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Article

The role of international production sharing in EU productivity and competitiveness

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ABSTRACT

Is international production sharing associated with stronger competitiveness? We address this question from the complementary viewpoints of firms and industries. We show that international production sharing is indeed associated with stronger competitiveness not only at the firm level but also at the industry level. From the viewpoint of firms, stronger competitiveness gives access to a larger number of more complex options when it comes to the design of international operations. From the viewpoint of industries, stronger competitiveness arises from the possibility of reallocating resources from less to more productive firms. For both firms and industries stronger competitiveness arises from the possibility of exploiting a richer set of internationalization strategies to deal with the challenges and the opportunities of globalization.

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The role of international production sharing in EU productivity and competitiveness

1. Introduction

The ability of ‘growing out’ of the crisis is widely recognised nowadays as the only long-term viable option for the sustainability of the EU and its model of social market economy. The latter requires enhanced competitiveness at the EU level, which in turn would allow capturing growth currently taking place mainly in emerging markets.

Given the macroeconomic context, growth and competitiveness are thus strongly linked to the international performance of firms. Indeed, and more generally, a recent economic literature has increasingly underlined and shown empirically that aggregate industrial performance depends strongly on firm-level factors, such as size, organization, technological capacity, as well as on other conditions firms are confronted with in their specific environments, not least their ability to successfully operate on international markets. The punchline of this literature is that it is not countries that produce, sell and export but rather firms within countries, so competitiveness at the country level is determined by the aggregation of individual firms’ ability to compete successfully. It follows that the competitiveness of a country should be defined as the ability of its firms to mobilize and efficiently employ (also outside the country’s borders) the productive resources required to offer the goods and services in exchange for which other goods and services can be obtained, domestically or internationally, at favorable rates of substitution or terms of trade. In this sense, competitiveness is just “a poetic way of saying productivity” (Krugman 1997).

In this paper, we take this ‘bottom-up’ approach and discuss the ways through which international exposure and competitiveness interact both at the industry and at the firm level. In so doing, we capitalize on a dataset that has recently become available thanks to the EFIGE project coordinated by Bruegel and financed by the European Commission and UniCredit within the 7th Framework Program.¹ This dataset is unique in its kind in that it allows for a comparison of firms’ international activities, both across a rich set of internationalization activities and across key EU countries.

In particular, we assess the correlation patterns between the entire range of firms’ international activities (imports, exports, foreign direct investment (FDI), international outsourcing) in the biggest EU economies (France, Germany, Italy, Spain, UK) and their competitiveness measured as total factor productivity (TFP). We also assess the correlation patterns between the same range of international activities and alternative measures of firm-level competitiveness, namely labour productivity and unit labour costs. The latter measure is typically used as the basis for the analysis of competitiveness at the country level. Our analysis is made possible by the fact that the EU-EFIGE/Bruegel-UniCredit dataset can be matched with balance sheet information available from the Amadeus dataset of Bureau van Dijk. The aim is to check whether and to what extent firms involved in the various types of internationalization activities display higher levels of competitiveness compared with firms that are internationally inactive.

Based on aggregate information, we then calculate for each industry an ‘internationalisation intensity’ index and link it to the average productivity levels of its firms.² This allows us to see to what extent countries and industries that are more internationally exposed display higher levels of competitiveness as measured by the average productivity of their firms.

¹ For additional details and updates on the project, see www.efige.org.

² Throughout the paper, ‘industry’ refers to the manufacturing industries of the NACE Rev. 1 classification at two-digit level of aggregation. The terms ‘industry’ and ‘sector’ are used interchangeably.



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We find that international exposure is indeed positively correlated with competitiveness both at the firm and at the industry level. Moreover, competitiveness, when measured by TFP (as economic theory would suggest), is positively correlated with the complexity of firms' internationalization strategies. This is true also when competitiveness is measured by labour productivity whereas it holds to a lesser extent when competitiveness is measured in terms of unit labour costs. The reason is that labour productivity exhibits a strong positive correlation with TFP whereas the correlation between unit labour costs and TFP, though negative as expected, is much weaker. This casts a shadow on the soundness of using unit labour costs as the building block of competitiveness measures at the macro level.

