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International trade has contributed to improving the living conditions of the populations. Its features, however, have been changing towards a higher degree of heterogeneity among the firms involved. The increasing complexity of the participation in trade, the capital participations between the firms involved, the characteristics of the firms that trade services, and the way firms perceive barriers to internationalisation are some of the reasons behind this heterogeneity. What does the data on Portugal tell us? Portuguese firms that combine different trade flows, in particular services, perform better than those who don't. There is a predominance of capital participation in firms that are involved in more complex trade flows. Nearly half of the traders of non-tourism services are engaged in both exports and imports, with a high concentration of this type of trade in a small number of firms. And, finally, the aspects that stand out regarding barriers to internationalisation, as perceived by the Portuguese firms involved, are not directly connected to exports and imports.

Features of Portuguese International Trade

A Firm-Level Perspective

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Introduction

International trade is one of the main dimensions of economic activity across countries, generating important welfare gains. International trade plays a central role in the Portuguese economy, with exports and imports accounting for around 44 and 43 per cent of gross domestic product (GDP) in 2018. The weight of trade in Portuguese economic activity, as a whole, has increased consistently since the 1960s and has risen markedly in the last decade. These developments have contributed to economic growth and the correction of the serious macroeconomic imbalances that led to the 2011-2014 economic and financial assistance programme.

The profile of international trade has changed over time. In essence, new types of exchanges have been added to previously existing ones. Initially, exchanges were dominated by the so-called interindustry trade, in which countries trade products of different types. Later on, intra-industry trade, in which countries exchange different varieties of the same product, gained relevance. More recently, a significant part of international trade became related to the international fragmentation of production and global value chains. Its importance has steadily increased in recent decades, and it is currently estimated that around 60 per cent of global trade corresponds to intermediate goods and services incorporated in different stages of the production chain.

Another important development in international trade was the increase in the share of services. The classic paradigm was based on the notion that services were essentially non-tradable internationally, as opposed to goods produced by different industries, which were considered tradable and, therefore, subject to international competition. At present, this distinction is still broadly valid, but the boundary between the two categories has clearly shifted towards considering more services as tradable. Sectors such as transport, communications and tourism have long had relevant participation in international transactions, but sectors such as financial services, computer, communication and other services provided to companies have gained significant importance in international trade. This process is expected to continue in the coming decades as a result of the accelerated development of technologies that facilitate the remote provision of services, such as automatic translation, virtual reality and other artificial intelligence tools. This will tend to increase competition in segments of the labour market previously protected from international competition, with the potential to generate profound discontent and social tensions. Competition from abroad will be amplified by the use of artificial intelligence in tasks currently performed by workers in the services sector, particularly those who perform repetitive tasks.

The discussion on the policies to adopt in the international trade area, notably from the firms' perspective, is extensive and complex. However, survey data makes it possible to assess the perception of firms regarding the barriers they face in the internationalisation process. These barriers are part of the so-called regulatory costs and are often related to administrative and procedural measures, rather than non-tariff measures.

As for the methodological dimension of research in international trade, there have also been important changes in recent decades. Economic theory has undergone a significant transformation in the late 1980s and traditional aggregate or sectoral analyses have been bypassed in favour of microeconomic approaches. The perspective that economic reality results from the actions of individual agents, typically very different and subject to different shocks, quickly gained ground. In fact, the increasing availability of microeconomic information, both at the firm level and at the level of transactions in international trade, has allowed for more in-depth analysis and identification of important structural stylized facts.

This research project is composed of three blocks, all of which using business data from Portuguese international traders. The first block presents a **taxonomy of participants in the international trade of goods and services**, highlighting the different layers of complexity and the characteristics of the firms operating in each of them. We further study the importance of the existing capital participations between firms in different categories, to assess their substitutability with trade. We conclude that more complex international traders tend to be larger, younger, more productive and pay higher wages. However, their profitability is not explicitly different from that of other traders. Moreover, evidence on capital linkages between different types of traders suggests that minor traders do not compensate for their low engagement in foreign markets through strong capital participations with other types of traders. Conversely, complex traders present strong capital linkages, thus combining two layers of complexity. In addition, the existence of many external capital participations, for more complex traders, is associated with labour productivity gains. The second block of the project relates to **exporters and importers of non-tourism services**, focusing on their heterogeneity. We confirm most of the evidence on international service traders observed for other countries, namely the strong heterogeneity of the firms in the type of services traded and the concentration of trade flows between and within firms. Two-way traders with diversified service and geographical portfolios, in particular, account for a large proportion of Portuguese import and export of services. Besides, two-way traders tend to be larger, older, more productive and more profitable than one-way traders. We also unveil new evidence on the bi-modality of the distributions of export intensities, common to both types of traders and firms of different size, class and age groups. Drawing on the detailed data, we consider two extensive margins of firm-level trade (number of trading partners and number of services traded) and an intensive margin (trade per country-service type combination). We show that the intensive margin of firm-level trade is more important than the extensive margins to explain the differences in traded values among Portuguese service traders, both for exports and imports. Moreover, larger and more productive firms have higher values of service exports and imports, they trade more per country and type of service, and they trade more types of services with more countries. Most of the correlations between firm productivity, profitability and size, on the one hand, and firm-level trade flows, on the other, are explained by the intensive margin of firm-level trade.

The third block analyses the relevance of the **barriers to interna-tionalisation faced by Portuguese firms** in connection with their performance in terms of export intensity and productivity. We use a representative micro-level database from a survey on Portuguese firms' perceptions of the regulatory framework in 2014 (Inquérito aos Custos de Contexto — IaCC), along with a balance sheet data. Although no causality is established, we find several statistically signi-ficant relations between the firms' performance and their assessment of regulatory costs. Regarding productivity, only obstacles related to "human resources" are identified as having a significant negative relationship both in terms of the importance of the barrier for the type of activity performed by the firm and the actual level of the barrier. The same result is observed in export intensity for obstacles related with the "judicial system". When examining the "barriers to internationalisation" in more detail, we find that considering these costs important to a firm's activity tends to be associated with lower productivity and higher export intensity.

I.

Types of International Traders and the Network of Capital Participations

Abstract

The landscape of international traders is quite diverse. Firms can operate as exporters and importers, and also in the goods and services dimensions. Some firms engage strongly in several of these international trade flows, some only participate in one kind of trade flow, and for other firms, trade flows are just a small share of their turnover. In this paper, we suggest a taxonomy that classifies international traders by the complexity of their participation in international trade. In addition, we study the linkages between different types of traders and build the network of their capital participations. This paper concludes that more complex international traders tend to be larger, younger, more productive and pay higher wages. However, their profitability is not explicitly different from that of other traders. Moreover, evidence on capital linkages between different types of traders suggests that minor traders do not compensate for their low engagement in foreign markets through strong capital participations with other types of traders. Conversely, complex traders present strong capital linkages, thus combining two layers of complexity. In addition, the existence of many external capital participations, for more complex traders, is associated with labour productivity gains.

JEL: F1, F14, L25
Keywords: Exports, Imports, Services, Goods, Capital Participations, Networks.

Section 1
Introduction

International traders are very different in terms of the complexity of their foreign activities. Firms range from minor traders, i.e., those whose exports and imports of goods and services represent a small share of their turnover, up to traders who engage strongly in exports and imports of goods and services. The second layer of complexity relates to the possibility of indirect linkages to external markets through capital participations in other traders. These two layers of complexity are not independent. Although capital participations may be driven by pure financial or speculative motives, for example, to diversify the sector-specific risk faced by the firm, it is also likely that capital participations in international traders exist as a way of complementing existing external activities. For example, a goods exporter may participate in the capital structure of a services exporter to facilitate the bundling of goods and services in foreign markets. Therefore, capital participations between international traders could be interpreted as a dimension through which firms strengthen participation in foreign markets. Alternatively, complex traders may be more prepared to engage in capital participations that leverage their overall performance.

International trade theory offers models that explain why firms participate in international trade as exporters and importers of goods and services. A broad strand of research focuses on the combination of export and import flows at the firm-level, identifying the characteristics of two-way traders along different dimensions. In parallel, research on the increasing role of services in international trade has been growing. The characteristics of services traders have been identified and compared with those of goods traders. Nevertheless, the layers of complexity that result from combining exports and imports of goods and services have not yet been fully explored in the literature.

It is also acknowledged that many firms only participate in international trade indirectly. For example, firms can supply intermediate products to exporters or, in the mirror image, buy from firms that import foreign intermediates. Although ultimately almost all firms in the economy participate in international trade through a complex domestic network of value-added flows, some of them are just one step away from different types of trade flows. Recent papers have addressed this issue using rich business-to-business databases. However, the full network of the firms internal and external connections is still virtually unknown.

Another way of identifying complementary trade relationships is through the network of capital participations between different types of international traders. The literature focusing on the mapping and on the drivers of capital participations across firms is still scarce. This research is mostly carried out in the areas of management and finance, for example, to study the investment strategies of venture capital funds. To the best of our knowledge, capital participations have not been studied within the framework of international trade, especially as an alternative dimension through which firms can strengthen their participation in foreign markets.

This paper addresses two research questions using firm-level international trade and capital participations data for Portugal in 2014 and 2015. First, we assess the extent to which different degrees of complexity in international trade participation are associated with firms' characteristics such as size, age, productivity, wages, profitability and debt. We go beyond the existing research by combining the firms' statuses in terms of exports and imports of goods and services. In this context, we suggest a taxonomy of international traders with 16 categories, where exports, imports, goods and services are combined, while also taking into account their relevance on the firms' turnover. This implies setting a threshold for the relevance of each trade flow in the firm. Secondly, we investigate the network of capital participations between the different types of international traders to assess the full extent of their participation in international markets. It is relevant to know if minor traders increase their engagement in trade by participating in the capital of more complex traders, or if the latter firms are, themselves, key players in the network of capital participations.

We observe that about one-quarter of the firms in the database are both exporters and importers of goods (two-way traders of goods). Their share in total trade is also about one quarter. However, those who add imports of services to their set of trade flows are even more relevant, representing more than one-third of international trade in the Portuguese economy. In addition, we find that more complex types of participation in international trade (e.g., exporting and importing both goods and services) are associated with traders with a larger size,

higher productivity and higher wages but not necessarily higher profitability. More complex traders are also those with stronger capital participation, which indicates that these two dimensions are complementary and not substitutes. As for the network of capital linkages between international traders, two-way traders of goods and two-way traders of services occupy a central position, i.e., they are strongly connected with other types of international traders. Nevertheless, firms that export goods and import goods and services are also very relevant in the network. Finally, we conclude that, the existence of many external capital participations, for more complex traders, is associated with labour productivity gains.

This paper is organised into six sections. Section 2 briefly overviews the literature on the characteristics of firms that engage in international trade. Section 3 briefly describes the two databases that are combined in this paper. Section 4 details the classification of the traders and compares the different characteristics of each group of firms. Section 5 maps the linkages between the classes of firms in terms of capital participation and assesses their impact on labour productivity. Finally, section 6 draws some concluding remarks.

Section 2
Literature Review

The growing availability of firm-level data on exports and imports has been feeding a broad strand of empirical literature that distinguishes between exporters, importers, two-way traders (firms that export and also import) and non-traders (firms that are only active in the domestic market). The typical approach is to analyse trade in goods and services separately, though recent papers have begun to assess the interaction of goods and services in the trade portfolios of firms.

The literature on firm-level trade in goods provides solid evidence that two-way traders outperform exporters, importers and non-traders in terms of size (turnover, employment or value added), productivity (labour productivity or TFP), capital-intensity and wage level, while exporters and importers outperform non-traders (Wagner 2012). In addition, importers are often more productive than exporters. Similar results emerge in the more recent firm-level literature on trade in services: two-way traders are larger, more productive and capital-intensive, and tend to pay higher wages, while exporters and importers outperform non-traders (see, e.g. Ariu (2016) for Belgium; Breinlich and Criscuolo (2011) for the UK; and Damijan et al. (2015) for Finland, France, Ireland and Slovenia).

Regarding trade in goods, there is evidence that the most productive firms self-select into export and import markets (Wagner 2007; Wagner 2012; ISGEP). Moreover, some papers document a positive relation between imports and productivity, although there is no evidence of the causal direction of such relationship (Castellani et al.

2010 and Muûls and Pisu 2009). As for trade in services, the literature documents a positive relationship between exports of services and productivity, as well as evidence of self-selection (Temouri et al. (2013) on France, the UK and Germany; Vogel (2011) on Germany; Kox and Rojas- Romagosa (2010) on the Netherlands; and Lööf (2010) on Sweden). There also seems to exist a positive linkage between imports of services and productivity, although the direction of such causality lacks conclusive evidence.

Another important question is whether firms increase productivity by engaging in exports and imports of goods and services, i.e. the learning-by-exporting/importing argument. On the one hand, the evidence on producers of goods becoming more productive after starting to export is mixed and inconclusive (Wagner 2012 and ISGEP). The latter paper uses comparable micro-level panel data for 14 countries to assess the linkage between exports and productivity and finds evidence in favour of self- selection, but not in favour of learning-by-exporting. On the other hand, there is evidence suggesting that the use of foreign intermediate goods increases firm productivity and, thereby, export performance (Bas and Strauss-Kahn 2014; Damijan et al. (2014); and Goldberg et al. 2010). Firms can improve their productivity by importing intermediates, as they may represent high-quality inputs not available in the domestic market (transfer of knowledge and technology), thus also allowing firms to specialize in particular stages of the value chain. Positive effects on profitability can materialize by

importing low-cost inputs and improving the quality of products, as outlined above. Finally, if importing increases productivity, it can contribute to firms self-selecting into export markets, which partially explains the high level of success of two-way traders in international trade. Bas and Strauss-Kahn (2014), Damijan *et al.* (2014) and Goldberg *et al.* (2010) provide evidence that supports these channels. However, Vogel and Wagner (2010) do not find evidence in favour of the learning-by-importing hypothesis.

The literature on the interaction of goods and services in export and import portfolios of individual firms is scarce. One exception is Ariu (2016), who divides Belgium manufacturing and services firms into non-traders, exporters of goods, exporters of services and exporters of both goods and services. This paper categorises firms similarly on the import side but does not consider export and import flows simultaneously. Breinlich and Criscuolo (2011), and Damijan *et al.* (2015) use the same taxonomy for firm types, but the former only considers the export side.

These papers provide some relevant insights on differences between firm types, particularly concerning services versus manufacturing firms. Firstly, the rate of firms participating in international trade in services, as well as their export and import values are lower than those of manufacturing firms. Ariu (2016) shows that the extensive and intensive margins are important to understand these differences because manufacturing firms export or import more products to more countries and also perform more transactions. Nevertheless, services firms have higher values of transactions per destination and product. Secondly, exporters or importers of both goods and services have higher estimated premia in terms of size (turnover, employment or value added), productivity (labour productivity or TFP), capital-intensity and wage Level

versus non-traders and one-way traders, while the latter outperform non-traders. Interestingly, Ariu (2016) shows that there is not much difference in the characteristics of firms that only export goods and firms that only export services; a result that also applies when comparing similar firms on the import side. According to Ariu (2016), these results suggest that firms' characteristics are not an adequate explanation for the different degrees of the firms' involvement in international trade in services and goods, and that there are more relevant factors, such as fixed costs, variable costs and the lower tradability of services. However, Breinlich and Criscuolo (2011) find that, although differences in productivity, capital-intensity and wages are less pronounced, exporters of goods are larger than exporters of services, but services firms have higher skill intensity. Thirdly, Ariu (2016) shows that both exporters and importers entering foreign markets with pure portfolios of services or goods tend to add the opposite product one year after entering the market. However, the additional trade dimensions account for a relatively low share of such firms' exports and imports in the following years. In a cross-country study on Finland, France, Ireland and Slovenia, Damijan *et al.* (2015) show that changes in the trading statuses of firms by either adding a trade flow (exports or imports) or a trade dimension (services or goods) are infrequent, and associated with significant pre-switching premia. Learning-effects from such switching are rare. In sum, these results suggest that a firm is larger and more productive the more complex its trade basket is. In this paper, we contribute to the literature by assessing flows (exports and imports) and trade dimensions (services and goods) simultaneously.

A growing strand of literature focuses on manufacturing firms that increasingly include services in their production and sales

(i.e. servicification). Several papers mention that a process of servicification has actually taken place within manufacturing firms (see, e.g. Crozet and Milet (2014) for France; Lodefalk (2014) for Sweden; Kelle (2013) for Germany; and Mastrogiacomo *et al.* (2017) for Italy). Lower trade costs and improved firm competitiveness are key motivations for the shift towards services among manufacturers (Baines *et al.* 2008). Services can dilute fixed costs associated with entering foreign markets such as over-coming informal trade barriers, while transaction costs can be reduced by selling or sourcing goods with a common foreign market. The competitiveness of the firms might also improve, as services are crucial instruments to differentiate goods, create customer loyalty and accommodate changes in demand. Furthermore, the bundling of goods and services is harder for competitors to imitate. In this perspective, combining goods with services is a key channel to increase exports and profits.

This paper is also connected with the research on the linkages between firms and international trade, mostly taking a network perspective. The literature on international trade and networks is recent and related to the operation of global value chains (e.g., Bernard and Jensen (1999)). However, this is not the perspective that will be adopted here. Another related strand of research concerns the transactions between firms and endogenous network formation, which requires very rich business-to-business databases (e.g., Mogstad *et al.* (2017) and Magerman *et al.* (2015)). Finally, the existence of direct linkages between firms that emerge from capital participations has been studied only from a financial and entrepreneurial angle (e.g. Ferrary and Granovetter (2009) Hochberg *et al.* (2007)). Therefore, also from this perspective, this paper's approach brings some novelty.

Section 3
Data

We have merged two databases to obtain the set of variables necessary for the analysis. First, we use a database that collects the transactions of Portuguese firms and other agents comparing them to the rest of the world, which forms the computation base of the Balance of Payments (BoP). This database reports the firm identifier, the classification of the service and the destination or source country (except for goods). Although it covers the 2014-2016 period, we only focus on the two initial years. Secondly, we use the detailed balance sheet and income statement information for Portuguese firms reported under Simplified Corporate Information (*Informação Empresarial Simplificada*, IES). The IES follows the new accounting standards system from 2010 to 2016, forming a virtual coverage of the Portuguese universe of non- financial corporations. The IES has an almost universal coverage because it is the system through which corporations report mandatory information to the tax administration and statistical authorities. It further contains information on firm characteristics such as the number of employees, age and sector of economic activity.

Another relevant block of information in the IES concerns the capital participation of each reporting firm on other firms, as well as the reference to the firms that participate in the capital of the reporting firm. This information includes the identifier of owned and owner firms, as well as the amount of participation both in euros and as a share of the capital of the owned and owner firm. This set of information establishes a group of bilateral linkages that can be explored to identify whether specific classes of firms in international trade participate in the capital structure of other classes, signalling possible synergies or group strategies. We focus on the subset of information that corresponds to international traders, therefore excluding participations that involve non-traders. In addition, some capital participations involve foreign firms. Although it would be interesting to consider foreign participations, there is not enough information to classify those firms in one of the classes suggested in our taxonomy. The overall number of bilateral capital relationships considered in data from 2015 is 1650 out of a universe of international traders with more than 15 thousand firms. Therefore, only a small share of traders participates in the capital structure of other traders, and many of these investments are small in terms of value.

Table A.1, in the Appendix, presents the median and the interquartile range of firms' characteristics in each class based on firm-year observations in 2014-2015. Table A.2 presents some descriptive statistics relative to participations in the capital structure amongst Portuguese international traders.

Section 4
Types of International Traders

4.1. A Taxonomy

One of the main objectives of this paper is to classify international traders regarding their relevance in terms of goods and services trade. If we depart from the four basic trade flows, namely exports and imports of goods and services, we can consider 16 combinations to position the firms, ranging from not engaging significantly in any flow – a minor trader – to being strongly engaged in all of these flows – a four-way bi trader. All 16 combinations make it possible to draw a detailed landscape of international traders and assess whether firms placed in each class share similar features. In addition, it is relevant to identify the dynamics of firms across classes and linkages between firms placed in different positions of the taxonomy.

One initial feature in the taxonomy is that it should be relative to the firm's size. For example, a firm is considered a relevant exporter of services if the ratio between the value of services exported and the turnover is larger than a specific threshold. The threshold taken in this paper is the first quartile in the distribution of this ratio across all firms, excluding those that do not engage in the basic trade flow at all (for those with a zero ratio). Therefore, a firm can export services (even substantial amounts), however, if its turnover is large enough for the ratio to stay below the threshold, it is not considered a relevant services exporter. This means that for the remaining three-quarters of services exporters the relevance of that type of trade flow on their turnover is higher than the threshold. Although the distributions of

trade flows on turnover are not necessarily Gaussian and differ across the type of trader, it seems reasonable to take the same criterion for relevance in all cases. Needless to say that, for the purpose of international comparisons, the taxonomy is only meaningful if the data from firms of different countries is pooled. The distributions for each country imply different thresholds, thus a similar firm in two country-level distributions could be classified in a different class.

Figure 1 presents some examples that aim to clarify the method used to classify international traders in the taxonomy. In each of the four panels, we represent hypothetical firms with different profiles and plot the share of each basic trade flow (exports and imports of goods and services) on their turnover. In addition, we add four hypothetical thresholds that correspond to a fixed percentile in the cross-firm distributions of each separate trade flow over turnover. Therefore, the four thresholds are the same in all panels, but the shares of each trade flow over turnover change according to the firm. In panel A) there is a firm whose four basic trade flows as a percentage of turnover are all lower than the thresholds. In this case, we label the firm as a minor trader. Panel B) presents a firm whose shares of imports and exports of goods surpass the respective thresholds but not for the imports and exports of services. Therefore, we label this firm as a two-way goods trader (XgMg). In panel C) the firm presents shares of imports and exports of goods and services on turnover that are above the respective thresholds, thus we label the firm as a two-way goods exporter

and services exporter and importer (XgMgs). Finally, in panel D) all four shares on turnover surpass the respective thresholds, thus the firm is labelled as a two-way trader of goods and services (XgsMgs).

The distribution of Portuguese firms across the 16 previously defined classes per number of traders and total trade is presented in the two panels of Figure 2. The results based on the threshold that corresponds to the 25 per cent percentile, show that two-way goods traders (XgMg) represent about one-quarter of international traders, followed in the ranking at some distance by importers of goods (Mg), exporters of goods (Xg) and exporters of services (Xs). As for the share in total trade (panel B) the largest class includes goods exporters, and importers of goods and services (XgMgs) with a value of about one-third. In addition, the two-way goods traders (XgMg) represent one-quarter of the total international trade. Table A.3, in the Appendix, details this information by reporting the share of each class separately in total goods and services trade.

Figure 1 Taxonomy: An Example

(A) Minor trader

Legend: Trade flows over turnover (firm) ◇ Thresholds (percentiles in the distribution)

(B) Two-way goods trader

Legend: Trade flows over turnover (firm) ◇ Thresholds (percentiles in the distribution)
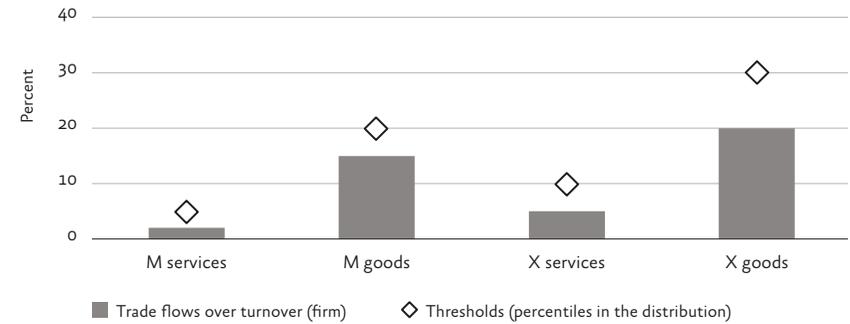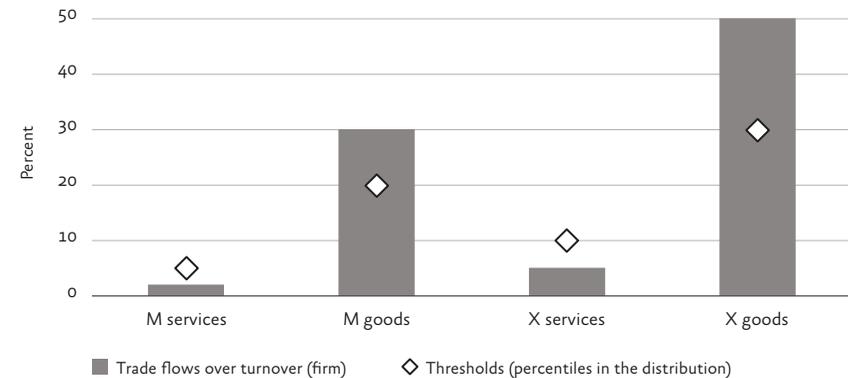
(C) Two-way goods trader and importer of services

M services · M goods · X services · X goods

■ Trade flows over turnover (firm)   ◇ Thresholds (percentiles in the distribution)

(D) Four-way trader

M services · M goods · X services · X goods

■ Trade flows over turnover (firm)   ◇ Thresholds (percentiles in the distribution)

Notes: The thresholds for each basic trade flow correspond to a fixed percentile in the respective cross-firm distributions of the trade flow on turnover (excluding zeros).

A very important aspect is the robustness of the taxonomy to changes in the threshold, which determines whether each trade flow is considered relevant for the firm. In this perspective, figure 2 also reports the shares of different classes according to the 20th and 30th percentiles. The distributions for the alternative percentiles are close to the baseline, both in terms of number of firms and total trade, thus pointing to a robust classification of international traders.

Another robustness test concerns the transition of firms between classes in consecutive years. Table A.4 consists of a transition matrix between 2014 and 2015 for the subset of international traders that operate in the two years. As previously mentioned, we take the first quartile as the relevant threshold for all basic trade flows, i.e. firms where a basic trade flow on turnover stays above the first quartile of the distribution are considered relevant traders. The diagonal cells generally present values above 50 per cent, meaning that most firms remain in the same category in two consecutive years. Moreover, as it would be expected, transitions occur to classes that are in the neighbourhood. For example, nearly one-fifth of the firms classified as exporters of goods and services in 2014 are classified as exporters of goods in 2015, and only 0.8 per cent become exporters and importers of goods and services.

Figure 2 Share in Total Number of Firms and Trade

(A) Share in total number of firms
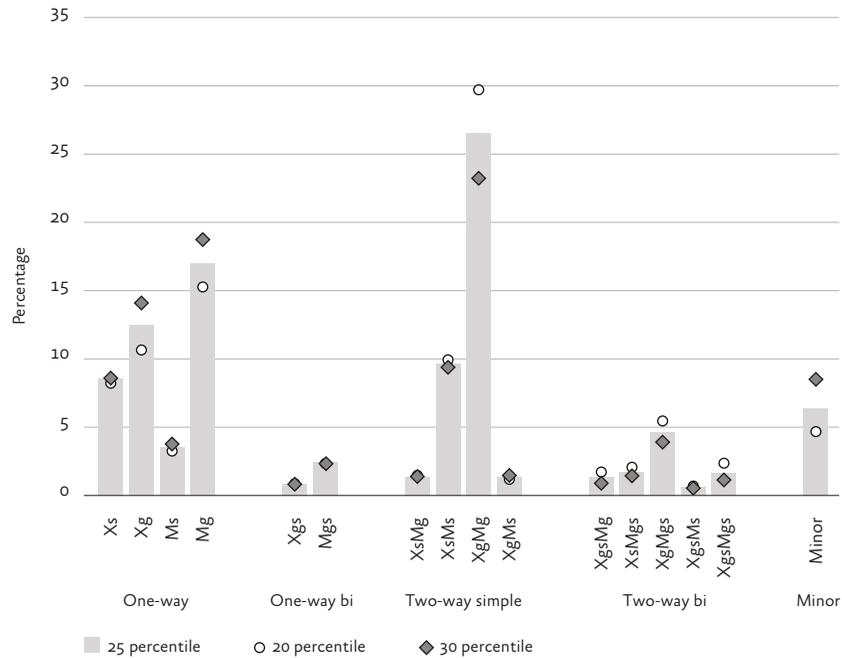
(B) Share in total trade
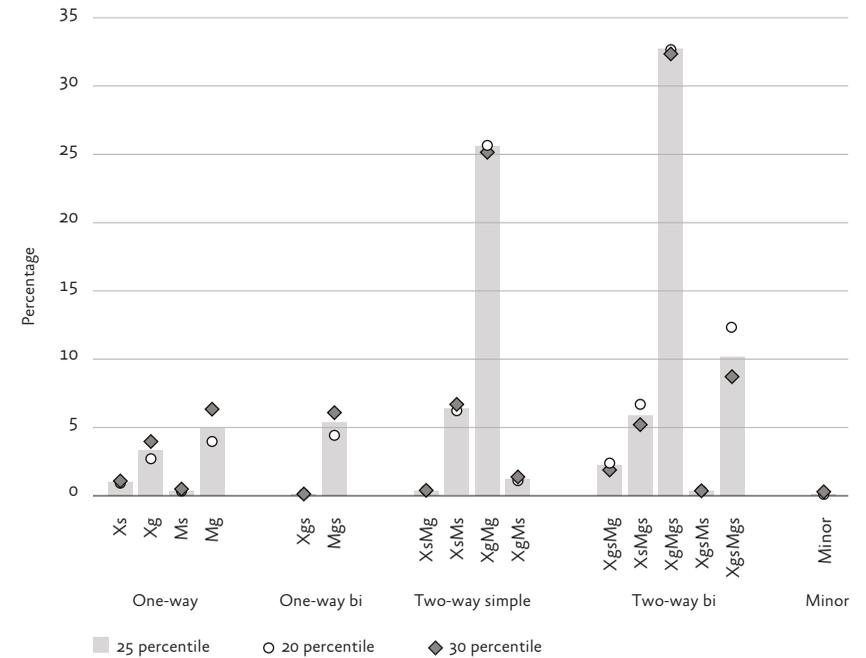
The most stable classes of firms are one-way (Xs, Xg, Ms and Mg) and two-way simple traders (XsMs and XgMg), where around 70-80 per cent of the firms' classifications remain unchanged. A less stable group is that of one-way bi-importers (Mgs), two-way simple (XsMg and XgMs) and two-way bi-traders (XgsMg and XgsMs) with around 50 per cent of the firms' classifications unchanged between 2014 and 2015.

The most unstable categories are two-way bi exporters (Xgs) and two-way bi (XgsMg and XgsMs). These firms tend to drop exports of either services or goods but maintain their initial import statuses. Finally, two-way bi-traders (XsMgs and XgsMs) have the highest probability of becoming exporters and importers of both goods and services (XgsMgs).

4.2. Characteristics of International Traders

In this section, we follow Bernard and Jensen (1999) and regress standard firm characteristics against 15 dummies that identify the different firm types, along with industry and year dummies. We exclude the dummy for minor traders, which becomes the reference category. The estimates are interpreted as the average difference in the respective firm's characteristic, between minor traders and each firm type, after controlling for sector and time fixed effects. It should be noted that the descriptive regressions in Table 1 represent simple correlations and not causal linkages.

On the export side, one-way traders are smaller (turnover and employment), younger and less capital-intensive than minor traders and firms with more complex trade portfolios. One-way exporters of either goods or services are not too different in size and age, although services firms are less capital intensive and pay higher wages, which is in line with their higher productivity. Goods exporters are less productive than minor traders, and services exporters are more profitable and less indebted than minor traders. On the import side, one-way importers are smaller and younger than minor traders (Ms estimates for size are non-significant). In addition, one-way services importers are more productive and pay higher wages than minor traders, while goods importers are slightly more profitable and less indebted than minor traders.

One-way bi exporters (exporting both goods and services) are similar to one-way exporters in terms of size and age but are less capital-intensive and more profitable.[1] In contrast, one-way bi importers (importing both goods and services) are larger, more productive and more profitable, with higher wage levels than minor traders and one-way importers. Moreover, they are younger and less capital-intensive than minor traders but older and more capital-intensive than one-way importers. When comparing one-way bi-exporters with one-way bi importers, the latter are larger, younger, more productive and more profitable, with higher capital-intensity and wage levels.

Two-way simple traders are, in general, smaller and younger than minor traders. However, they show higher levels of wage, productivity and profitability. The estimates for capital-intensity and leverage are mixed and mostly insignificant, but results suggest that two-way goods traders are more capital-intensive and less indebted than minor traders, while two-way services traders are less capital-intensive than minor traders.

