04

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Types of International Traders and the Network of Capital Participations

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

JEL: F1, F14, L25

Keywords: Exports, Imports, Services, Goods, Capital Participations, Networks.

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1. Introduction

International traders are very different in terms of the complexity of foreign activities. Firms range from being a minor traders, i.e., those whose exports and imports of goods and services represent a small share of turnover, up to traders that strongly engage in both exports and imports of both goods and services. A second layer of complexity relates with the possibility of indirectly linking 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 in order 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 those 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. One 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 traders of goods. 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 participate in international trade only indirectly. For example firms can be suppliers of intermediate products to exporters or, in the mirror image, be clients of 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 but the full network of firm's internal and external connections is still almost unknown.

Another way of identifying complementary trade relationships is though 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 context of international trade, notably 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 the years 2014-2015. Firstly, we assess to what extent different degrees of complexity in the participation in international trade are associated with firms' characteristics like size, age, productivity, wages, profitability or debt. We go beyond existing research by combining firms' status 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, also taking into account their relevance on the turnover of firms. 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 with a view to assess the full extent of the participation in international markets. It is relevant to know if minor traders enlarge their engagement in trade by participating in the capital of more complex traders or if the latter firms are the themselves key players in the network of capital participations.

We observe that about one quarter of 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 but those that add imports of services to the set of trade flows are even more relevant, representing a 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 larger size, higher productivity and wages but not necessarily higher profitability. More complex traders are also those with stronger capital participations, signaling 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 have a central position, i.e., they are strongly connected with other types of international traders. However, firms that export goods and import goods and services are also very relevant in the network. Finally, we conclude that, for more complex traders, the existence of many external capital participations is associated with labour productivity gains.

The paper is organized as follows. 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 the paper. Section 4 details the classification of traders and compares those groups of firms along different characteristics. Section 5 maps the linkages between the classes of firms in terms of capital participations and assesses their impact on labour productivity. Finally, section 6 offers some concluding remarks.

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 only

active in the domestic market). The typical approach is to analyse trade in goods and services separately, though recent papers started to assess the interaction of goods and services in trade portfolios of firms.

The firm-level literature on 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 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). In addition, some papers document a positive relation between imports and productivity, but there is no evidence of the causal direction of the 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, UK and Germany; Vogel (2011) on Germany; Kox and Rojas-Romagosa (2010) on the Netherlands; and Lööf (2010) on Sweden). Moreover, there seems to exist a positive linkage between imports of services and productivity, though there is not conclusive evidence on the direction of causality.

Another 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 access to 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 by 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 explain the high success of two-way traders in international trade. Bas and Strauss-Kahn (2014), Damijan *et al.* (2014) and Goldberg *et al.* (2010) provide evidence supporting these channels. However, Vogel and Wagner (2010) does not find evidence in favor 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), which divides Belgium manufacturing and services firms into non-traders, only exporters of goods, only exporters of services and those exporting both goods and services. The paper categorises firms similarly on the import side, but does not simultaneously consider the export and import flows. Breinlich and Criscuolo (2011) and Damijan *et al.* (2015) use the same taxonomy of firm types, but the former only considers the export side.

These papers provide some relevant insights on differences between firm types, particularly about services versus manufacturing firms. Firstly, the participation rate in international trade of services firms as well as their export and import values are lower than for manufacturing firms. Ariu (2016) shows that the extensive and intensive margins are important in understanding these differences because manufacturing firms export or import more products to more countries and also have a larger number of 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 firms only exporting goods and those only exporting services do not differ much in these firm characteristics, a result that also applies when comparing similar firms on the import side. According to Ariu (2016), these results suggests that firm characteristics are not an adequate explanation for the different degree of involvement in international trade of services and goods firms, but that factors such as fixed costs, variable costs, and the lower tradability of services are more relevant. However, Breinlich and Criscuolo (2011) finds that exporters of goods are larger than exporters of services whereas differences in productivity, capital-intensity and wages are less pronounced, but services firms have higher skill intensity. Thirdly, Ariu (2016) shows that both exporters and importers entering in foreign markets with pure portfolios of services or goods tend to add the opposite product in the year after entry. 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 trading status of firms by either adding a trade flow (exports or imports) or trade dimension (services or goods) are infrequent, and are 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 both 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 refer that a process of servicification has indeed 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 within manufacturers (Baines *et al.* 2008). Services can dilute fixed costs associated with entering foreign markets such as overcoming informal trade barriers, while transaction costs can be reduced by selling or sourcing goods with a common foreign market. Firm's competitiveness might also improve as services are key 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 also relates to 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 relates with the operation of global value chains (e.g., Bernard and Jensen (1999)). However, this is not the perspective taken 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 the finance and entrepreneurship angles (e.g. Ferrary and Granovetter (2009) Hochberg *et al.* (2007)). Therefore, also from this perspective, the approach developed in this paper brings some novelty.

