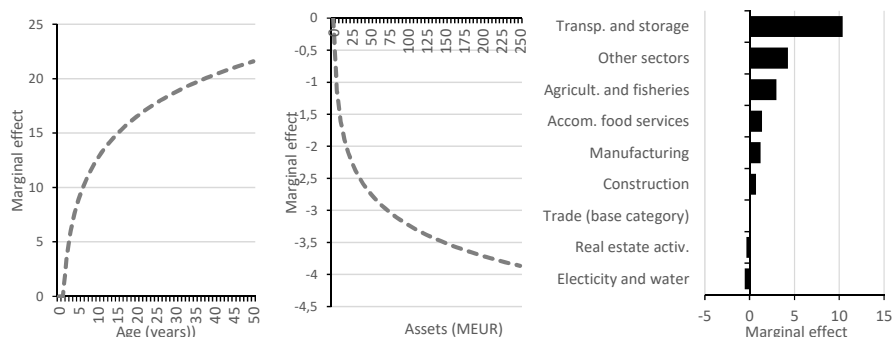


FIGURE 7: Capital ratio: marginal effect of age, size and sector of economic activity on the firm fixed effects

Note: Results from column (2) of Table 2 in Appendix.

the commercial gap ratio models (as described in equation (2)). In the bank loans to liabilities ratio model we find a quadratic relation (as described in equation (3)). Figures 7, 8, and 9 synthetize the main results for the coefficients presented in column (2) of Tables 2, 3 and 4.

In what concerns the capital ratio, presented in Figure 7, we find a positive relation between the firms' fixed effect and age, which is stronger for younger firms; the marginal effect decreases for older firms. This effect is, on average, 13 pp higher in a firm that has been active for 10 years than in a startup, but the expected difference between a firm active for 20 years and a firm active for 10 years is only 4 pp. This positive relation between age and the firm fixed effects for the capital ratio is consistent with the hypothesis that firms prefer equity to external funding and retain earnings throughout their lifecycle to accumulate own funds. Additionally, this results suggest that firms with a higher capital ratio have higher survival rates.

The relation between the firm fixed effect and size is estimated to be negative. The results suggest that a firm with the same age, the same financial situation, and operating in the same economic activity sector, is expected to have less equity as size increases. The marginal effect is more pronounced for smaller than for larger firms.

The estimated coefficients on sectorial differences point out a higher proportion of equity in the funding structure of transportation and storage firms, when compared to firms in the remaining economic activity sectors. In contrast, firms operating in the real estate activities and electricity and water resort more to external debt for funding, on average. In the accommodation and food services activities, the average capital ratio stands in a middle position when compared with other activities; this may be related to the

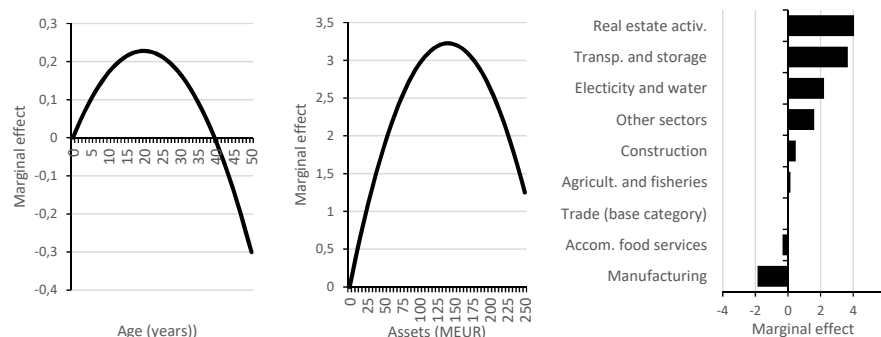


FIGURE 8: Bank loans to liabilities ratio: marginal effect of age, size and sector of economic activity on the firm fixed effects

Note: Results from column (2) of Table 3 in Appendix.

exclusion of firms with negative equity when estimating the model, affecting more than half of firms of this sector.

The results for the bank loans to liabilities ratio presented in Figure 8 suggest that the firm fixed effects for this ratio are estimated to be higher to older and bigger firms but decrease from some intermediate value onwards, suggesting higher values for the bank loans to liabilities ratio in the intermediate classes of size and age. Moreover, the firm fixed effects are expected to be higher for firms active for around 20 years. Very mature firms (active for more than 40 years) are estimated to have a smaller fixed effect than startups with similar characteristics.