The positive correlation between firm competitiveness and international activity reflects the presence of a positive productivity gap between internationalized firms and purely domestic ones. Higher complexity is associated with higher competitiveness precisely because more complex internationalization strategies entail higher costs. This gap hints at the existence of additional costs that internationalizing firms have to face and only firms that are productive enough can bear. At the same time, international competition has a cleansing effect on industries that forces less productive firms out of the market and reallocates their resources to more productive survivors. This effect may be stronger in expanding industries in which a country has a comparative advantage, thus establishing a dynamic link between international exposure and traditional sources of competitiveness.

We analyze the relationship between competitiveness and international exposure of firms and industries.

Turning to aggregate results, we investigate the correlation between the competitiveness of an industry, measured as the average productivity of its firms, and an index of international exposure, constructed for each industry as the ratio of the value of intermediate goods imported from abroad to the value of total output. We find evidence of a positive correlation in the simplest empirical specification. The correlation holds after controlling for country and industry-specific time invariant characteristics, provided that we also account for the dispersion of productivity across firms. We interpret this finding as showing that international exposure and industry competitiveness go hand in hand as long as there is enough room for reallocating resources from less to more productive firms.

The remainder of the paper is organized as follows. Section 2 provides a selective overview of the existing theoretical and empirical literature on the relation between internationalisation of production and firm- and industry-level costs and productivity. Section 3 presents the original firm-level dataset used for the analyses in the subsequent sections. Section 4 assesses the correlation patterns between the entire range of international activities of firms in the biggest EU economies and their productivity (measured as both labour productivity and TFP). It also discusses the correlation patterns between the range of international activities of firms in those EU economies and their unit labour costs accounting for the country and industry dimensions. Section 5 calculates for each industry an 'internationalisation intensity' index and investigates its relation with industry performance. Section 6 offers a summary of the main results of the paper and discusses their policy implications for the EU.

2. Literature review

This section presents a selective overview of the existing theoretical and empirical literature on the relation between the internationalisation of production and firm- and industry-level costs and productivity. In so doing, it draws on Behrens and Ottaviano (2011), Behrens *et al.* (2011) and Bernard *et al.* (2011).

Behrens *et al.* (2011) discuss the rapid development of 'New trade theory' (henceforth, NTT) since the late 1970s. Its aim was to explain the fact that a large share of world trade takes place between countries with relatively similar technologies and factor endowments (Grubel and Lloyd 1975). This phenomenon

was at odds with in the perfect-competition paradigm of traditional Ricardian and Heckscher-Ohlin trade theories, according to which trade is driven by cross-country differences rather than similarities. While NTT has proposed various theoretical solutions to that conundrum relying on imperfectly competitive market structures, two main strands of models have survived the test of time. In the wake of seminal work by Spence (1976) and Dixit and Stiglitz (1977), the first strand consists of models emphasizing monopolistic competition, firm-level scale economies, and product differentiation (Krugman 1979 and 1980; Lawrence and Spiller 1983). These models assume that, due to scale economies, each firm produces a single variety of a horizontally differentiated good in one location only. Trade takes place because consumers in each location 'love variety' and thus buy diversified consumption baskets. The second strand of NTT focuses on oligopolistic competition. It highlights the key role of firms' strategic interdependence in generating trade even in homogeneous goods between identical countries (Markusen 1981; Brander 1981; Brander and Krugman 1983). This happens because, when there are trade barriers, firms face a higher price elasticity of demand abroad, which makes it worthwhile to 'dump' their products into the export markets.

Unlike traditional Ricardian and Heckscher-Ohlin theories, NTT assigns centre stage to firms rather than industries. In so doing, it emphasizes a number of strategic decisions firms have to make. First of all, firms decide on prices, which explains why the early NTT literature has focused on the fundamental problem of market structure (Helpman and Krugman 1985). More recently, the interest of NTT has moved to two additional decisions: the location choice (Fujita *et al.* 1999; Baldwin *et al.* 2003) and the organizational choice of multinationals (Markusen 2002; Barba Navaretti and Venables 2004).

Key strategic choices by firms include: which price to set, where to locate production, and how to serve foreign markets.