3. Data

Two databases were merged to obtain the set of variables necessary for the analysis. Firstly, we use a database that collects the transactions of Portuguese firms and other agents versus the rest of the world, which is the base for the computation of the Balance of Payments (BoP). This database reports the firm identifier, classification of the service and destination or source country (but not for goods) and it covers the 2014-2016 period, though 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, and it covers virtually the universe of Portuguese non-financial corporations. The almost universal coverage of IES emerges from its nature, as it is the system through which corporations report mandatory information to the tax administration and the statistical authorities. It further contains information on firm characteristics such as number of employees, age and sector of economic activity.

Another relevant block of information in IES respects to the capital participations of each reporting firm on others, as well as the reference to 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 the participation

both in euros and as a share of the capital of the owned and owned firm. This set of information establishes a set 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, signaling possible synergies or group strategies. We focus on the subset of information that corresponds to international traders, that is, participations that involve non-traders are eliminated. In addition, some capital participations involve foreign firms. Although it would be very 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 in 2015 is 1650 out of a universe of international traders of 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.

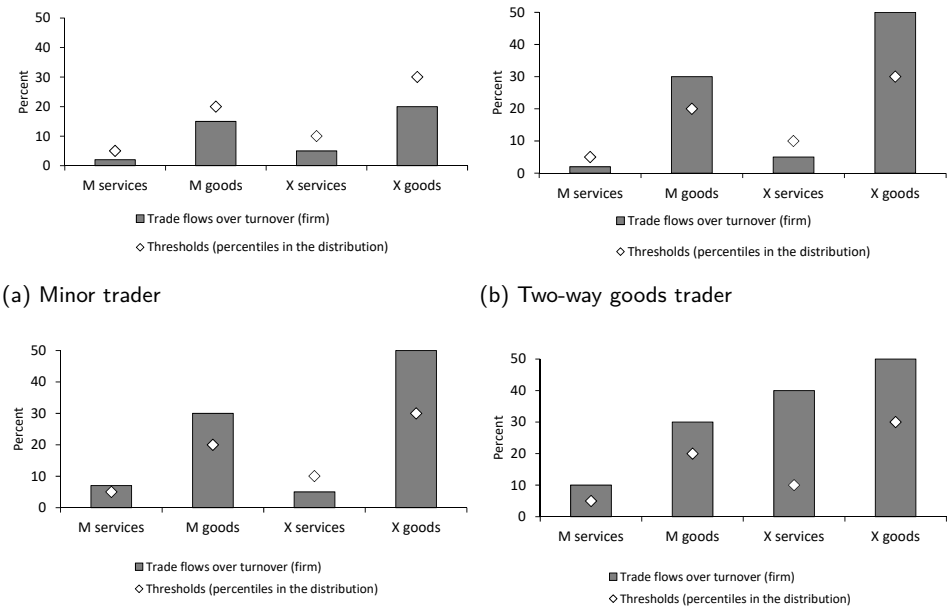
Table A.1 in the Appendix presents the median and the interquartile range of firm's characteristics in each class basing on firm-year observations in 2014-2015. Table A.2 presents some descriptive statistics relative to participations in the capital structure amongst Portuguese international traders.

4. Types of international traders

4.1. A taxonomy

A basic aim of the paper is to classify international traders along 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, 16 combinations can be considered for the position of firms, ranging from not engaging significantly in any flow - a minor trader - up 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 firm's size. For example, a firm is considered a relevant services exporter if the ratio between the value of services exported over turnover is larger than a specific threshold. In the paper, the threshold taken is the first quartile in the distribution of this ratio across all firms, excluding those that do not engage at all in the basic trade flow (for those the ratio is zero). Therefore, a firm can export services (even a substantial amount in level) but if it's turnover is large enough for the ratio to stay below the threshold it is not considered as 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 larger 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.



(a) Minor trader

(b) Two-way goods trader

(c) Two-way goods trader and importer of services

(d) Four-way trader

Figure 1: Taxonomy: An example

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).

Needless to say that for the purpose of international comparisons, the taxonomy is only meaningful if 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 taken 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, as well as 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 the situation of a firm whose shares of imports and exports of goods surpass the respective thresholds but this is not the case for exports and imports of services. Therefore, we label this firm as a two-way goods trader (XgMg). In panel c) the firm presents shares of goods exports and imports of goods and services on turnover that are above the respective