The firm fixed effects for the bank loans to liabilities ratio increases with firms' size. For the largest firms, this relation becomes negative. This is consistent with the fact that bank loans weight less on the funding structure of both smaller and larger firms, as presented in Figure 5.

The estimated differences in the firm fixed effects for the bank loans to liabilities ratio arising from the sector of economic activity may reach 6 pp. In the manufacturing sector, the firm fixed effect is lower than in the remaining activities, on average, while in real estate activities and in transportation and storage sectors the firm fixed effects are expected to be higher.

The estimation results regarding the commercial gap ratio are presented in Figure 9. The firm fixed effects for the commercial gap ratio in the accommodation and food services sector are higher on average than in the remaining activities. In contrast, transportation and storage, electricity and water and manufacturing are the economic activities that present the lowest firm fixed effects. The firm fixed effects for this ratio increase with firms' size, suggesting a higher market power of larger firms when dealing with suppliers

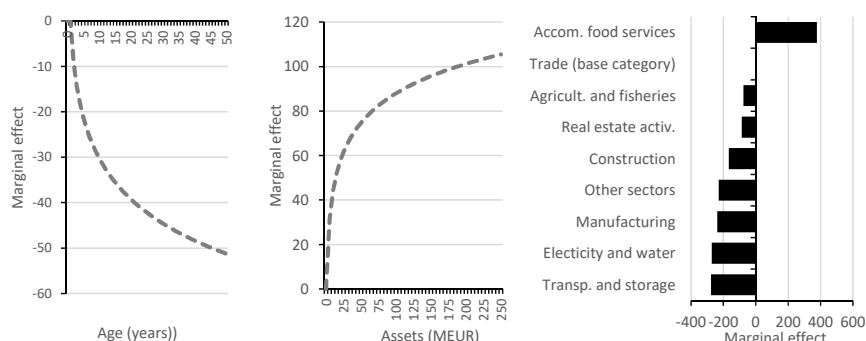


FIGURE 9: Commercial gap ratio: marginal effect of age, size and sector of economic activity on the firm fixed effect

Note: Results from column (2) of Table 4 in Appendix.

and customers. The importance of the commercial gap ratio also appears to be higher for younger firms. This can be related to the fact that startups may resort more to trade credits to increase their funding.

Conclusions

From the Great Recession emerged an environment more uncertain, complex and dynamic, explaining the increasing attention to the study of the firms' vulnerability to future macroeconomic shocks. During the most recent period, the Portuguese firms' financial position has been improving. Nevertheless, Portuguese firms still present lower levels of equity, higher shares of bank loans and some short-time liquidity constraints, as trade credits obtained from their suppliers are, in general, insufficient to cover the credits granted to costumers.

In this paper, we argue that the financial indicators that are commonly used to characterize the firms' financial situation depend on firms' structural characteristics. Resorting to three financial ratios, covering the use of own funds, bank loans, and trade credits and debts, we find significant differences according to the firms' size, age and sector.

The results point out that younger firms tend to have lower levels of both capital ratio and bank loans to liabilities ratio. The proportion of intra-group financing and shareholders in the firms' total liabilities is higher for younger firms. These firms also have a higher commercial gap ratio. The results suggest that as firms age, equity increases (mainly due to retained earnings), as well as the use of financial debt. In the intermediate age classes, firms rely more substantially on bank loans for external funding, while more mature firms

have other alternatives of funding, such as debt securities. The estimates for the firm fixed effects of the bank loans over liabilities ratio is consistent with this result.

In what concerns the firm's size, the capital ratio is higher for smaller firms. The results also suggest that small firms rely less on banks for external funding, and have a smaller commercial gap ratio. As firms' size increase, firms resort more to external debt. While small and medium-sized firms have a higher proportion of bank loans in their liabilities' structure, large firms obtain a relevant proportion of debt from alternative sources such as debt securities and intra-group financing. The commercial gap ratio is also higher for larger firms on average, as they have more negotiating power vis-à-vis customers and suppliers.

The economic activity sector also plays an important role when analyzing these financial indicators. It is crucial to consider the heterogeneity underlying the sectors of economic activity to understand these indicators. Firms in the transportation and storage activities resort more to equity, and firms in the accommodation and food services activities are able to obtain funding through trade creditors, while in the remaining activities net trade credits give a negative contribute to short-term funding. The bank loans to liabilities ratio is also considerably heterogeneous across sectors of economic activity. Firms in the transportation and storage and in the real estate activities show a higher ratio than firms in the remaining activities.