Just like the conundrum of intra-industry trade ignited NTT in the 1970s, starting with the 1990s new empirical evidence has pushed the limit one step further. As discussed by Bernard *et al.* (2011), the focus of research in international trade has moved from industries and countries to firms and products as increasingly rich micro datasets emerged revealing great within-industry heterogeneity in firm characteristics and performance indicators. Theoretical models have risen to the challenge of explaining such heterogeneity, thereby unveiling new channels through which economies react to international openness.

A hallmark of recent analyses based on micro data is that only a very small fraction of firms are active in international markets and that international activity is highly correlated with exceptional economic performance. Internationally active firms are larger, more productive, more skill- and capital-intensive, and pay higher wages prior to their entry into international markets than non-trading firms. These facts suggest that some kind of self-selection is at work. The performance of internationalized firms is better not so much because they are active in international markets. Rather, better performing firms become active in international markets because they are better able to generate the resources needed to overcome the costs of internationalization. Mayer and Ottaviano (2007) provide an overview of these findings for a sample of European countries showing that internationalised firms are indeed "the happy few".

The practical importance of the implications of self-selection cannot be overstated. Theories that neglect firm heterogeneity highlight several sources of gains from trade: enhanced specialization according to comparative advantage; richer product variety; weaker firm market power; and enhanced exploitation of scale economies. Among these sources, only the last one points at a mechanism through which trade liberalization and an individual firm's efficiency can directly interact.

In his seminal contribution, Melitz (2003) shows that, if one considers that firms are heterogeneous, trade liberalization has an additional positive impact on aggregate productivity through the selection of the most productive firms. This is due to a combination of import competition and export market access.

International trade integration fosters aggregate productivity by suppressing the least productive firms and reallocating resources from less to more efficient firms.

Lower trade costs allow foreign producers to target the domestic markets, squeezing the operating profits of domestic firms in those markets whatever their productivities. At the same time, it also offers domestic firms the opportunity of gaining access to foreign markets and of earning additional profits from them. This opportunity, however, is open only to the firms that are productive enough to bear the additional costs of foreign operations arising from transportation, administrative duties, institutional and cultural barriers. As a result, the initially active domestic firms end up being partitioned into three groups. The least productive firms start making losses in their home markets without gaining access to foreign markets and have to exit. The most productive firms compensate lost profits on domestic sales with new profits on foreign sales. They are, therefore, able to survive and expand their market shares abroad. Firms with intermediate productivity also survive but are not productive enough to gain access to foreign markets. They are thus relegated to serving only domestic customers and their market shares shrink. In this framework, international trade integration suppresses the least productive firms and aggregate productivity rises thanks to the reallocation of productive resources from less to more efficient firms.

This mechanism has found supportive evidence in firm-level studies that try to pin down the direction of causation behind the positive correlation between a firm's export status and its productivity ("exceptional exporter performance" in the words of Bernard and Jensen 1999). This is of paramount importance for trade policy. Causation going from export status to firm performance would reveal the existence of 'learning by exporting', which in turn would call for export promotion. However, apart from specific cases typically confined to some developing countries, the bulk of the existing evidence supports the opposite direction of causation already discussed above and known as 'selection into export status': firms with better initial performance have a stronger propensity to export than those with lower initial performance (Tybout 2003).

Two additional effects are consistent with the theoretical arguments discussed above. For one, exposure to trade causes the exit of the least productive firms (Clerides *et al.* 1998; Bernard and Jensen 1999; Aw *et al.* 2000). For another, trade liberalization also causes market share reallocations towards the most productive firms (Pavcnik 2002; Bernard *et al.* 2006). For both reasons, aggregate productivity rises in the liberalizing countries. Another source of aggregate productivity growth following trade liberalization is productivity improvements within plants or firms (Pavcnik 2002; Trefler 2004). Improved plant or firm productivity may be the outcome of reallocations across heterogeneous economic activities within plants or firms. These reallocations operate much like those across heterogeneous firms of an industry.³