Two-way bi traders are the largest firms in the taxonomy, but only those that import both flows (XsMgs, XgMgs and XgsMgs). In fact, firms that only import one flow have either insignificant estimates (XgsMs) or are smaller than the minor trader (XgsMg). The age estimates are mostly insignificant in this group, but results do suggest that firms involved in exports of both flows, and imports of one flow (XgsMg and XsMgs), are younger than minor traders. Furthermore, two-way bi firms are more productive and pay higher wages than minor traders and other less complex types of firms. Moreover, firms that import both flows (XsMgs, XgMgs and XgsMgs) have the highest productivity and wage premia (particularly XsMgs). Regarding profitability, XgsMg, XsMgs and XgMgs

are more profitable than minor traders, though not so different from other less complex traders.

In summary, regressions indicate that more complex international traders, i.e., those engaged in different types of flows, tend to be larger, younger, more productive and pay higher wages. However, their profitability is not explicitly different from that of other traders. These more complex traders seem to be less capital intensive, and there are no clear results regarding leverage.

As mentioned earlier, it is important to assess if the results obtained are robust to the options taken in the taxonomy. Therefore, we perform a robustness check by running the descriptive regressions on the subsample of firms that do not change classification from 2014 to 2015. Table A.5 presents the results based on the same empirical strategy described above. Coefficients slightly increase for all firm characteristics across the taxonomy, except profitability. Although some estimates turn insignificant, in particular for labour productivity (Mg, XsMg, XgMg, and XgsMs) and profitability (Mg, Xgs, XsMg, XgMg, XgsMg and XsMgs), the main results reported above are maintained.

Another dimension of robustness concerns testing the regressions with different thresholds for the relevance of each trade flow in the firms. Tables A.6 and A.7, in the Appendix, present the coefficients for thresholds of 20 and 30 per cent, respectively. Moreover, tables A.8 and A.9 repeat the exercise for the subsample of international traders that remain in the same class in 2014 and 2015. In all cases, coefficients are not distant from those obtained for the baseline 25 per cent threshold, thus pointing towards the robustness of the results.

Table 1 Descriptive Regressions, 2014-2015

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
One-way								
Xs	-51.4	-68.4	-26.5	1.8	-53.1	9.3	2.667	-9.8
	(0.000)	(0.000)	(0.000)	(0.484)	(0.000)	(0.000)	(0.000)	(0.000)
Xg	-50.6	-56.0	-20.7	-11.7	-14.4	-12.3	0.490	4.0
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.124)	(0.108)
Ms	5.5	14.5	-13.2	25.7	-9.7	26.1	0.529	-1.2
	(0.378)	(0.050)	(0.000)	(0.000)	(0.220)	(0.000)	(0.294)	(0.741)
Mg	-36.5	-40.0	-5.2	-3.5	-7.4	-6.2	0.919	-8.5
	(0.000)	(0.000)	(0.015)	(0.090)	(0.129)	(0.000)	(0.002)	(0.000)
One-way bi								
Xgs	-56.0	-67.8	-31.2	-2.8	-26.7	2.0	1.570	-2.6
	(0.000)	(0.000)	(0.000)	(0.524)	(0.016)	(0.544)	(0.042)	(0.603)
Mgs	29.3	51.6	-6.7	44.5	-16.0	35.9	2.714	-2.1
	(0.000)	(0.000)	(0.057)	(0.000)	(0.036)	(0.000)	(0.000)	(0.573)
Two-way simple								
XsMg	-41.9	-53.3	-12.6	10.8	-13.2	16.8	1.468	-6.4
	(0.000)	(0.000)	(0.002)	(0.006)	(0.131)	(0.000)	(0.023)	(0.140)
XsMs	3.5	-13.7	-18.5	27.0	-44.4	31.7	2.645	-3.6
	(0.491)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.198)
XgMg	-20.5	-14.5	-3.9	5.8	20.2	-1.4	1.030	-5.2
	(0.000)	(0.000)	(0.060)	(0.005)	(0.000)	(0.282)	(0.000)	(0.019)
XgMs	-10.4	-14.7	-9.4	9.4	2.6	7.2	0.385	0.2
	(0.160)	(0.082)	(0.025)	(0.027)	(0.793)	(0.010)	(0.505)	(0.964)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employment	Turnover	Age	Labour productivity	Capital to labour	Wage to labour	Profitability	Leverage ratio
Two-way bi								
XgsMg	-33.9	-33.4	-9.0	14.3	14.8	11.1	1.589	0.4
	(0.000)	(0.000)	(0.034)	(0.001)	(0.136)	(0.000)	(0.012)	(0.926)
XsMgs	28.3	42.6	-3.8	44.1	-13.8	54.3	1.896	-4.3
	(0.002)	(0.000)	(0.363)	(0.000)	(0.113)	(0.000)	(0.001)	(0.264)
XgMgs	44.8	66.2	1.3	26.9	39.1	19.7	1.324	-7.4
	(0.000)	(0.000)	(0.647)	(0.000)	(0.000)	(0.000)	(0.001)	(0.008)
XgsMs	6.6	-12.8	-12.7	11.7	-28.8	27.6	-0.511	11.5
	(0.583)	(0.314)	(0.025)	(0.050)	(0.020)	(0.000)	(0.587)	(0.102)
XgsMgs	47.1	91.2	-3.0	40.8	8.1	42.9	0.234	-0.4
	(0.000)	(0.000)	(0.467)	(0.000)	(0.356)	(0.000)	(0.685)	(0.925)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	No	No	No	No	No	No	No	No
Obs	33720	33379	33686	33379	32142	33380	33380	31173
R^2	0.239	0.172	0.0849	0.196	0.199	0.273	0.0382	0.0227

Notes: Wage to labour is defined as the total labour costs divided by total employment; labour productivity is defined as the gross value added per worker; profitability is defined as the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) over total assets; leverage ratio as total assets to equity ratio. The definition of firm types is based on the 25 percentile threshold. We drop the top and bottom one percentiles of the dependent variable, and control for sector and year effects. Reported estimates are the estimated regression coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by 100 * (exp($ß$) – 1). All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Section 5
Capital Linkages Between International Traders

This section maps the network of capital participations between international traders while relating to the complexity of their participation in international trade. The network is plotted at the firm level, and the shape of the nodes signals the class to which each trader belongs. Alternatively, the analysis can be carried out at the class level, i.e., collapsing all firms belonging to the same class into one node. Finally, the identification of how capital participations link different types of traders is complemented by assessing how the interaction between the two dimensions of complexity correlates with productivity.

5.1. The Network of Capital Participations

Firms relate to each other in many ways. The most common interaction is the client-supplier relationship. However, firms can also interact as competitors in a specific market or establish a joint venture in a project. Firms also interact by participating in each other's capital structure, which leads to the creation of complex economic groups. The existence of capital participations between two firms does not necessarily mean that they cooperate in international trade, especially if they operate in very different sectors. Nevertheless, it is likely that many capital participations mirror the organisation of firms in groups where there is some degree of specialisation in international activities. For example, one firm in the group may deal with services or goods imports, while another related firm uses them as inputs to produce

goods directed to foreign markets. In addition, even if a capital participation does not reflect the existence of an economic group, firms prefer to do business with those who are closer, and the existence of a capital participation is a source of proximity.

The information regarding capital participations is available within the setup of *Simplified Corporate Information (Informação Empresarial Simplificada, IES)*, which is also the source of data on the traders' attributes used in section 4.2. More precisely, firms report the identification of other firms where they hold participations, as well as the corresponding capital shares. In addition, firms report the identification of their shareholders and corresponding capital shares. These two pieces of information are partially complementary, and we used them to construct a database of capital participations of Portuguese firms. We eliminate the duplicates resulting from having the participating and the participated firm reporting the same information. We also eliminate cases where firms report the identification of a participating or participated firm, but there is no information on the capital share or capital level of the firms involved.

We rely on this set of information and focus on the subset of participations involving Portuguese international traders. Therefore, if a firm does not export or import goods or services, it is eliminated. The same happens if a firm holds a foreign fiscal identification number.

The international dimension of capital participation is an interesting topic, but it stands as a research question by itself, which is beyond the scope of this paper.

Table A.2 presents some basic descriptive statistics on capital participations in 2014-2015 for different types of individual traders. The average and median sizes of capital participations in the database are 8459.2 and 143.6 thousand euros, while the average and median capital shares are 49.5 and 49.2 per cent, respectively. As regards the classes of international traders, the number of participating and participated firms is higher in two-way service traders (XsMs), two-way goods traders (XgMg) and exporters of goods that also import goods and services (XgMgs). Along the different classes, the median and average participating and participated capital shares are similar and close to 50 per cent.

Figure 1 shows a classic tree-type network where each node corresponds to a single trader, and the edges connect those among who there is capital participation in 2015. Edges are directed from the participating to the participated firm, and the shape of each node is associated to the trade class of the respective firm. For simplicity, as also presented above, we use 5 classes of firms (Minor, One-way, One-way bi, Two-way simple and Two-way bi trader) and not the 16 classes that compose the full taxonomy suggested in section 4. Due to its inherent complexity, the visualisation of the network is mostly illustrative. Moreover, at this scale of analysis, it is not possible to visualize and associate the class of the international trader to a specific positioning in the network. Nevertheless, the network does not convey a reality with many organised economic groups of traders, i.e., one node linking with multiple others.

The network that results from restricting edges to capital participations corresponding to control positions (more than 50 per cent in the capital of the participated firm) is presented in Figure 2. Although we typically take a 10 per cent capital participation as the threshold for a significant stake in a firm (e.g., this is the threshold to separate portfolio from foreign direct investment), we take a larger number to capture only the

situations where participations result in the control of the participated firm. Although the network remains very complex and still with a high number of nodes, the visualisation algorithm places most firms in a core and an outer ring with a set of peripheral nodes. The core and the ring are both heavily populated by one-way traders (solid triangles) and two-way simple traders (disks), which are also dominant in the database.

It is useful to assess capital linkages between international traders with regards to both the size and number of participating firms. One way to do this is to collapse the individual traders into classes and assess how the number and amount of capital participations are distributed among classes of participated traders. These conditional distribution matrices are presented in the Appendix, in tables A.10 and A.11, respectively. Such relative conditional distributions can also be used to plot a simplified network formed by the linkages (edges) between the 16 classes (nodes) identified in the taxonomy of international traders.

The two panels in Figure 5 represent the networks associated with the conditional distributions for the number and amount of capital participations among classes of traders. More specifically, each node is a

class of trader, and the edges are directed from participating towards participated classes. Moreover, the width of the edges is proportional to the share of each participated class on the participating one. Therefore, the thicker the edge departing from a class of traders, the more important the destination class for the participating one.

Furthermore, as in the above case, the shape of the nodes is associated with groups of classes, and the size of the nodes is proportional to its outdegree (number of edges departing from it). Although the network is not complete because some classes do not have capital participations in others, the outdegrees are similar for each class, and thus the size of nodes does not differ much. Finally, the self-loops resulting from participations within each class of international traders (the diagonal elements in the conditional distribution) are not represented.

Figure 3 **The Network of Capital Participations Across International Traders (All Participations)**
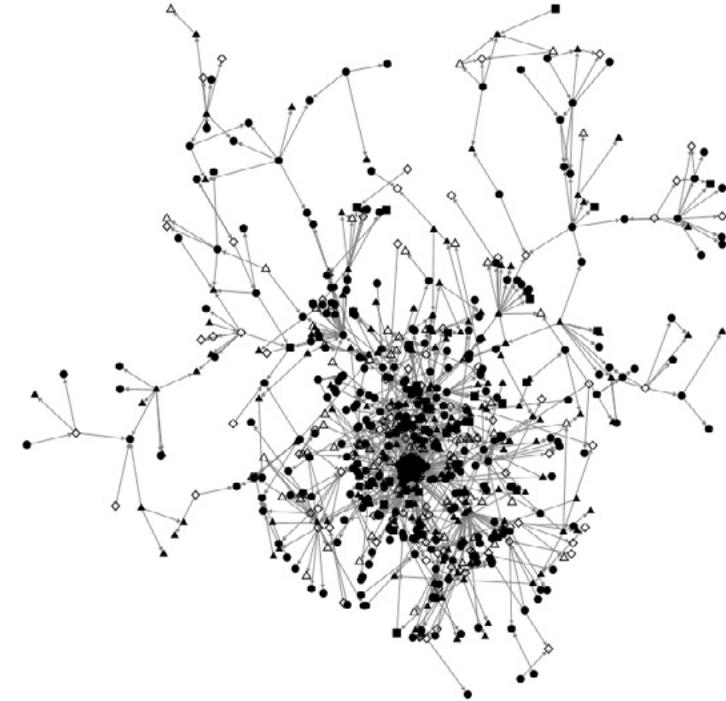
Notes: Nodes correspond to traders and edges connect those among which there is a capital linkage. Edges are directed from the participating to the participated firms. The shape of each node corresponds to: Minor trader (triangle); One-way (solid triangle); One-way bi (solid square); Two-way simple (disk); Two-way bi trader (diamond). The network graph is based on Harel-Koren's fast multiscale algorithm and is drawn with NodeXL (Hansen *et al.* (2010).

Figure 4 The Network of Majority Capital Participations Across International Traders (>50 per cent)
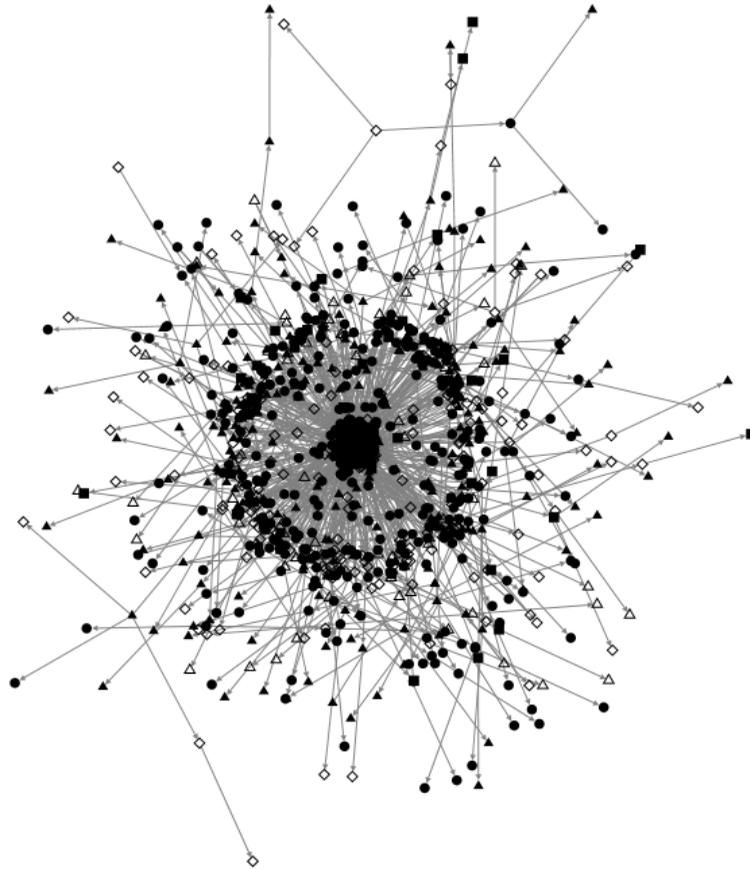
Notes: Nodes correspond to traders and edges connect those among which there is a capital linkage. Edges are directed from the participating to the participated firms. The shape of each node corresponds to: Minor trader (triangle); One-way (solid triangle); One-way bi (solid square); Two-way simple (disk); Two-way bi trader (diamond). The network graph is based on Harel-Koren's fast multiscale algorithm and is drawn with f NodeXL (Hansen *et al.* (2010).

The network in panel A), Figure 5, indicates that two-way traders of goods (XgMg) and two-way traders of services (XsMs) are key classes in terms of quantity of capital linkages among international traders, and are thus represented in a central position. This observation is closely connected with the information in table A.2. These classes of traders participate and are participated by almost all other classes (high indegrees and outdegrees), closely followed by exporters of goods and importers of goods and services (XgMgs), and two-way exporters of goods and services (XgsMgs). The exporters of services participate evenly in all other classes. In addition, a large share of capital participations originated in other classes (thicker incoming edges) is directed to two-way traders of goods, notably one-way exporters of goods (Xg), one-way importers of goods (Mg), and exporters of goods and services and importers of goods (XgsMg). Overall, services exporters are strongly engaged in capital participations and, to a lesser extent, this is also true for traders covering more types of flows.

Panel B), in Figure 5, replicates the analysis above while focusing on the amounts underlying the capital participations across classes of international traders. The distinctive feature in this network is the uneven distribution of the amounts corresponding to capital participations among participated classes, which is visible through a series of thick edges. For example, participations from exporters of goods and services (Xgs) are almost totally concentrated in exporters of goods and services and importers of goods (XgsMg) (99.7 per cent), with the participations of the latter class strongly concentrated in exporters of goods and importers of goods and services (XgMgs) (56.6 per cent). This feature results from the substantially high value of some participations (even moderate shares can imply large participations

if the capital of the participated firm is very high). Therefore, a single bilateral relationship between two traders can drive the relevance of the entire class. In fact, the top 10 participations among international traders represent about 60 per cent of the total amount of capital participations considered in the database. This is related to the structure of the Portuguese economy, which is populated by many small firms and a few very large ones. Nevertheless, two-way traders of goods (XgMg), as well as exporters of goods and importers of goods and services (XgMgs) remain in the centre of the network establishing links with many other classes.

Overall, in both networks studied, although linked with other classes, minor traders do not seem to compensate for their low engagement in foreign markets through strong capital participations with other types of traders. Conversely, more complex traders have stronger capital participations, thus combining the two layers of complexity discussed in this paper. No causality link can be established between these two features and there are probably other variables, like size or management practices, that explain both facts.

Figure 5 **The Network of Capital Participations Across Classes of Traders**

(A) Number of traders
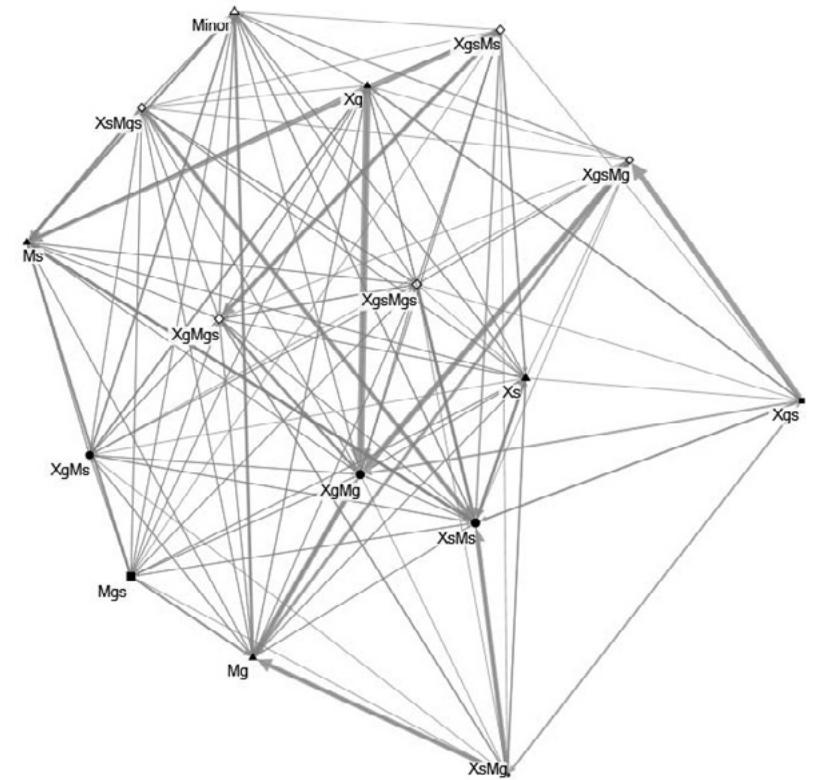
(B) Amount of participations
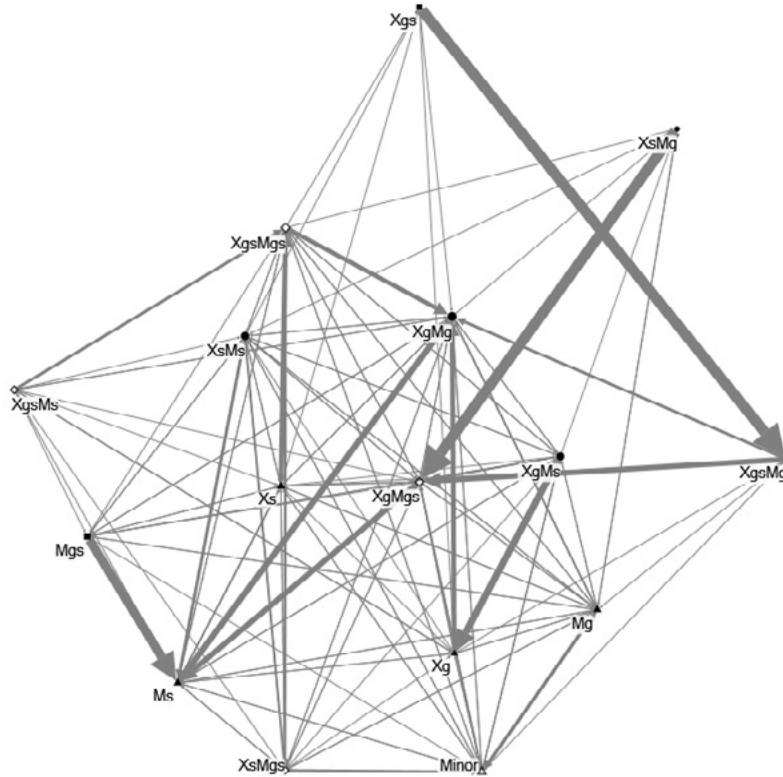
Notes: Nodes correspond to classes of traders and edges are directed from participating towards participated classes. The width of the edges is proportional to the share of each participated class on the participating one, and the size of the nodes is proportional to the respective outdegree. Self-loops are not represented. The shape of each node corresponds to: Minor trader (triangle); One-way (solid triangle); One-way bi (solid square); Two-way simple (disk); Two-way bi trader (diamond). The network graph is based on Harel-Koren's fast multiscale algorithm and is drawn with NodeXL (Hansen *et al.* (2010).

5.2. Capital Participations, Types of Traders and Productivity

In this section, we further develop the analysis by exploring the interconnection between capital participations, types of international traders and labour productivity. The objective is to assess the extent to which the number of capital participations in other firms (outdegree) or the number of traders participating in the capital of the firm (indegree), the class of the international trader and the interaction between these dimensions are associated with performance, measured as labour productivity. Regressions include year and 2-digit sector fixed effects. In brief, we estimate regressions of the following type:

$$logY_{it} = \alpha + \beta_0 d_i + \beta_1 X_i + \beta_2 X_i * d_i + \gamma_j + \gamma_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} is the dependent variable of interest (labour productivity in logs) of firm i in year t. d_i is a dummy variable that associates the firm to a specific class of trader in the taxonomy (minor trader is the omitted category), X_i is the number of participations (outdegree), or, alternatively, the number of participating firms (indegree). Sector and time fixed effects are included in γ_j and γ_t, respectively. The control for the main sector of activity of the firm is defined at the *Portuguese Classification of Economic Activities* (CAE) 2-digit level, comprising different sectors. ε_{it} is an error term, potentially clustered at the firm-level.

The focus of the analysis is the sign of the interaction coefficient for each class of trader. If it is significantly positive, it means that on top of the performance differences associated to each type of trader there is a larger number of capital participations in other traders associated to improved performance (regardless of their type). As argued above, capital participations could be used by less complex traders to

complement their external linkages indirectly, hence reaching higher productivity. It is also possible to establish the argument for firms accepting capital participations from other traders. In this case, the variable used in connection to the importance of capital participations is the indegree (number of firms participating).

Panels A and B, in Figure 6, plot the estimated coefficients of regression 1, considering the outdegree as the indicator for the intensity of capital participations.[2] Panel A points out that more complex traders are also more productive, though a larger outdegree is not significantly associated with a better performance (top coefficient in the panel). As for the interaction coefficients in panel B, there are no negative and significant estimates and, therefore, the thesis that capital participations complement trade activities with an impact on predacity (relatively to the omitted category) is not corroborated.

Figure 6 Labour Productivity and Outdegree, 2014-2015

(A) Outdegree and firm dummies
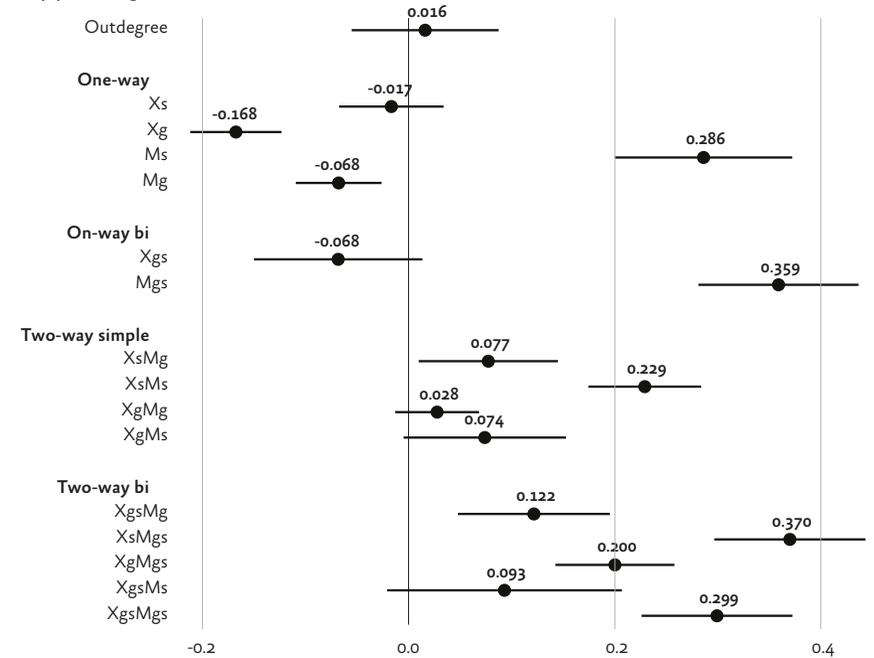
Figure 7 Labour Productivity and Indegree, 2014-2015

(b) Interaction between outdegree and firm dummies
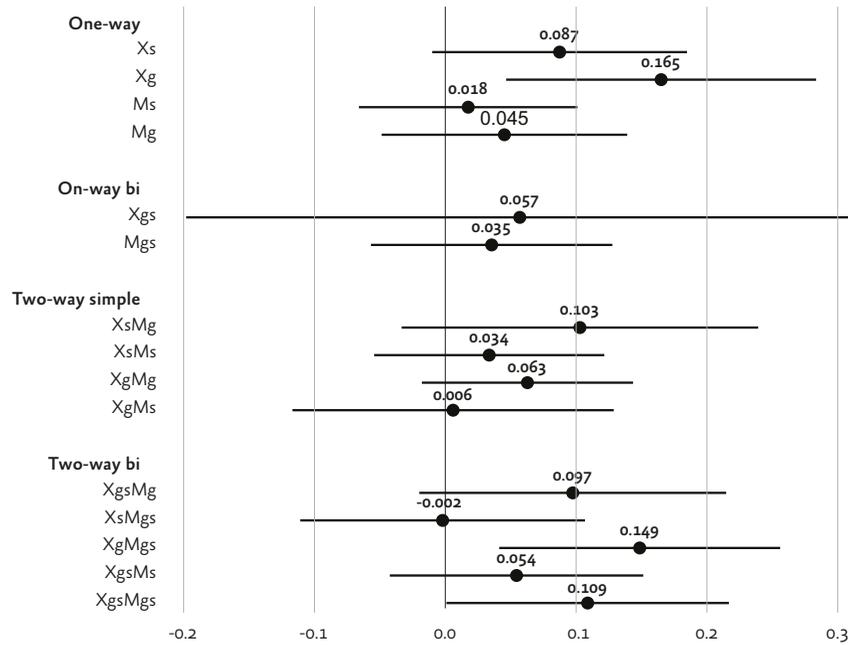
(a) Indegree and firm dummies
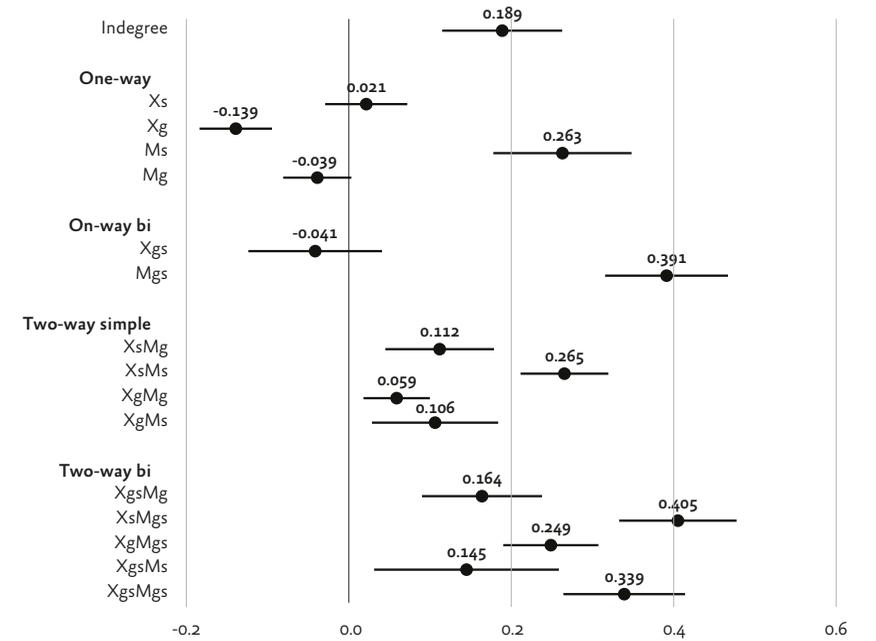
Note: Robust standard errors clustered at the firm-level. The specifications include year effects and sector fixed effects at the 2-digit level. Horizontal lines reflect the 90 per cent confidence intervals. See Table A.12 in the Appendix for details.

(b) Interaction between indegree and firm dummies
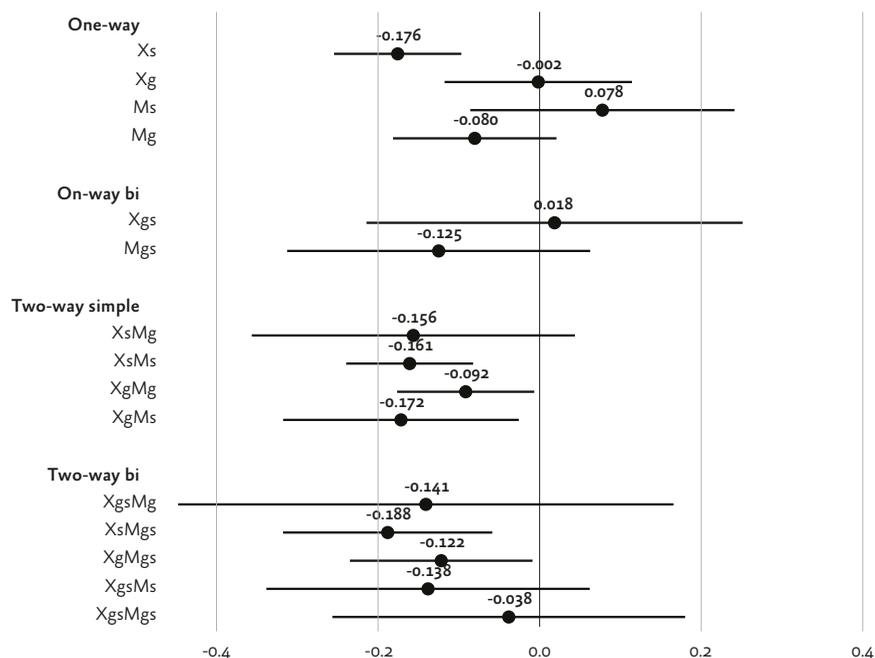
One-way
Xs   -0.176
Xg   -0.002
Ms   0.078
Mg   -0.080

On-way bi
Xgs   0.018
Mgs   -0.125

Two-way simple
XsMg -0.156
XsMs -0.161
XgMg -0.092
XgMs -0.172

Two-way bi
XgsMg -0.141
XsMgs -0.188
XgMgs -0.122
XgsMs -0.138
XgsMgs -0.038

-0.4   -0.2   0.0   0.2   0.4

Note: Robust standard errors clustered at the firm-level. The specifications include
year effects and sector fixed effects at the 2-digit level. Horizontal lines reflect the 90
per cent confidence intervals. See Table A.12 in the Appendix for details.