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Appendix

Variable	Description	Mean	Std. Dev	Std. Dev / Overall Std. Dev (%)	
Variables included in the set of regressors X					
Capital ratio	Equity / total assets	33.6	overall	22.0	100%
			between	21.6	98%
			within	9.8	45%
Commercial gap ratio	Trade creditors / trade debtors	209.8	overall	752.8	100%
			between	820.3	109%
			within	457.2	61%
Bank loans over liabilities	Bank loans / liabilities	30.8	overall	24.3	100%
			between	22.2	91%
			within	13.6	56%
Bank loans over liabilities (only positive values)	Bank loans / liabilities (if bank loans > 0)	33.3	overall	23.6	100%
			between	21.4	91%
			within	13.3	56%
EBITDA over financial debt	EBITDA / financial debt	135.9	overall	469.5	100%
			between	466.8	99%
			within	339.9	72%
Financial pressure	EBITDA / interest paid	21435.1	overall	198779.0	100%
			between	235057.2	118%
			within	141060.5	71%
Cost of debt	Interest paid / financial debt	8.1	overall	13.3	100%
			between	11.9	90%
			within	10.0	75%
Gross margin	EBITDA / income	9.8	overall	24.6	100%
			between	26.2	106%
			within	16.3	66%
Assets turnover	Total assets / turnover	194.7	overall	439.5	100%
			between	514.1	117%
			within	226.6	52%
Current liabilities over assets	Current liabilities / total assets	47.7	overall	25.1	100%
			between	24.1	96%
			within	14.3	57%
Cash and deposits over assets	Cash and deposits / total assets	11.8	overall	15.5	100%
			between	15.6	100%
			within	8.1	52%
Days accounts payables	Trade creditors * 365 / (Purchases and services and external supplies)	133.2	overall	356.9	100%
			between	370.9	104%
			within	235.8	66%
Days accounts payables	Trade creditors * 365 / (Purchases and services and external supplies)	133.4	overall	166.3	100%
			between	156.5	94%
			within	97.4	59%
Inventory turnover	Inventories / (Purchases and services and external supplies)	258.7	overall	1775.0	100%
			between	2154.1	121%
			within	970.0	55%
Fiscal benefits of debt	Amortizations and depreciations / EBITDA	35.1	overall	66.9	100%
			between	51.9	78%
			within	54.5	81%
Collateral	Tangible fixed assets / total assets	25.6	overall	23.6	100%
			between	23.1	98%
			within	8.6	37%
Continuous variables included in the set of regressors Z					
Age	Number of years of activity	14.6	overall	12.2	100%
			between	11.5	94%
			within	2.4	20%
Total assets	Total assets in million euros	3.3	overall	90.2	100%
			between	60.5	67%
			within	19.9	22%
Nº observations				938,513	
Nº of units				208,370	
Average nº of years per unit				4.50	