In the last few years a burgeoning empirical literature has confirmed and enriched those early results while much of the theoretical research has informed the new empirical findings by extending the basic model of selection put forth by Melitz (2003). Studies have explored various issues. Among them, the self-selection of multinationals (Helpman *et al.* 2004), the interaction between comparative advantage and firm heterogeneity (Bernard *et al.* 2007), variable mark-ups and market size (Melitz and Ottaviano 2008), country asymmetries (Arkolakis *et al.* 2008), multi-product firms (Bernard *et al.* 2011; Eckel and Neary 2010; Mayer *et al.* 2011), the decision whether to organize production activities within or beyond the boundaries of the firm (Antràs and Helpman 2004 and 2008), managerial hierarchies within firms (Caliendo and Rossi-Hansberg 2011), labour market frictions (Amiti and Davis 2011; Egger and Kreickemeier 2009; Helpman and Itskhoki 2010; Helpman *et al.* 2011), financial constraints (Chaney 2005; Manova 2011), product market regulation and unemployment (Felbermayr and Prat 2011).

³ Productivity within plants and firms improves because trade liberalization makes competition tougher, forcing firms to rationalize their product lines and innovate. These effects of international competition are consistent with the overall finding that trade liberalization fosters selection. They are distinct from the kind of 'learning-by-exporting' effects that have been so hard to identify in the data.

As pointed out by Bernard *et al.* (2011), a general issue that remains ahead is further consideration of the relationship between findings from disaggregated data and the economy's aggregate response to trade. The present paper contributes to this line of research by investigating the relation between the international exposure of an industry in a given country and the distribution of the productivity of its firms, thus combining the traditional industry-level view with the new firm-level view of internationalization.

Our unique firm-level dataset includes close to 15,000 firms from seven EU countries.

3. The EU-EFIGE/Bruegel-UniCredit dataset

Our analysis is based on the EU-EFIGE/Bruegel-UniCredit dataset, a unique firm-level dataset collected within the project EFIGE - European Firms in a Global Economy: internal policies for external competitiveness - supported by the Directorate General Research of the European Commission through its 7th Framework Programme. The dataset has been constructed in order to obtain representative samples of manufacturing firms across European countries. In particular the dataset includes around 3,000 firms for Germany, France, Italy and Spain, more than 2,200 firms for the UK, and some 500 firms for Austria and Hungary (Table 1). Firms with less than 10 employees have been excluded from the survey. As a result, internationally active firms should be over-represented in our sample compared with the actual distribution of firms in a country, typically characterized by a large number of relatively small, domestically-oriented firms. Tables A1 and A2 in the Annex provide the distribution of the sample by industry and size class for each country.⁴

Variables of interest have been collected for each firm through a survey questionnaire. In particular, the questionnaire contains both qualitative and quantitative data on firms' characteristics and activities, for a total of around 150 different variables split into six different sections: Proprietary structure of the firm; Structure of the workforce; Investment, technological innovation and R&D; Internationalization; Finance; Market and pricing. All questions mainly concern the year 2008, with some questions asking information for 2009 and for earlier years in order to have a picture of the effects of the crisis as well as the dynamic evolution of firms' activities.⁵

Table 1. The EU-EFIGE/Bruegel-UniCredit dataset by country

Country	Number of firms
Austria	443
France	2,973
Germany	2,935
Hungary	488
Italy	3,021
Spain	2,832
UK	2,067
Total	14,759

Source: EFIGE Survey dataset

Note: Industry codes are not available for 316 firms.

4 The representativeness of the sample with respect to the actual population of firms is discussed in Barba Navaretti *et al.* (2011). The sampling design has been structured following a stratification by industry and firm size, with an oversampling of large firms. Throughout the analysis, we have applied a weighting procedure in order to guarantee the representativeness of our results.

5 The questionnaire has been administered between January and April 2010 via either CATI (Computer-assisted telephone interview) or CAWI (Computer-assisted web interview) procedures. The complete questionnaire is available on the EFIGE web page, see www.efige.org. A discussion of the dataset as well as preliminary evidence on the internationalization modalities of firms is available in the second EFIGE Policy Report by Barba Navaretti *et al.* (2011). The third EFIGE Policy Report (Békés *et al.* 2011) discusses explicitly the reaction of firms to the crisis.