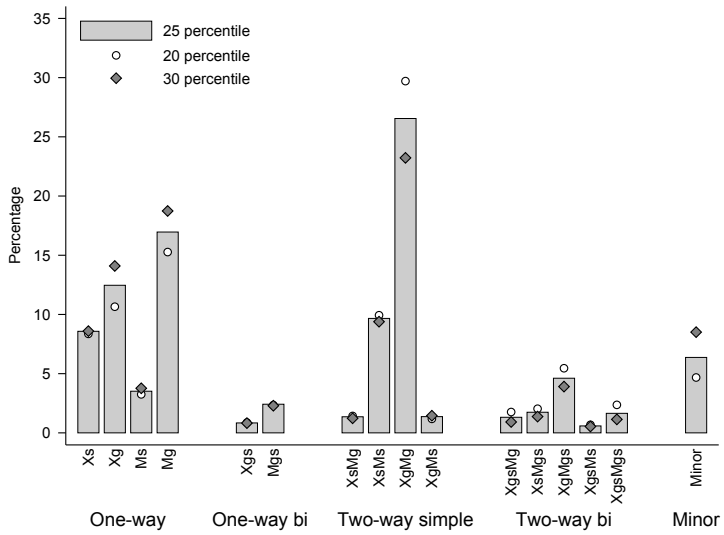
thesholds, thus we label the firm as a two-way goods exporter and services exporter and importer (XgMgs). Finally, in panel d) all four shares on turnover surpass the respective thresholds, thus the firm is labelled as a two-way trader of goods and services (XgsMgs).

The distribution of Portuguese firms across the previously defined 16 classes in terms of the 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 percent 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 is the one of goods exporters and importers of both goods and services (XgMgs) with a value of about one-third. In addition, the two-way goods traders (XgMg) represent one-quarter of total international trade. Table A.3 in Appendix details this information by reporting the share of each class separately in total goods and services trade.

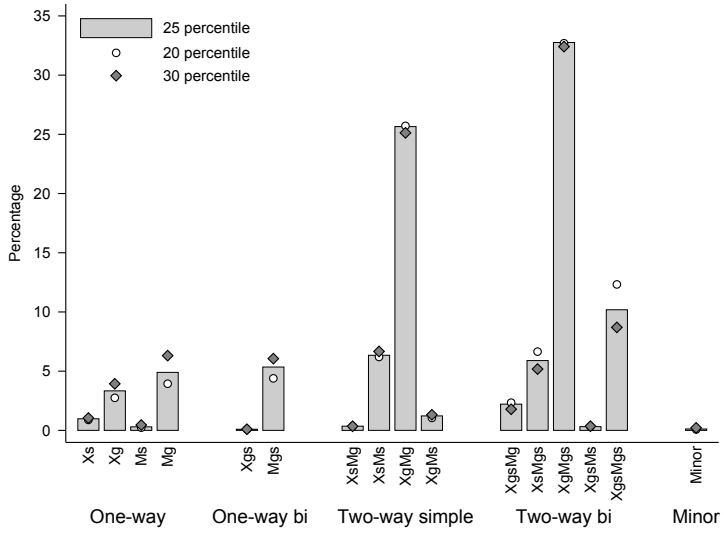
A very important aspect is the robustness of the taxonomy to changes in the threshold that determines whether each trade flow is considered relevant for the firm. In this perspective, figure 2 also reports the shares of different classes according to the 20th and 30th percentiles. The distributions for the alternative percentiles are close 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 is taken as a relevant trader. The diagonal cells generally present values above 50 percent, 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 neighborhood. For example, nearly one fifth of firms classified as exporters of goods and services in 2014 are classified as exporters of goods in 2015 and only 0.8 percent become exporters and importers of goods and services.

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 percent of firms classifications remain unchanged. A less stable group are one-way-bi importers (Mgs), two-way-simple (XsMg and XgMs) and two-way-bi traders (XgsMg and XgsMs) with around 50 percent of firm's 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 the initial import status. Finally, two-way-bi traders (XsMgs and XgsMs) have the highest probability to become exporters and importers of both goods and services (XgsMgs).



(a) Share in total number of firms



(b) Share in total trade

Figure 2: Share in total number of firms and trade

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 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 accordance 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 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 profitable, with higher capital-intensity and wage levels.

Two-way simple traders are in general smaller and younger than minor traders but 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 only importing 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 XgsMs) are younger than minor traders. Furthermore, two-way bi firms are more productive and pay higher wages than minor traders and other less complex firm types. 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.

1. In fact, the transition matrix in table A.4 shows that one-way-bi exporters tend to change into one-way goods or services exporters.

	(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)
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

Table 1. Descriptive regressions, 2014-2015

Notes: Wage to labour defined as total labour costs divided by total employment, labour productivity defined as gross value added per worker, profitability defined as the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over total assets, leverage ratio as total assets to equity ratio. Definition of firm types are 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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

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 clearly 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 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 does not

change classification from 2014 to 2015. Table A.5 presents the results, which are 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, A.7 in Appendix present the coefficients for thresholds of 20 and 30 percent, 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 percent threshold, thus pointing towards the robustness of results.

5. Capital linkages between international traders

This section maps the network of capital participations between international traders, while relating with the complexity of their participation in international trade. The network is plotted at the firm level, with the shape of nodes signaling the class to which the 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 firm-level productivity.