Results in panels A and B of, Figure 7, where the perspective for capital participations is the existence of investments by other firms (indegree), are somewhat different.[3] While panel A also points out that more complex traders are more productive and a larger indegree is associated with better performance (top coefficient in the panel), panel B shows several positive and significant interaction coefficients that are somewhat higher for more complex traders. Therefore, the existence of many external capital participations (indegree) in more complex traders is associated with additional labour productivity gains. Rescuing the intuition above, it is possible that only more sophisticated traders may have the ability or the underlying conditions to benefit from capital participations as a productivity-enhancing channel.

Section 6
Concluding Remarks

In this paper, we suggest a taxonomy to classify international traders according to the complexity of their external activities. Notably, we assess participation in export and import flows, combined with the goods and services dimension. The taxonomy only considers active participation in each of the trade flows if its level is deemed relevant to the turnover of the firm. The taxonomy is the starting point to identify differences between types of traders in a broad set of dimensions, especially in what concerns the linkages that result from capital participations. Moreover, this paper tests whether less complex traders make up for their status by participating in the capital of other traders or if, on the contrary, more complex traders leverage their activity with strong capital linkages.

This paper concludes that two-way goods traders are the most populous class in the landscape of Portuguese international traders. However, as for the share in total trade, the largest class is that of goods exporters and importers of both goods and services, followed by two-way goods traders. The most complex type of traders, i.e., those that export and import both goods and services, are not numerous but represent about 10 per cent of total Portuguese international trade.

The classification of international traders in terms of complexity of trade is strongly associated with several characteristics of the firms. A regression analysis indicates that more complex international traders tend to be larger, younger, more productive and pay higher wages. However, their profitability is not explicitly different from that of other traders.

The network of capital participations among Portuguese firms that participate in international trade shows that two-way traders of goods and two-way traders of services are key classes due to the number of capital linkages. In addition, services exporters are strongly engaged in capital participations and, to a lesser extent, this is also true for complex traders. Two-way traders of goods and those who export goods and import both goods and services take a central position when the network is defined in terms of the amount of capital participations. Moreover, this paper concludes that minor traders do not seem to compensate for their low engagement in foreign markets with a strong participation in the capital of other types of traders. Conversely, for more complex traders, there is some association between receiving capital participations and their labour productivity.

From a policy perspective, knowledge about the profile of international traders helps eliminate barriers to the amplification of firms' external activities into multiple types of trade flows. For example, superimposing regulation on exports and imports of goods and services can inhibit firms from taking a more sophisticated approach towards international trade, which is associated with higher productivity. Furthermore, regulatory burdens on capital participations can limit the ability to indirectly assess foreign markets through linkages with complementary or more complex international traders.

In terms of future research, several avenues can be followed. Firstly, it would be interesting to replicate the analysis for other countries or,

preferably, to pool data from a group of countries. Secondly, further analyses on capital participations among international traders could convey interesting results, notably by exploring the time dimension and assessing the role of foreign multinationals.

Appendix

Table A.1. Descriptive Statistics of Firm Characteristics, Median and Interquartile Range, 2014-2015

(1) Firm type	(2) Employment	(3) Turnover	(4) Age	(5) Labour productivity	(6) Capital to Labour	(7) Wage to labour	(8) Profitability	(9) Leverage ratio
One-way								
Xs	8	538.4	14	29.5	6.7	21.2	10	2.3
	(18)	(1512.7)	(14)	(26.2)	(20.0)	(14.9)	(16.4)	(2.6)
Xg	13	979.2	17	21	13.3	14.2	7.1	2.8
	(24)	(1893.1)	(18)	(18.0)	(30.8)	(8.2)	(9.9)	(2.8)
Ms	24	2747.8	16	39.6	21.8	23.8	7.9	2.6
	(69)	(9445.5)	(16)	(60.4)	(139.2)	(21.3)	(13.7)	(3.2)
Mg	10	1432	19	28.3	14.5	17.3	7.2	2.4
	(14)	(2657)	(17)	(24.6)	(35.5)	(10.6)	(9.7)	(2.3)
One-way bi								
Xgs	8	676.1	13	26.7	10.1	19.3	8.3	2.6
	(16)	(1261.3)	(15)	(23.3)	(29.9)	(11.4)	(11)	(2.8)
Mgs	21	3873.2	18	40.5	13.8	24.5	8.5	2.6
	(64)	(12418.3)	(18)	(49.8)	(40.9)	(23.1)	(12.3)	(2.6)
Two-way simple								
XsMg	10	990.3	16	31.6	16.5	22.2	8.6	2.5
	(17)	(2188.6)	(15)	(26.4)	(30)	(13.5)	(11.4)	(2.4)
XsMs	17	1784.2	14	39.2	5.1	28.6	10.1	2.7
	(42)	(4990.8)	(15)	(38.9)	(21.1)	(20.7)	(15.8)	(3.0)
XgMg	17	2124.2	21	28	19.2	17.2	7.8	2.6
	(37)	(4750.1)	(19)	(24.0)	(41.3)	(9.8)	(9.3)	(2.3)
XgMs	23	2211	20	30.7	24.7	18.3	7.3	2.6
	(47)	(5284.5)	(20)	(30.6)	(61.8)	(11.9)	(9.3)	(2.5)

Notes: Wage to labour is defined as the total labour costs divided by the total employment; labour productivity is defined as the gross value added per worker; profitability is defined as the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) over total assets; leverage ratio is defined as total assets to equity ratio. The table reports the median and interquartile range (in parentheses) of firm characteristics for each firm type in 2014 and 2015. Statistics are based on firm-years and, therefore, a firm can change classes in these two years. The definition of the trade status is based on the 25 percentile threshold. Labour productivity and turnover are expressed in 1000 euros. Leverage ratio and profitability are expressed in percentage.

(1) Firm type	(2) Employment	(3) Turnover	(4) Age	(5) Labour productivity	(6) Capital to Labour	(7) Wage to labour	(8) Profitability	(9) Leverage ratio
Two-way bi								
XgsMg	11	1482.8	18	33	19.2	21.2	8	2.7
	(25.5)	(4176.9)	(16)	(28.6)	(36.9)	(13.3)	(10.6)	(2.6)
XsMgs	23	3885.9	18	42.4	13.5	30.7	9.3	2.6
	(53)	(13614)	(18)	(46.2)	(32.7)	(25.5)	(12.8)	(2.8)
XgMgs	38	5041	23	34.6	28.6	21.1	8.4	2.4
	(100)	(17051.1)	(22)	(32.9)	(56.5)	(12.2)	(10.1)	(2)
XgsMs	22.5	1982.5	15	33	9.5	26.9	6.6	3.1
	(66.5)	(6577.4)	(16)	(29)	(28.4)	(19.8)	(10.5)	(3.8)
XgsMgs	30	5555.1	21	40.6	17.6	28	8.5	2.7
	(126)	(21543.4)	(19)	(39.5)	(42.6)	(19.3)	(11.1)	(2.5)
Minor	21	2590.2	20	26.7	19.2	17.4	6.8	2.7
	(47)	(7829.4)	(19)	(23.8)	(57.8)	(9.8)	(9.9)	(3.0)

Table A.2. Descriptive Statistics of Capital Participations, 2015

		Participated				Participating			
		average	p25	p50	p75	average	p25	p50	p75
One-way									
Xs	Amount	1847,4	20,7	245,4	2699,8	1292,8	3,8	27,7	356,0
	Share	42,8	1,6	25,1	99,0	48,9	2,7	50,0	99,7
	nb	151				106			
Xg	Amount	2248,1	14,0	90,4	953,8	453,8	9,3	96,5	449,8
	Share	52,2	20,0	50,0	98,0	40,6	2,1	33,3	70,0
	nb	111				99			
Ms	Amount	12636,6	20,3	442,3	3887,7	8872,7	22,9	503,7	2464,9
	Share	50,8	7,5	50,0	100,0	58,2	14,0	60,0	100,0
	nb	158				187			
Mg	Amount	32503,1	23,4	203,7	819,1	1052,6	8,7	57,9	545,9
	Share	56,1	22,2	50,0	96,8	41,1	6,7	33,3	72,0
	nb	163				145			
One-way bi									
Xgs	Amount	139,3	12,8	47,0	224,4	528,5	5,3	312,6	742,3
	Share	78,7	61,8	87,5	95,0	52,0	20,0	52,0	88,5
	nb	7				6			
Mgs	Amount	12851,9	66,6	716,5	2969,7	7469,5	14,9	380,4	1416,1
	Share	50,3	7,1	50,0	100,0	46,1	3,8	30,3	97,2
	nb	59				56			

		Participated				Participating			
		average	p25	p50	p75	average	p25	p50	p75
Two-way simple									
XsMg	Amount	239,3	1,1	66,7	259,9	124,3	1,5	31,1	66,9
	Share	39,1	5,2	26,3	62,8	47,3	27,1	41,7	68,8
	nb	20				6			
XsMs	Amount	3750,3	6,5	92,3	1745,8	9221,8	4,0	66,2	630,8
	Share	51,9	3,2	50,0	100,0	53,6	10,0	50,0	100,0
	nb	220				247			
XgMg	Amount	2547,7	16,0	214,7	1012,1	1310,4	18,6	150,2	1022,9
	Share	50,7	10,4	50,0	95,0	45,9	7,2	42,5	85,5
	nb	310				319			
XgMs	Amount	2055,9	24,1	27,1	1212,7	121745,6	48,8	956,0	3897,8
	Share	23,3	0,0	10,0	31,3	54,5	11,2	50,5	100,0
	nb	45				44			

		Participated				Participating			
		average	p25	p50	p75	average	p25	p50	p75
Two-way bi									
XgsMg	Amount	264,1	8,6	163,4	486,7	1048,3	54,8	214,4	1334,3
	Share	62,5	40,0	74,0	95,0	56,2	20,6	51,0	99,0
	nb	9				27			
XsMgs	Amount	9888,1	30,6	238,0	531,9	2051,2	51,9	324,8	1382,2
	Share	43,8	4,7	22,4	98,6	60,7	23,0	55,5	100,0
	nb	54				46			
XgMgs	Amount	27715,0	96,9	880,7	3777,9	5610,4	63,5	449,8	2395,6
	Share	54,8	15,0	51,0	100,0	53,4	9,6	50,0	100,0
	nb	101				131			
XgsMs	Amount	1483,0	0,0	9,5	26,7	69563,1	8,1	181,4	1925,8
	Share	42,0	0,0	49,5	65,3	64,4	20,1	88,7	100,0
	nb	10				30			
XgsMgs	Amount	5654,0	31,0	153,1	1482,6	2631,1	30,5	244,2	1548,9
	Share	59,1	5,6	78,6	100,0	57,7	8,1	62,5	100,0
	nb	34				66			
Minor	Amount	1708,9	11,9	155,5	1264,3	2748,1	10,9	137,4	1216,2
	Share	45,0	10,0	30,2	98,0	38,1	2,4	20,0	80,3
	nb	198				135			

Notes: Amounts are expressed in 1000 euros; shares are expressed in percentage.

Table A.3. Share of Each Trade Flow and Total Firms, 2014-2015 (25 percentile)

	Services		Goods		Total
	Exports	Imports	Exports	Imports	Firms
One-way					
Xs	9.5	0.0	0.0	0.0	8.6
Xg	0.0	0.0	8.9	0.1	12.5
Ms	0.1	4.6	0.0	0.1	3.5
Mg	0.0	0.0	0.2	10.2	17.0
One-way bi					
Xgs	0.3	0.0	0.2	0.0	0.8
Mgs	0.2	6.2	0.1	10.4	2.4
Two-way simple					
XsMg	1.0	0.0	0.0	0.5	1.4
XsMs	41.3	37.9	0.0	0.2	9.7
XgMg	0.0	0.0	35.6	26.4	26.6
XgMs	0.1	1.1	2.9	0.2	1.4
Two-way bi					
XgsMg	4.9	0.0	1.8	2.2	1.3
XsMgs	19.8	19.5	0.1	5.9	1.7
XgMgs	0.3	8.1	41.4	35.9	4.6
XgsMs	1.2	1.1	0.3	0.0	0.6
XgsMgs	21.2	21.5	8.6	7.8	1.7
Minor	0.0	0.0	0.1	0.2	6.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes: The table reports the percentage share of each firm type (column 1) in total trade flows, and firms in 2014 and 2015. The statistics are based on firm-years and, therefore, a firm can change classes in these two years. The definition of trade status is based on the 25 percentile threshold.

Table A.4. Transition Matrix (% shares) Using the Percentile 25 as Threshold

	Share firms	Percentage share of firms by trade status in 2015 (for the set of those present also in 2014)																
	2014	Xs	Xg	Ms	Mg	Xgs	Mgs	XsMg	XsMs	XgMg	XgMs	XgsMg	XsMgs	XgMgs	XgsMs	XgsMgs	Minor	Total
One-way																		
Xs	7.7	75.4	0.4	0.9	0.4	2.2	0.0	1.3	15.0	0.2	0.0	0.3	0.6	0.0	0.5	0.1	2.7	100
Xg	12.2	0.3	71.2	0.2	1.0	1.4	0.0	0.1	0.1	16.4	3.0	0.0	0.1	0.7	0.1	0.1	5.4	100
Ms	3.3	1.1	0.2	69.5	0.6	0.0	5.7	0.0	11.4	0.0	0.6	0.0	0.8	0.2	0.0	0.2	9.7	100
Mg	16.7	0.1	0.7	0.1	79.0	0.0	2.8	0.7	0.0	11.8	0.0	0.2	0.2	0.5	0.0	0.0	4.0	100
One-way bi																		
Xgs	0.8	22.9	17.8	0.0	0.0	33.9	0.0	0.8	4.2	5.9	0.8	5.9	0.0	0.0	5.1	0.8	1.7	100
Mgs	2.6	0.3	0.3	8.0	17.0	0.0	57.4	1.1	0.8	1.9	0.5	0.5	5.1	4.3	0.0	1.3	1.6	100
Two-way simple																		
XsMg	1.5	6.7	0.0	0.0	9.0	0.4	0.9	49.8	1.3	4.0	0.0	9.9	14.8	0.0	0.0	1.8	1.3	100
XsMs	9.9	12.3	0.3	4.1	0.0	0.1	0.1	0.3	77.8	0.1	0.2	0.1	1.8	0.1	1.2	0.7	0.7	100
XgMg	28.5	0.1	6.5	0.0	10.1	0.2	0.3	0.1	0.0	75.3	0.2	1.1	0.0	4.4	0.1	0.3	1.1	100
XgMs	1.5	0.0	26.5	1.9	0.5	0.9	0.0	0.5	0.0	5.1	49.8	0.5	0.5	11.6	0.9	0.5	0.9	100
Two-way bi																		
XgsMg	1.5	3.2	5.1	0.0	2.3	3.2	0.5	10.2	0.5	21.3	0.5	38.4	2.3	2.8	0.0	8.8	0.9	100
XsMgs	1.8	1.5	0.0	0.8	1.5	0.0	7.6	5.7	10.3	0.0	0.0	3.0	54.8	1.5	0.8	12.2	0.4	100
XgMgs	5.0	0.0	2.2	0.3	2.0	0.1	4.6	0.0	0.0	22.3	4.0	1.0	0.7	57.8	0.0	4.6	0.4	100
XgsMs	0.7	6.6	5.7	3.8	0.0	1.9	0.9	0.0	28.3	0.9	5.7	0.9	1.9	2.8	24.5	13.2	2.8	100
XgsMgs	1.8	0.4	0.7	0.7	0.7	1.1	2.2	1.5	1.5	6.3	1.5	6.0	10.8	16.8	3.4	45.9	0.4	100
Minor	4.5	4.0	6.1	8.8	9.0	0.0	0.9	0.2	1.2	3.8	0.3	0.2	0.2	0.0	0.3	0.0	65.1	100
Total	100	7.7	11.8	3.5	17.4	0.8	2.7	1.4	9.8	27.4	1.5	1.4	1.9	5.0	0.5	1.8	5.3	100

Notes: The transition matrix is based on the subsample of firms that are involved in international trade in both 2014 and 2015 (14,597 unique firms). Column (2) shows the share of firms according to the trade status in 2014. Column (3) - (18) shows the percentage share of firms by trade status in 2015 along with the trade status in 2014 (column 1). The diagonal elements show the percentage share of firms with unchanged trade statuses from 2014 to 2015, while off-diagonal elements show the share of firms with changed trade statuses.

Table A.5 Descriptive Regressions, Subsample and 25 Percentile, 2014-2015

One-way

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
Xs	-62.5	-76.8	-25.2	5.8	-57.6	9.7	3.346	-10.1
	(0.000)	(0.000)	(0.000)	(0.163)	(0.000)	(0.001)	(0.000)	(0.024)
Xg	-66.1	-72.8	-22.3	-14.4	-23.7	-16.3	-0.0122	4.1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.981)	(0.358)
Ms	-12.6	-2.6	-18.3	30.2	-17.5	26.4	0.408	2.5
	(0.198)	(0.810)	(0.000)	(0.000)	(0.153)	(0.000)	(0.586)	(0.672)
Mg	-55.4	-63.4	-7.6	-5.3	-18.5	-10.4	0.511	-10.1
	(0.000)	(0.000)	(0.027)	(0.117)	(0.017)	(0.000)	(0.293)	(0.010)

One-way bi

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
Xgs	-68.7	-78.9	-30.3	3.8	-33.6	9.3	1.461	-0.3
	(0.000)	(0.000)	(0.001)	(0.656)	(0.123)	(0.247)	(0.359)	(0.979)
Mgs	24.2	34.3	-12.4	47.6	-35.5	35.3	3.804	-1.3
	(0.077)	(0.025)	(0.020)	(0.000)	(0.001)	(0.000)	(0.000)	(0.836)

Two-way simple

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
XsMg	-63.1	-75.2	-12.4	-0.6	-21.3	7.1	0.397	-10.0
	(0.000)	(0.000)	(0.041)	(0.913)	(0.114)	(0.104)	(0.704)	(0.174)
XsMs	-15.0	-35.5	-18.8	27.3	-47.1	31.0	2.279	-4.2
	(0.054)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.368)
XgMg	-40.7	-43.4	-6.7	6.3	14.9	-3.9	0.557	-5.9
	(0.000)	(0.000)	(0.047)	(0.068)	(0.093)	(0.072)	(0.241)	(0.141)
XgMs	-18.2	-28.0	-10.1	14.5	-1.4	5.6	0.619	-0.5
	(0.145)	(0.045)	(0.131)	(0.048)	(0.933)	(0.240)	(0.508)	(0.944)

Two-way bi

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
XgsMg	-48.4	-51.1	-16.2	15.7	7.8	10.3	1.849	4.7
	(0.000)	(0.000)	(0.014)	(0.048)	(0.658)	(0.049)	(0.114)	(0.617)
XsMgs	17.7	14.0	-2.7	52.8	-23.4	60.0	2.210	-9.0
	(0.251)	(0.423)	(0.700)	(0.000)	(0.077)	(0.000)	(0.014)	(0.150)
XgMgs	27.1	34.9	0.1	36.3	35.5	20.4	1.871	-11.3
	(0.007)	(0.004)	(0.975)	(0.000)	(0.003)	(0.000)	(0.003)	(0.014)
XgsMs	-0.8	-21.7	-4.6	0.6	-31.7	27.0	-2.175	16.8
	(0.979)	(0.408)	(0.674)	(0.962)	(0.230)	(0.008)	(0.207)	(0.344)
XgsMgs	40.8	83.3	-1.3	51.7	-5.1	46.8	-0.509	-2.3
	(0.017)	(0.001)	(0.847)	(0.000)	(0.725)	(0.000)	(0.613)	(0.725)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No
Obs	20446	20240	19901	20239	19638	20239	20240	19152
R^2	0.276	0.211	0.0968	0.231	0.210	0.314	0.0531	0.0271

Notes: Restricted to the subsample of firms that did not change their trade statuses from 2014 to 2015 (10,326 unique firms). The definition of firm types is based on the 25 percentile threshold. We drop the top and bottom one percentiles of the dependent variable and control for sector and year effects. Reported estimates are the estimated coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by $100 * (\exp(\beta) - 1)$. All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Table A.6 Descriptive Regressions, Full Sample and 20 Percentile, 2014-2015

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
One-way								
Xs	-54.7	-71.2	-27.4	0.1	-52.1	7.0	2.697	-10.1
	(0.000)	(0.000)	(0.000)	(0.978)	(0.000)	(0.000)	(0.000)	(0.000)
Xg	-55.4	-61.2	-22.0	-13.5	-14.5	-15.0	0.495	3.4
	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.164)	(0.229)
Ms	-7.7	6.0	-15.5	25.7	-9.0	24.7	0.391	0.2
	(0.212)	(0.430)	(0.000)	(0.000)	(0.294)	(0.000)	(0.460)	(0.948)
Mg	-42.2	-46.6	-7.4	-5.6	-5.7	-9.2	0.923	-8.8
	(0.000)	(0.000)	(0.002)	(0.012)	(0.303)	(0.000)	(0.005)	(0.000)
One-way bi								
Xgs	-55.0	-67.5	-29.9	-4.4	-29.7	-0.9	1.818	-0.7
	(0.000)	(0.000)	(0.000)	(0.309)	(0.005)	(0.770)	(0.014)	(0.894)
Mgs	15.6	33.5	-9.5	42.0	-10.3	30.0	2.650	-5.1
	(0.044)	(0.000)	(0.008)	(0.000)	(0.210)	(0.000)	(0.000)	(0.183)
Two-way simple								
XsMg	-41.4	-55.2	-13.5	8.8	-7.4	13.0	1.441	-8.4
	(0.000)	(0.000)	(0.001)	(0.025)	(0.416)	(0.000)	(0.024)	(0.043)
XsMs	-1.1	-17.8	-19.2	25.6	-44.1	29.6	2.686	-4.9
	(0.830)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.103)
XgMg	-26.7	-23.6	-5.7	3.6	20.4	-4.0	1.042	-6.6
	(0.000)	(0.000)	(0.013)	(0.110)	(0.000)	(0.003)	(0.001)	(0.007)
XgMs	-15.7	-20.5	-10.1	8.0	5.0	5.1	0.757	0.0
	(0.050)	(0.023)	(0.028)	(0.086)	(0.637)	(0.092)	(0.236)	(0.997)

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
Two-way bi								
XgsMg	-38.3	-37.3	-11.0	13.0	17.9	9.2	1.482	-2.1
	(0.000)	(0.000)	(0.005)	(0.001)	(0.059)	(0.000)	(0.008)	(0.620)
XsMgs	24.6	37.6	-5.1	45.1	-12.1	49.2	2.179	-3.5
	(0.005)	(0.000)	(0.198)	(0.000)	(0.171)	(0.000)	(0.000)	(0.387)
XgMgs	28.0	43.9	-0.1	22.6	43.0	15.6	1.251	-8.5
	(0.000)	(0.000)	(0.965)	(0.000)	(0.000)	(0.000)	(0.002)	(0.003)
XgsMs	11.0	-7.9	-12.1	13.7	-21.2	23.2	0.0402	11.3
	(0.340)	(0.518)	(0.027)	(0.016)	(0.098)	(0.000)	(0.960)	(0.081)
XgsMgs	41.1	76.5	-1.2	40.6	8.7	40.9	0.484	-0.9
	(0.000)	(0.000)	(0.738)	(0.000)	(0.295)	(0.000)	(0.348)	(0.794)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No
Obs	33720	33379	33686	33379	32142	33380	33380	31173
R^2	0.242	0.176	0.0843	0.198	0.199	0.276	0.0380	0.0226

Notes: Definition of firm types are based on the 20 percentile threshold. We drop the top and bottom one percentiles of the dependent variable and control for sector and year effects. Reported estimates are the estimated coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by $100 * (\exp(\beta) - 1)$. All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Table A.7 Descriptive Regressions, Full Sample and 30 Percentile, 2014-2015

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
One-way								
Xs	-47.9	-65.6	-26.1	4.9	-52.3	12.6	2.658	-10.4
	(0.000)	(0.000)	(0.000)	(0.042)	(0.000)	(0.000)	(0.000)	(0.000)
Xg	-46.2	-50.7	-20.2	-9.5	-13.4	-10.1	0.515	2.8
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.071)	(0.203)
Ms	15.0	25.1	-11.8	28.5	-12.5	28.9	0.400	-1.7
	(0.016)	(0.001)	(0.000)	(0.000)	(0.098)	(0.000)	(0.405)	(0.598)
Mg	-31.8	-33.2	-4.4	0.2	-5.9	-3.0	0.876	-8.9
	(0.000)	(0.000)	(0.022)	(0.934)	(0.177)	(0.011)	(0.001)	(0.000)
One-way bi								
Xgs	-54.4	-66.7	-30.3	1.5	-28.8	3.9	1.752	0.2
	(0.000)	(0.000)	(0.000)	(0.731)	(0.008)	(0.242)	(0.028)	(0.971)
Mgs	47.1	79.0	-7.2	52.3	-16.1	44.5	2.614	-2.9
	(0.000)	(0.000)	(0.046)	(0.000)	(0.035)	(0.000)	(0.000)	(0.441)
Two-way simple								
XsMg	-43.8	-53.9	-13.7	12.0	-24.9	20.8	1.357	-7.3
	(0.000)	(0.000)	(0.001)	(0.003)	(0.003)	(0.000)	(0.039)	(0.097)
XsMs	7.1	-8.9	-18.5	27.8	-44.1	33.2	2.489	-4.2
	(0.151)	(0.090)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.107)
XgMg	-14.6	-4.2	-3.7	8.8	21.0	1.7	0.986	-5.0
	(0.000)	(0.289)	(0.055)	(0.000)	(0.000)	(0.159)	(0.000)	(0.011)
XgMs	-1.2	-1.1	-9.0	14.0	4.9	11.0	0.237	3.0
	(0.867)	(0.892)	(0.020)	(0.000)	(0.603)	(0.000)	(0.669)	(0.483)

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
Two-way bi								
XgsMg	-34.6	-36.9	-12.2	15.6	11.9	11.9	1.486	-2.1
	(0.000)	(0.000)	(0.012)	(0.002)	(0.283)	(0.000)	(0.041)	(0.679)
XsMgs	34.0	43.6	-5.2	43.9	-14.6	56.2	1.607	-5.7
	(0.001)	(0.000)	(0.249)	(0.000)	(0.113)	(0.000)	(0.011)	(0.151)
XgMgs	54.8	87.6	1.6	30.6	37.0	23.4	1.320	-8.6
	(0.000)	(0.000)	(0.586)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
XgsMs	11.1	-5.7	-11.9	15.6	-28.3	31.7	-0.583	7.0
	(0.345)	(0.680)	(0.035)	(0.012)	(0.030)	(0.000)	(0.523)	(0.291)
XgsMgs	53.1	91.9	-7.1	45.6	6.8	48.4	0.136	1.1
	(0.000)	(0.000)	(0.141)	(0.000)	(0.496)	(0.000)	(0.840)	(0.804)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No
Obs	33720	33379	33686	33379	32142	33380	33380	31173
R^2	0.236	0.168	0.0849	0.195	0.198	0.270	0.0382	0.0227

Notes: The definition of firm types is based on the 30 percentile threshold. We drop the top and bottom one percentiles of the dependent variable, and control for sector and year effects. Reported estimates are the estimated coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by $100 * (\exp(\beta) - 1)$. All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Table A.8 Descriptive Regressions, Subsample and 20 Percentile, 2014-2015

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
One-way								
Xs	-62.5	-77.2	-23.4	3.7	-56.4	8.7	3.201	-13.3
	(0.000)	(0.000)	(0.000)	(0.427)	(0.000)	(0.007)	(0.000)	(0.011)
Xg	-68.6	-74.7	-22.0	-16.3	-24.4	-18.5	-0.118	0.5
	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.000)	(0.845)	(0.924)
Ms	-22.6	-4.8	-19.7	29.7	-13.0	25.7	0.107	2.3
	(0.028)	(0.698)	(0.000)	(0.000)	(0.356)	(0.000)	(0.896)	(0.743)
Mg	-58.5	-65.1	-8.0	-7.5	-18.6	-12.4	0.249	-12.8
	(0.000)	(0.000)	(0.056)	(0.055)	(0.049)	(0.000)	(0.662)	(0.008)
One-way bi								
Xgs	-67.2	-80.3	-30.8	-6.3	-33.6	-1.5	1.912	4.3
	(0.000)	(0.000)	(0.000)	(0.456)	(0.161)	(0.849)	(0.216)	(0.731)
Mgs	4.6	13.0	-17.8	46.1	-27.9	30.7	3.359	-6.7
	(0.738)	(0.395)	(0.002)	(0.000)	(0.032)	(0.000)	(0.001)	(0.333)
Two-way simple								
XsMg	-58.1	-70.9	-6.4	-1.3	-6.1	6.2	-0.0358	-13.4
	(0.000)	(0.000)	(0.326)	(0.831)	(0.696)	(0.180)	(0.973)	(0.067)
XsMs	-13.6	-33.8	-18.0	25.2	-47.7	29.7	2.137	-8.0
	(0.132)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.137)
XgMg	-43.7	-46.4	-7.0	4.1	14.6	-5.7	0.431	-9.8
	(0.000)	(0.000)	(0.084)	(0.300)	(0.179)	(0.019)	(0.434)	(0.043)
XgMs	-20.2	-29.2	-4.5	13.4	-0.3	4.7	0.578	2.0
	(0.164)	(0.067)	(0.564)	(0.113)	(0.987)	(0.398)	(0.584)	(0.814)

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
Two-way bi								
XgsMg	-50.4	-55.3	-12.5	9.5	16.9	10.4	0.429	-1.2
	(0.000)	(0.000)	(0.068)	(0.184)	(0.347)	(0.030)	(0.674)	(0.891)
XsMgs	21.0	24.1	-4.8	55.1	-28.3	57.9	2.190	-6.2
	(0.184)	(0.175)	(0.467)	(0.000)	(0.047)	(0.000)	(0.020)	(0.395)
XgMgs	13.4	21.7	-1.8	28.8	34.3	16.0	1.175	-15.1
	(0.196)	(0.081)	(0.711)	(0.000)	(0.010)	(0.000)	(0.079)	(0.004)
XgsMs	19.2	-1.9	-5.7	11.7	-36.5	22.8	-1.885	5.9
	(0.516)	(0.946)	(0.602)	(0.327)	(0.205)	(0.012)	(0.167)	(0.683)
XgsMgs	31.3	69.7	-0.7	49.6	-8.7	44.9	-0.515	-5.0
	(0.037)	(0.001)	(0.918)	(0.000)	(0.517)	(0.000)	(0.551)	(0.433)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No
Obs	20183	19979	19651	19980	19404	19979	19980	18899
R^2	0.276	0.208	0.0935	0.230	0.206	0.324	0.0496	0.0280

Notes: Restricted to the subsample of firms that did not change their trade statuses from 2014 to 2015 (10,193 unique firms). The definition of firm types is based on the 20 percentile threshold. We drop the top and bottom one percentiles of the dependent variable, and control for sector and year effects. Reported estimates are the estimated coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by 100 * (exp(β) – 1). All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Table A.9 Descriptive Regressions, Subsample and 30 Percentile, 2014-2015

	(1) Employment	(2) Turnover	(3) Age	(4) Labour productivity	(5) Capital to labour	(6) Wage to labour	(7) Profitability	(8) Leverage ratio
One-way								
Xs	-61.2	-77.0	-24.5	5.1	-56.7	10.7	3.000	-10.4
	(0.000)	(0.000)	(0.000)	(0.182)	(0.000)	(0.000)	(0.000)	(0.009)
Xg	-63.0	-70.9	-21.5	-14.7	-21.7	-14.8	0.170	5.4
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.702)	(0.160)
Ms	-8.2	2.2	-16.4	32.7	-15.2	27.3	0.569	0.5
	(0.378)	(0.828)	(0.000)	(0.000)	(0.201)	(0.000)	(0.411)	(0.919)
Mg	-52.6	-60.2	-6.9	-2.8	-14.9	-7.1	0.704	-9.3
	(0.000)	(0.000)	(0.020)	(0.347)	(0.034)	(0.000)	(0.089)	(0.006)
One-way bi								
Xgs	-64.7	-76.4	-28.1	2.7	-48.6	12.1	1.156	3.4
	(0.000)	(0.000)	(0.001)	(0.755)	(0.014)	(0.138)	(0.469)	(0.730)
Mgs	44.6	58.6	-9.5	53.6	-26.6	45.4	3.804	-0.4
	(0.002)	(0.000)	(0.070)	(0.000)	(0.016)	(0.000)	(0.000)	(0.940)
Two-way simple								
XsMg	-64.7	-75.8	-11.8	1.0	-32.7	14.5	0.548	-10.9
	(0.000)	(0.000)	(0.059)	(0.858)	(0.009)	(0.001)	(0.589)	(0.133)
XsMs	-10.8	-34.5	-18.5	25.1	-46.8	30.6	2.213	-3.6
	(0.145)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.386)
XgMg	-36.9	-38.4	-5.3	6.3	17.4	-1.5	0.641	-4.7
	(0.000)	(0.000)	(0.079)	(0.044)	(0.031)	(0.434)	(0.117)	(0.171)
XgMs	-16.5	-23.5	-10.8	19.6	19.6	6.3	1.129	-3.2
	(0.157)	(0.063)	(0.076)	(0.005)	(0.246)	(0.134)	(0.197)	(0.608)
Two-way bi								
XgsMg	-56.4	-64.9	-18.3	8.1	-9.4	6.3	1.621	6.4
	(0.000)	(0.000)	(0.010)	(0.366)	(0.616)	(0.267)	(0.216)	(0.566)
XsMgs	10.4	-2.2	-5.8	43.2	-28.5	56.2	2.236	-9.2
	(0.507)	(0.897)	(0.423)	(0.000)	(0.036)	(0.000)	(0.019)	(0.130)
XgMgs	40.6	50.8	2.5	35.5	37.6	23.5	1.785	-12.8
	(0.000)	(0.000)	(0.561)	(0.000)	(0.001)	(0.000)	(0.004)	(0.003)
XgsMs	17.9	-7.1	-1.3	8.6	-11.9	27.5	-2.169	18.5
	(0.517)	(0.799)	(0.907)	(0.493)	(0.713)	(0.004)	(0.180)	(0.265)
XgsMgs	53.1	98.6	-6.0	60.6	3.5	57.6	-0.226	-1.6
	(0.011)	(0.001)	(0.459)	(0.000)	(0.843)	(0.000)	(0.844)	(0.817)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No	No	No	No
Obs	20753	20544	20200	20544	19940	20544	20543	19418
R^2	0.277	0.216	0.0918	0.226	0.204	0.308	0.0506	0.0303

Notes: Restricted to the subsample of firms that did not change their trade statuses from 2014 to 2015 (10,481 unique firms). The definition of firm types is based on the 30 percentile threshold. We drop the top and bottom one percentiles of the dependent variable, and control for sector and year effects. Reported estimates are the estimated coefficients and the p-values (in parentheses) from the OLS estimation of the respective firm's characteristics. To facilitate interpretation, the estimated coefficients for the firm dummies that are in logs have been transformed by 100 * (exp(β) – 1). All variables are expressed in logs, except profitability, which is expressed in percentage. Specifications (5) and (8) exclude firm-years with missing values of the dependent variable.