FIGURE A.1: Characterization of the dependent and independent variables

VARIABLES	Step 1 - Fixed effects estimator (1)	Step 2 - OLS on fixed effects (2)	Pooled OLS (3)
EBITDA over financial debt	0.00292*** (0.00005)		0.00637*** (0.00006)
Financial pressure	1.00e-06*** (4.31e-08)		1.05e-06*** (1.07e-07)
Cost of debt	0.0587*** (0.00143)		0.0845*** (0.00167)
Gross margin	0.0490*** (0.00116)		0.0348*** (0.00129)
Assets turnover	0.000423*** (0.00009)		-0.000147 (0.0001)
Current liabilities over assets	-0.317*** (0.00144)		-0.526*** (0.00144)
Cash and deposits over assets	0.0684*** (0.0019)		0.168*** (0.00191)
Days accounts payables	-0.00135*** (0.00008)		-0.00198*** (0.0001)
Days accounts receivables	-0.00414*** (0.00018)		0.000872*** (0.00021)
Inventory turnover	-0.0000323 (0.00002)		-0.000338*** (0.00002)
Fiscal benefits of debt	0.00164*** (0.00021)		-0.00208*** (0.00031)
Collateral	-0.110*** (0.0022)		-0.122*** (0.00171)
2007	0.643*** (0.0365)		0.434*** (0.0483)
2008	1.187*** (0.0449)		0.478*** (0.0551)
2009	1.974*** (0.0508)		0.727*** (0.0594)
2010	1.335*** (0.058)		-0.851*** (0.0643)
2011	2.472*** (0.0621)		-0.169** (0.0678)
2012	3.528*** (0.0664)		0.492*** (0.071)
2013	4.035*** (0.0699)		0.107 (0.0728)
2014	4.361*** (0.074)		-0.903*** (0.0757)
2015	5.420*** (0.0772)		-0.868*** (0.0767)
2016	6.427*** (0.0803)		-0.665*** (0.0774)
Agricult. and fisheries		3.005*** (0.221)	1.686*** (0.217)
Accom. food services		1.390*** (0.252)	-0.0194 (0.269)
Construction		0.710*** (0.106)	-0.461*** (0.0986)
Electricity and water		-0.537 (0.497)	-3.806*** (0.537)
Real estate activ.		-0.368 (0.237)	-2.226*** (0.253)
Manufacturing		1.230*** (0.0986)	0.470*** (0.0925)
Other sectors		4.295*** (0.1)	1.244*** (0.095)
Transp. and storage		10.39*** (0.174)	5.525*** (0.152)
ln(age)		5.519*** (0.0393)	4.049*** (0.0356)
ln(total assets)		-0.701*** (0.0265)	-0.105*** (0.0258)
Constant	47.09*** (0.124)	-16.81*** (0.117)	48.24*** (0.179)
Observations	938,513	207,651	938,420
R-squared	0.322	0.114	0.498

Standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURE A.2: Estimation outputs for the capital ratio model

VARIABLES	Step 1 - Fixed effects estimator (1)	Step 2 - OLS on fixed effects (2)	Pooled OLS (3)
EBITDA over financial debt	-0.00640*** (0.00008)		-0.0116*** (0.00008)
Financial pressure	-3.33e-06*** (3.38e-06)		-7.00e-06*** (1.90e-07)
Cost of debt	-0.265*** (0.00245)		-0.213*** (0.00194)
Gross margin	0.0101*** (0.00137)		0.0604*** (0.00181)
Assets turnover	0.000361*** (0.00012)		0.000411*** (0.00013)
Current liabilities over assets	-0.204*** (0.00181)		-0.249*** (0.00176)
Cash and deposits over assets	-0.00879*** (0.00272)		-0.0409*** (0.00263)
Days accounts payables	-0.00311*** (0.00014)		-0.00385*** (0.00015)
Days accounts receivables	-0.00330*** (0.00026)		-0.00572*** (0.00028)
Inventory turnover	6.44e-05** (0.00003)		0.000352*** (0.00003)
Fiscal benefits of debt	-0.000969*** (0.0003)		-0.00850*** (0.00042)
Collateral	0.190*** (0.00319)		0.143*** (0.0022)
2007	1.020*** (0.0599)		1.039*** (0.0692)
2008	1.477*** (0.0729)		1.464*** (0.0805)
2009	2.399*** (0.0813)		2.239*** (0.0864)
2010	4.542*** (0.0895)		2.779*** (0.0904)
2011	2.299*** (0.095)		0.494*** (0.0952)
2012	1.608*** (0.1)		-0.00833 (0.0999)
2013	1.451*** (0.104)		-0.00515 (0.102)
2014	1.656*** (0.108)		0.375*** (0.104)
2015	2.264*** (0.112)		0.866*** (0.106)
2016	1.823*** (0.115)		0.434*** (0.106)
Agricult. and fisheries		0.157 (0.293)	0.334 (0.304)
Accom. food services		-0.332 (0.326)	0.646* (0.35)
Construction		0.479*** (0.14)	-0.832*** (0.138)
Electricity and water		2.214*** (0.643)	2.358*** (0.614)
Real estate activ.		4.056*** (0.316)	1.733*** (0.328)
Manufacturing		-1.860*** (0.124)	-1.116*** (0.129)
Other sectors		1.611*** (0.122)	2.018*** (0.129)
Transp. and storage		3.677*** (0.199)	3.302*** (0.193)
Age		0.0234*** (0.00783)	-0.00588 (0.00797)
Age^2		-0.000580*** (0.00013)	-0.000203 (0.00014)
Total assets		0.0468*** (0.00948)	0.0273*** (0.00921)
Total assets^2		-0.000164*** (0.00002)	-0.000148*** (0.00002)
Constant	40.19*** (0.171)	-0.878*** (0.11)	45.09*** (0.195)
Observations	866,344	180,110	866,265
R-squared	0.176	0.007	0.224

Standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURE A.3: Estimation outputs for the bank loans to liabilities ratio model

VARIABLES	Step 1 - Fixed effects estimator (1)	Step 2 – OLS on fixed effects (2)	Pooled OLS (3)
EBITDA over financial debt	-0.00531*** (0.00175)		-0.0121*** (0.00189)
Financial pressure	1.07e-05** (0.00001)		1.21e-05** (0)
Cost of debt	0.111* (0.0591)		-0.292*** (0.0653)
Gross margin	-0.558*** (0.0545)		-0.908*** (0.0529)
Assets turnover	0.0728*** (0.00601)		0.115*** (0.00423)
Current liabilities over assets	1.331*** (0.0525)		1.633*** (0.0496)
Cash and deposits over assets	1.509*** (0.092)		0.822*** (0.0879)
Days accounts payables	0.139*** (0.00663)		0.256*** (0.00836)
Days accounts receivables	-0.464*** (0.00872)		-0.885*** (0.0101)
Inventory turnover	-0.0128*** (0.00119)		0.00243*** (0.00094)
Fiscal benefits of debt	-0.0357*** (0.011)		-0.109*** (0.0141)
Colateral	0.801*** (0.0928)		0.793*** (0.0706)
2007	3.135 (2.646)		-0.251 (3.152)
2008	-3.218 (2.779)		-5.109 (3.264)
2009	-9.800*** (2.857)		-8.670*** (3.316)
2010	-1.584 (2.944)		-2.691 (3.356)
2011	4.421 (3.079)		3.136 (3.459)
2012	3.222 (3.194)		-2.317 (3.51)
2013	4.558 (3.307)		-1.375 (3.601)
2014	0.356 (3.373)		-7.062** (3.588)
2015	-0.273 (3.49)		-4.662 (3.635)
2016	-7.702** (3.531)		-5.288 (3.611)
Agricult. and fisheries		-76.49*** (10.75)	-18.98** (7.504)
Accom. food services		377.7*** (21.89)	275.7*** (17.25)
Construction		-167.8*** (5.684)	-111.2*** (3.605)
Electricity and water		-271.0*** (13.79)	-163.5*** (10.31)
Real estate activ.		-86.05*** (11.41)	-93.99*** (9.094)
Manufacturing		-238.6*** (4.838)	-159.7*** (3.329)
Other sectors		-229.2*** (4.96)	-146.3*** (3.508)
Transp. and storage		-276.8*** (5.389)	-174.5*** (3.656)
ln(age)		-13.18*** (2.149)	-4.095*** (1.471)
ln(total assets)		19.10*** (1.338)	3.573*** (0.959)
Constant	147.4*** (5.136)	234.5*** (7.332)	279.4*** (6.567)
Observations	938,513	207,651	938,420
R-squared	0.015	0.029	0.067

Standard errors clustered by firm in parentheses. *** p<0.01, ** p<0.05, * p<0.1

FIGURE A.4: Estimation outputs for the commercial gap ratio model

Borrowing constraints and firm dynamics

Sónia Félix
Banco de Portugal

July 2018

Abstract

What is the impact of credit market frictions on firm dynamics? In this paper we investigate the role of partial credit constraints on the firm's investment and probability of survival. We consider the probability of credit rationing estimated using a disequilibrium model to identify SMEs that were affected by borrowing constraints in the period between 2010 and 2012. We find that firms that were estimated to have been partially credit constrained in this period have lower contemporaneous probability of survival and invest less, *ceteris paribus*. (JEL: C41, D22, G21, G33)

That said, credit conditions remain very heterogeneous across countries and sectors. According to the latest ECB survey on credit access by small- and medium-sized enterprises (SMEs), supply constraints remain especially strong for SMEs in stressed countries. The percentage of financially constrained but viable SMEs – i.e. those with positive turnover in the last six months seeking a bank loan – varies from a minimum of 1% in Germany and Austria to a quarter of the total population in Spain and as much as a third in Portugal.

by Mario Draghi, ECB Forum on Central Banking, 2014

Introduction

Borrowing constraints have important implications for firm dynamics. Firms may be forced to operate at a smaller scale than desired, may forgo investment opportunities, and may not be able to overcome temporary liquidity needs in the presence of negative shocks. While the heterogeneity underlying firm dynamics is not yet fully understood, it is well established that firm dynamics are an important determinant of aggregate outcomes (Hopenhayn and Rogerson (1993), Melitz (2003), and Klette and Kortum (2004)).