5.1. The network of capital participations

Firms relate with each other in many ways. The most common interaction concerns the client-supplier relationship, though firms can also interact as competitors in a specific market or may establish a joint venture in a project. Firms also interact by participating in the capital structure of each other, thus leading 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 it they operate in very different sectors of activity. Nevertheless, it is likely that many capital participations mirror the organization of firms along groups where there is some degree of specialization in international activities. For example, one firm in the group may deal with the importing of services or goods 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 preferentially do business with those that 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 *Informação Empresarial Simplificada*, which is also the source of data on 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 own shareholders and the 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 on the 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 is eliminated and the same happens if it holds a foreign fiscal identification number. The international dimension of capital participations 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 individual traders and their different types. The average and median size 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 percent, respectively. As regards the classes of international traders, the number of participating and participated firms is higher in two-way traders of services (XsMs), two-way traders of goods (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 percent.

Figure 3 shows a classic tree-type network where each node corresponds to a single trader and edges connect those among which there is a 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 to which belongs 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 to the full taxonomy suggested in section 4. Due to its inherent complexity, the visualization 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 organized economic groups of traders, i.e., one node linking with multiple others.

The network that results from restricting edges to capital participations that correspond to control positions (more than 50 percent in the capital of the participated firm) is presented in figure 4. Although a 10 percent capital participation is typically taken 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 situations where participations convey control of the participated firm. Although the network remains very complex and with a

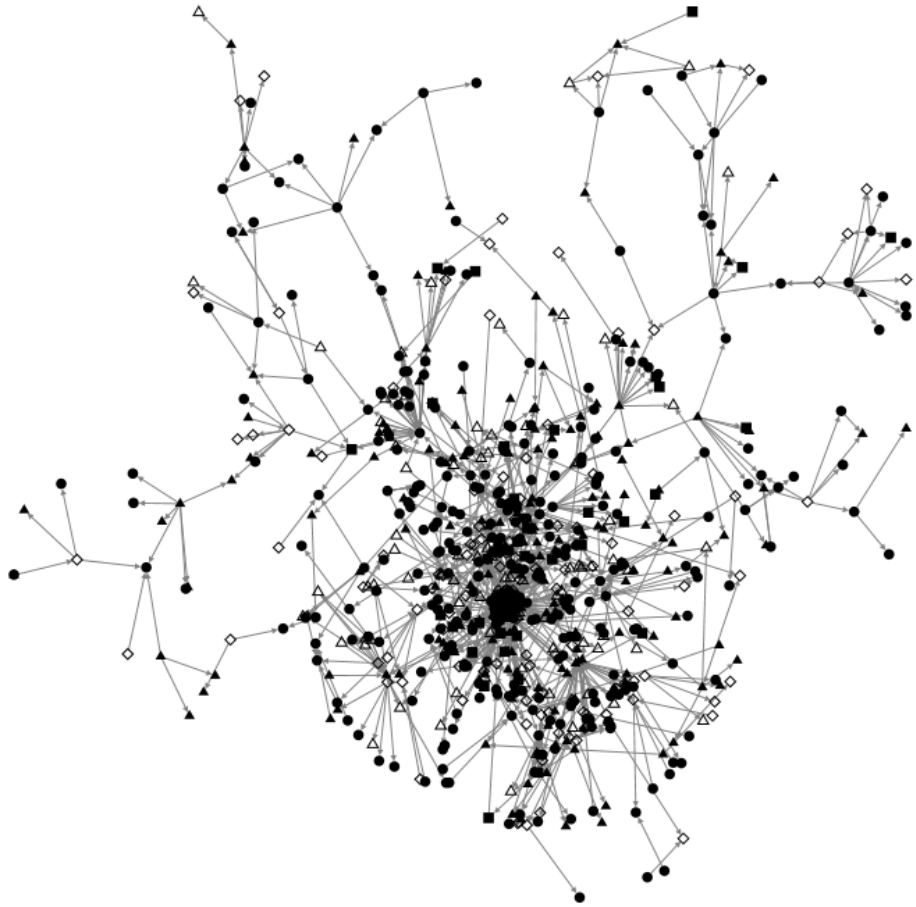


Figure 3: The network of capital participations across international traders (all participations)

Notes: Nodes correspond to traders and edges connect those among which there is a capital linkage. Edges are directed from participating to the participated firms. The shape of each node is associated with 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 fast multiscale algorithm and is drawn with the use of NodeXL (Hansen *et al.* (2010)).

still large number of nodes, the visualization algorithm places most firms in a core and in 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 asses capital linkages between international traders relatively to both size and number of participating firms. One way to do this is to collapse the individual traders into classes and assess how does the number and the amount