An interesting characteristic of the EU-EFIGE/Bruegel-UniCredit dataset is that, on top of the unique and extensive cross-country firm information contained in the survey, data can be matched with balance sheet information. In particular, the EFIGE data have been integrated with balance sheet data drawn from the Amadeus database managed by Bureau van Dijk, retrieving nine years of usable balance sheet information for each surveyed firm, from 2001 to 2009. These data can be used to further improve on the characterization of firms included in the survey, in particular by enabling the calculation of firm-specific measures of productivity.

We distinguish different types of international activities such as exporting, importing, international outsourcing and FDI.

Given the aim of this paper, the EFIGE data can be used to identify and compare firms across countries in terms of their different modes of internationalization. In particular, we have classified firms along seven, non-mutually-exclusive, internationalization categories, using the following information from the survey. Firms are considered exporters if they reply “yes, directly from the home country” to a question asking whether the firm has sold abroad some or all of its own products / services in 2008.⁶ Concerning imports, we follow the same procedure, distinguishing between materials and service imports. With respect to FDI and international outsourcing, we have exploited a question asking whether firms were running at least part of their production activity in another country: firms replying “yes, through direct investment (i.e. foreign affiliates/controlled firms)” are considered as undertaking FDI, while firms replying “yes, through contracts and arm’s length agreements with local firms” are considered as pursuing an active international outsourcing strategy.⁷ We have then looked at firms involved in international value chains, although not actively pursuing an internationalization strategy, through a question asking whether part of the firm’s turnover was made up by sales produced according to a specific order coming from a customer (produced-to-order goods): firms replying positively, and indicating that their main customers for the production-to-order activity are other firms located abroad, are considered as pursuing a passive outsourcing strategy. Hence, a passive outsourcer is the counterpart of an active outsourcer in an arm’s length transaction. Finally, thanks to a question that allows identifying the main geographical areas of the exporting activity, we have identified ‘global exporters’, i.e. firms that export to countries outside the EU.

Table 2 provides some descriptive statistics for the seven categories of firms active abroad as well as for the residual category of local firms not active abroad. Figures A1 and A2 in the Annex provide additional information on the various international activities of firms across countries, displaying the average share of firms in each category (extensive margin), and how much each international activity represents, on average, as a percentage of firms’ total turnover (intensive margin). Table A3 in the Annex summarizes the relevant questions in the EFIGE survey associated with each internationalization category as well as the data used in the analysis.

As can be seen, we can identify a clear ranking of firm characteristics with respect to the degree of involvement in international activities, in line with an enriched theory of self-selection of heterogeneous firms into international activities à la Helpman *et al.* (2004). In particular, Table 2 shows that internationally active firms tend to be larger, have higher sales and are more capital intensive. The position along the turnover ranking tends to increase with the degree of complexity of international activities, from exporter, to importer of material / active outsourcing, to importer of services and FDI. Local firms

6 In order to encompass the phenomenon of temporary traders, we have considered as exporter also a firm replying “regularly/always” or “sometimes” to the question “Before 2008, has the firm exported any of its products?”. For importing firms, we combine the following questions: firms replying “yes, from abroad” to “In 2008 has the firm purchased any materials (services) for its domestic production?” and firms replying “regularly/always” or “sometimes” to “Before 2008, did the firm purchase any materials (services) from abroad?”.

7 These firms are attributed to the country in which they are located and thus surveyed, although the ‘nationality’ of the group they possibly belong to may be different. In this paper we do not control for foreign ownership, that is, whether a firm is controlled by a foreign entity. We do control for foreign investment undertaken by the same firm.

involved in international value chains ('passive outsourcers') are somewhat smaller than the average of all internationally active firms, but larger than purely local firms.