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E-mail: scfelix@bportugal.pt

The theoretical literature has emphasized the role of financing constraints in explaining firm dynamics, namely the firm's investment and exit decisions. Fazzari *et al.* (1988) explain the behaviour of aggregate investment based on financial constraints. Albuquerque and Hopenhayn (2004) develop a theory of endogenous borrowing constraints and find that these are important determinants of firm growth and survival. Cabral and Mata (2003) find that the firm size distribution of Portuguese manufacturing firms is quite skewed to the right but evolving over time toward a more symmetric one. The explanation relies on the presence of financing constraints for young and smaller firms. Cooley and Quadrini (2001) introduce financial-market frictions in a model of industry dynamics with persistent shocks and show that the combination of these can explain the dependence of firm dynamics on size and age. Furthermore, the models of firm dynamics document that smaller firms may be more sensitive to the worsening of credit market conditions during recessions (Perez-Quiros and Timmermann (2000)) and a tightening of monetary policy (Gertler and Gilchrist (1994)).

Little empirical evidence can be found on the importance of the firm's capital structure for firm dynamics. Audretsch and Mahmood (1994) use data from the Netherlands and show that the firm and industry debt structures do not significantly influence the likelihood of new firm survival. In contrast, Mata *et al.* (2010) document that firms with a higher share of long-term debt survive more. Farinha *et al.* (2018) establish this argument with respect to new firms. Farinha and Prego (2013) show that the firms' investment decisions are correlated with the firms' financial standing. Recently, Carreira and Teixeira (2016) use firm-level data for Portugal and show that credit market conditions in the period between 2004 and 2012 explain firm exit, especially in the case of large firms, and employment change.

Portuguese small and medium-sized enterprises (SMEs) were substantially affected by credit constraints during the economic and financial crisis. Farinha and Félix (2015) estimate a disequilibrium model for the period between 2010 and 2012 and document that approximately 15 percent of Portuguese SMEs were partially credit constrained. In particular, the smaller and the younger firms were the most credit constrained in this period. Moreover, the authors estimate that in this period Portuguese SMEs searched for bank loans mainly to finance their operational activity and not for investment. The smaller firms and those with smaller amounts of internal resources are estimated to have higher demand for bank loans. In turn, firms with a higher capacity to generate cash-flows and pay their debt and with more assets to pledge as collateral are estimated to borrow more from banks.

In this study we present a very simple empirical model to investigate the impact of borrowing constraints on the firm's investment and exit decisions. We proceed with the analysis in two steps: first, we pick the credit demand and credit supply estimates of the credit disequilibrium model estimated in Farinha and Félix (2015), to determine the probability of credit rationing

and to identify which firms were partially credit constrained in the period between 2010 and 2012; and second, we estimate how firm's investment and exit probability responded to the firm's credit conditions.

The results suggest that financial-market frictions are important to explain the firm's investment and probability of survival. Firms that were estimated to have been partially credit constrained in the period between 2010 and 2012 are less likely to survive, *ceteris paribus*. The estimates also suggest that firm's investment is negatively correlated with the presence of financing constraints. Overall, these results suggest that financing constraints played a role in explaining firm dynamics in this period.

The paper proceeds as follows. In the next section we present the data. Section 3 presents the empirical methodology and discusses the results. Section 4 concludes.