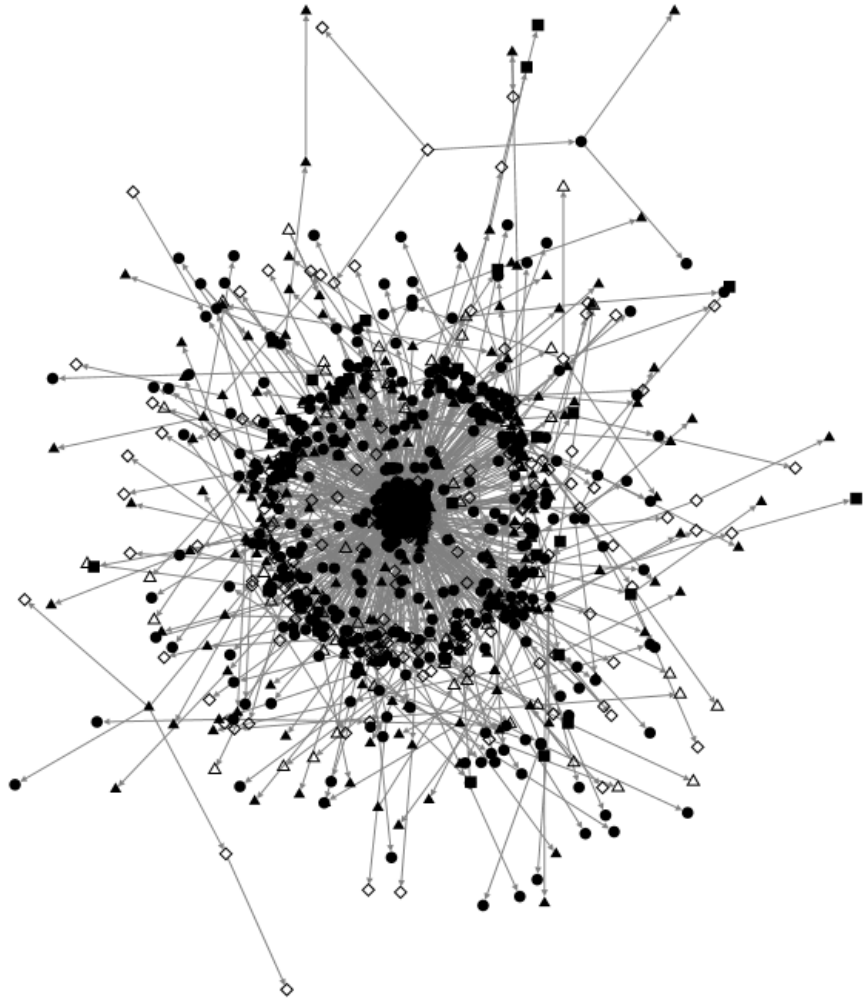


Figure 4: The network of majority capital participations across international traders (>50 percent)

Notes: Nodes correspond to traders and edges connect those among which there is a capital linkage. Edges are directed from participating to the participated firms. The shape of each node is associated with 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 fast multiscale algorithm and is drawn with the use of NodeXL (Hansen *et al.* (2010)).

of capital participations distributes along 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.

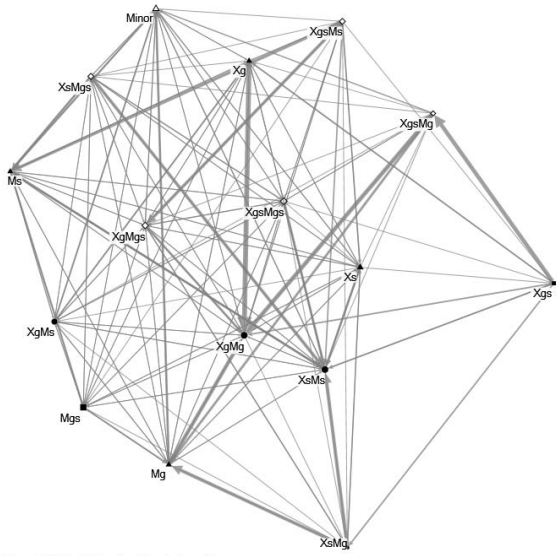
The two panels of figure 5 present the networks associated with the conditional distributions for the number and amount of capital participations along classes of traders. More specifically, each node is a class of trader and the edges are directed from participating towards participated classes. Moreover, the width of 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 is the destination class for the participating one. Furthermore, as above, the shape of nodes is associated with groups of classes. Moreover, the size of 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, thus the size of nodes is not very different. Finally, the self loops resulting from participations within each class of international traders (the diagonal elements in the conditional distribution) are not represented.

The network in panel a) of figure 5 indicates that two-way traders of goods (XgMg) and two-way traders of services (XsMs) are key classes in terms of number of capital linkages among international traders, thus being represented in a central position. This closely connects with information in table A.2. These classes of traders participate and are participated by almost all other classes (high indedrees 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, the two-way traders of goods is the destination of a large share of capital participations originated in other classes (thicker incoming edges), notably one-way exporters of goods (Xg), one-way importers of goods (Mg), as well as 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.