Table A.10 Conditional Distribution of the Number of Capital Participating Traders Per Class of Participated Traders

From / Into	Xs	Xg	Ms	Mg	Xgs	Mgs	XsMg	XsMs	XgMg	XgMs	XgsMg	XsMgs	XgMgs	XgsMs	XgsMgs	Minor
One-way																
Xs	47	0,9	5,2	5,2	1,7	1,7	0,9	18,3	8,7	0,9	0,9	0,9	0,9	0,9	0,9	5,2
Xg	4,6	23,9	2,8	11	0,9	0,9	0	1,8	33,9	6,4	0	0	2,8	1,8	0	9,2
Ms	6,1	3,6	22,8	3,6	0	5,1	0	17,3	8,6	3,6	0	4,6	5,1	0	2,5	17,3
Mg	2,5	8,9	1,9	27,8	0	3,8	0,6	0,6	27,2	2,5	0	1,3	3,8	0	0,6	18,4
One-way bi																
Xgs	0	14,3	0	0	14,3	0	14,3	14,3	14,3	0	28,6	0	0	0	0	0
Mgs	3,3	1,7	16,7	15	0	36,7	1,7	6,7	3,3	3,3	0	5	1,7	0	1,7	3,3
Two-way simple																
XsMg	12,5	0	0	25	0	0	25	25	0	0	0	0	12,5	0	0	0
XsMs	13,9	1,1	17,6	3	0,7	1,9	0,7	39	3	0,7	0,4	2,6	1,9	0	1,5	12
XgMg	4,2	10,5	2,2	12,2	0	1,4	1,7	4,2	48,2	1,9	1,1	1,1	4,7	0,8	0,3	5,5
XgMs	0	14,9	8,5	10,6	0	4,3	6,4	10,6	4,3	10,6	0	2,1	10,6	0	2,1	14,9
Two-way bi																
XgsMg	0	6,5	0	19,4	0	0	0	0	29	3,2	9,7	6,5	9,7	0	3,2	12,9
XsMgs	2,1	4,3	19,1	6,4	0	4,3	0	23,4	6,4	2,1	0	14,9	4,3	0	4,3	8,5
XgMgs	7,1	6,4	3,6	7,9	0	2,1	0,7	7,1	18,6	2,9	0	2,1	24,3	0,7	5	11,4
XgsMs	13,3	3,3	23,3	0	3,3	3,3	3,3	13,3	3,3	0	0	3,3	23,3	0	6,7	0
XgsMgs	0	3	4,5	9,1	3	4,5	4,5	19,7	7,6	1,5	1,5	12,1	12,1	3	9,1	4,5
Minor	11,2	7	9,1	9,1	0	1,4	0	7	9,1	3,5	0	6,3	4,2	0,7	1,4	30,1

Notes: The table corresponds to a relative conditional distribution of capital participating classes (rows) and capital participated ones (columns). Each cell defines the percentage of total firms belonging to the row class whose participation lays in firms belonging to the column class. Therefore, each row adds up to 100 per cent.

Table A.11 Conditional Distribution of Amounts by Capital Participating Traders Per Class of Participated Traders

From / Into	Xs	Xg	Ms	Mg	Xgs	Mgs	XsMg	XsMs	XgMg	XgMs	XgsMg	XsMgs	XgMgs	XgsMs	XgsMgs	Minor
One-way																
Xs	1,3	0	25,8	0,9	0,5	0,2	0	4,3	2,6	0	0	0,1	4,6	0	50,7	9,1
Xg	14,8	17,1	0,3	3,2	0	0	0	0	51,2	0,8	0	0	5,5	0	0	7,2
Ms	0,5	1,9	7,7	0,3	0	16,7	0	1,3	62	0,5	0	0,6	3,4	0	0,5	4,6
Mg	0,1	1,8	8,2	10,1	0	2,1	0	0	26,9	0,1	0	0	14,5	0	0	36,2
One-way bi																
Xgs	0	0,2	0	0	0	0	0	0	0,1	0	99,7	0	0	0	0	0
Mgs	0,3	0	85,6	0,6	0	12	0	0,1	0	1,4	0	0	0	0	0	0
Two-way simple																
XsMg	0	0	0	0,1	0	0	0	0,8	0	0	0	0	99,1	0	0	0
XsMs	0,4	0	36,9	1,5	0	0	0	25,3	1,4	0	0	28,7	0,6	0	4,9	0,2
XgMg	0,6	5,3	2,3	5,5	0	1,1	0	8,6	58,4	0,2	0,3	0	15,5	0	0	2,1
XgMs	0	68,2	0	13,2	0	0,6	0,9	3	0,1	3,5	0	0	8,4	0	0,1	1,8
Two-way bi																
XgsMg	0	1,9	0	6,9	0	0	0	0	34,6	0	0	0	56,6	0	0	0
XsMgs	0	18,2	0	3,9	0	0	0	9,7	0,2	0,1	0	34,3	1,9	0	0,2	31,4
XgMgs	0,1	3,6	57,9	0,1	0	1,4	0	0,1	15,1	0,9	0	0	18,3	0	0,4	2,1
XgsMs	0,7	21,8	9,9	0	0	9,7	0	2,1	8	0	0	0	12,4	0	35,5	0
XgsMgs	0	0	0,3	1,2	0,1	4,3	1,9	0	47,5	0	0	31,6	10,6	0	0,8	1,6
Minor	3,1	0,9	5,3	36,8	0	0	0	2,1	0,7	22,8	0	0,2	25,6	0	0	2,5

Notes: The table corresponds to a relative conditional distribution of capital participating classes (rows) along capital participated ones (columns). Each cell defines the percentage of total capital participations by firms belonging to the row class that is directed to firms belonging to the column class. Therefore, each row adds up to 100 per cent.

Table A.12 Number of Capital Participations, Type of Trader and Productivity, 2014-2015

		(1)		(2)	
		Productivity		Productivity	
		0.0161		0.189	
		(0.0434)		(0.0449)***	
Outdegree	Indegree	Dummy	Interaction	Dummy	Interaction
One-way	**One-way**				
Xs	Xs	-0.0167	0.0874	0.0215	-0.176
		(0.0308)	(0.0592)	(0.0307)	(0.0479)***
Xg	Xg	-0.168	0.165	-0.139	-0.00167
		(0.0269)***	(0.0720)**	(0.0271)***	(0.0705)
Ms	Ms	0.286	0.0175	0.263	0.0777
		(0.0523)***	(0.0508)	(0.0517)***	(0.0994)
Mg	Mg	-0.0678	0.0452	-0.0388	-0.0803
		(0.0253)***	(0.0571)	(0.0255)	(0.0615)
One-way bi	**One-waybi**				
Xgs	Xgs	-0.0683	0.0569	-0.0414	0.0185
		(0.0497)	(0.155)	(0.0500)	(0.142)
Mgs	Mgs	0.359	0.0354	0.391	-0.125
		(0.0472)***	(0.0561)	(0.0460)***	(0.114)
Two-way simple	**Two-waysimple**				
XsMg	XsMg	0.0774	0.103	0.112	-0.156
		(0.0410)*	(0.0829)	(0.0407)***	(0.122)
XsMs	XsMs	0.229	0.0336	0.265	-0.161
		(0.0333)***	(0.0535)	(0.0329)***	(0.0477)***
XgMg	XgMg	0.0277	0.0628	0.0589	-0.0915
		(0.0247)	(0.0491)	(0.0248)**	(0.0516)*
XgMs	XgMs	0.0740	0.00595	0.106	-0.172
		(0.0479)	(0.0747)	(0.0473)**	(0.0887)*

		(1)		(2)	
		Productivity		Productivity	
		0.0161		0.189	
		(0.0434)		(0.0449)***	
Outdegree	Indegree	Dummy	Interaction	Dummy	Interaction
Two-way bi	**Two-waybi**				
XgsMg	XgsMg	0.122	0.0974	0.164	-0.141
		(0.0448)***	(0.0713)	(0.0449)***	(0.186)
XsMgs	XsMgs	0.370	-0.00204	0.405	-0.188
		(0.0446)***	(0.0662)	(0.0440)***	(0.0787)**
XgMgs	XgMgs	0.200	0.149	0.249	-0.122
		(0.0351)***	(0.0653)**	(0.0356)***	(0.0687)*
XgsMs	XgsMs	0.0931	0.0545	0.145	-0.138
		(0.0692)	(0.0589)	(0.0691)**	(0.122)
XgsMgs	XgsMgs	0.299	0.109	0.339	-0.0382
		(0.0445)***	(0.0656)*	(0.0456)***	(0.133)
Constant	Constant	10.34		10.31	
		(0.0596)***		(0.0595)***	
Year fixed effects	Year fixed effects	Yes		Yes	
Sector fixed effects	Sector fixed effects	Yes		Yes	
Firm fixed effects	Firm fixed effects	No		No	
Cluster	Cluster	Yes		Yes	
Observations	Observations	34,060		34,060	
R^2	R^2	0.199		0.200	

Notes: Stars indicate significance levels of 1% (***), 5% (**) and 10% (*). Robust standard errors clustered at the firm level. The specifications include year effects and sector fixed effects at the 2-digit level.

II.
International Trade in Services: Evidence for Portuguese Firms

Abstract

This paper describes the main features of Portuguese international trade in non-tourism services, using a new transaction-level database on services trade merged with detailed balance sheet data. We find that a few two-way traders with diversified service and geographical portfolios account for a substantial share of exports and imports. Compared with one-way traders, two-way traders are larger, older, more productive and more profitable. We also unveil new evidence on the bimodality of the export intensity distributions, with density concentrating on both ends of the distribution. Moreover, when considering all margins of firms' services trade and controlling for several firm characteristics, the intensive margins of exports and imports of services are positively related to both productivity and profitability. Regarding the extensive margins, the number of different types of services imported by a firm is also positively associated with its performance.

JEL: F1, F14, L25
Keywords: International trade, Services, Trade margins, Firm-level data.

Section 1
Introduction

International trade in services has been growing substantially since the mid-eighties. This trend translated into rising shares in total gross output, employment and trade in this sector (Figure 1). The drivers of international trade in services are similar to those of trade in goods, and include the reduction of political and economic barriers to trade, the development of global value chains and the acceleration of technological progress. The latter aspect, in particular, has been vital to move services away from the traditional notion of non-tradables. The lower costs and the increased speed and reliability of transportation facilitate the travel of individuals to provide and consume services around the globe. In addition, the sharp progress in information and communication technologies, and the dramatic fall in telecommunication costs have led to the strong growth in exchanges of electronically transmitted business services. Hence, financial, computer, information and other commercial and business services are increasingly traded internationally. Overall, the expansion of services has fundamentally altered the economic landscape across the world and is likely to play a crucial role in the future. In the next decades, as new technological developments (like telepresence and telerobotics) reduce the costs of face-to-face interactions, it is likely that more workers start providing services abroad, even in tasks that require physical presence today (see Baldwin (2016) for a discussion on globalisation's *third unbundling*).

A significant development in the literature on empirical trade is the utilisation of micro-level data to understand the reality of international trade. This literature has advanced significantly when it comes to goods trade, but it is still relatively scarce for international trade in services. The seminal paper of Breinlich and Criscuolo (2011), for the UK, provided a novel set of stylized facts on firms engaging in international trade in services and was followed by studies on the profiles of service traders using Balance of Payments data at the firm-level for other European countries. The list of these studies includes Federico and Tosti (2017) for Italy, Minondo (2016) for Spain and Ariu (2016) for Belgium. Comparable cross-country evidence on the characteristics of trading firms in service sectors is provided by Haller *et al.* (2014) and Damijan *et al.* (2015) for Finland, France, Ireland and Slovenia, while Ariu *et al.* (2017) analyse the role of firm heterogeneity in shaping aggregate service exports in Belgium, France, Germany and Spain.

This literature finds many similarities between services and goods trade at the firm level, suggesting that models of heterogeneous firms for trade in goods are an appropriate starting point to explain trade in services. These studies show that a small number of firms engage in exports or imports (one-way traders), and even fewer firms are active in both dimensions (two-way traders). Moreover, firms participating in international trade in services are larger and have higher productivity, skill intensity and wages than non-traders. Available evidence also confirms the strong heterogeneity among firms in terms of traded values, number of partner countries and service types, as well as the concentration of services trade values between and within firms.

Figure 1 International Trade in Non-Tourism Services in Percentage of GDP

(A) International trade in services

— World   -- Portugal

(B) Portuguese exports and imports

Balance   — Exports   -- Imports
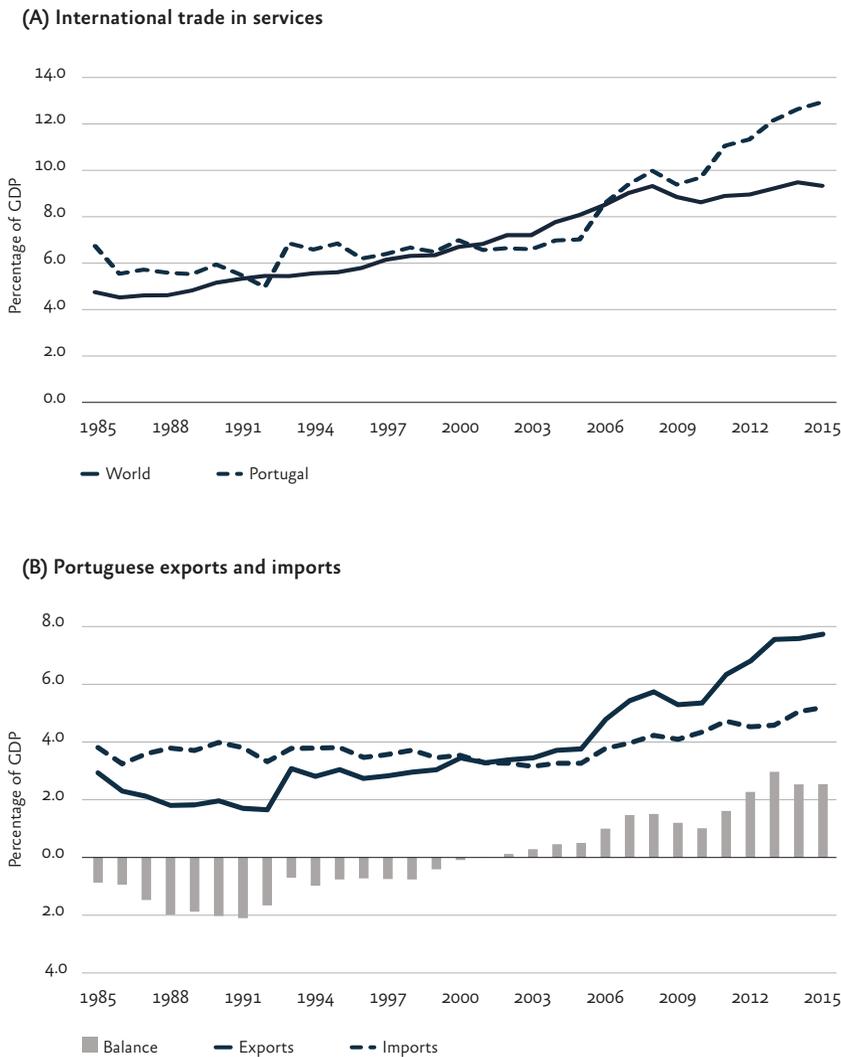
Source: CEPII-Chelem database.
Notes: Nominal Balance of Payments transactions and nominal GDP denominated in current US dollars. Exports and imports of services exclude transactions in the travel account.

This paper contributes to the literature by reporting a set of stylised facts using detailed firm-level data on Portuguese service exporters and importers. Portugal is an interesting case study because its export performance stands out as a key variable in the recovery from the latest sudden stop in external financing, triggered by the sovereign debt crisis in the euro area.

Portugal has been experiencing a progressive increase in trade openness, and there has been a growing importance of trade in services. Even though tourism remains the largest sector in Portuguese trade in services, accounting for around 45 per cent of total exports and 28 per cent of total imports of services, trade in non-tourism services has been gaining importance since the 2000s (Figure 1). In 2015, the total Portuguese trade in non-tourism services represented around 13 per cent of the GDP, against around 9.5 per cent in the world economy. In addition, as of the 2000s, Portugal has been recording surpluses in the non-tourism services account, contrasting with the systematic deficits registered previously. In 2015, the Portuguese services account, excluding tourism, showed a surplus of 2.5 per cent of GDP, with exports and imports representing 7.7 and 5.2 per cent of GDP, respectively.

Our analysis relies on transaction data on Portuguese international trade in non-tourism services using a disaggregated breakdown by partner country, as collected by the Statistics Department of the Banco de Portugal merged with balance sheet information of the firms for 2014 and 2015. This set of information makes it possible to improve the existing knowledge about services trade in Portugal, for instance, regarding the role of multi-service and multi-country firms. In this paper, we distinguish between firms that only export, firms

that only import, and firms that engage in both international flows of services (two- way traders). We confirm most of the evidence on international service traders observed for other countries, namely the strong level of heterogeneity in services trade and the concentration of trade flows between and within firms. In particular, two-way traders with diversified service and geographical portfolios account for a large proportion of Portuguese service exports and imports. In addition, two-way traders tend to be larger, older, more productive and more profitable than one-way traders. We also unveil new evidence on the bi-modality of the export intensity distributions, common to both types of traders and firms of different size classes and age groups.

Taking advantage of the transactional dimension of the data, we consider two extensive margins of firm-level trade (number of trading partners and number of services traded) and one intensive margin (trade per country-service type combination). We show that the intensive margin of firm-level trade is more important than the extensive margins to explain the differences in traded values among Portuguese service traders, for both exports and imports. Moreover, larger and more productive firms have higher values of services exports and imports, they trade more per country and service type, and they trade more types of services with more countries. Most of the correlations between firm productivity, profitability and size, on the one hand, and firm-level trade flows, on the other hand, are explained by the intensive margin of firm-level trade. Considering all the different margins of a firm's trade and controlling for several firm characteristics, there is a positive link between the average values traded per service- country and between the firms' productivity and profitability. The number of different types of services imported by a firm is also positively related

with the firm's performance, pointing to the importance of foreign services as inputs for firms.

This paper is organised into four sections. Section 2 briefly discusses the specificities of measuring international trade flows of services, describes the main features of the two databases used, and provides some basic descriptive statistics of the sample. Section 3 reports our findings along three main blocks. First, we describe some basic attributes of the three types of service traders in terms of sector of activity, age, size, productivity and profitability. Secondly, we examine the portfolios of trading firms at the transaction-level, concerning the number of services and partner countries. Thirdly, we assess how the intensive and extensive trade margins correlate with the firms' productivity and profitability. Finally, section 4 offers some concluding remarks.

Section 2
Concepts, Measurement and Data

2.1. Concepts and Measurement

The relatively limited number of firm-level studies on international trade in services is partially explained by the difficulties in compiling and interpreting the available data. The services sector has several specificities that lead to fundamental differences in trade in goods.

Firstly, services are intangible, and hence their international trade does not involve shipping. Consequently, services are inherently harder to monitor, measure and tax. Secondly, services are non-storable, so their production and consumption tend to co-occur. Thirdly, services are highly differentiated, as they are sometimes tailored to the needs of the customers. Fourthly, all services require some form of interaction between the provider and the user, the so-called joint production. It can consist of direct person-to-person contact (e.g., haircut), remote forms of contact (e.g., internet banking) or the 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 provider to move to the consumer's 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 service providers or on the scope of their activities. Moreover, regulations also 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 where most economic regulation is concentrated and where domestic regulations are most relevant for the economic activity. Nordås and Rouzet (2017) use a recent OECD regulatory database on services trade restrictions and highlight the high potential costs of regulations that restrict trade and investment in services.

The intangible nature of trade in services also makes these flows difficult to measure. As such, finding efficient ways to collect data on international services transactions constitutes 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 primary 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.

To understand the consequences of the analysis arising from alternative definitions of trade in services, it is useful to provide additional detail 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 suppliers and consumers of traded services.

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 consumers and suppliers remain in their respective region. Freight transport services, correspondence courses and telediagnosis are examples of cross--border service supply.

Mode 2 (consumption abroad) comprises the cases when a consumer that resides 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 exceptions are short-term construction projects by unincorporated site offices, which are recorded in the BoP under construction services.

Finally, mode 4 (presence of natural persons) includes situations in which a provider moves temporarily to the country of the consumer 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 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 and 2, a small part of mode 3, and a significant part of mode 4. Therefore, international trade in services is being underestimated when 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 service exports 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 trade 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.[4]

2.2. Databases

The empirical analysis relies on transactional data of Portuguese firms trading services from the Portuguese BoP services account compiled by Banco de Portugal. This data is merged with detailed balance sheet and income statement information from the Simplified Corporate Information (*Informação Empresarial Simplificada*, Portuguese acronym: IES). We link the databases by using a common and unique firm identifier, analysing the period for which both databases were available namely 2014 and 2015.

The services account of the Portuguese BoP measures services transactions between resident and non-resident entities in accordance with the Balance of Payments Manual (6th edition) of the IMF (2016). 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 away from a subset of the BoP and reflecting the modes by which services are supplied.

The Banco de Portugal collects transaction-level data on international trade in non-tourism services every month to compile the services account of the Portuguese BoP. No firm-level data for travel and tourism flows is available. The survey defines a non-reporting threshold of 100 thousand euros on the yearly value of all economic and financial operations of a firm with non-residents.

Hence, no specific reporting threshold is imposed on the international transactions of services. The firm-level data covers more than 90 per cent of total Portuguese exports of non-tourism services and around 80 per cent of imports of non-tourism services, as published in the official BoP. We aggregated the data by year, and all values are expressed in current euros. For each external transaction, the database reports the firm identifier, the classification of the service, the partner country and the time period. Types of services are defined according to the 2010 classification of the Extended Balance of Payments Services (EBOPS). We use a breakdown that comprises 29 categories of services, as described in the Appendix. Although this is a relatively disaggregated level in the EBOPS classification, it is much more aggregated than the usual product classifications available for trade in goods. Hence, the interpretation of our results on the contribution of the "extensive margin" of services trade (i.e., the number of types of service traded) should take this fact into consideration.

The balance sheet data draws on annual information for Portuguese firms reported under the Simplified Corporate Information (*Informação Empresarial Simplificada*, IES), which results from a collaboration between the Ministry of Finance, the Ministry of Justice, the Statistics Portugal and the Banco de Portugal. The IES follows the new accounting standards system from 2010 to 2015, forming a virtual coverage of the Portuguese universe of non-financial corporations.[5]

The IES has universal coverage, because it is the system through which corporations report mandatory information to the tax administration and statistical authorities. Under IES, firms provide detailed annual balance sheet, profit and loss accounts data. It further contains information on firms' characteristics such as the number of employees,

age and main sector of economic activity according to the Portuguese industrial classification Rev 3 – *Portuguese Classification of Economic Activities* (CAE).

Some filters were imposed on the data to eliminate erroneous, inconsistent or missing observations. Firstly, the analysis was restricted to firms with available information on a set of key variables, such as age and sector of activity. Secondly, we further restricted the sample to firms with positive values for gross value-added, employment, labour costs and total assets.

The sample used in this paper is based on firms that are part of both BoP and IES databases. Therefore, it only includes Portuguese firms that are active in the international services market, i.e., firms that either exported and/or imported non-tourism services in 2014 and/or 2015. Given the merge with the IES data, the final sample excludes most of the banking and insurance sector. This leads to reduced coverage of the international trade activity of these types of services, even if the database contains information on financial services provided by non-bank institutions. Note that the classification of service types is different from the one used to assign firms to sectors of economic activity. Firms are officially classified in a sector of CAE according to their main reported activity and, according to their import and/or export activities of one or more of the 29 types of services of the EBOPS classification with independent classifications.

2.3. Descriptive Aggregate Statistics

We classify international service traders into three categories according to their trading statuses: only export (one-way exporters), only import (one-way importers) or engaging in both activities (two- way traders). The general terms exporters/importers refer to firms exporting or importing services regardless of their import/export dimension. Throughout the analysis, we calculate the statistics using firm-year observations, where a firm active in services trade in both years is counted as a new observation each year, i.e., it is calculated twice in the pooled dataset. For simplicity, we will use the term *firm* for *firm--year* and the term *services* for *non-tourism services* in the remaining of this chapter. Finally, the tables and graphs represent pooled results for 2014 and 2015.

Table 1 Sample of Portuguese International Service Traders, 2014-2015

| | Traders | | Exports | | Imports | |
Firm type	Number	%	Value	%	Value	%
One-way exporters	4,506	28.0	2,389,858	10.9	–	–
One-way importers	4,430	27.5	–	–	736,306	6.4
Two-way traders	7,181	44.6	19,570,445	89.1	10,850,840	93.6
Exporters	11,687	72.5	21,960,303	100.0	10,850,840	–
Importers	11,611	72.0	19,570,445	–	11,587,146	100.0
Total	**16,117**	**100.0**	**21,960,303**	**100.0**	**11,587,146**	**100.0**

The final sample contains 9,903 unique firms. Considering the two years, there are 16,177 firms-year, of which 4,506 only export, 4,430 only import and 7,181 engage in both activities, i.e., 11,687 firms-year

report positive exports and 11,611 firms-year report positive imports (Table 1). For the UK, Breinlich and Criscuolo (2011) find that exporting services is more common than importing, while (Federico and Tosti 2017) have the opposite result for Italy. In our sample, the proportions of one-way exporters and importers are very similar, each representing around 28 per cent of traders. An interesting fact in Table 1 is that a substantial share of Portuguese firms that participate in international trade are active in both flows: two-way traders represent around 45 per cent of trading firms. Another feature that stands out in Table 1 is the striking concentration of trade values in two-way traders: these firms account for around 90 per cent of total exports, and around 94 per cent of total imports.

Table 2 shows the representation of firms and trade flows according to 10 broad categories of services at the 2-DIGIT level of the 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" as regards exports, and "Telecommunications, computer and information" as regards imports. The two latter service categories are third in the ranking of the number of importers and exporters, respectively.

In terms of values traded "Transport" accounts for almost half of the value exported (48.2 per cent), followed by "Other business services" (30.6 per cent). On the import side, "Other business services" rank first (35.7 per cent) and "Transport" second (27.5 per cent). "Telecommunications, computer and information" accounts for the third highest shares in exports and imports (10.6 and 15.6 per cent, respectively). Hence, Portuguese international trade in non-tourism services is dominated by three main categories of services: "Other

business services", "Transport" and "Telecommunications, computer and information". Within these broad categories of services, 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", regarding both exports and imports.[6]

Table 2 Shares in Total Trade and Firms by Broad Service Categories, 2014-2015

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

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 type of services for a disaggregated breakdown of the 29 types of services 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.

To examine the geographical composition of Portuguese international trade in services, Table 3 reports the ten largest export and import partner countries in terms of number of firms and their percentage share in the respective trade flows. The main trade partners are almost identical on the export and import side, dominated by European Union (EU) and Portuguese speaking countries. The UK, Spain and France are the top export destinations, while Spain, the UK and Germany are the top import origins. Interestingly, Spain has a larger share of imports from Portugal than exports (17.7 versus 11.1 per cent). In addition, Spain is also the country with the largest number of both exporters and importers. Regarding non-European countries, Angola and Brazil are more relevant in terms of exports, while the USA is more relevant in terms of imports.

Table 3 Main Partner Countries – Shares in Total Trade and Firms, 2014-2015

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

Notes: Firms are counted each time they export or import from 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.

Section 3
A Portrait of Portuguese International Service Traders

In this section, we report a set of stylized facts on Portuguese service exporters and importers, distinguishing between one-way exporters, one-way importers and two-way traders. First, we describe some basic attributes of the three types of service traders along several dimensions like their sector of activity, age, size, productivity and profitability. Second, we examine the portfolios of the trading firms in terms of number of services and partner countries. Third, we assess how the intensive and extensive margins of trade at the firm level correlate with attributes of the firms, such as productivity and profitability.

3.1. Characteristics of Portuguese International Service Traders

We start by examining the frequency and trade representativity of the different types of traders by main sectors of economic activity. Table 4 illustrates the sectoral distribution of the trading firms, while Table 5 reports the same information for the values of exports and imports. The distribution of firms within sectors of activity reveals that there is a high heterogeneity among 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 almost half of the firms in the manufacturing industry only import services. In contrast, the sectors of transportation and professional activities are dominated by exporters and two-way traders, with the latter firm type representing almost 80 per cent of the trading firms in the information and communication sectors.

Table 4 International Service Traders by Firm
Type and Sector of Activity, 2014-2015

| Sector of activity | No. firms Total | 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 and other 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**

Notes: Values are based on firm-year observations, implying that a firm can appear more than once and change its category type within the two years. The sample contains 16,177 firms-year, of 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 regardless of the import (export) dimension of the firm.

The last two columns of Table 4 show that wholesale is the largest sector in number of trading firms, accounting for more than 20 per cent of both exporters and importers. As found for other countries, manufacturing firms further represent a significant part of the total international service traders. The fact that more than 14 per cent of all firms exporting services belong to the manufacturing industry (23 per cent for importers) links with recent evidence on the relevance of the 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 providing an integrated combination of goods and services that add value and contribute to product differentiation (for a discussion, see Baines *et al.* (2009). Other relevant sectors in terms of number of service traders are transportation, professional activities, and information and communication.

Table 5 Services Trade Values by Firm Type and Sector of Activity, 2014-2015

(A) Exports

Sector of activity	Exports Total	Within sectors Exp Only	Within sectors Exp & Imp	By sector 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 and other 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 Total	Within sectors Imp Only	Within sectors Exp & Imp	By sector 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 and other 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**

Notes: Trade values are expressed in thousand euros. The table shows 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.

The representativity of sectors and firm types differs when assessing their importance in exports and imports values, rather than in number of firms (Table 5). On the export side, the relevance of wholesalers in terms of total exports decreases, as they represent 21.4 per cent of exporters but only 6.2 per cent of overall exports. The same is visible for the manufacturing industry, which accounts for 14.2 of total services exporters and 5.9 per cent of total exports. On the import side, the change in the importance of both wholesalers and manufacturers is smaller, with each accounting for about 23 per cent of importers and 13 per cent of imports. Accordingly, firms in the wholesale and manufacturing sectors appear to be more relevant in terms of imports than exports, suggesting that sourcing services inputs is important in these sectors. The opposite pattern applies to transportation, which is the largest sector in terms of trade values, representing nearly half of total exports and more than one-third of imports. Firms in the information and communication sectors account for around 20 per cent of total imports, with a smaller share in exports (11.1 per cent). The opposite applies to professional activities, with a higher relevance in exports than imports (16.0 per cent and 5.2 per cent, respectively).