Data description

The variables included in the analysis were computed using the Portuguese dataset Simplified Corporate Information - IES - which consists of detailed balance sheet data and covers the population of virtually all Portuguese nonfinancial corporations. In the estimation of the disequilibrium model, Farinha and Félix (2015) consider a sample of Portuguese SMEs in the period between 2005 to 2012. Nevertheless, the relevant period for the estimation starts in 2010 because it is imposed in the estimation that firms stay at least for four consecutive years in the sample.¹

The estimation of the credit disequilibrium model allows us to identify which firms were credit constrained. The disequilibrium model is comprised of three equations: one equation for the demand of new loans, one equation for the supply of new loans, and one equation that links the observed quantity of credit with the unobservable credit demand and supply. Loan demand is assumed to depend on the firm's economic activity, availability of substitute (internal and external) funds, and the cost of bank credit. Loan supply is assumed to be determined by a set of variables that measure the firm-specific credit risk and firm collateral.² The formal details of the model and a description of the determinants of the demand and supply of new loans are presented in Farinha and Félix (2015). Based on these estimates it is possible to identify the firms that were granted a new loan in the period between 2010

1. Moreover, the authors also consider the Rivers and Vuong (1988) estimation strategy to deal with the endogeneity problems raised by some variables and consider the first differences of the explanatory variables lagged one and two periods as instruments of the endogenous variables.

2. The estimation of the credit disequilibrium model relies on firm balance sheet data and, therefore, the authors do not account for bank-specific characteristics in the specification of the credit supply function.

and 2012 but in a lower amount than they had applied for, which we call partially credit rationed firms. It is important to consider the fact that the obtained results on borrowing constraints are conditional on the estimated model and the time period under analysis.

A firm exit in year t is defined by its absence from the IES in that year, provided that this absence does not constitute a reporting gap.³ We follow Farinha and Prego (2013) and define the firm's investment rate as the ratio between the change from year $t-1$ to year t in net fixed assets, i.e. not adjusted for depreciations, and total assets. Observations below the 1st and above the 99th percentiles of the investment rate distribution were not considered in the analysis in order to avoid extreme values.

We end up with a sample of 51,872 observations in the period between 2010 and 2012. The main descriptive statistics of the variables considered in the estimated models are presented in Table 1.

	Mean	St. dev.	Q1	Q2	Q3
Investment rate	-0.012	0.091	-0.039	-0.014	0.005
Probability of partial rationing	0.218	0.250	0.018	0.119	0.330
Exit	0.025				
Very small firms	0.573				
Small firms	0.356				
Medium firms	0.071				

TABLE 1. Main descriptive statistics.

Number of observations: 51,872 (17,037 firms in 2010, 17,713 firms in 2011, and 17,122 firms in 2012). The average number of observations per firm in the sample is approximately 2.37. Q1, Q2, and Q3 correspond to the first, second (median), and third quartiles of the investment rate and probability of partial credit rationing distributions. Exit, very small firms, small firms, and medium firms are dummy variables and, therefore, the mean corresponds to the fraction of firms in the sample.

Empirical methodology and results

Empirical methodology

In this study we consider the probability of partial credit rationing calculated in Farinha and Félix (2015) to determine which firms were credit constrained in the period between 2010 and 2012. Then, to assess the importance of borrowing constraints on the firm's investment and likelihood of survival we consider the following baseline equation:

3. We considered IES data until 2014 to identify a firm exit.

$$y_{it} = \beta_0 + \alpha_i + \delta_s + \lambda_t + \beta_1 \text{BorrowingConstraints}_{it} + \beta_2 \text{Size}_{it} + u_{it}, \quad (1)$$

where y_{it} assumes two outcomes: exit and investment rate of firm i in year t . We consider two different specifications of the variable *BorrowingConstraints*: the probability of partial credit rationing as estimated in Farinha and Félix (2015), and a dummy variable that equals one whenever the probability that the latent credit demand is higher than the supply of credit exceeds 0.5, and zero otherwise (*Partial rationing*).⁴ *Size* is a categorical variable for firm size with categories very small, small, and medium-sized firms.⁵ The terms δ_s and λ_t denote a set of sector of economic activity and time fixed effects, respectively. Sector of economic activity fixed effects account for time-invariant specific (observed and unobserved) sectoral characteristics and time fixed effects capture the cyclical position of the economy. The term α_i denotes a vector of firm fixed effects that account for firm (observed and unobserved) time-invariant heterogeneity. Firm fixed effects are only included in the investment specification because of the single failure per firm data that would lead to the inconsistency of the fixed effects in the exit model.

The investment model is estimated by ordinary least squares and the exit model is estimated using the complementary log-log estimator, which is suitable to deal with transition discrete data, namely the estimation of the probability of firm exit at a certain moment conditional on having survived until that moment.⁶ The logarithm of duration is included in the exit model in order to account for duration dependence, i.e. how the hazard rate varies with survival times.