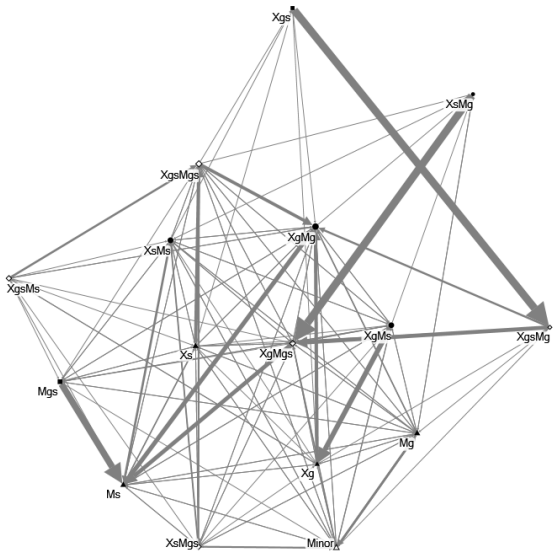
Panel b) of figure 5 replicates the analysis above, while focusing on the amounts underlying the capital participations across classes of international traders. The distinctive feature in this network is the uneven distribution of the amounts corresponding to capital participations among participated classes, which is visible by a number 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 percent) and participations of the latter class are strongly concentrated in exporters of goods and importers of goods and services (XgMgs) (56.6 percent). This feature results from the fact that some participations are substantially high in value (even moderate shares can imply large participations if the capital of the participated firm is very large), thus 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 percent 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 size firms and a few very large ones. Nevertheless, two-way traders of goods (XgMg) and

exporters of goods and importers of goods and services (XgMgs) remain in the center of the network with linkages versus many other classes.

Overall, in both networks studied, although linked with other classes, minor traders do not seem to compensate their low engagement in foreign markets through strong capital participations with other types of traders. Conversely, more complex traders present stronger capital participations, thus adding the two layers of complexity discussed in the 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.



(a) Number of traders



(b) Amount of participations

Figure 5: The network of capital participations across classes of traders

Notes: Nodes correspond to classes of traders and edges are directed from participating towards participated classes. The width of edges is proportional to the share of each participated class on the participating one and the size of nodes is proportional to its outdegree. Self loops are not represented. The shape of each node is associated with 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 fast multiscale algorithm and is drawn with the use of 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 to what extent the number of capital participations in other firms (outdegree) or, alternatively, the number of traders participating in the capital of the firm (indegree), the class of the international trader and the interaction between these dimensions is associated to performance, measured as labour productivity. Regressions include year and 2-digit sector fixed effects. In brief, we estimate regressions of the type:

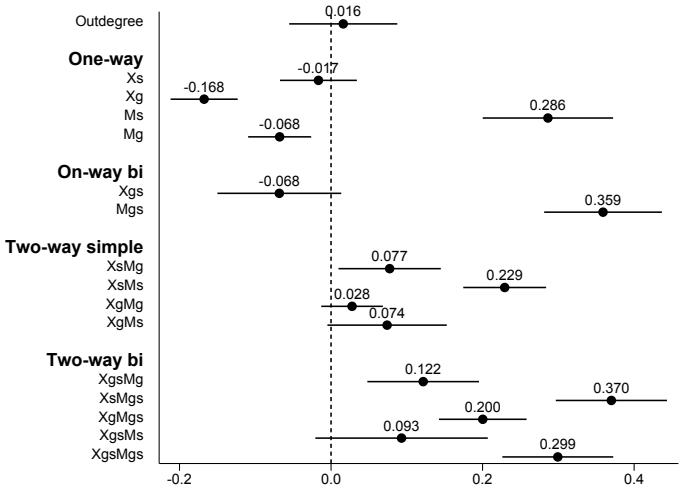
$$logY_{it} = \alpha + \beta_0 d_i + \beta_1 X_i + \beta_2 X_i * d_i + \gamma_j + \gamma_t + \varepsilon_{it}, \quad (1)$$

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 *Classificação Portuguesa das Actividades Económicas* (CAE) 2-digit level, comprising 77 different sectors. ε_{it} is an error term potentially clustered at the firm-level.

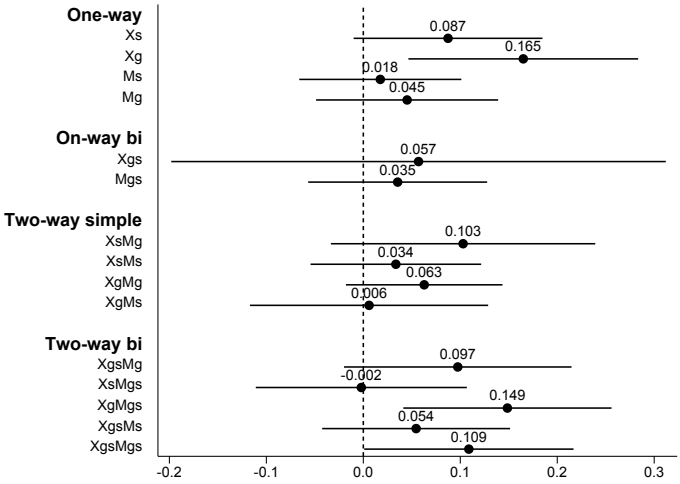
The focus of the analysis is the sign of the interaction coefficient for each class of trader. If it is significantly positive, it means that, on top of performance differences associated to each type of trader, a larger number of capital participations in other traders (no matter their type) is associated to improved performance. As argued above, capital participations could be used by less complex traders to indirectly complement their external linkages and hence reach higher productivity. The argument is also possible to establish in terms of 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 of 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, thus not corroborating the thesis that capital participations complement trade activities with an impact on productivity (relatively to the omitted category).