Another feature that stands out in Table 5 is that the concentration of services exports and imports in two-way traders is common to most sectors of activity. In two of the main Portuguese services trade sectors: – transportation, and information and communication – two-way traders account for 99 per cent of the imports and more than 90 per cent of the exports of the respective sector. One-way traders have above-average importance in exports of professional activities, accounting for more than 23 per cent of the flows.

Table 6 presents the joint distribution of traded values and traders in the firm type and size categories. The four categories of size are defined according to the EU official classification, which combines the number of employees, turnover and balance sheet total.[7] Large firms account for the majority of international service trade flows in Portugal, representing 63 per cent of exports and 67 per cent of imports. However, most international service traders are micro and small firms. In particular, around half of one-way exporters are micro firms, while more than 40 per cent of one-way importers are small firms. The proportion of large firms is higher in two-way traders, representing more than 11 per cent of the total firms. The distribution of firms and international service trade flows within size classes is in line with that identified for Portuguese international trade in goods (Amador and Opromolla 2013).

The joint distributions of Portuguese international service trade regarding the age and type of firm shown in Table 7. Older firms are responsible for a substantial proportion of Portuguese international trade in services. Firms with more than 20 years represent 37.3 per cent of total exporters and 43.3 per cent of total importers, accounting for around 60 per cent of both trade flows. On average, 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.

Table 6 Joint Distribution of Trade Values and Traders by Firm Type and Size Category

(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

(A) 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

Notes: Each cell represents the percentage of total exporters (importers) or exports (imports) associated with firms-year belonging to a specific size class (row category), and type of firm (column category) in 2014-2015. The four size classes are defined according to the EU official classification (for more details, see footnote 4 of the main text).

Table 7 Joint Distribution of Trade Values and Traders by Firm Type and Age Group

(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

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

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, with more than 90 per cent of one-way importers and more than 70 per cent of two-way traders located in the first bin of the respective histograms. The percentage of firms exporting less than 250 thousand euros amounts to 73.8 per cent for one-way exporters and 52.1 per cent for two-way traders. The spikes on the last bin of the histograms for two-way traders indicate that some of these firms have very high trade flows. This feature is more important for exports than for imports: the percentage of two-way traders exporting more than 3000 thousand euros is 10.5 per cent, while the corresponding shares for imports amount to 6.7 per cent.

Figure 2 Distribution of Trade Values by Firm Type, 2014-2015

(A) Exports of one-way exporters

(B) Exports of two-way traders

(C) Imports of one-way importers
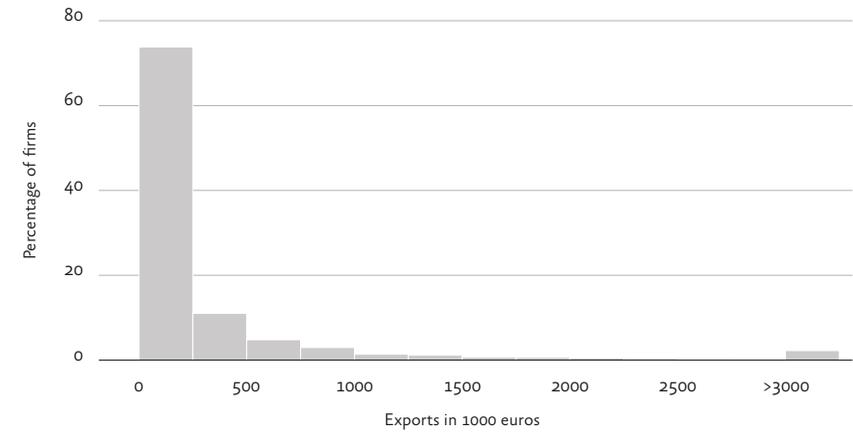
(D) Imports of two-way traders
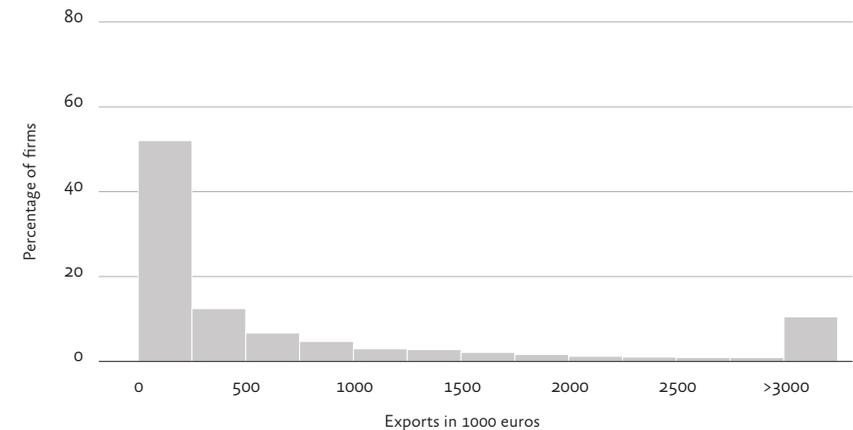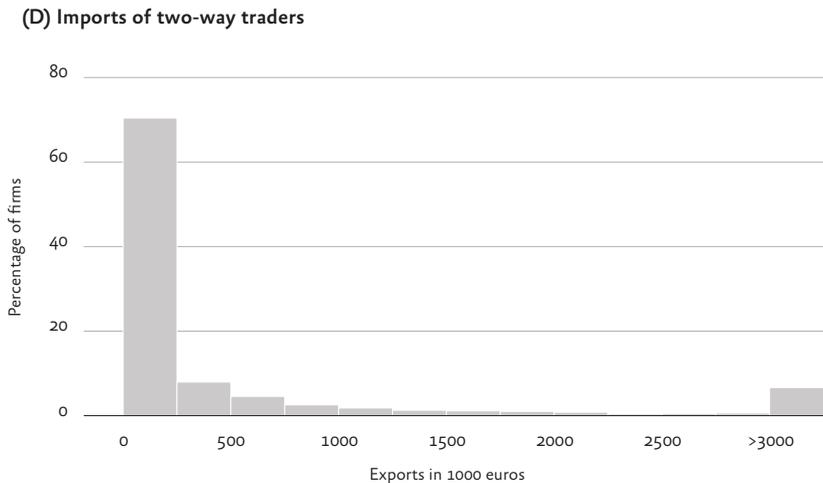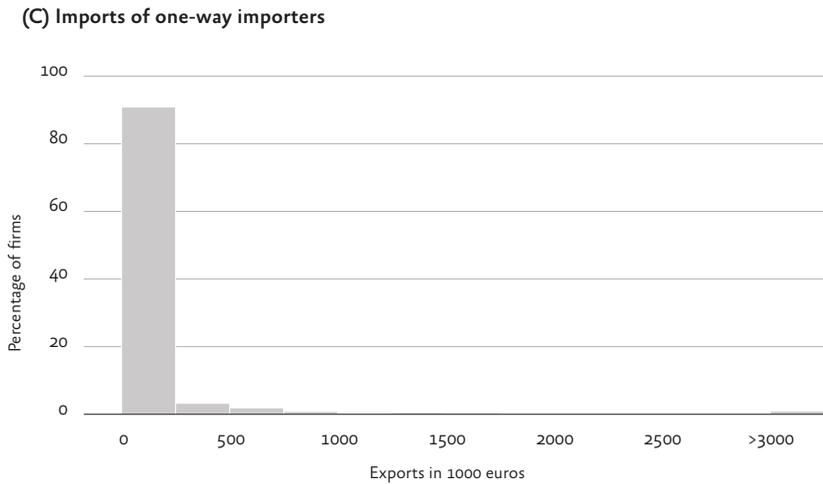
Notes: Exports and imports are in thousand euros. Distributions are based on firm-year observations in 2014-2015.

Figure 3 plots the distributions of service export and import intensities for the three firm types, measured as the ratio of each flow in total (foreign and domestic) service sales. Export intensity reflects the importance of external markets in the total service sales of a firm, while import intensity indicates the importance of the external markets as origins of services in the corresponding activity. The distribution of import intensity (panel B) shows that most service importers have low import intensities. On the export side, panel A suggests that service exporters have a bi-modal distribution, with two-way firms more concentrated in the first mode, and one-way exporters in the second one. This high concentration of firms on both ends of the distribution of export intensity contrasts with one important stylised fact in these firms' international trade in goods: most exporters sell the majority of their output domestically. However, our finding is in line with recent evidence from Defever and Riaño (2017) on the existence of a bi-modal distribution of export intensities. These authors use harmonised firm-level data on the manufacturing sector for 72 countries and show that these "twin peaks" in the distributions are typical of two-thirds of the countries in the sample. Even if Figure 3 gives strong evidence on bi-modality, we perform a formal test: the so-called dip statistic proposed by Hartigan and Hartigan (1985), which measures the departure of a sample from unimodality. The results of the test clearly reject the null hypothesis of unimodality in the distribution of export intensity of both types of Portuguese international service traders at a 0.1 per cent significance level.

Figure 3 Distribution of Trade Intensities by Firm Type, 2014-2015
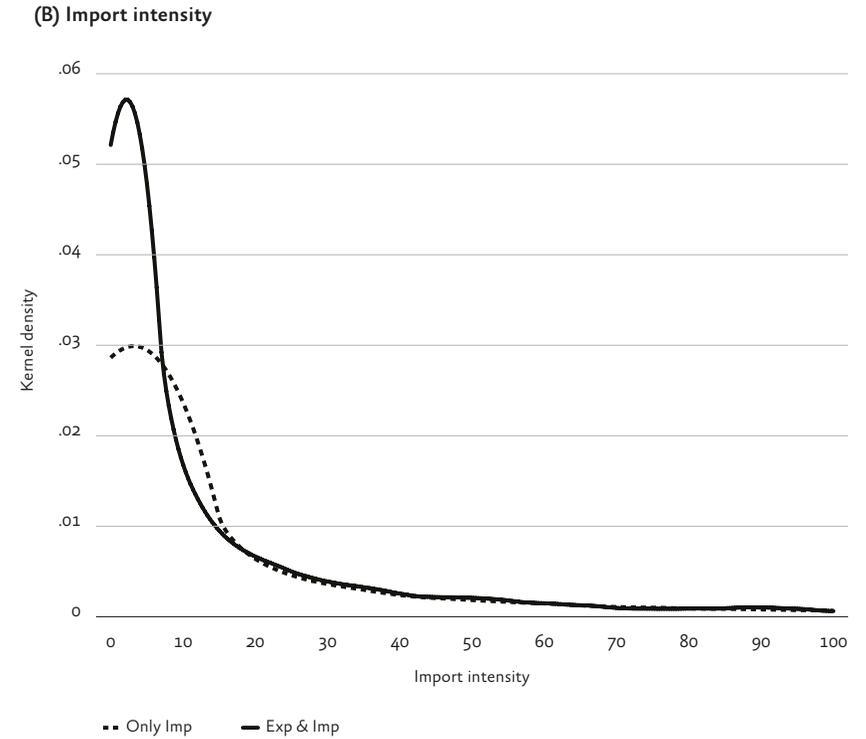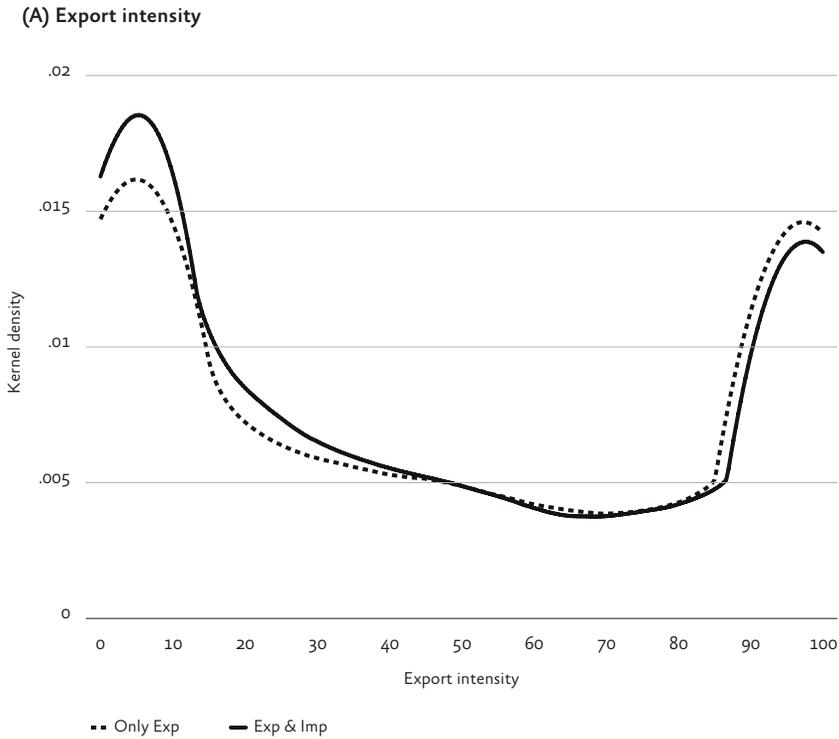
(A) Export intensity

Kernel density / Export intensity

- - - Only Exp —— Exp & Imp

(B) Import intensity

Kernel density / Import intensity

- - - Only Imp —— Exp & Imp

Notes: Export (import) intensity equals the percentage share of exports (imports) in total (domestic and foreign) sales of services. Export intensity is based on all 11,687 firms-year exporting services in 2014-2015. Import intensity is truncated at 100 and excludes 1,259 firms-year that have zero total service sales. Hence, import intensity is based on 8,790 firms-year importing services in 2014-2015.

The distributions of export and import intensities of the firms in the four different size classes and age groups are shown in Figure 4. The evidence of the bi-modality of the distribution of export intensity of Portuguese international service traders is common to firms of distinct sizes and ages. However, there are some differences between the groups. The smaller the exporters, the higher the density in high export intensities, that is, smaller firms seem relatively more engaged in exports. The older the exporters, the higher the density in lower export intensities, that is, younger firms appear to be relatively more engaged in exports. This feature is particularly evident for micro-firms and firms with 5 years at most: in both cases, at least 25 per cent of the firms sell all of their services in external markets, i.e., they have an export intensity of 100 per cent. As for the import side, small and micro firms have a high concentration in low import intensity ratios, while large firms have a more dispersed distribution of import intensity. In addition, the high concentration of firms in low import intensity ratios is evident for all age classes, though it is slightly less marked for firms with more than 20 years.

Figure 4 Distribution of Trade Intensities by Size Class and Age Group, 2014-2015

(A) Export intensity by size class
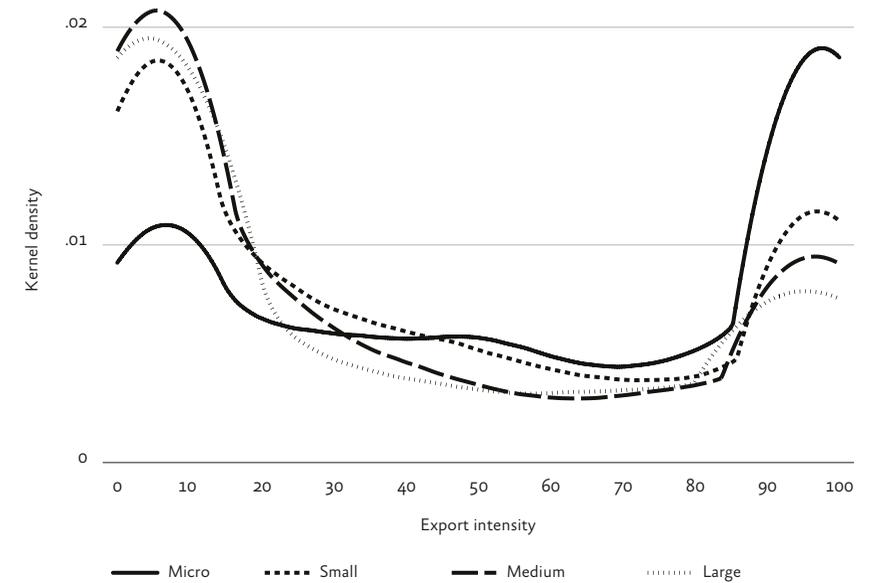
(B) Import intensity by size class

Kernel density / Import intensity

Micro · · · · · · Small — — Medium · · · · · · · · Large

(C) Imports of one-way importers

Kernel density / Export intensity

1-5 years · · · · · 6-10 years — — 11-20 years · · · · · · · · >20 years
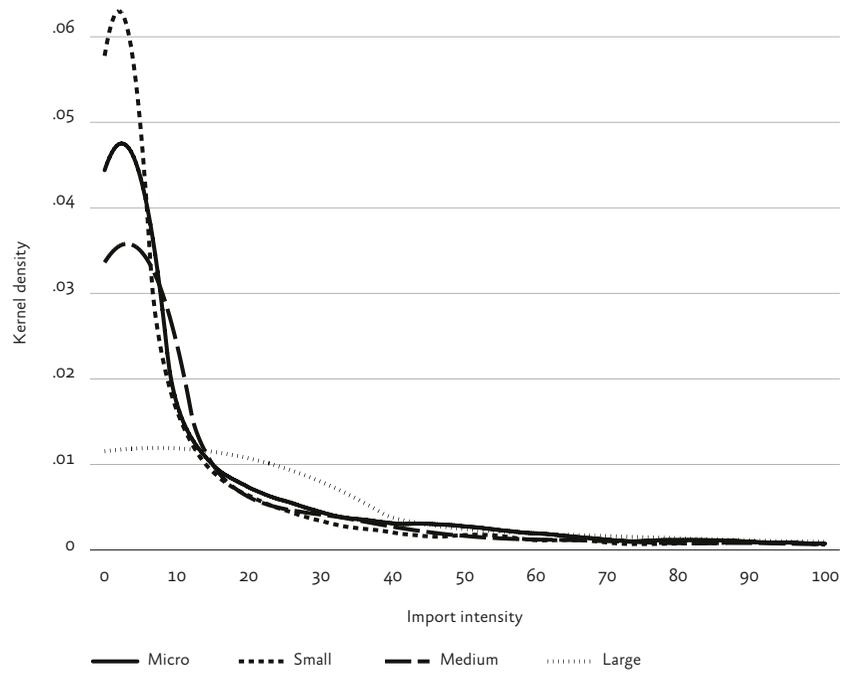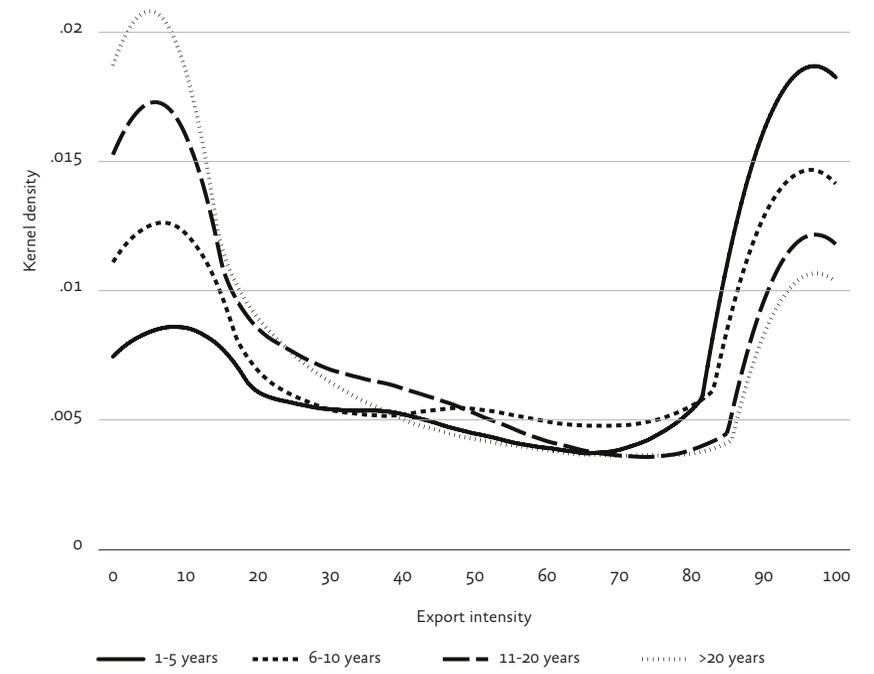
(D) Imports of two-way traders

Notes: Export (import) intensity equals the percentage share of exports (imports) in total domestic and foreign sales of services. Export intensity is based on all 11,687 firms-year exporting services in 2014-2015. Import intensity is truncated at 100 and excludes 1,259 firms-year that have zero total service sales. Hence, import intensity is based on 8,790 firms-year importing services in 2014-2015. The four size categories are defined according to the EU official classification (for more details, see footnote 4 of the main text).

The two panels depict the distributions of productivity and profitability of the three types of Portuguese international service traders. Labour productivity is defined as gross value added per worker, and profitability is defined as the ratio of earnings before interest, taxes, depreciation and amortisation (EBITDA) over total assets, which is an approximate measure of a firm's operating cash flow based on their income statement data. This is a commonly used indicator for profitability assessment, and can be applied to 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 only export. The profitability distributions are closer to a normal distribution, but the distribution for two-way traders is less dense for lower profit rates. Therefore, this set of firms tends to be not only more productive but also more profitable than one-way service traders.

Figure 5 Distribution of Labour Productivity and Profitability, 2014-2015

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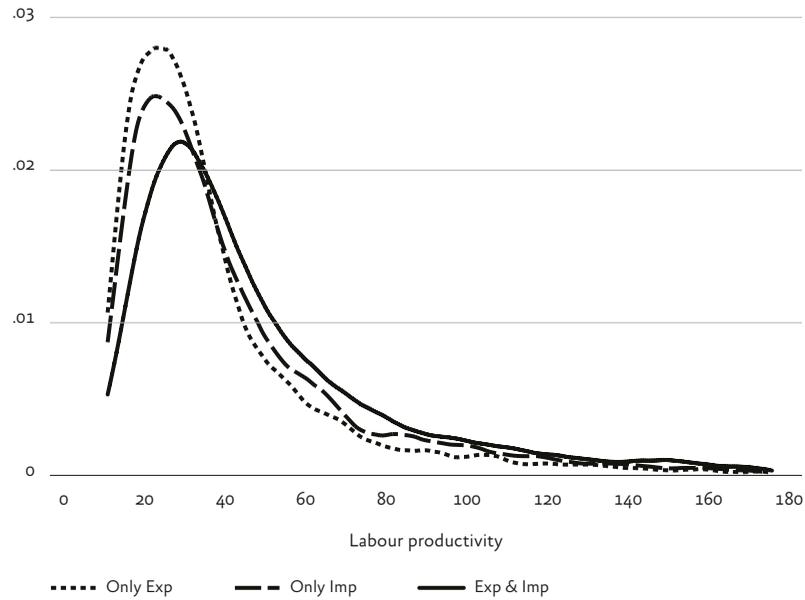
(B) Profitability
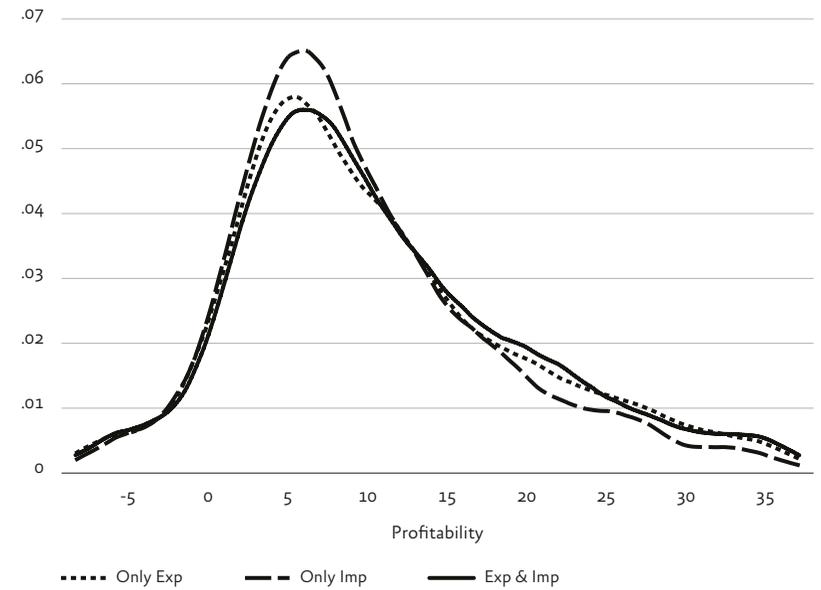
Notes: Labour productivity is expressed in thousand euros and is defined as a firm's gross value added divided by the number of employees. Profitability is defined as the percentage share of a firm's earnings before interest, taxes, depreciation and amortisation (EBITDA) in total assets. Firms-year with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

To conclude this section, we use descriptive regressions to provide evidence of the magnitude of the differences between one-way and two-way traders in a series of firms' attributes. More precisely, we regress several firm-level variables in logs on a dummy variable identifying two-way service traders, i.e., one-way traders are the reference group. The regressions also include year and industry fixed-effects to control for differences in firm's characteristics across sectors. The control for the firm's main sector of activity is defined at the CAE 2-digit level, comprising different sectors. The advantage of these estimates, although showing simple correlations, is that the coefficients can be interpreted in percentage. As found by Damijan *et al.* (2015), firms that both export and import tend to outperform one-way traders in most variables. The estimates show that two-way service traders are more than 100 per cent larger than one-way traders in terms of employment, total service sales and gross value added.[8] However, there is no significant difference between Portuguese international service traders in terms of capital-labour ratios and average wages per employee. Firms that both export and import services tend to be older than one-way traders and have a higher leverage ratio. Finally, the advantage of two-way traders in terms of labour productivity is around 25 per cent and, with profitability premia rounding, on average, 5 per cent. As discussed in Muûls and Pisu (2009) on international trade in goods, the significance of most of these results suggests that there are additional spillovers between importing and exporting, which benefit two-way traders.

Table 8 **Characteristics of Two-way Service Traders, 2014-2015**

	(1) Employment	(2) Total service sales	(3) Gross value added	(4) Age	(5) Capital labour ratio	(6) Average wages	(7) Productivity	(8) Profitability	(9) Leverage ratio
Two-way traders	0.732***	1.110***	0.956***	0.086***	0.036	0.046	0.223***	0.051**	0.046**
	(0.028)	(0.044)	(0.032)	(0.015)	(0.039)	(0.024)	(0.017)	(0.020)	(0.016)
Adjusted R^2	0.225	0.368	0.192	0.096	0.241	0.246	0.198	0.048	0.028
Observations	16,117	16,117	16,117	16,117	15,343	16,117	16,117	14,319	14,859

Notes: The dependent variables are reported in the column headings: total employment, total domestic and foreign sales of services, gross value added, age, capital to labour ratio, average wages as total labour costs divided by total employment, labour productivity as gross value added per worker, profitability as the EBITDA over total assets and leverage ratio as total assets to equity ratio. All variables are in log-form. Each of them is regressed on a dummy variable identifying two- way service traders. Only firms with positive capital-labour ratio, profitability and leverage ratio are included in the respective regressions. All regressions include a constant, a 2-digit sector and year-fixed effects. See the main text for more details. Standard errors in parenthesis are clustered at the firm-level and are robust to heteroscedasticity. Stars indicate significance levels of 5% (*), 1% (**), and 0.1% (***).

3.2. Trade Patterns of Portuguese International Service Traders

This section takes advantage of the availability of transaction-level data for Portuguese international trade in services to examine trade patterns in several dimensions, differentiating between the three types of traders.

Table 9 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 1 and 3 for one-way exporters. The 25th/75th percentile dispersions are always higher in the number of partner countries than in the number of types of services traded, which should be related to the more aggregate breakdown of services in the database. These simple statistics reveal the high variance and skewness in the underlying distributions of the number of service types, and especially, the number of partner countries and traded values between firms.

Table 9 Summary Statistics of the Trade Portfolios of Portuguese International Service Traders, 2014-2015

(A) Exports

Firm-level	Only Exp			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	Exp & Imp			Only 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

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

In order to examine the heterogeneity of service exports and imports between firms, Table 10 reports the joint distribution of traders and trade values over the number of types of services types and partner countries.

Table 10 Joint Distribution of Trade Values and Traders by Number of Services and Partner Countries, 2014-2015

(A.1) Exporters — Number of services

No. of countries	1	2	3	>3	Total
Only Exp					
1	18.5	1.0	0.1	0.0	19.7
2	5.4	0.9	0.2	0.0	6.5
3	2.8	0.4	0.1	0.0	3.3
4-10	5.5	0.7	0.2	0.1	6.4
11-50	2.1	0.2	0.0	0.1	2.3
50+	0.3	0.0	0.0	0.0	0.4
Total	34.6	3.1	0.6	0.2	38.6
Exp & Imp					
1	16.0	1.9	0.3	0.1	18.3
2	6.2	3.2	0.6	0.2	10.1
3	3.7	1.8	0.6	0.3	6.5
4-10	10.1	4.0	2.1	1.4	17.5
11-50	4.1	2.1	1.0	1.2	8.4
>50	0.1	0.1	0.1	0.3	0.6
Total	40.2	13.0	4.7	3.6	61.4

(A.2) Exports — Number of services

No. of countries	1	2	3	>3	Total
Only Exp					
1	1.5	0.1	0.0	0.0	1.7
2	0.7	0.2	0.0	0.0	0.9
3	0.5	0.1	0.0	0.0	0.6
4-10	1.9	0.2	0.1	0.0	2.2
11-50	1.9	0.1	0.0	0.1	2.1
>50	3.4	0.0	0.1	0.0	3.5
Total	9.9	0.7	0.3	0.1	10.9
Exp & Imp					
1	2.7	0.8	0.4	0.3	4.2
2	2.1	1.0	0.2	0.1	3.4
3	1.6	0.7	0.2	0.5	3.0
4-10	7.6	3.5	1.7	2.0	14.8
11-50	9.9	7.2	3.0	6.8	26.9
>50	5.9	2.7	0.3	27.9	36.9
Total	29.9	15.9	5.7	37.5	89.1

(B.1) Importers — Number of services

No. of countries	1	2	3	>3	Total
Only Imp					
1	17.8	2.1	0.6	0.4	20.9
2	2.9	3.5	0.8	0.5	7.5
3	1.0	1.3	0.9	0.6	3.9
4-10	1.0	1.2	1.2	1.9	5.3
11-50	0.1	0.1	0.0	0.2	0.5
>50	0.0	0.0	0.0	0.0	0.0
Total	22.9	8.2	3.5	3.7	38.2
Exp & Imp					
1	13.0	2.2	0.9	0.6	16.7
2	4.6	4.0	1.3	0.9	10.8
3	2.6	2.0	1.6	1.4	7.7
4-10	5.8	3.9	3.3	6.8	19.8
11-50	1.8	0.9	0.7	3.1	6.5
>50	0.1	0.0	0.0	0.2	0.3
Total	27.9	13.0	7.9	13.0	61.8

(B.2) Imports — Number of services

No. of countries	1	2	3	>3	Total
Only Imp					
1	0.8	0.1	0.1	0.4	1.4
2	0.2	0.2	0.1	0.1	0.6
3	0.3	0.1	0.1	0.3	0.7
4-10	0.3	0.3	0.4	1.3	2.3
11-50	0.3	0.3	0.1	0.5	1.2
>50	0.1	0.0	0.0	0.0	0.1
Total	2.0	1.0	0.9	2.6	6.4
Exp & Imp					
1	4.3	1.6	0.9	0.1	6.9
2	1.3	0.4	0.3	0.6	2.7
3	0.7	0.6	0.3	0.8	2.4
4-10	3.1	4.0	2.1	9.6	18.8
11-50	5.0	2.7	1.8	22.0	31.5
>50	0.1	0.0	0.1	31.1	31.4
Total	14.6	9.3	5.6	64.2	93.6

Notes: Each cell represents the percentage of total exporters (importers) or exports (imports) associated with firms-year exporting (importing), on a certain number of services types (column category) to (from) a certain number of partner countries (row category) in 2014-2015.