Results

The estimation results of equation (1) are reported in Table 2. According to the estimates presented in column (1), borrowing constraints played a role in explaining investment dynamics in this period. The results suggest that a one standard deviation increase in the probability of being credit constrained contributes to decrease the investment rate by 1.6 percentage

4. We follow the work conducted in Farinha and Félix (2015) and consider 0.5 as the threshold to identify partially credit constrained firms. In the original work, the authors considered different thresholds in a reasonable neighborhood of 0.5 and the results on credit rationing are qualitatively the same.

5. The classification of firms according to size follows the European classification of SMEs.

6. The complementary log-log model (cloglog) arises as a suitable estimator for discrete duration data in which only two outcomes are possible in each time interval - the firm either exits the market or continues operating - and has the advantage of allowing a neat interpretation of the estimates in terms of the hazard ratio. An alternative model to deal with discrete-time transition data is the logit model. The estimation of the exit specification using the logit model yields very similar average marginal effects to those obtained with the cloglog model.

points. Furthermore, according to the estimates presented in column (2), the investment rate of SMEs that were estimated to have been partially credit constrained is on average 2.7 percentage points lower than that of their counterparts, *ceteris paribus*. In the sampling period, the average investment rate equals -1.2 percent.

	Investment		Exit	
	(1)	(2)	(3)	(4)
Probability of partial rationing	-0.0642*** (0.0040)		1.3443*** (0.1352)	
Partial Rationing		-0.0273*** (0.0018)		0.6432*** (0.0868)
In time			-0.1842** (0.0880)	-0.1886** (0.0882)
Firm size dummies	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	No	No
Economic activity sector fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Number of firms	25,763		25,758	
Number of observations	51,872		51,834	

TABLE 2. The impact of financing constraints on the firm's investment and likelihood of survival.

The dependent variable in columns (1) and (2) is the firm's investment rate and in columns (3) and (4) is firm exit. All specifications include sector of economic activity and time fixed effects. Firm fixed effects are included in the investment specifications presented in columns (1) and (2). Ordinary least squares estimates presented in columns (1) and (2), and complementary log-log estimates reported in columns (3) and (4). The logarithm of duration is included in the exit model specifications in order to account for duration dependence. Robust standard errors clustered at the firm level in parentheses. *** and ** denote statistical significance at 1 and 5 percent, respectively.

The estimates reported in columns (3) and (4) suggest that financing constraints are important to explain the probability of survival of Portuguese SMEs. In particular, the estimated average marginal effect after fitting a complementary log-log model equals 0.034⁷, which implies that the higher the probability of being affected by borrowing constraints the higher the likelihood of firm exit. Moreover, according to the estimates reported in column (4), firms that were estimated to have been partially credit constrained in the period between 2010 and 2012 are on average 1.61 percentage points less likely to survive, *ceteris paribus*. The average exit rate for the firms in the sample in this period is approximately 2.5 percent and therefore this estimate implies that credit constrained firms are on average 64 percent less likely to

7. In the complementary log-log model, the probability of exit is given by $\Pr[exit = 1|x] = 1 - \exp[-\exp(x'\beta)]$ and, therefore, the marginal effect depends on the values of the estimated coefficients and the values of the explanatory variables. In this study we consider the average marginal effect.

survive than their counterparts. The duration dependence term is estimated to be negative in both columns (3) and (4), which suggests that the probability of firm exit decreases with time.

Overall, these results suggest that financing constraints are important to explain market dynamics, namely investment and exit decisions, in the period between 2010 and 2012.

Summing up

Farinha and Félix (2015) estimate that a substantial fraction of Portuguese SMEs were affected by borrowing constraints in the period between 2010 and 2012. The authors consider a credit disequilibrium model to estimate the probability that the firm's latent credit demand is higher than credit supply, conditional on the observed amount of bank loans.

It is well established in the firm dynamics literature that financing constraints are an important determinant of firm growth and survival. This study contributes to the empirical literature on borrowing constraints and firm dynamics by analyzing the investment behaviour and exit decisions of Portuguese SMEs that were estimated to have been partially credit rationed in those years. Bank loans are a significant source of funding for Portuguese SMEs and, therefore, a credit market tightening may have important implications for firm dynamics. The results suggest that credit constrained firms are significantly less likely to survive than their counterparts. Moreover, it is estimated that in this period firm's investment is negatively correlated with the presence of financing frictions in the credit market.

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