2. Estimated coefficients are presented in columns 1-3 of table A.12 in the Appendix.



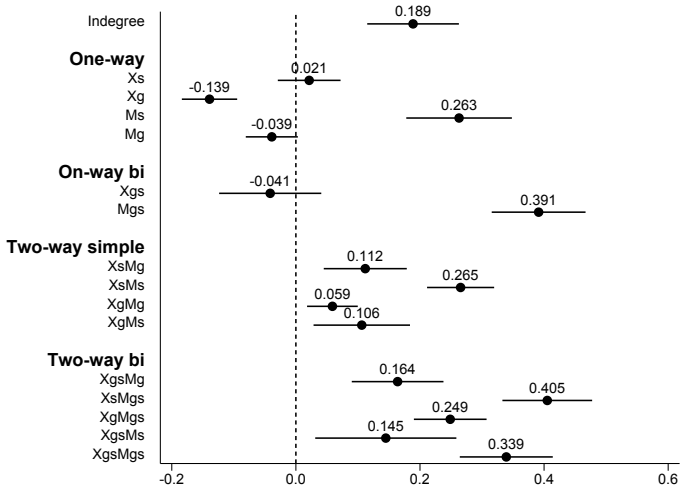
(a) Outdegree and firm dummies



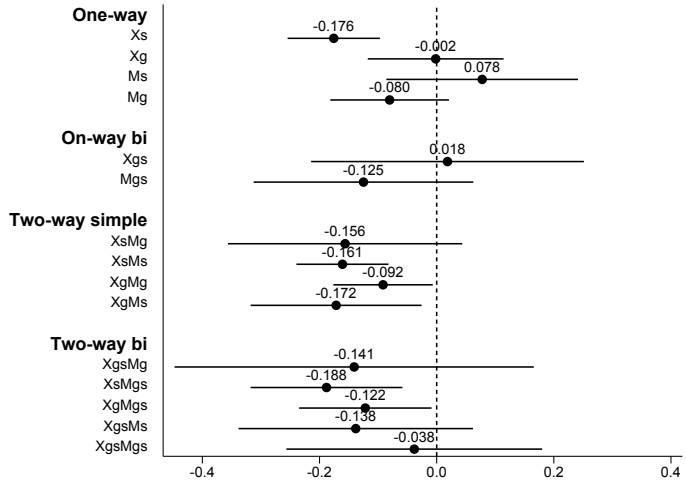
(b) Interaction between outdegree and firm dummies

Figure 6: Labour productivity and outdegree, 2014-2015

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.



(a) Indegree and firm dummies



(b) Interaction between indegree and firm dummies

Figure 7: Labour productivity and indegree, 2014-2015

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.

As for panels A and B of figure 7, where the perspective for capital participations is the existence of investments by other firms (indegree), results are somewhat different.[3] While panel A also points out that more complex traders are also more productive and a larger indegree is also associated with a better performance (top coefficient in the panel), panel B shows several positive and significant interaction coefficients that are somewhat larger for the case of 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, possibly only more sophisticated traders have the ability or the underlying conditions to benefit from capital participations as a productivity enhancing channel.

6. Concluding remarks

In this paper we suggest a taxonomy to classify international traders according to the complexity of their external activities. Particularly, we assess participation in export and import flows, combined with the goods and services dimension. The taxonomy only considers an active participation in each of the trade flows if its level is considered relevant in the turnover of the firm. The taxonomy is the starting point to identify differences between types of traders in a wide set of dimensions, especially in what concerns the linkages that result from capital participations. Moreover, the 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.

The 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 percent 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 clearly 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 in terms of 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 that export

3. Estimated coefficients are presented in columns 4-6 of table A.12 in the Appendix.

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, the paper concludes that minor traders do not seem to compensate their low engagement in foreign markets by strongly participating in the capital of other types of traders. Conversely, for more complex traders there is some association between receiving capital participations in their labour productivity.

From a policy perspective, knowledge about the profile of international traders clears the way for the elimination of barriers that burden the amplification of firm's 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 very interesting to replicate the analysis for other countries or, preferably, pool data from a group of countries. Secondly, further analysis on capital participations among international traders, notably by exploring the time dimension and assessing the role of foreign multinationals could convey interesting results.

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Appendix

(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)
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.1. Descriptive statistics of firm characteristics, median and interquartile range, 2014-2015

Notes: Wage to labour defined as total labour costs divided by total employment, labour productivity defined as gross value added per worker, profitability defined as the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) over total assets, leverage ratio 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 class in the two years. Trade status definition based on 25 percentile threshold. Labour productivity and turnover are expressed in 1000 euros. Leverage ratio and profitability are in percentage.