Another pattern evident in Table 10, and also found for trade in goods, is that large fractions of exports and imports are concentrated among a few two-way traders, who trade multiple types of services with many countries. For instance, two-way traders exporting more than 3 types of services to more than 50 countries represent only 0.3 per cent of exporters, but 27.9 per cent of exports (panels A.1 and A.2). A similar concentration is found on the import side, with 0.2 per cent of total importers accounting for 31.1 per cent of overall imports (panels B.1 and B.2). The importance of two-way traders that trade more than 3 types of services is particularly strong on the import side, as they account for 64.2 per cent of total imports and 13.0 of total importing firms. Evidence on the concentration of traded values in a small group of firms is corroborated by the fact that the top 1 per cent exporters account for 59 per cent of the total export value. In comparison, the top 10 per cent exporters represent 86 per cent 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 per cent and 10 per cent importers accounting for 60 and 91 per cent of total import value, respectively. Again, the vast majority of these top exporters and importers are two-way traders. This strong concentration of Portuguese trade in services is in line with one of the main findings of empirical studies that use transaction-level data to examine international trade in goods: exports and imports are dominated by "superstars" trading many goods with many countries. Empirical analyses of international trade in services reached the same conclusions. Breinlich and Criscuolo (2011) for the UK, Federico and Tosti (2017) for Italy and Minondo (2016) for Spain also found that the values of services traded are highly concentrated among a small group of firms that tend to trade several types of services and cover a large

geographical area. For Portugal, we further show that firms in this small group of "super-traders" are predominantly two-way traders.

It is also interesting to examine how service exports and imports are concentrated within firms in terms of their service and geographical portfolio. Table 11 shows the average share of a firm's exports and imports accounted for by its top five types of services and partner countries.

For both exports and imports, and for all firm types, the top service type accounts for the majority of a firm's trade, while the lower-ranked services types have a much smaller role. For instance, the first and second most sold services account, on average, for 73.9 and 17.0 per cent of exports of a one-way exporter selling more than 3 service types. The relative importance of the main type of services seems to be slightly smaller for imports than for exports, particularly for firms with larger portfolios.

Export and import shares present a similar pattern when considering partner countries instead of service types. Still, the role played by the top country appears to be less dominant, especially as the geographical scope broadens. However, even for firms trading with more than 50 countries, the main partner accounts for more than 20 and 30 per cent of the respective firm flow, for one-way and two-way traders, respectively. This evidence of concentration of international service trade flows within firms is similar to that of other countries and that of Amador and Opromolla (2013) regarding Portuguese exports of goods. However, one should be careful with this latter comparison of the concentration by type of services, because the disaggregation level is much larger for goods than for services.

Table 11 Concentration of Firms' Exports and Imports by Service Type and Partner Country, 2014-2015

(A) Exports

Service rank	Number of services				Country rank	Number of countries					
	1	2	3	>3		1	2	3	4-10	11-50	>50
Only Exp					**Only Exp**						
1	100.0	82.7	74.7	73.9	1	100.0	83.9	75.7	63.7	41.0	22.4
2		16.8	19.8	17.0	2		16.1	18.9	20.1	18.1	12.8
3			5.1	5.7	3			5.4	8.5	10.8	9.0
4				2.7	4				4.2	7.1	6.6
5				4.4	5				2.6	4.9	5.4
No. firms	4,044	364	71	27	No. firms	2,295	757	390	749	274	41

Service rank	Number of services				Country rank	Number of countries					
	1	2	3	>3		1	2	3	4-10	11-50	>50
Only Exp					**Only Exp**						
1	100.0	87.9	79.7	73.3	1	100.0	85.3	76.1	63.3	45.0	33.1
2		12.1	16.5	18.7	2		14.6	18.7	20.3	18.3	15.8
3			3.8	5.6	3			5.0	8.8	10.8	10.4
4				1.8	4				4.2	7.1	7.2
5				0.9	5				2.5	4.9	5.4
No. firms	4,699	1,516	547	419	No. firms	2,146	1,186	758	2,045	980	66

(B) Imports

Service rank	Number of services				Country rank	Number of countries					
	1	2	3	>3		1	2	3	4-10	11-50	>50
Only Imp					**Only Imp**						
1	100.0	83.8	75.1	67.0	1	100.0	82.2	73.4	64.7	50.5	24.7
2		16.1	19.9	21.0	2		17.6	20.0	19.9	20.0	17.7
3			4.8	7.5	3			6.1	8.8	10.5	10.7
4				3.1	4				4.1	6.6	9.0
5				1.7	5				2.5	4.0	4.6
No. firms	2,654	949	402	425	No. firms	2,427	876	449	615	61	2

Service rank	Number of services				Country rank	Number of countries					
	1	2	3	>3		1	2	3	4-10	11-50	>50
Exp & Imp					**Exp & Imp**						
1	100.0	85.8	78.7	69.1	1	100.0	84.1	76.9	65.5	47.3	33.5
2		14.0	17.0	19.3	2		15.9	18.2	19.6	19.5	16.4
3			4.3	7.3	3			4.9	8.4	10.9	11.0
4				2.7	4				3.8	6.9	7.6
5				1.4	5				2.1	4.5	4.9
No. firms	3,239	1,508	919	1,515	No. firms	1,946	1,252	891	2,301	752	39

Notes: For the rank of services, values report the average share of a firm's exports (imports) accounted for by its five most important service types exported (imported), for firms-year exporting (importing) 1, 2, 3 or >3 types of services. For the countries rank, values report the average share of a firm's exports (imports) accounted for by its five most important export (import) partner countries, for firms-year exporting (importing) precisely to 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 or imports in 2014-2015.

Following Breinlich and Criscuolo (2011), we analyse the contribution of the intensive and extensive margins to the differences in the traded values between firms. We consider two extensive margins of firm-level trade – the number of trading partners (destination and source countries) And the number of services traded – and the intensive margin (trade per country-service type combination). In order to assess the role of the different margins, we run separate regressions of each component's log on the log of firm-level trade. For exports, the regression is as follows:

$$logY_{it} = \alpha + \beta_1 logX_{it} + \gamma_j + \gamma_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} is the dependent variable of the interest (number of destination countries, number of service types, and exports per country-service type) of firm i in year t. And X_{it} are total exports of firm i in year t. γ_t are time fixed-effects, γ_j is a vector of sector fixed-effect at the CAE 2-digit level, and ε_{it} is a standard error term. In addition, we also estimate for one-way exporters and two-way traders separately. The same exercise is performed for imports, and the results for both flows and types of firms are presented in Table 12. All variables are expressed in logs and, thus, the reported coefficients add up to unity.

Table 12 Intensive and Extensive Margins of Firm-level Services Trade, 2014-2015

Panel A – Exports

	Total sample of exporters			One-way exporters			Two-way traders		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	& Value service/ country	Number of services	Number of countries	Value service/ country	Number of services	Number of countries	Value service/ country	Number of services	Number of countries
Value of exports	0.770***	0.046***	0.184***	0.834***	0.013***	0.153***	0.760***	0.054***	0.185***
	(0.0048)	(0.0020)	(0.0038)	(0.0066)	(0.0017)	(0.0062)	(0.0059)	(0.0026)	(0.0045)
Adjusted R^2	0.841	0.148	0.437	0.883	0.052	0.419	0.834	0.156	0.447
Observations	11,687	11,687	11,687	4,506	4,506	4,506	7,181	7,181	7,181

Panel B – Exports

	Total sample of importers			One-way importers			Two-way traders		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	& Value service/ country	Number of services	Number of countries	Value service/ country	Number of services	Number of countries	Value service/ country	Number of services	Number of countries
Value of imports	0.718***	0.109***	0.173***	0.786***	0.093***	0.121***	0.700***	0.109***	0.191***
& (0.0042)	(0.0023)	(0.0027)	(0.0061)	(0.0033)	(0.0041)	(0.0055)	(0.0030)	(0.0036)	
Adjusted R^2	0.827	0.272	0.453	0.864	0.247	0.316	0.793	0.262	0.442
Observations	11,611	11,611	11,611	4,430	4,430	4,430	7,181	7,181	7,181

Notes: The table reports OLS estimates of Equation (1) for exports in panel A and for imports in panel B.
The dependent variables are reported in the column headings: log of the average trade value per country-service type combination, log of the number of types of services traded and log of the number of partner countries.
Each of them is regressed on the log of trade value of the firm. The regressions are estimated separately for the different types of service traders. All regressions include a constant, a 2-digit sector and year fixed-effects.
See the main text for more details. Standard errors in parenthesis are clustered at the firm-level and are robust to heteroscedasticity. Stars indicate significance levels of 5% (*), 1% (**), and 0.1% (***).

In Table 12, the first 3 columns of each panel show that the intensive margin is much more important than the extensive margins in explaining the differences in traded values among Portuguese firms, both for exports and imports (77 per cent for exports and 72 per cent for imports). Regarding the two extensive margins, the country margin is more relevant than the services margin, in particular for exports. However, the relatively broad service classification used (29 types of services) tends to underestimate the relevance of the services extensive margin. These results are broadly in line with those of other countries like the UK (Breinlich and Criscuolo 2011), Italy (Federico and Tosti 2017), Germany (Kelle and Kleinert 2010), and Spain for exports (Minondo 2016). In these countries, the contribution of the intensive margin was found to be around 70 per cent, and the country-extensive margin was also more relevant than the service margin. Nevertheless, the importance of the intensive margin seems to be somewhat higher in Portugal than in these countries.

When differentiating between the distinct types of traders (in the following columns of both panels), the intensive margin is especially relevant for one-way traders, accounting for around 84 per cent of the differences in exports across this type of firms (79 per cent for one-way importers).[9] Regarding the extensive margins, the highest value of both margins is estimated for two-way importers, accounting for 30 per cent of inter-firm imports variation.

3.3. Trade Margins, Productivity and Profitability

The empirical literature on international trade in goods and firm performance has grown exponentially since the seminal paper of Bernard *et al.* (1995). One of the key stylised facts of this literature is the positive association between productivity and participation in external markets. In the decade following the publication of Bernard *et al.* (1995), the picture that emerged from dozens of micro-econometric studies was that exporters were more productive than non-exporters and that the more productive firms self-selected into export markets, although exporting does not necessarily improve productivity (Wagner 2007). This strand of research continued to grow, and more important facts emerged on the relationship between international trade (exports and imports) and several dimensions of firm performance (productivity, wages, profitability and survival), namely the positive link between importing and productivity in manufacturing firms, and the productivity premia of two- way traders (Wagner 2012). In parallel, new trade theories, pioneered by Melitz (2003) (see Melitz and Redding (2014) for a review), have been developed to capture these features of the data, with a focus on international activities of heterogeneous firms.

More recently, the use of transaction-level data on goods exports or imports of firms has allowed the study of different margins of trade at the firm-level and their links with several characteristics of a firm (Wagner 2016). Among the main findings of these studies is the fact that productivity is not only positively related to export participation, but also to the extensive margins of exports (the number of goods exported and the number of export destination countries). Motivated by this vast literature on international trade in goods, this section assesses whether the margins of international trade in services at the firm-level are related to firm-level attributes, like productivity and profitability.

Firstly, we examine the correlation of the firms' trade margins with firm-level characteristics, differentiating between the various types of traders. For exports, we estimate several regressions of the form:

$$logY_{it} = \alpha + \beta_1 logX_{it} + \gamma_j + \gamma_t + \varepsilon_{it}, \tag{2}$$

where Y_{it} is the dependent variable of the interest (total exports, number of destination countries, number of service types, and exports per country-service type) of firm i in year t. While X_{it} represents three different firm-level attributes taken separately: firm size (proxied by total employment), labour productivity (defined as gross value added per worker) and profitability (proxied by the EBITDA over total assets). 2-digit level sector and time fixed-effects are included in γ_j and γ_t, respectively, and ε_{it} is a standard error term. Again, since all variables are expressed in logs, the reported coefficients of the three trade

margins add up to the coefficient of total exports. As before, we also estimate Equation (2) separately for one-way and two-way exporters. The same exercise is performed for imports, and Table 13 includes the results for both flows and types of firms.[10] We also estimate a different version of Equation (2) using pairs of covariates, namely employment and productivity (as in Breinlich and Criscuolo 2011) and employment and profitability. The results are very similar to the ones shown in Table 13, where each covariate is regressed alone, and are available from the authors upon request.

Table 13 Firm-level Services Trade Employment, Productivity, Profitability and Margins, 2014-2015

Panel A – Exports

	Total sample of exporters				One-way exporters				Two-way traders			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total value	Average value	No. services	No. countries	Total value	Average value	No. services	No. countries	Total value	Average value	No. services	No. countries
Employment	0.444***	0.146***	0.076***	0.221***	0.206***	0.037	0.011**	0.159***	0.492***	0.192***	0.082***	0.218***
	(0.020)	(0.017)	(0.0039)	(0.0072)	(0.035)	(0.030)	(0.0033)	(0.012)	(0.025)	(0.021)	(0.0052)	(0.0091)
Productivity	0.601***	0.466***	0.047***	0.087***	0.595***	0.518***	0.011	0.065***	0.513***	0.440***	0.032***	0.041**
	(0.038)	(0.032)	(0.0055)	(0.013)	(0.051)	(0.046)	(0.0062)	(0.019)	(0.048)	(0.041)	(0.0074)	(0.016)
Profitability	0.140***	0.161***	−0.006	−0.015	0.213***	0.199***	−0.003	0.017	0.094*	0.143***	−0.010	−0.039**
	(0.028)	(0.025)	(0.0044)	(0.011)	(0.041)	(0.038)	(0.0045)	(0.014)	(0.037)	(0.033)	(0.0064)	(0.014)

Panel B – Imports

	Total sample of exporters				One-way exporters				Two-way traders			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total value	Average value	No. services	No. countries	Total value	Average value	No. services	No. countries	Total value	Average value	No. services	No. countries
Employment	0.822***	0.419***	0.159***	0.245***	0.696***	0.440***	0.108***	0.147***	0.785***	0.358***	0.165***	0.262***
	(0.022)	(0.019)	(0.0053)	(0.0070)	(0.038)	(0.032)	(0.0076)	(0.0094)	(0.025)	(0.021)	(0.0065)	(0.0085)
Productivity	0.750***	0.540***	0.101***	0.108***	0.553***	0.403***	0.066***	0.084***	0.734***	0.541***	0.101***	0.093***
	(0.041)	(0.033)	(0.0082)	(0.011)	(0.063)	(0.053)	(0.011)	(0.013)	(0.049)	(0.039)	(0.011)	(0.015)
Profitability	0.044	0.041	0.013	−0.010	0.121*	0.072	0.024*	0.025*	−0.051	−0.008	−0.000	−0.043**
	(0.034)	(0.028)	(0.0074)	(0.010)	(0.052)	(0.044)	(0.010)	(0.012)	(0.041)	(0.033)	(0.0096)	(0.013)

Notes: The table reports OLS estimates of Equation (2) for exports in panel A, and imports in panel B. The dependent variables are reported in the column headings: log of the total trade value of the firm, log of the average trade value per country-service type combination, log of the number of traded service types, log of the number of partner countries. Each of them is regressed individually on the log of the total employment, the log of labour productivity, and the log of the firm's profitability. Labour productivity is defined as the gross value added per worker, and profitability is defined as the EBITDA over total assets. Only firms with positive profitability are included in the respective regressions. The regressions are estimated separately for the different types of service traders. The number of observations in each regression is the same as in Table 12, with the exception of the regressions using profitability that include 10,364, 3,981 and 6,383 observations for the total sample of exporters, one-way exporters and two-way exporters, respectively; and 10,338, 3,955 and 6,383 for the total sample of importers, one-way importers and two-way importers, respectively. All regressions include a constant, a 2-digit sector and year fixed-effects. See the main text for more details. Standard errors in parenthesis are clustered at the firm-level and are robust to heteroscedasticity. Stars indicate significance levels of 5% (*), 1% (**), and 0.1% (***).

As identified for the UK (Breinlich and Criscuolo 2011) and Italy (Federico and Tosti 2017), higher employment is associated with a higher value of firm-level exports and imports and also with all three margins of both flows. For exports, the largest coefficient corresponds to the geographical extensive margins, while, for imports, the largest coefficient is the parameter of the intensive margin. Moreover, all estimates are higher for two-way traders than one-way traders, with the exception of the intensive margin of imports. Labour productivity is also positively and significantly correlated with the value of exports and imports of a firm, especially with the average values per country and service type (intensive margin). In terms of the type of trader, the correlations between productivity and firm's imports are higher for two-way traders, but the opposite happens on the export side. The links between the firms' profitability and international trade in services are less clear. The intensive margins of exports explain most of the correlations between the firms' profitability and trade flows, for both types of firms, and the parameter is higher for one-way exporters. On the import side, most estimates are not statistically significant.

Secondly, we analyse how firm-level productivity and profitability are associated with the different margins of firms' exports and imports taken together while controlling for other features like size, age and capital intensity. More precisely, we estimate regressions of the form:

$$logY_{it} = \alpha + \beta_1 logX_{it} + \beta_2 logM_{it} + \beta_3 Z_{it} + \varepsilon_{it}, \tag{3}$$

where Y_{it} is the dependent variable of the interest (labour productivity defined as gross value added per worker) or profitability (proxied by the EBITDA over total assets), in log form. X_{it} and M_{it} are the log of the total value of exports and imports of a firm, respectively. A number of firms'

characteristics that potentially affect productivity and profitability (and may be correlated with different levels of trade in services) are included in the vector Z_{it}, namely age, capital-labour ratio, average wage per employee and leverage ratio, all in log form, and a dummy variable identifying large firms, according to the EU official classification (described in footnote 4). A 2-digit sector and year fixed-effects are also included. In a more detailed version of Equation (3), we replaced the total value of exports and imports of a firm by the respective trade margins, namely the average export and import value per country-service, number of types of services exported and imported and number of export and import partner countries. Again, all trade variables are in log form. All regressions were also estimated separately for two-way traders to take into account the fact that these firms differ from one-way traders in several dimensions, as described previously.

The estimates in columns (1) and (5) of Table 14 show that the total value of exports and imports of a firm correlates positively with its labour productivity and profitability, with very similar parameters for both flows.[11] For two-way traders, no statistically significant relationship is found between profitability and international trade in services (column (6). On the contrary, the link between imports and exports of services and productivity is stronger for two-way traders than for other firms.

Taking into account the several margins of a firm's exports and imports, columns (3)-(4) and (7)-(8), the results indicate that the intensive margins of exports and imports of services, i.e., the average trade value per country-service type combination, is positively related to both productivity and profitability. Regarding the extensive margins of trade in services, the only statistically significant estimates are the

number of different types of services imported, both for productivity and profitability. This evidence suggests that having access to a large number of different foreign inputs is advantageous for firms. Moreover, all estimated parameters of both margins are always greater for two-way traders.

The non-statistically significant association between the geographical extensive margins and productivity for Portuguese international service traders contrasts with results obtained in several countries for international trade in goods (Wagner 2016). This finding may be driven by the fact that the positive relation between firm size and exports results primarily from the number of partner countries. Hence, after controlling for firm size in the estimation of Equation (3), the link between a firm's performance and the number of its export destinations is not statistically significant.

Table 14 Productivity, Profitability and Firm-Level International Trade in Services, 2014-2015

	Productivity				Profitability			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All firms	Two-way traders	All firms	Two-way traders	All firms	Two-way traders	All firms	Two-way traders
Total exports	0.023***	0.043***			0.005**	0.007		
	(0.0017)	(0.0050)			(0.0018)	(0.0058)		
Total imports	0.029***	0.045***			0.009***	0.010		
	(0.0016)	(0.0046)			(0.0019)	(0.0054)		
Average exports			0.025***	0.052***			0.006**	0.013*
			(0.0020)	(0.0059)			(0.0023)	(0.0066)
Average imports			0.029***	0.052***			0.010***	0.013*
			(0.0021)	(0.0054)			(0.0026)	(0.0064)
Number of services exported			-0.037	-0.008			-0.029	-0.017
			(0.022)	(0.025)			(0.026)	(0.030)
Number of services imported			0.116***	0.126***			0.045*	0.048*
			(0.016)	(0.020)			(0.020)	(0.024)
Number export countries			0.017	0.022			0.010	-0.013
			(0.011)	(0.014)			(0.013)	(0.018)
Number import countries			-0.013	-0.016			-0.016	-0.012
			(0.012)	(0.015)			(0.016)	(0.019)
Adjusted R^2	0.368	0.395	0.370	0.400	0.213	0.224	0.213	0.225
Observations	14198	6348	14198	6348	13076	5845	13076	5845

Notes: The table reports OLS estimates of Equation (2) for labour productivity and profitability, both in log form. Labour productivity is defined as the gross value added per worker, and profitability is defined as the EBITDA over total assets. Only firms with positive profitability are included in the respective regressions. The regressors are reported in the row headings: log of the total exports and imports of the firm, log of the average export and import per country-service type combination (intensive margin), log of the number of traded service types, log of the number of partner countries. All regressions include a constant. Firm-level controls include age, capital-labour ratio, average wage per employee, leverage ratio, all in log form, a dummy variable identifying large firms, a 2-digit sector and year fixed-effects. See the main text for more details. Standard errors in parenthesis are clustered at the firm-level and are robust to heteroscedasticity. Stars indicate significance levels of 5% (*), 1% (**), and 0.1 % (***).

Section 4
Concluding Remarks

This paper contributes to the growing literature on firm-level international trade in services by examining the Portuguese case and identifying some empirical regularities. Two datasets in the period of 2014-2015 – the Balance of Payments Statistics compiled by Banco de Portugal and the Simplified Corporate Information (IES) – are merged to create a representative database of Portuguese international trade in non-tourism services at the transaction-level, with balance sheet and income statement information on the trading firms. Throughout the analysis, we distinguish between three groups of international service traders: firms that only export; firms that only import; and firms that import and export. The richness of the data, which includes information on partner countries and types of services traded, allows us to provide a comparison with the stylised facts on service traders reported by previous literature (such as Breinlich and Criscuolo (2011) for the UK, and Federico and Tosti (2017) for Italy), as well with the previous findings on Portuguese international trade in goods (namely, Amador and Opromolla (2013)). Overall, a set of stylized facts is provided on international trade in services. Some facts confirm the existing empirical research, while others are new to the literature.

A new contribution to the literature on services trade is the evidence on a bi-modal distribution of export intensities, in line with recent findings by Defever and Riaño (2017) for international trade in goods, but contrasting with one of the main stylised facts about goods trade. Portuguese exporters of services have a bi-modal distribution of export

intensities, with some firms exporting most of their output and others only a small share. This feature is common to one-way and two-way traders, and to firms belonging to different size classes and age groups.

We find that a significant proportion of Portuguese firms that participate in international trade are active in both flows (45 per cent). In addition, there is a striking concentration of trade values in these firms: two-way traders account for 90 per cent of the total international trade in services. This concentration of exports and imports of services in two-way traders is common to most sectors of economic activity. As documented for other countries, firms that both export and import tend to outperform one-way traders in variables like size, age, productivity and profitability.

Not only do two-way traders have higher levels of exports and imports than one-way traders, they also have broader portfolios of partner countries and service types for both flows. In fact, a large proportion of Portuguese services trade is concentrated among a few two-way traders, which trade multiple services types with many countries, i.e., the so-called "superstars". However, even if these traders have diversified portfolios of service types and partner countries, we still find evidence of within-firm concentration of trade values, i.e., the main service/ partner country accounts for a substantial share of a firm's trade.

Taking advantage of the transaction-level detail in our data, this paper also examines the intensive margin (trade per country and service

type) and the extensive margins (number of trading partners and number of services traded) of firm-level trade. In line with findings for other countries, the intensive margin is much more important than the extensive margins in explaining the differences in traded values among Portuguese firms, both for exports and imports. In addition, larger and more productive firms have higher values of exports and imports of services, trade more per country and service type, and trade more types of services with more countries. For the three types of traders, the intensive margin of firm-level trade explains most of the correlations between firm productivity and size, on the one hand, and firm-level trade flows, on the other hand. The main exception is the link between firm size and exports, which depends mainly on the geographical extensive margin. The correlations between firm-level service exports and imports and profitability are less clear, but more profitable firms tend to have higher total export values and export more per country-service type.

Considering all different margins of a firm's services trade together, while controlling for features like size, age or capital intensity, we show that the intensive margins of exports and imports are positively related to both productivity and profitability. Regarding the extensive margins of trade, the number of different types of services imported is significantly and positively linked to these two dimensions of a firm's performance, suggesting that access to a wide range of foreign inputs is beneficial for firms.

From a policy perspective, the positive link between firm performance and international trade in services highlights the importance of services for economic growth and structural transformation. In recent decades, the rapid growth of services trade was mostly driven by technological progress, and trade opportunities are likely to expand even more in the future as new digital technologies allow a greater range of services to be traded internationally. In parallel, there are still pervasive and complex barriers to trade in services around the globe. Large potential gains could be reaped through a greater liberalisation of services trade and investment. Expanding trade in services requires the implementation of trade policy frameworks that focus, for instance, on intellectual property protection rights, professional licensing, government procurement, mutual recognition of professional credentials and other regulations, as well on the reduction of restrictions to the operation of foreign affiliates (for a discussion, see Hufbauer *et al.* (2012)).

Appendix: Detailed Breakdown of the 29 Types of Services Traded

Table A.1 Description of the 29 Types of Services

EBOPS code	Description
SB	Maintenance and repair services n.i.e.
SC1	Sea transport
SC2	Air transport
SC3	Other modes of transport
SC4	Postal and courier services
SE	Construction
SF	Insurance and pension services
SG	Financial services
SH1	Franchises and trademarks licensing fees
SH3	Licenses to reproduce and/or distribute computer software
SH4	Licenses to reproduce and/or distribute audio-visual and related products
SI1	Telecommunications services
SI2	Computer services
SI3	Information services
SJ1	Research and development services

EBOPS code	Description
SJ211	Legal services
SJ212	Accounting, auditing, bookkeeping, and tax consulting services
SJ213	Business and management consulting, and public relations services
SJ22	Advertising, market research, and public opinion polling services
SJ311	Architectural services
SJ312	Engineering services
SJ313	Scientific and other technical services
SJ32	Waste treatment and de-pollution, agricultural, and mining services
SJ33	Operating leasing services
SJ34	Trade-related services
SJ35	Other business services n.i.e.
SK1	Audio-visual and related services
SK2	Other personal, cultural, and recreational services
SL	Government goods and services n.i.e.

Notes: The table reports the 29 types of service taken into consideration 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.

Table A.2 Types of Services Exported: Values, Firms, Countries and Transactions, 2014-15

Code	Description	Exports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SB	Maintenance and repair services n.i.e.	750845	3,4	853	5,1	104	3,3	2357	3,3
SC1	Sea transport	1278382	5,8	606	3,6	179	5,6	6919	9,8
SC2	Air transport	7238084	33	528	3,2	198	6,2	4632	6,5
SC3	Other modes of transport	1871417	8,5	1947	11,7	156	4,9	9263	13,1
SC4	Postal and courier services	204204	0,9	100	0,6	123	3,9	571	0,8
SE	Construction	975247	4,4	1118	6,7	90	2,8	2148	3
SF	Insurance and pension services	80207	0,4	566	3,4	87	2,7	1340	1,9
SG	Financial services	99430	0,5	359	2,2	84	2,6	820	1,2
SH1	Franchises and trademarks licensing fees	53349	0,2	85	0,5	40	1,3	145	0,2
SH3	Licenses to reproduce or distribute computer software	5250	0	43	0,3	47	1,5	166	0,2
SH4	Licenses to reproduce or distribute audio-visual	60574	0,3	100	0,6	74	2,3	462	0,7
SI1	Telecommunications services	1037562	4,7	212	1,3	191	6	1560	2,2
SI2	Computer services	1261934	5,7	1026	6,2	156	4,9	4402	6,2
SI3	Information services	29770	0,1	149	0,9	70	2,2	613	0,9
SJ1	Research and development services	168137	0,8	166	1	56	1,8	468	0,7

Code	Description	Exports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SJ211	Legal services	283157	1,3	248	1,5	140	4,4	2659	3,8
SJ212	Accounting, auditing, bookkeeping, and tax consulting	223073	1	266	1,6	118	3,7	1714	2,4
SJ213	Business and management consulting, and public relations	542116	2,5	673	4	110	3,5	2129	3
SJ22	Advertising, market research, and public opinion polling	540719	2,5	819	4,9	102	3,2	2783	3,9
SJ311	Architectural services	92774	0,4	268	1,6	88	2,8	851	1,2
SJ312	Engineering services	457938	2,1	394	2,4	110	3,5	1325	1,9
SJ313	Scientific and other technical services	750156	3,4	1546	9,3	131	4,1	4018	5,7
SJ32	Waste treatment and de-pollution, agricultural, and mining services	34678	0,2	166	1	37	1,2	266	0,4
SJ33	Operating leasing services	216728	1	448	2,7	103	3,2	1506	2,1
SJ34	Trade-related services	531173	2,4	1881	11,3	196	6,2	8956	12,7
SJ35	Other business services n.i.e.	2883445	13,1	1453	8,7	139	4,4	5285	7,5
SK1	Audio-visual and related services	114485	0,5	148	0,9	115	3,6	775	1,1
SK2	Other personal, cultural, and recreational services	175293	0,8	470	2,8	133	4,2	2645	3,7
SL	Government goods and services n.i.e.	177	0	4	0	2	0,1	4	0
	Total	**21960303**	**100**	**16642**	**100**	**3179**	**100**	**70782**	**100**

Notes: Exports are expressed in thousand euros. Values are pooled for 2014 and 2015. Firms are counted each time they export a particular type of service at the disaggregated breakdown level in the current year, implying that a firm-year can appear more than once across the listed types of services. 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.

Table A.3 Types of Services Imported: Values, Firms, Countries and Transactions, 2014-15

Code	Description	Imports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SB	Maintenance and repair services n.i.e.	567084	4,9	2038	7,9	104	3,5	4258	6,4
SC1	Sea transport	183295	1,6	522	2	145	4,9	2945	4,5
SC2	Air transport	2704447	23,3	936	3,6	175	5,9	3968	6
SC3	Other modes of transport	155889	1,3	1312	5,1	103	3,5	3406	5,2
SC4	Postal and courier services	143842	1,2	218	0,8	135	4,5	744	1,1
SE	Construction	172660	1,5	715	2,8	109	3,7	1670	2,5
SF	Insurance and pension services	119101	1	1187	4,6	79	2,7	1773	2,7
SG	Financial services	130646	1,1	1366	5,3	152	5,1	2939	4,4
SH1	Franchises and trademarks licensing fees	671716	5,8	388	1,5	54	1,8	583	0,9
SH3	Licenses to reproduce or distribute computer software	109629	0,9	135	0,5	30	1	253	0,4
SH4	Licenses to reproduce or distribute audio-visual	277265	2,4	227	0,9	75	2,5	916	1,4
SI1	Telecommunications services	950790	8,2	1001	3,9	198	6,7	2689	4,1
SI2	Computer services	836546	7,2	2783	10,8	118	4	7056	10,7
SI3	Information services	25721	0,2	808	3,1	63	2,1	1610	2,4
SJ1	Research and development services	255436	2,2	423	1,6	60	2	913	1,4

Code	Description	Imports		Firms		Countries		Transactions	
		Level	Share	No.	Share	No.	Share	No.	Share
SJ211	Legal services	72105	0,6	1140	4,4	142	4,8	2775	4,2
SJ212	Accounting, auditing, bookkeeping, and tax consulting	86996	0,8	670	2,6	112	3,8	1427	2,2
SJ213	Business and management consulting, and public relations	382631	3,3	1398	5,4	110	3,7	3139	4,7
SJ22	Advertising, market research, and public opinion polling	374203	3,2	2635	10,3	120	4	6971	10,5
SJ311	Architectural services	48517	0,4	320	1,2	91	3,1	849	1,3
SJ312	Engineering services	120851	1	373	1,5	79	2,7	886	1,3
SJ313	Scientific and other technical services	652998	5,6	490	1,9	118	4	2072	3,1
SJ32	Waste treatment and de-pollution, agricultural and mining	36362	0,3	401	1,6	53	1,8	749	1,1
SJ33	Operating leasing services	451107	3,9	1645	6,4	115	3,9	2815	4,3
SJ34	Trade-related services	490265	4,2	418	1,6	102	3,4	2041	3,1
SJ35	Other business services n.i.e.	1166330	10,1	609	2,4	122	4,1	2346	3,5
SK1	Audio-visual and related services	249962	2,2	246	1	82	2,8	816	1,2
SK2	Other personal, cultural, and recreational services	150535	1,3	1241	4,8	110	3,7	3451	5,2
SL	Government goods and services n.i.e.	218	0	41	0,2	21	0,7	51	0,1
	Total	**11587146**	**100**	**25686**	**100**	**2977**	**100**	**66111**	**100**

Notes: Imports are expressed in thousand euros. Values are pooled for 2014 and 2015. Firms are counted each time they import a particular type of service at the disaggregated breakdown level in the current year, implying that a firm-year can appear more than once across the listed types of services. 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.