		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			
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			
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			

Table A.2. Descriptive statistics of capital participations, 2015

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

	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

Table A.3. Share of each trade flow and total firms, 2014-2015 (25 percentile)

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

Table A.4. Transition matrix (% shares) using percentile 25 as threshold

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) gives the share of firms according to trade status in 2014. Column (3)-(18) give the percentage share of firms by trade status in 2015 along trade status in 2014 (column 1). The diagonal elements give the percentage share of firms with unchanged trade status from 2014 to 2015, while off-diagonal elements give the share of those with changed trade status.

	(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	-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								
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								
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								
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

Table A.5. Descriptive regressions, subsample and 25 percentile, 2014-2015

Notes: Restricted to the subsample of firms that do not change trade status from 2014 to 2015 (10,326 unique firms). Definition of firm types are 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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

	(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)
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

Table A.6. Descriptive regressions, full sample and 20 percentile, 2014-2015

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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

	(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)
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

Table A.7. Descriptive regressions, full sample and 30 percentile, 2014-2015

Notes: Definition of firm types are 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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

	(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)
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

Table A.8. Descriptive regressions, subsample and 20 percentile, 2014-2015

Notes: Restricted to the subsample of firms that do not change trade status from 2014 to 2015 (10,193 unique firms). 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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

	(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

Table A.9. Descriptive regressions, subsample and 30 percentile, 2014-2015

Notes: Restricted to the subsample of firms that do not change trade status from 2014 to 2015 (10,481 unique firms). Definition of firm types are 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 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 in logs, except profitability that is in percentage. Specification (5) and (8) exclude firm-years with missing values of the dependent variable.

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

Table A.10. Conditional distribution of number of capital participating traders per class of participated traders

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 firms with capital participations in the row class whose participation lays in the column class. Therefore, each row adds up to 100 percent.

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

Table A.11. Conditional distribution of amounts by capital participating traders per class of participated traders

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 in the row class that is directed to the column class. Therefore, each row adds up to 100 percent.

	(1) Productivity			(2) Productivity	
Outdegree	0.0161		**Indegree**	0.189	
	(0.0434)			(0.0449)***	
	Dummy	**Interaction**		**Dummy**	**Interaction**
One-way			**One-way**		
Xs	-0.0167	0.0874	Xs	0.0215	-0.176
	(0.0308)	(0.0592)		(0.0307)	(0.0479)***
Xg	-0.168	0.165	Xg	-0.139	-0.00167
	(0.0269)***	(0.0720)**		(0.0271)***	(0.0705)
Ms	0.286	0.0175	Ms	0.263	0.0777
	(0.0523)***	(0.0508)		(0.0517)***	(0.0994)
Mg	-0.0678	0.0452	Mg	-0.0388	-0.0803
	(0.0253)***	(0.0571)		(0.0255)	(0.0615)
One-way bi			**One-way bi**		
Xgs	-0.0683	0.0569	Xgs	-0.0414	0.0185
	(0.0497)	(0.155)		(0.0500)	(0.142)
Mgs	0.359	0.0354	Mgs	0.391	-0.125
	(0.0472)***	(0.0561)		(0.0460)***	(0.114)
Two-way simple			**Two-way simple**		
XsMg	0.0774	0.103	XsMg	0.112	-0.156
	(0.0410)*	(0.0829)		(0.0407)***	(0.122)
XsMs	0.229	0.0336	XsMs	0.265	-0.161
	(0.0333)***	(0.0535)		(0.0329)***	(0.0477)***
XgMg	0.0277	0.0628	XgMg	0.0589	-0.0915
	(0.0247)	(0.0491)		(0.0248)**	(0.0516)*
XgMs	0.0740	0.00595	XgMs	0.106	-0.172
	(0.0479)	(0.0747)		(0.0473)**	(0.0887)*
Two-way bi			**Two-way bi**		
XgsMg	0.122	0.0974	XgsMg	0.164	-0.141
	(0.0448)***	(0.0713)		(0.0449)***	(0.186)
XsMgs	0.370	-0.00204	XsMgs	0.405	-0.188
	(0.0446)***	(0.0662)		(0.0440)***	(0.0787)**
XgMgs	0.200	0.149	XgMgs	0.249	-0.122
	(0.0351)***	(0.0653)**		(0.0356)***	(0.0687)*
XgsMs	0.0931	0.0545	XgsMs	0.145	-0.138
	(0.0692)	(0.0589)		(0.0691)**	(0.122)
XgsMgs	0.299	0.109	XgsMgs	0.339	-0.0382
	(0.0445)***	(0.0656)*		(0.0456)***	(0.133)
Constant	10.34		Constant	10.31	
	(0.0596)***			(0.0595)***	
Year fixed effects	Yes		Year fixed effects	Yes	
Sector fixed effects	Yes		Sector fixed effects	Yes	
Firm fixed effects	No		Firm fixed effects	No	
Cluster	Yes		Cluster	Yes	
Observations	34,060		Observations	34,060	
R^2	0.199		R^2	0.200	

Table A.12. Number of capital participations, type of trader and productivity, 2014-2015

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.

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