III.

Regulatory Costs and Performance of Portuguese Firms

Abstract

This article studies the relations between the perception of firms regarding nine domains of regulatory costs and two performance variables: labour productivity and export intensity. We use a representative micro-level database from a survey on Portuguese firms' perceptions of the regulatory framework in 2014 (Business Costs of Context Survey, IaCC) merged with balance sheet data. Although no causality is established, we find several statistically significant relations between firms' performances and their assessment of regulatory costs. Regarding productivity, only obstacles related to "human resources" are identified as having a significant negative relation both in terms of the importance of the barriers to the activity of the firms and the level of the barrier. The same result is observed for export intensity for obstacles related to the "judicial system". The article examines the "barriers to internationalisation" in more detail showing that considering these costs important tends to be associated with lower productivity and higher export intensity. (JEL: D22, L51)

Section 1
Introduction

The institutional setting of an economy, defined as the existing legislation and its inherent costs, strongly impacts the operation of firms in the different sectors of activity and the overall economic performance.[12] Nevertheless, regulatory costs are often neglected or misinterpreted in micro-level analyses. One reason is the relatively scarce firm-level information on the evaluation of regulatory costs. Another reason is the lack of a clear and consistent definition, as well as a practical and exhaustive typology of regulatory costs and their impacts. Figure 1 presents the main categories of regulatory costs, as suggested by the OECD (1997), highlighting that regulations affect virtually all agents in the economy, including the public sector and households. However, firms tend to concentrate most of their attention on the economic analysis of regulatory costs, due to their crucial role in the creation of employment and value added. The areas shaded in grey in Figure 1 correspond to different types of regulatory impacts on firms. Although specific types of regulations are not detailed in the diagram, it is straightforward to conclude that regulatory costs imposed on firms are quite diverse in nature, ranging from licensing procedures to the functioning of the judicial system, as well as labour market rules and ease of access to finance. The terminology used in the literature to identify such regulatory costs is diverse, including terms like "institutional costs", "red tape costs", "business environment" or "costs of doing business".

The economic analysis of regulatory costs at the firm-level is typically carried out in two stages. The first stage is to collect information on how firms perceive the importance of the different regulatory costs. Given their diffuse nature, firms are typically unable to quantify the impacts of regulatory costs on their balance sheet in monetary terms, but they can state their views qualitatively in terms of the relative level of the different obstacles. Nevertheless, even this type of qualitative information is difficult to obtain, for several reasons. Firstly, beyond the previously mentioned need for an adequate classification of regulatory costs, it is necessary to set a scale to measure their intensity. However, the responses of firms inevitably involve subjective assessments. Two similar firms operating in the same regulatory environment may post different answers in a survey. Secondly, a firm may evaluate the level of obstacles associated with a given regulatory cost as high, but also consider that such obstacle does not interfere significantly with its performance. For example, a firm can answer in a survey that there are high obstacles in the judicial system, but acknowledge that this is not important to its activity because it has no pending cases in court or litigation is typically reduced in its business. Conversely, a firm may claim that a specific barrier to internationalisation is a mild regulatory obstacle, but very important to its activity because of its large export intensity. Therefore, it is necessary to combine these two dimensions of firms' assessment: the *level of the obstacles* in each domain and their *importance for the activity of the firms*.

Figure 1 Main Categories of Regulatory Costs
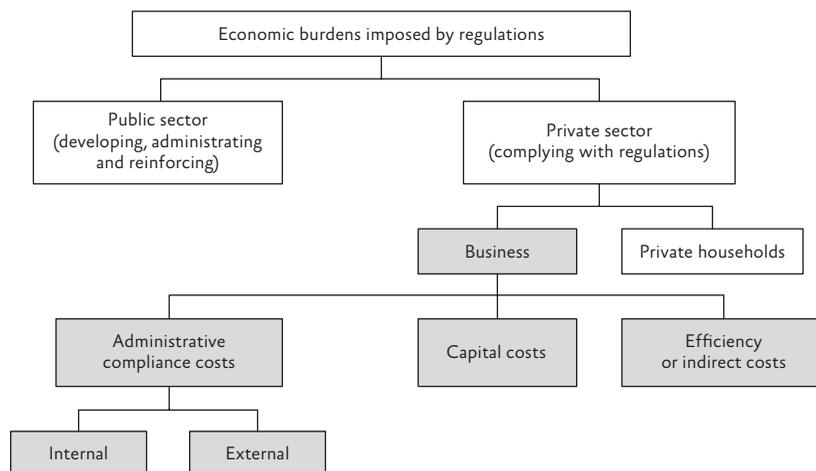
Source: OECD (1997), The OECD Report on Regulatory Reform.

The second step of the analysis explores the relationship between firms' qualitative assessments of regulatory costs and their performance. Most surveys that collect firms' evaluations of regulatory costs do not contain information on performance indicators, such as productivity or participation in international trade. Therefore, such information must be merged from balance sheet and income statement databases using a common firm identifier.

In the methodological front, there are two additional points worth mentioning. Firstly, surveys often break down the assessment of a given area of regulatory costs throughout several questions, failing to provide a direct evaluation of each broad type of costs. In this case, it is necessary to aggregate multiple dimensions into a composite indicator. However, this procedure should go beyond a simple average of

the individual answers, because each of them can have different information content regarding the regulatory cost being studied. Secondly, endogeneity bias, mostly associated with simultaneous causality, makes it difficult to establish a robust causal effect of institutional constraints on firms' performance. Although it is more plausible that regulatory costs affect firms' performance, rather than the reverse, some omitted variables may be the real drivers of both performance and assessment of regulatory costs.

In this article, we discuss the relation between several regulatory costs and two dimensions of firms' performance: labour productivity and export intensity. These two performance variables are also imperfect. Labour productivity does not account for the impact of capital; however, the consideration of sector-specific effects can help reduce this problem. Nevertheless, high productivity can result from high prices due to low competition and not from the efficient use of resources. In turn, export intensity does not necessarily relate to the creation of value added if the import content of production is high.

We use detailed data from the Business Costs of Context Survey (*Inquérito aos Custos de Contexto*, Portuguese acronym: IaCC) for 2014, a survey conducted by Statistics Portugal (INE), which is representative of the universe of Portuguese non-financial firms. The survey covers nine domains of regulatory costs ("starting activity", "licensing", "network industries", "financing", "judicial system", "tax system", "administrative burden", "barriers to internationalisation", "human resources") and comprises several questions on the current level of different obstacles within each domain. We apply methods of Item Response Theory (IRT) to aggregate the individual responses in each Domain, and obtain nine composite indicators (latent obstacle) of how

firms rate the level of the obstacles associated with each regulatory cost. Additionally, the IaCC includes a complementary question on the firms' perceived importance of each domain of regulatory costs to their activity.

The estimates show a negative link between the productivity of the firms and the way they perceive the importance of regulatory costs in the domains "starting activity", "administrative burden", "barriers to internationalisation", and "human resources". For export intensity, we estimate a negative relation for the importance of "starting activity", "licensing", and "judicial system". Moreover, the association of the firms' labour productivity and export intensity with the level of latent obstacles tends to differ between the firms that evaluate regulatory costs as important to their activity, and those who don't. Finally, for productivity, we only identify obstacles with a significant and negative relation regarding "human resources", while, for export intensity, the same is true for obstacles related to the "judicial system".

We also analyse in more detail the responses on the current level of obstacles in the domain of "barriers to internationalisation". We find that firms evaluating this domain as important to their activity tend to have lower productivity and higher export intensity. Moreover, significant negative links of firms' export intensity with the level of obstacles are estimated mostly for firms that perceive this domain as important, and for obstacles not related to international trade.

The article is organised into five sections. Section 2 briefly overviews some of the literature on the impact of institutional quality on economic performance, presenting some results for Portugal from surveys carried out by international organisations. Section 3 presents the databases used and the main aggregate results of the survey on regulatory costs in Portugal. Section 4 estimates the relations between how firms perceive the level of the obstacles associated with each regulatory cost, the importance of the respective domain to their activity, and the outcome variables, detailing the domain "barriers to internationalisation". Finally, Section 5 offers some concluding remarks.

Section 2
Related Literature

International organisations regularly conduct surveys to collect firms' assessment of the strength of different types of regulatory costs. These surveys convey information that goes beyond the regulatory indexes strictly based on legislation (for instance, OECD (2014)) as they also reflect how firms evaluate the enforcement of such laws. However, the sample of firms surveyed is typically small and not representative of the universe of firms in the respective economy. Well-known examples of this type of surveys are those run by the World Economic Forum (e.g., World Economic Forum 2017) and the World Bank (e.g., World Bank 2018), which offer both cross- country and temporal perspectives.

The Global Competitiveness Index (GCI) of the World Economic Forum assesses the factors and institutions identified by theoretical and empirical research as drivers of productivity and sustainable growth. It tracks the performance of around 140 countries on 12 pillars of competitiveness over time.[13] There are a total of around 100 indicators in the index, derived from a combination of data from international organisations and the World Economic Forum's Executive Opinion Survey. This survey, which is associated with the GCI, collects the opinions of business leaders on a broad range of topics for which alternative statistics are unreliable, outdated, or non-existent. Nevertheless, the number of respondents per country is limited: in Portugal, the number of business leaders that responded in 2016 and 2017 was 220 and 140, respectively. Respondents to the Executive Opinion Survey are asked to identify and rank, every year, the five most problematic factors for doing business in their country. The scores for Portugal, calculated on the basis of 2017 data, are presented in Figure 2. The strongest obstacles identified are "government bureaucracy" and "tax rates".

Figure 2 Most Problematic Factors for Doing Business, Portugal 2016-2017

Source: World Economic Forum, Executive Opinion Survey, 2017.
Notes: From a list of 16 factors, respondents were asked to select the five most problematic for doing business in their country and rank them from 1 (most problematic) to 5 (least problematic). The results were then tabulated and weighted according to the ranking assigned by respondents. The score corresponds to the percentage of responses weighted according to their rankings.

The Doing Business (DB) report conducted by the World Bank since 2003 measures aspects of business regulation and their implications for the establishment and operation of the firms, surveying areas which are, primarily, the responsibility of policymakers.[14] At present, DB presents quantitative indicators on several business regulations that can be compared across 190 countries over time. The 2018 edition of the DB measures regulations affecting 11 broad areas, and their indicators are used to analyse economic outcomes and identify which past reforms have worked better. Figure 3 presents the distance to the frontier indicator (best practice) for some dimensions of the DB in Portugal during the last three years. The distance to the frontier is higher in terms of "access to credit", "protecting minority investors" and "enforcing contracts", while Portugal is among the countries with the best performance in "trading across borders".

The Business Environment and Enterprise Performance Survey (BEEPS) is another extensive economic survey undertaken as a joint initiative of the World Bank and the European Bank for Reconstruction and Development, covering several Eastern European and Central Asian countries.[15] The BEEPS surveys a sample of firms from the private sector and aims to understand how firms perceive the environment in which they operate. The BEEPS covers a broad range of areas including access to finance, corruption, infrastructure, crime, competition and performance measures. Its findings can be used to help policymakers better understand the business environment faced by the private sector and identify, prioritise and implement policy reforms and institutions that support efficient private economic activity. This survey has been carried out in five rounds with the latest being 2012-2016.

Figure 3 Distance to Frontier (DTF) on Doing Business (DB) Topics, Portugal's Average 2015-2017
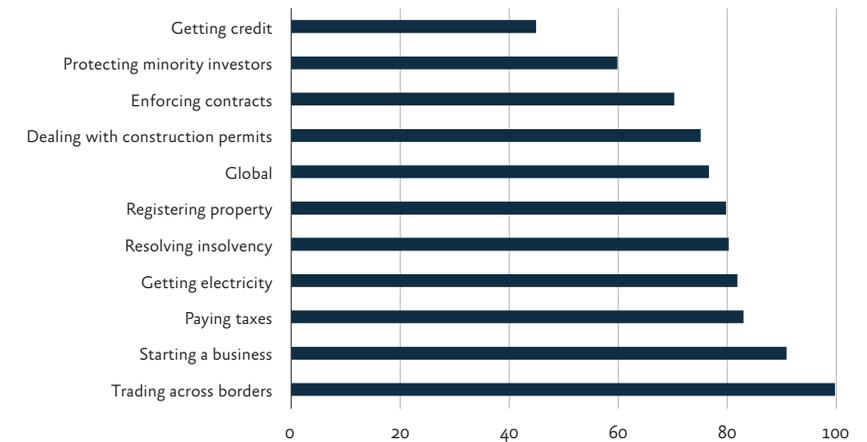
Source: World Bank.
Notes: The distance to frontier (DTF) measure shows the distance of each economy to the "frontier", which represents the best performance observed on each of the indicators across all economies in the sample since 2005. An economy's distance to frontier is reflected on a scale of 0 to 100, where 0 represents the lowest performance, and 100 represents the frontier. For each of the 10 topics, the chart shows the simple average of each score as published in DB 2016, DB 2017, DB 2018 (scores refer to the previous year).

The theoretical and empirical academic research on the role of institutions as drivers of long-run economic growth is vast and growing. There are several extensive reviews of the literature on institutions and growth, for instance, Acemoglu *et al.* (2005), Porta *et al.* (2008), Leite *et al.* (2014), Ogilvie and Carus (2014), and Lloyd and Lee (2016).

The micro-level empirical literature on the impact of regulatory costs on firms' performance is more restricted, mostly due to data limitations. Some works relate country-level indicators of national institutions to firms' performance (e.g., Goedhuys and Srholec (2015)

and Grosanu *et al.* (2015)), but the identification of causal effects is difficult in this framework. Other researchers examine the impact of various aspects of the business environment on firms' performance using micro-level data on domestic institutions. Commander and Svejnar (2011) use cross-country firm-level data from the BEEPS survey to analyse the performance effects of ownership, competition, export orientation, and the institutional environment. They find little evidence of a robust link between managers' perceived constraints on the business environment and firms' revenues, as country fixed-effects largely absorb that impact. On the contrary, also using data from the BEEPS survey, Gorodnichenko and Schnitzer (2013) find unambiguous evidence that financial constraints negatively affect the innovation activities of a firm in non-OECD countries. Recently, the estimates of Bhaumik *et al.* (2018) show that there are large intra and intercountry differences in the firm-level impact of institutional quality on performance, as measured by the firms' productivity. This evidence suggests that the one-size-fits-all approach to changes in legislation may not have the expected impact at the micro-level.

In the case of Portugal, Arnold and Barbosa (2015) provide empirical evidence on links between the productivity of Portuguese manufacturing firms and a number of regulatory costs between 2006 and 2011. Their results suggest that firm productivity is negatively affected by higher administrative requirements for starting a business, a more extensive coverage of collective wage bargaining agreements, higher taxes and tax compliance costs, and the number of procedures required to enforce a contract. Branstetter *et al.* (2014) use matched employer-employee data to evaluate the effect of a regulatory reform that substantially reduces the cost of firm entry in Portugal.[16] They

find that entry deregulation positively impacted firms and job creation, but such impact was observed mostly among entrepreneurs who were near the margin in terms of their firm formation decision. In addition, these start-ups were smaller, headed by relatively inexperienced and poorly educated entrepreneurs, and operating primarily in low-technology sectors. In comparison with firms that entered before the reform, these marginal firms were also less likely to survive their first two years. Recently, Félix and Maggi (2019) used the same Portuguese entry deregulation reform in a natural experiment and concluded that the reform had a positive impact on firm entry and aggregate employment. They found that a substantial part of the increase in employment came from older incumbent firms expanding their size, in particular from the most productive incumbents before the reform.

Domestic institutions can also have important effects on international trade. Nunn and Trefler (2014) review the literature on institutions as a source of comparative advantage, providing evidence that institutional sources are quantitatively as important as traditional sources of comparative advantage. In addition, they review the literature on the impact of international trade on domestic institutions, concluding that it is substantial.

Some of the recent empirical analyses on the link between institutions and international trade are based on the gravity model of trade. Álvarez *et al.* (2018) use a sectoral gravity equation to study the extent to which institutional quality affects aggregate and sectoral bilateral trade. They find that both the institutional conditions at the destination and the institutional distance between exporting and importing countries are relevant for bilateral trade, confirming the hypothesis that it is easier to trade with partners with better institutions.

A similar point is made by Gani and Scrimgeour (2016), who study exports from New Zealand to Asia. Martínez-Zarzoso and Márquez-Ramos (2019) use a gravity model of trade augmented with governance indicators to assess whether better governance facilitates the integration of the Middle East and North Africa (MENA) regions into world trade. They show that improvements in five of the six governance indicators increase exports from MENA countries, whereas better governance in destination countries does not affect MENA exports. In addition, the country-pair similarity in governance indicators also has a positive effect on exports from MENA countries. Söderlund and Tingvall (2014) use firm-level data on exports, combined with macro-data for countries, to investigate how institutional quality in destination countries affects Swedish exporting firms. The results show that weak institutions in recipient countries make exports to these countries less likely and characterised by relatively short durations and small volumes.

Section 3
Database and Exploratory Analysis

This article uses two firm-level databases merged in a unique firm identifier. The first database is the Integrated Enterprise Accounts System (*Sistema de Contas Integradas das Empresas*, Portuguese acronym: SCIE). This administrative database incorporates the Simplified Business Information (the IES – *Informação Empresarial Simplificada*), which includes annual balance sheet and income statement information, and is complemented with data for individual entrepreneurs and self-employed workers from protocols established between Statistics Portugal (INE) and various bodies of the Ministry of Finance and Public Administration.

The second dataset corresponds to the firms' answers to the Business Costs of Context Survey (the IaCC – *Inquérito aos Custos de Contexto*) for 2014. The INE (2015) provides an analysis of the main aggregate results and a detailed description of the methodology used in the survey. In 2018, the INE published a second edition of the same survey (INE 2018), and the results of both vintages were very similar, as it will be shown below. In both editions of the IaCC, around five thousand non-financial firms were asked about their perception of the level of different regulatory obstacles. The IaCC is based on a stratified random sample by size-class (defined in terms of employment and turnover), and on the main sector of activity, and is, therefore, representative of the structure of Portuguese non-financial firms. The stratification was made using 31 sectors and 4-dimension classes, resulting in 124 strata. For all firm-level regressions reported in the

next section, we use weights based on ex-post sampling probabilities, in accordance with the design of the IaCC. More precisely, each firm is weighted according to the inverse of the probability that this observation was sampled using the weight of its stratum in terms of turnover.

The IaCC comprises several detailed questions on the levels of the obstacles perceived by firms, which are organised into nine domains of regulatory costs: "starting activity", "licensing", "network industries", "financing", "judicial system", "tax system", "administrative burden", "barriers to internationalisation", and "human resources". There is also a complementary question on the importance of each of the nine domains to the firms' activity.

The questions on the current level of obstacles have a qualitative nature, expressed in a 5-level scale of response ls: 1 – not an obstacle; 2 – very reduced obstacle; 3 – reduced obstacle; 4 – high obstacle; 5 – very high obstacle. For each individual question in the survey, an aggregate indicator (the obstacle indicator) is computed as the weighted average of all firms' responses in the 5 levels, thus ranging between 1 and 5. In addition, a composite indicator for each of the nine domains of regulatory costs is calculated as a simple average of the respective obstacle indicators. Finally, a global indicator is computed, taking into account the additional question, which assesses the impact of each of the nine areas of regulatory costs in business activities, as perceived by firms, as well as their weight in the corresponding stratum in terms of turnover. It can be the case that a firm

assesses the *level of obstacles* in a given domain of regulatory costs as high, but also as not *important for its activity*.

Figure 4 presents the composite indicators for each of the nine domains of regulatory costs in 2014 and 2017, as well as the global indicator. The latter indicator scored a value of 3.04 and 3.05 in 2014 and 2017, respectively, signalling an overall intermediate assessment of regulatory costs by Portuguese firms. In the domains of regulatory costs, the "judicial system" scores the highest composite index (3.7), followed by "licensing" and "tax system" (3.5 and 3.3, respectively).

The obstacle indicators for the 2014 and 2017 vintages of the IaCC are very similar (Figure 5). Therefore, although in the next section, we only use information IaCC's information for 2014, the main results should hold for the most recent years. The linear correlation between the 2014 and 2017 obstacle indicators, measured by the Pearson correlation coefficient, is 99 per cent. This means that, from the perspective of firms, the underlying regulatory environment in Portugal has not changed in this period. However, it should be noted that a stable regulatory framework is sometimes beneficial. Firms face costs in adapting to new legislation, which may overturn the gains arising from changes in the existing regulation.

Figure 4 Composite Indicators of the Nine Domains of Regulatory Costs in Portugal

Not an obstacle = 1   Very high obstacle = 5
■ 2014   ■ 2017
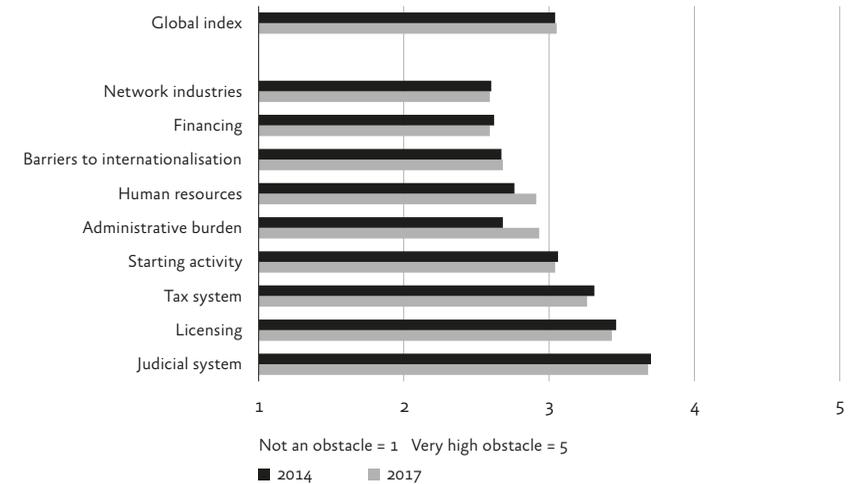
Source: Statistics Portugal (INE).
Notes: The composite indicator for each of the nine domains of regulatory costs is computed as a simple average of the respective obstacle indicators. For more details, see INE (2015) and INE (2018).

Figure 5 Correlation of the Detailed Obstacle Indicators in 2014 and 2017
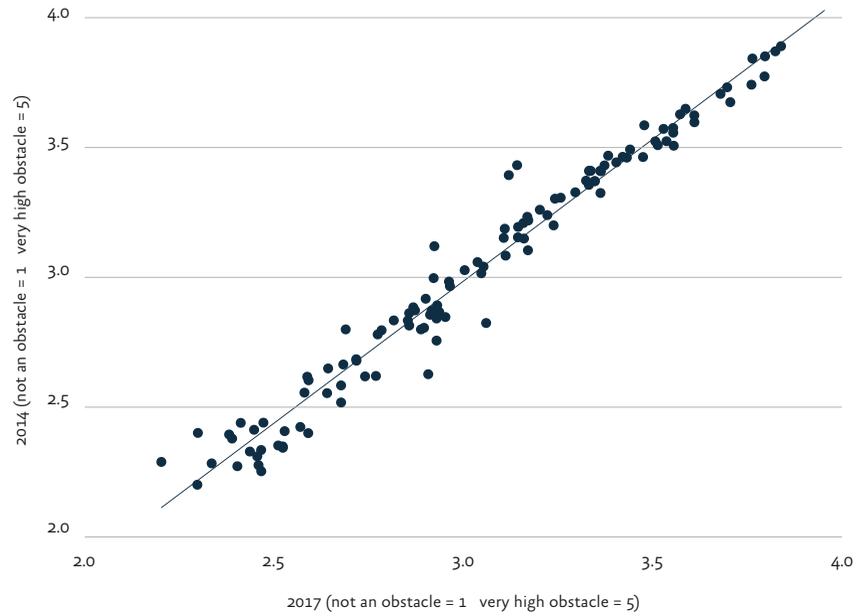
Source: Statistics Portugal (INE).
Notes: For each individual question in the survey, the obstacle indicator is computed as the weighted average of all firms' responses along the 5 levels considered, thus also ranging from 1 (not an obstacle) to 5 (very high obstacle). For more details, see INE (2015) and INE (2018).

Section 4
Regulatory Costs, Labour Productivity and Export Intensity

In this section, we move beyond the aggregate description of how firms evaluate the regulatory environment in Portugal and link the individual responses of firms with two indicators of their performance, namely labour productivity and export intensity. Labour productivity is defined as the gross value added per worker, and export intensity equals the ratio of total exports of goods and services to turnover.

In the analysis, we pool information regarding firms' performance along several years (2010-2016). Although the IaCC refers to a specific moment, and includes questions on how firms assessed the obstacles in 2014, we cannot correctly capture firm performance with information from a single year. For example, the firms' turnover may not correspond to their production in that same year due to changes in inventories or breaks in the production process for reorganisation purposes. In addition, the relevance of exports for a firm's business is poorly assessed with data from a single year. For example, the export intensity may be affected by specific shocks taking place in a destination market in a given year. Therefore, pooling information regarding firms' productivity and export intensity in different years offers a clearer picture of their performance. We consider the period 2010-2016, which includes some years before and after the period covered by the survey. Moreover, as mentioned above, to make the sample representative of the underlying population, we use weights based on

inverse sampling probabilities for all the results reported below. In the second part of this section, we detail a specific domain of

regulatory costs, namely "barriers to internationalisation", and reassess its relationship with firm performance variables. The analysis of the several components of the regulatory costs associated with "barriers to internationalisation" is both an illustration of a more detailed analysis of the IaCC and important *per se*. In fact, it has been widely acknowledged that Portuguese growth prospects depend on the increased participation of firms in international markets. Therefore, knowing about the firms' perceptions of "barriers to internationalisation" can be useful for policy purposes.

4.1. Nine Domains of Regulatory Costs in Portugal

As previously mentioned, the structure of the IaCC comprises several questions in each of the nine domains of regulatory costs and a complementary question on the importance of each domain to the firms' activity. In order to associate the level of obstacles in each domain with firm performance, we start by aggregating the answers of each firm in a composite variable using the Item Response Theory (IRT). Most of the theoretical work on IRT originates in the fields of psychometrics and educational measurement, with seminal contributions by Rasch (1980) and Birnbaum (1968). In practice, IRT is a

method of analysing responses to tests or surveys used to improve the accuracy and reliability of the measurement. This methodology has been used extensively in the study of educational outcomes and household characteristics. The basic principle is that a composite variable can give a more reliable estimate of the quality being measured than any of the separate constituent variables. In our case, a firm's evaluation of the level of the obstacles in a given domain of regulatory costs is better captured by the composite indicator (latent obstacle) than by the firm's answers to each individual question in that domain. These methods improve with the option of having, for instance, a simple average of each firm's responses in each domain, while also accommodating cases of non-response, and allowing for the weighting of observations.

We use an IRT procedure with a graded response model for ordered items and obtain the level of the latent obstacle associated with each domain of regulatory costs for each firm. The distribution of the latent obstacle was standardised with mean zero and a standard deviation equal to one. We drop observations in which all responses of a given domain are missing. In addition, in the "financing" domain, some of the questions are excluded from the IRT procedure due to the sparse number of responses.[17]

We also implement a partition of firms that corresponds to what they responded in the complementary question on the importance of each domain of regulatory costs to their activity. We group the firms' responses to this question into two categories: "important", which corresponds to the two highest levels in the scale of response (4 – important, and 5 – very important); and "not important",

corresponding to the remaining three levels (1 – not important, 2 – of little importance, and 3 – indifferent).

Figure 6 plots the kernel distributions of firms' labour productivity for each of the nine domains of regulatory costs, separating between firms whose level of latent obstacle stands above and below zero, which should be interpreted as the cases where the latent obstacle is perceived as high or low, respectively. In addition, the distributions include only firms in the category "important", hence comparing the distributions of labour productivity for firms whose latent obstacle is perceived as high and the regulatory cost is important to their activity with those for which the latent obstacle is perceived as low but the regulatory cost is also important. The reasoning for focusing the distributions on firms for which the regulatory cost is important derives from the assumption that the level of obstacles could have a higher association with the performance of these firms.

Figure 6 Labour Productivity (2010-2016) and Perception of Regulatory Costs (2014)

(A) Starting activity

— High, important   ▪▪ Low, important

(B) Licensing

— High, important   ▪▪ Low, important

(C) Network industries

— High, important   ▪▪ Low, important

(D) Financing

— High, important   ▪▪ Low, important

(E) Judicial system

— High, important   ▪▪ Low, important

(G) Administrative burden

— High, important   ▪▪ Low, important

(F) Tax system

— High, important   ▪▪ Low, important

(H) Barriers to internationalisation

— High, important   ▪▪ Low, important

(I) Human resources

(A) Starting activity

Legend: High, important — — Low, important (I) Human resources

Legend: High, important — — Low, important (A) Starting activity

Notes: Labour productivity is the gross value added over the total employment in 1000 euros. The distributions exclude firms with productivity in the 5th and 95th percentiles. Kernel density estimates are weighted by inverse sampling probabilities. High refers to firms whose latent obstacle is positive; low refers to firms whose latent obstacle is negative; important refers to firms that evaluate the regulatory cost as important or very important to their activity. The latent obstacle associated with the level of the obstacles in each domain of regulatory costs in 2014 is computed with an IRT graded response model.

(B) Licensing
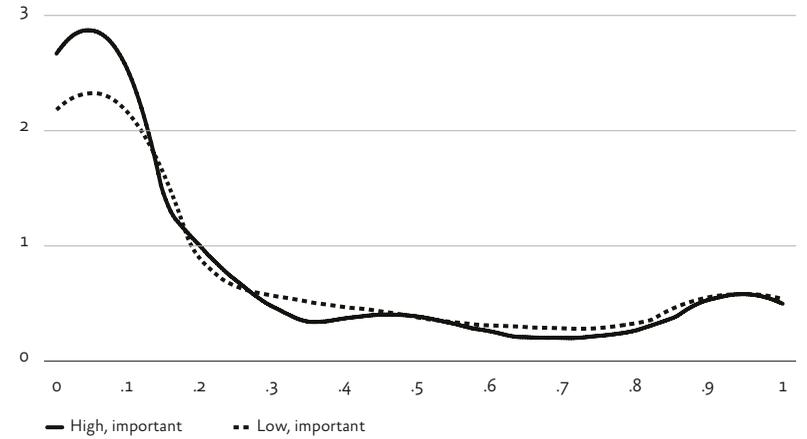
Legend: High, important — — Low, important (B) Licensing

(C) Network industries

— High, important ▪▪ Low, important

(D) Financing

— High, important ▪▪ Low, important

(E) Judicial system

— High, important ▪▪ Low, important

(F) Tax system

— High, important ▪▪ Low, important

(G) Administrative burden

— High, important ▪▪ Low, important
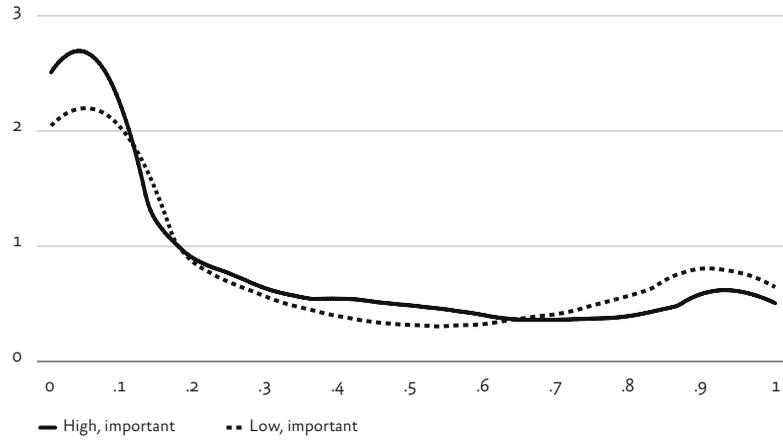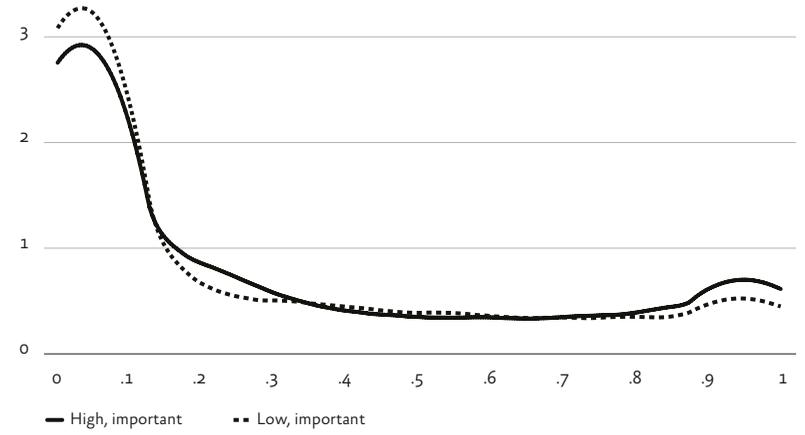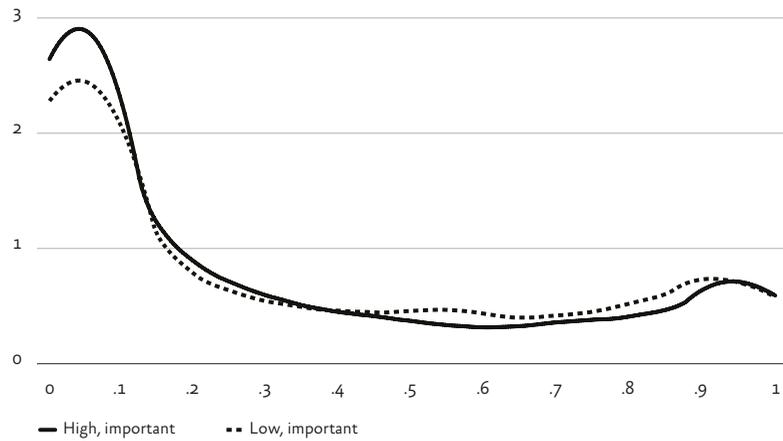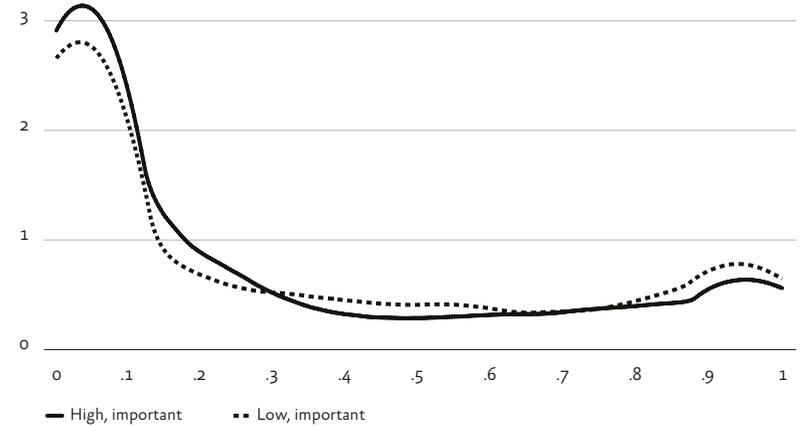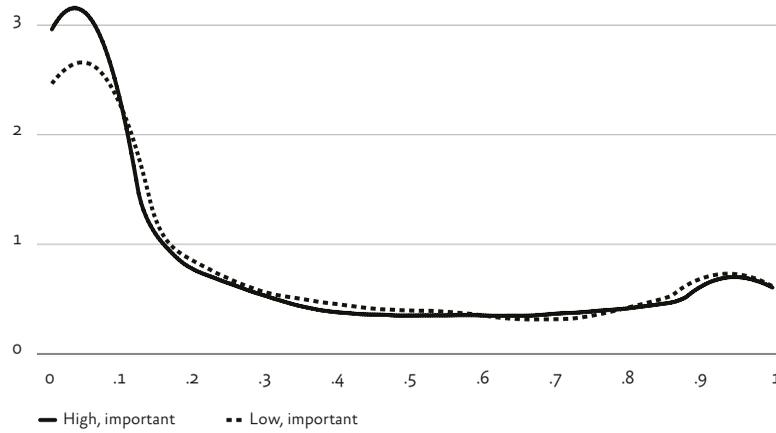
(I) Human resources

— High, important ▪▪ Low, important
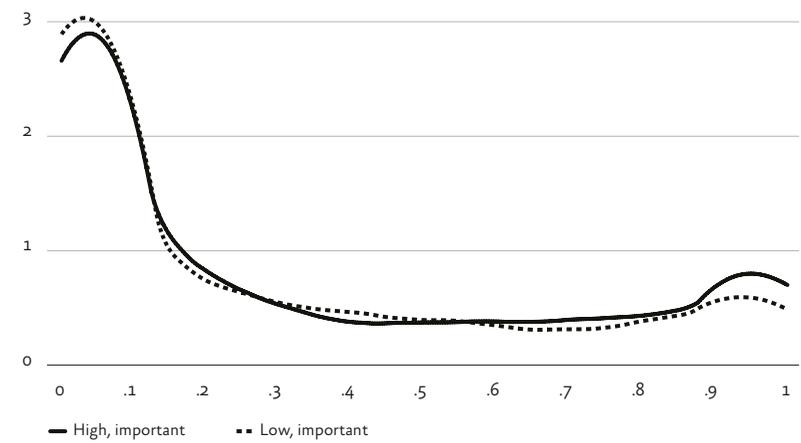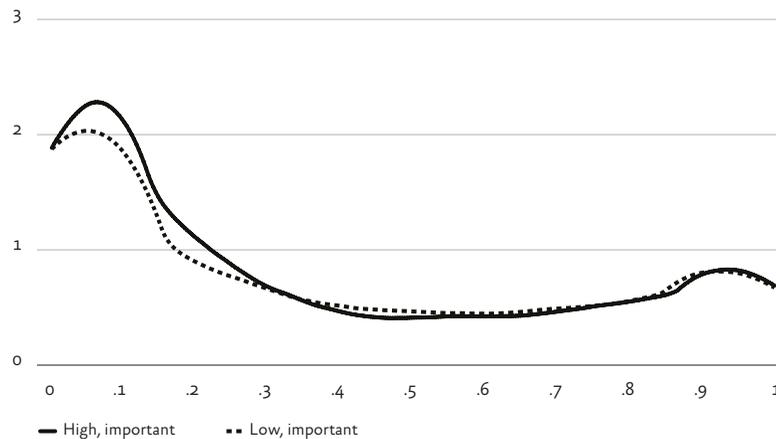
Notes: Export intensity corresponds to the total exports of services and goods over turnover. The distributions exclude firms with zero exports. Kernel density estimates are weighted by inverse sampling probabilities. High refers to firms whose latent obstacle is positive; low refers to firms whose latent obstacle is negative; important refers to firms that evaluate the regulatory cost as important or very important to their activity. The latent obstacle associated with the level of the obstacles in each domain of regulatory costs in 2014 is computed with an IRT graded response model.

(H) Barriers to internationalisation

— High, important ▪▪ Low, important

Although the differences between the pairs of kernels in each panel of Figure 6 are not substantial, some facts stand out. For example, firms that assess the levels of the obstacles in the "judicial system" (panel E) as high and important are also those with lower labour productivity. This could mean that more efficient firms are better equipped to deal with the judicial system. This result is clearer for the levels of obstacles associated with "financing" (panel D), "tax system" (panel F), and "human resources" (panel I). Conversely, firms that consider the level of "barriers to internationalisation" (panel H), as low are also the least productive. However, results in this domain should be interpreted with

some caution, as the number of responding firms is smaller than in the other domains of regulatory costs. Around half of the firms consider this domain as "not applicable" because they are not directly engaging nor trying to initiate international activities.

Figure 7 replicates the analysis described above for firms' export intensity. Firms that assess "starting activity" (panel A) as a high obstacle are also those with relatively lower export intensities. This is also the case for "network industries" (panel C), "financing" (panel D), "tax system" (panel F), and "administrative burden" (panel G). On the contrary, the firms that see obstacles in the "judicial system" (panel E) as low are those with relatively lower export intensities. Finally, as regards "barriers to internationalisation" (panel H), the differences between distributions are small, but there are more firms with higher export intensities considering it a high obstacle.

The simple visual comparison of pairs of kernel distributions for the different domains of regulatory costs does not allow for a quantitative statistical assessment in the subset of firms that consider that type of regulatory costs important for their activity. Therefore, we run a set of descriptive regressions relating the regulatory obstacles with firm performance. The regression for each of the nine domains of regulatory costs is:

$$logY_{it} = \alpha + \beta_0 d_i + \beta_1 X_i + \beta_2 X_i * d_i + \gamma_j + \gamma_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} is the dependent variable of interest (labour productivity in logs or export intensity) of firm i in year t, from 2010 to 2016. d_i is a dummy variable that takes the value one for firms responding that the domain of regulatory costs is important or very important to their activity, in 2014, and the value zero otherwise, i.e., firms in the "important"

category. X_i is the IRT latent obstacle that is associated with the respective regulatory cost for firm i in 2014. The interaction term in the regression allows to link the latent obstacle with the performance variable to differentiate between the firms that consider the domain important to their activity, and those who don't. Sector and time fixed effects are included in γ_j and γ_t, respectively. The control for the main sector of activity of the firm is defined at the *Portuguese Classification of Economic Activities* (CAE) 2-digit level, comprising different sectors. ε_{it} is an error term robust to heteroscedasticity using the Huber-White variance estimator.

Table 1 reports the results for weighted least squares regressions of Equation (1) using sampling weights, with labour productivity as the dependent variable. The coefficients of the importance dummy variable, β_0, measure the gap in average productivity levels between firms that consider the respective regulatory cost as important to their activity and those who don't, for a zero-level latent obstacle. For instance, the productivity gap between similar firms that only differ in their assessment of the importance of the regulatory cost to their activity is −18.78 per cent (= 100 * (exp(−0.208) −1)) in the case of "administrative burden" and −13.76 per cent for "barriers to internationalisation", evaluated at zero-levels of the respective latent obstacles. For "starting activity" and "human resources", the estimated coefficient is also negative, while the opposite happens for "network industries" and "tax system". The coefficient of the latent obstacle, β_1, is significant for all domains of regulatory costs except "licensing" and "barriers to internationalisation". In all significant cases except for "starting activity" and "administrative burden", the coefficient is negative. This means that higher levels of the latent obstacle

are associated with lower average productivity for firms that do not consider the obstacle important ($d_i = 0$). For example, an increase by one of the latent obstacles of "tax system" is associated with a decline of 15.63 per cent of the average productivity of firms that do not assess this regulatory cost as important.

Table 1 Labour Productivity (2010-2016), Regulatory Costs and their Importance (2014)

	(1) Starting activity	(2) Licensing	(3) Network industries	(4) Financing	(5) Judicial system	(6) Tax system	(7) Administrative burden	(8) Barriers to internationalisation	(9) Human resources
Importance dummy (β_0)	-0.167***	0.00892	0.101***	-0.0411	0.0302	0.227***	-0.208***	-0.148***	-0.136***
	(0.0380)	(0.0325)	(0.0308)	(0.0369)	(0.0309)	(0.0616)	(0.0447)	(0.0392)	(0.0478)
Latent obstacle (β_1)	0.0311*	0.00993	-0.0388*	-0.0825***	-0.0489**	-0.170***	0.178***	-0.0301	-0.124***
	(0.0181)	(0.0277)	(0.0227)	(0.0281)	(0.0238)	(0.0402)	(0.0281)	(0.0298)	(0.0389)
Interaction term (β_2)	0.0744**	0.0385	0.0726**	-0.0663**	0.0142	0.0526	-0.171***	0.0497	0.000280
	(0.0351)	(0.0328)	(0.0313)	(0.0311)	(0.0301)	(0.0428)	(0.0325)	(0.0370)	(0.0409)
Constant	9.728***	9.676***	9.579***	9.614***	9.691***	9.472***	9.838***	9.872***	9.757***
	(0.0678)	(0.0611)	(0.0644)	(0.0658)	(0.0678)	(0.0777)	(0.0673)	(0.0761)	(0.0676)
Observations	13,507	18,047	15,012	18,831	18,211	22,888	22,724	10,888	21,925
R^2	0.385	0.444	0.458	0.380	0.412	0.368	0.404	0.355	0.386

Notes: Results of weighted least squares regressions using inverse sampling probabilities as weights. The reported number of observations refers to the unweighted count. The dependent variable is labour productivity defined as gross the value added over total employment, in logs, in 2010-2016. The nine domains of regulatory costs are reported in the column headings. The importance dummy takes the value one for firms responding that the domain of regulatory costs is important or very important to their activity in 2014. And the value zero otherwise. The latent obstacle associated with the level of the obstacles in each domain of regulatory costs in 2014 is computed with an IRT graded response model. All regressions include a 2-digit sector and year fixed- effects. See the main text for more details. Stars indicate significance levels of 1% (***), 5% (**) and 10% (*).

The coefficient of the interaction term, β_2, captures the difference in the link of the latent obstacle level with productivity between firms that perceive the regulatory cost as important and those who don't. This coefficient is significant in four out of nine domains of regulatory costs. For "starting activity" and "network industries" the coefficient is positive, while for "financing" and "administrative burden" it is negative. For example, in the case of "financing", a unitary increase in the latent obstacle is associated with a decline in the average productivity of 7.92 per cent for firms that do not assess this domain as important, and 13.83 per cent (= 100 * (exp(−0.0825 − 0.0663) − 1)) for similar firms that consider it important.

"Human resources" is the only domain that presents negative and significant coefficients in both the importance dummy variable and the latent obstacle (coefficients β_0 and β_1). This means, firstly, that firms considering this dimension as important for their activity are comparatively less productive and, secondly, that the perception of stronger obstacles in aspects related to the labour market is also associated with lower average productivity. This result is compatible with the conclusion based on the kernels, in Panel I, Figure 6. Therefore, as acknowledged in the literature, regulations on hiring and firing,

security and health in the workplace and the access of the firms to specific worker competences and skills seem to have a bearing on productivity. Although there have been substantial reforms in the Portuguese labour market legislation, there is still room for productivity-enhancing reforms. We replicate the analysis above using firm export intensity as the dependent variable, and present the results in Table 2. Overall, the number of statistically significant coefficients is lower than in the case of labour productivity.

The estimated parameters for the importance dummy, β_0, are negative for "starting activity", "licensing", and "judicial system", and positive for "tax system" and "barriers to internationalisation". For instance, in the latter domain, firms that report these barriers as important to their activity have an average export intensity 6.56 percentage points (p.p.) higher than those who don't consider these barriers important, evaluated for the latent obstacle at a neutral level (zero).

Table 2 Export Intensity (2010-2016), Regulatory Costs and their Importance (2014)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Starting activity	Licensing	Network industries	Financing	Judicial system	Tax system	Administrative burden	Barriers to internationalisation	Human resources
Importance dummy (β_0)	-0.0311***	-0.0308***	0.00613	0.00488	-0.0186**	0.0304***	-0.000608	0.0656***	-0.0171
	(0.00652)	(0.00928)	(0.00635)	(0.00940)	(0.00895)	(0.00948)	(0.0112)	(0.0105)	(0.0124)
Latent obstacle (β_1)	0.0132**	0.0161**	0.00208	0.00691	-0.0185***	-0.0414***	0.00670	-0.0139*	0.0168*
	(0.00560)	(0.00707)	(0.00400)	(0.00607)	(0.00601)	(0.0109)	(0.00681)	(0.00739)	(0.0102)
Interaction term (β_2)	-0.00838	-0.0191**	-0.00751	-0.00976	0.0310***	0.0387***	-0.00340	0.00158	-0.0130
	(0.00696)	(0.00842)	(0.00627)	(0.00732)	(0.00781)	(0.0113)	(0.00788)	(0.00938)	(0.0107)
Constant	0.0812***	0.103***	0.0861***	0.0699***	0.0863***	0.0549***	0.0843***	0.153***	0.0938***
	(0.0128)	(0.0141)	(0.0133)	(0.0142)	(0.0145)	(0.0140)	(0.0145)	(0.0227)	(0.0151)
Observations	14,201	18,836	15,633	19,587	18,903	23,893	23,718	11,249	22,833
R^2	0.253	0.305	0.329	0.281	0.262	0.271	0.270	0.269	0.269

Notes: Results of weighted least squares regressions using inverse sampling probabilities as weights. The reported number of observations refers to the unweighted count. The dependent variable is export intensity defined as the total exports of goods and services over turnover in 2010-2016. The nine domains of regulatory costs are reported in the column headings. The importance dummy takes the value one for firms responding that the domain of regulatory costs is important or very important to their activity in 2014, and the value zero otherwise. The latent obstacle associated with the level of obstacles in each domain of regulatory costs in 2014 is computed with an IRT graded response model. All regressions include a 2-digit sector and year fixed-effects. See the main text for more details. Stars indicate significance levels of 1% (***), 5% (**) and 10% (*).

The association between the level of the latent obstacle and the export intensity of firms that do not consider the respective regulatory cost as important is positive in three domains ("starting activity", "licensing", "human resources") and negative in three other domains ("judicial system", "tax system", "barriers to internationalisation"). On the contrary, the estimates for the interaction term, β_2, are positive for "judicial system" and "tax system" and negative for "licensing". Considering the sum of the coefficients β_1 and β_2, there are only two statistically significant relations between the level of the latent obstacle and the export intensity of firms that consider the regulatory domain important to their activity. In the case of the "judicial system", the sign of the link between the level of obstacles and export intensity differs between the two categories of firms. A unitary increase in the latent obstacle for firms that do not consider this cost important is associated with a 1.85 p.p. decline in their average export intensity, while there is an increase of 1.25 p.p. (= 100 * (–0.0185 + 0.0310)) for similar firms that consider this cost important. On the contrary, the relation is negative and significant for both categories of firms regarding "barriers to internationalisation", meaning that irrespective of how they assess the importance of this regulatory cost, higher levels of the latent obstacle are associated with lower export intensities.

As shown in Figure 4 of the previous section, among the composite indicators of the nine domains of regulatory costs, the main constraints to Portuguese firms are identified in the "judicial system". The results of Table 2, with export intensity as the dependent variable, reveal that "judicial system" is the only domain with significant and negative estimates for the coefficients of the importance dummy variable, β_0, and level of the latent obstacle, β_1. This suggests that judicial institutions may not only pose obstacles to firms' domestic activities but also be related to firms' international operations. In fact, there is a growing body of literature that examines how judicial quality affects international trade. For instance, Levchenko (2007) and Nunn (2007) show that a higher effectiveness and predictability of the judiciary system and a better enforcement of contracts shift a country's comparative advantage towards products that are more dependent on good judicial quality. Other empirical studies with firm-level data also show that judicial quality affects firms' exports. Ma *et al.* (2010) and Wang *et al.* (2014) find that a good legal system significantly increases firms' exports of goods for which relationship-specific investments are more important, i.e. goods that are contract-intensive.

4.2. The Case of "Barriers to Internationalisation"

In this section, we detail the study of one of the domains of regulatory costs, "barriers to internationalisation", to illustrate a possible second layer of analysis within the IaCC. Moreover, the examination of this type of institutional cost is also relevant per se. In fact, it has been widely acknowledged that the internationalisation of Portuguese firms is a way of promoting the growth of the economy while sustaining a balanced current account. Portuguese international trade in goods is regulated by the European Union's (EU) Common Commercial Policy

setting similar arrangements for imports from third countries, namely a customs tariff uniformly applied to all Member-States. Nevertheless, domestic regulations can affect other forms of participation of Portuguese firms in international markets as well as the implementation of these common policies for trade in goods and services.

The questions on the current level of obstacles comprised in this domain of regulatory costs refer to the complexity of the procedures associated with eight distinct forms of internationalisation: "imports of goods – intra-EU", "imports of goods – extra-EU", "exports of goods – intra-EU", "exports of goods – extra-EU", "applications to international tenders", "opening of establishments abroad", "opening of subsidiaries abroad", "applications for EU operational programmes and funds". As before, the responses to these questions are expressed in a scale of 1 to 5 (1 – not an obstacle; 2 – very reduced obstacle; 3 – reduced obstacle; 4 – high obstacle; 5 – very high obstacle).

While in the previous section the responses to these questions were aggregated to obtain the level of the latent obstacle associated with "barriers to internationalisation", in this section the regressions consider firms' answers to each question autonomously in the vector X_i of Equation (1). Apart from this difference, the specification of the regressions is the same, with the dummy variable d_i taking the value one for firms responding that the domain "barriers to internationalisation" is important or very important to their activity in 2014.

Table 3 presents the estimation results with labour productivity as the dependent variable, reporting each of the eight obstacles included in this domain in the column headings. In line with the results of the previous section, for almost all questions considered, we find a

negative relation between firms' productivity and the importance of the domain "barriers to internationalisation" to their activity. The only exception is "applications to international tenders", where the coefficient of the importance dummy is not significant.

Table 3 Labour Productivity (2010-2016), Level of Obstacles to International Activities, and their Importance (2014)

	(1) Imports intra-EU	(2) Imports extra-EU	(3) Exports intra-EU	(4) Exports extra-EU	(5) Applications to international tenders	(6) Opening establishments abroad	(7) Opening subsidiaries abroad	(8) Applications to EU programmes and funds
Importance dummy (β_0)	-0.163*	-0.503***	-0.320***	-0.486***	-0.0941	-0.395**	-0.572***	-0.227*
	(0.0909)	(0.114)	(0.105)	(0.115)	(0.153)	(0.154)	(0.139)	(0.134)
Level of obstacle (β_1)	0.0290	-0.121***	-0.0850**	-0.111***	0.123**	0.0653	-0.0282	0.0602
	(0.0319)	(0.0375)	(0.0362)	(0.0379)	(0.0528)	(0.0508)	(0.0473)	(0.0417)
Interaction term (β_2)	-0.00806	0.118***	0.0953**	0.148***	-0.109*	-0.0115	0.0824	-0.0209
	(0.0378)	(0.0425)	(0.0417)	(0.0420)	(0.0595)	(0.0565)	(0.0535)	(0.0491)
Constant	9.799***	10.20***	9.995***	10.02***	9.705***	9.831***	10.02***	9.669***
	(0.101)	(0.123)	(0.118)	(0.128)	(0.174)	(0.171)	(0.162)	(0.150)
Observations	9,906	8,735	9,216	8,566	4,828	4,413	4,424	6,281
R^2	0.376	0.378	0.389	0.348	0.450	0.455	0.456	0.399

Notes: Results of weighted least squares regressions using inverse sampling probabilities as weights. The reported number of observations refers to the unweighted count. The dependent variable is labour productivity defined as the gross value added over total employment, in logs, in 2010-2016. The eight obstacles included in the domain "barriers to internationalisation" are reported in the column headings. The importance dummy takes the value one for firms responding that the domain "barriers to internationalisation" is important or very important to their activity in 2014, and the value zero otherwise. The level of the obstacle refers to how firms respond to each question in a scale of 1 (not an obstacle) to 5 (a very high obstacle). All regressions include a 2-digit sector and year fixed-effects. See the main text for more details. Stars indicate significance levels of 1% (***), 5% (**) and 10% (*).

In the previous section, we do not find a statistically significant relationship between the level of the latent obstacle associated with "barriers to internationalisation" and firms' productivity for either category of firms. However, the detailed estimates of Table 3 show significant links between productivity and some of the obstacles of this domain. Starting with firms that do not consider this domain important to their activity, there is a negative relationship between productivity and the level of obstacles in "imports extra-EU", "exports intra-EU", "exports extra-EU". In contrast, for "applications to international tenders" the relationship is positive. The results differ for firms that consider this domain important: all significant coefficients associated with the interaction term have the opposite signs.

The results of a similar exercise for firms' export intensity are presented in Table 4. Overall, the significant coefficients of the different variables are mostly concentrated on obstacles that are not directly connected with international trade (columns 5 to 8). This points towards a complementarity of the different forms of internationalisation of a firm, as there is a link between firms' export intensity and how they assess obstacles related to foreign direct investment (FDI) and other international activities.

Starting with the estimates of the importance dummy, the significant coefficients are positive, as found in the previous section, signalling that firms which consider "barriers to internationalisation" important to their activity tend to have higher export intensities.

With the exception of "imports intra-EU", there is no significant association between how firms that do not assess this domain as important perceive the level of the different obstacles and their export intensity. Looking at the estimated parameters of the interaction term, the link between the average export intensity and the level of some obstacles is different for firms in the "important" category. In particular for the obstacles not related with international trade, namely "applications to international tenders", "opening of establishments abroad", "opening of subsidiaries abroad", "applications for operational programmes and EU funds", there is a negative relationship with export intensity for firms that consider "barriers to internationalisation" important to their activity. A plausible interpretation of this result is that the firms that deem this domain of regulatory costs important are relatively more engaged in export activities, but a higher level of obstacles could limit their export intensity.

Table 4 Export Intensity (2010-2016), Level of Obstacles
to International Activities, and their Importance (2014)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Imports intra-EU	Imports extra-EU	Exports intra-EU	Exports extra-EU	Applications to international tenders	Opening establishments abroad	Opening subsidiaries abroad	Applications to EU programmes and funds
Importance dummy (β_0)	0.0255	0.0544**	0.0367	0.0658*	0.199***	0.250***	0.214***	0.161***
	(0.0252)	(0.0272)	(0.0312)	(0.0348)	(0.0365)	(0.0404)	(0.0406)	(0.0343)
Level of obstacle (β_1)	-0.0185**	-0.00931	-0.0137	-0.00416	0.00675	0.0110	0.0162	-0.00199
	(0.00903)	(0.00813)	(0.0117)	(0.0110)	(0.0111)	(0.00984)	(0.00989)	(0.00851)
Interaction term (β_2)	0.0121	0.00204	-0.00511	-0.00965	-0.0419***	-0.0525***	-0.0446***	-0.0354***
	(0.0102)	(0.00995)	(0.0128)	(0.0129)	(0.0132)	(0.0128)	(0.0128)	(0.0107)
Constant	0.194***	0.177***	0.268***	0.153***	0.0350	0.0473	0.0400	0.135***
	(0.0303)	(0.0327)	(0.0380)	(0.0381)	(0.0381)	(0.0415)	(0.0415)	(0.0372)
Observations	10,177	8,961	9,442	8,779	4,987	4,557	4,571	6,531
R^2	0.283	0.276	0.280	0.259	0.259	0.280	0.269	0.317

Notes: Results of weighted least squares regressions using inverse sampling probabilities as weights. The reported number of observations refers to the unweighted count. The dependent variable is export intensity defined as the total exports of goods and services over turnover in 2010-2016. The eight obstacles included in the domain "barriers to internationalisation" are reported in the column headings. The importance dummy takes the value one for firms responding that the domain "barriers to internationalisation" is important or very important to their activity in 2014, and the value zero otherwise. The level of the obstacle refers to firms' responses to each question in a scale of 1 (not an obstacle) to 5 (a very high obstacle). All regressions include a 2-digit sector and year fixed-effects. See the main text for more details. Stars indicate significance levels of 1% (***), 5% (**) and 10% (*).

Section 5
Concluding Remarks

Regulatory costs exist in all economies and are perceived as barriers to firms' performance. Since regulatory costs have an impact on firms' decisions, policy makers should design legislation with a view to minimise negative effects and meet public goals. Implementing best international practices can be a good approach, but only if they are adapted to the domestic reality. In addition, frequent changes in the institutional framework impose a burden on firms, since the adjustment process requires the use of resources.

Micro-level studies on the relationship between institutional costs and firms' performance are still relatively scarce and rarely establish causal relations. In this article, we examine firms' responses to the 2014 Business Costs of Context Survey (IaCC), a representative survey conducted by Statistics Portugal (INE) on nine domains of regulatory costs: "starting activity", "licensing", "network industries", "financing", "judicial system", "tax system", "administrative burden", "barriers to internationalisation" and "human resources". The survey includes several questions on the current level of different obstacles within each domain. We obtain the latent obstacle associated with the level of the obstacles in a given domain of regulatory costs in 2014, applying the Item Response Theory (IRT) graded response model. In addition, the survey contains a complementary question on how firms assess the importance of each of the nine domains of regulatory costs to their activity.

The IaCC complements other surveys that assess framework conditions, and identifies the "judicial system", "licensing" and "tax system" as the three main regulatory barriers for Portuguese firms. The article provides a description of the relation between how firms evaluate the different domains of regulatory costs and two performance variables, namely labour productivity and export intensity. The comparison of the kernel distributions of these two performance variables for different groups of firms, classified according to their answers to the survey, gives some initial indications on the association between regulatory costs and firms' performance. To complement this information, we estimate several descriptive regressions that link the level of latent obstacles and the way firms perceive the importance of each domain with labour productivity and export intensity.

We find a negative relation between firms' productivity and their evaluation of the importance of regulatory costs in the domains "starting activity", "administrative burden", "barriers to internationalisation" and "human resources". Regarding export intensity, a negative link is estimated for the importance of "starting activity", "licensing" and "judicial system". Moreover, the association between firms' labour productivity and export intensity and the level of latent obstacles tends to differ between firms that evaluate the domain of regulatory costs as important to their activity and those who don't. Finally, two domains of regulatory costs stand out regarding the significant negative relations estimated both for the importance for firms' activity and

the level of the latent obstacle: "human resources" for labour productivity and "judicial system" for export intensity.

The article details the analysis in the domain "barriers to internationalisation", and finds a link between the perceived importance of these costs to the firms' activity and lower productivity and higher export intensity. For export intensity, significant negative links with the level of the obstacles are estimated mostly for firms that consider this domain important, and for obstacles not directly connected with international trade, namely FDI-related costs and costs associated with applications to international tenders and programmes.

Since the last economic and financial crisis, increased attention has been paid to productivity developments and the obstacles to Portugal's potential growth. Although the accumulation and the quality of the inputs play a major role in this process, the overall institutional framework is key. In this article, we show that there are aspects of regulatory costs that are closely linked with firms' performance. However, evidence is still limited, and further firm-level data and empirical research are necessary to better inform policy decisions.

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Notes

< **1.** The transition matrix in table A.4 shows that one-way-bi exporters tend to change into one-way goods or services exporters.

< **2.** Estimated coefficients are presented in columns 1-3 of Table 1, in the Appendix.

< **3.** Estimated coefficients are presented in columns 4-6 of Table 1, in the Appendix.

< **4.** See Baines *et al.* (2009) for a detailed discussion on servitisation, i.e., the rise of the participation of manufacturing firms in service activities.

< **5.** More precisely, it excludes firms whose main activity is in 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 – 98); U – Activities of extraterritorial organisations and bodies (division 99) of the Portuguese statistical classification of economic activities Rev 3 – *Portuguese Classification of Economic Activities* (CAE). In addition, most corporations in section K – Financial and insurance activities (divisions 64 – 66), like banks and insurance companies, are also excluded from IES, since they have specific accounting reporting requirements and a distinct balance sheet structure. However, other financial and insurance intermediaries and auxiliaries are available in the database.

< **6.** A detailed breakdown of the types of services exported and imported according to the 29 types of services of the EBOPS classification, comprising trade values, number of firms-year, partner countries and transactions of each service is included in Tables A.2 and A.3 of the Appendix.

< **7.** 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 that employ less than 250 persons and have annual turnovers below EUR 50 million, and/or annual balance sheet totals below EUR 43 million. Within the SME category, a small firm is defined as a firm that employs less 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 a firm that employs less 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 large firms.

< **8.** Since the differences between one-way and two-way traders are often significant, the log approximation understates the size of these differences. For example, taking the exponents of the employment coefficient in column (1) of Table 8, two-way traders have, on average, 107,9 per cent more employment (100 * (exp(0.732) – 1) = 107.9).

< **9.** We also estimated Equation (1) including interactions between all variables considered and a dummy variable identifying two-way traders. The coefficients estimated from the fully interacted model and the separate regressions for one-way and two-way traders, depicted in Table 12, are equivalent, even if, in the separate regressions, the variance of the different types of traders is allowed to differ. From the fully interacted model, we can see that the contributions of the three margins differ between the two types of traders in a statistically significant way for both exports and imports, at a level of significance of 0.1 per cent. All results are available from the authors upon request.

< **10.** Again, we also estimate a fully differentiated model including interactions between all variables and a two-way trader dummy, observing that the differences in the parameters between the two types of traders are always statistically significant. All results are available from the authors upon request.

< **11.** All controls have the expected signs. The results reporting the complete set of estimates are available from the authors upon request.

< **12.** For a survey of the recent literature on the importance of institutions for cross-country differences in growth rates, see Lloyd and Lee (2016).

< **13.** See World Economic Forum (2017) for the 2017 edition of the Global Competitiveness Report and **link** for the historical data.

< **14.** See World Bank (2018) for the 2018 edition of the Doing Business report and **link** for the historical data.

< **15.** See **link** for details on the methodology and to access the data.

< **16.** In 2005, Portugal implemented the "On the Spot Firm" programme (*Empresa na Hora*) which established one-stop shops that simplified firm creation procedures. This reform significantly reduced administrative fees and the time delay of legal incorporation. See **link** for more details.

< **17.** We keep the responses regarding obstacles in "short-term banking credit", "equity increase/shares issuance" and "government subsidies and support programmes"

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