Table 2. International categories of firms – Descriptive statistics (full sample), 2008

	Number of firms	Average turnover per firm (1,000 EUR)	Average number of employees	Average capital stock per employee (1,000 EUR)
Non Active abroad	3,402	4,443.33	31.44	152.16
Active abroad	11,357	19,273.46	139.85	196.40
<i>of which</i>				
Exporter	9,849	20,494.21	151.42	199.03
Importer of services	3,449	38,659.98	332.12	223.57
Importer of materials	7,298	24,976.44	191.17	200.36
FDI	719	77,637.20	334.13	239.55
Passive outsourcer	5,799	17,052.42	83.96	204.98
Active outsourcer	590	24,657.11	119.55	225.28
Global exporter	4,016	24,777.71	103.43	222.93
Whole sample	14,759	15,589.29	114.52	186.59

Source: EU-EFIGE/Bruegel-UniCredit dataset

4. Internationalization and firm competitiveness

We can now assess the correlation patterns between the degree of involvement in international activities and firm competitiveness. From a theoretical point of view, firm competitiveness is best captured by the concept of Total Factor Productivity. TFP measures productive efficiency: how much output a firm can produce for any given amounts of inputs. In other words, a firm has higher TFP than a competitor if it is able to produce more output with the same amounts of inputs.

Exploiting the merger between the EFIGE and Amadeus data, it is possible to calculate TFP for around 50 percent of the firms present in the dataset. To that end, we first assign our observational units to industries, and then we run for each industry the Levinsohn and Petrin (2003) semi-parametric production function estimation algorithm. This allows solving the simultaneity bias affecting standard estimates of firm level productivity, as well as to derive TFP estimates from heterogeneous, industry-specific production functions.⁸

More specifically, following standard practice in the literature, output is proxied in the estimations by value-added, deflated using industry-specific price indices retrieved from Eurostat. The labour input is measured by the number of employees. Capital is proxied by the value of tangible fixed assets deflated using the GDP deflator.

⁸ Using ordinary least squares when estimating productivity implies treating labour and other inputs as exogenous variables. However, profit-maximizing firms adjust their inputs each time they observe a productivity shock, which makes input levels correlated with the same shocks. Since the latter are unobserved to the econometrician, inputs turn out to be correlated with the error, biasing the OLS estimates of production functions. Olley and Pakes (1996) and Levinsohn and Petrin (2003) have developed two similar semi-parametric estimation procedures to overcome this problem, using investment and material costs, respectively, as proxies for these unobservable shocks.

Firm competitiveness is best measured by total factor productivity: a firm has higher TFP if it produces more output with the same amounts of inputs.

4.1 Descriptive statistics

Table 3 reports the average TFP of firms in the different international activities alongside the other firm characteristics already shown in Table 2, with the sample now limited to those firms for which it is possible to retrieve TFP. As can be seen, the resulting restricted sample does not show any particular bias in terms of representation by category of firms, nor in terms of overall ranking.

Table 3. International categories of firms – Descriptive statistics (restricted sample), 2008

	Number of firms	Average turnover per firm (1,000 EUR)	Average number of employees	Average capital stock per employee (1,000 EUR)	TFP	Unit labour cost (EUR per unit of value added)	Labour productivity (value added per employee in 1,000 EUR)
Non Active abroad	1,514	5,298.51	31.67	156.14	0.872	0.77	50.71
Active abroad	5,921	24,623.51	152.00	200.01	1.024	0.78	57.55
<i>of which</i>							
Exporter	5,201	26,104.12	164.41	203.19	1.033	0.77	58.09
Importer of services	1,900	50,004.76	372.81	230.61	1.159	0.84	61.81
Importer of materials	3,939	31,647.82	208.25	203.31	1.058	0.79	58.43
FDI	387	98,554.23	359.70	238.08	1.293	1.05	63.35
Passive outsourcer	2,965	20,763.66	84.31	208.06	1.060	0.79	59.86
Active outsourcer	306	32,991.62	127.39	224.94	1.066	0.76	56.03
Global exporter	2,211	28,345.27	104.42	224.77	1.094	0.79	62.56
Whole sample	7,435	20,303.82	125.60	190.39	0.991	0.78	56.05

Source: EU-EFIGE/Bruegel-UniCredit dataset

Notes: Numbers are weighted sample averages. TFP is the Solow residual of the production function.

We also look at two alternative measures of firm competitiveness: labour productivity and unit labour cost.

Table 3 also reports two additional measures of firm level competitiveness, namely labour productivity (value added per employee) and unit labour costs (total wage bill per unit of output). These are commonly used measures of competitiveness. In particular, unit labour costs at the firm level constitute the building block of aggregate measures of competitiveness such as the real exchange rate, and are thus interesting to compare with our estimated TFP.

The relative correlations between the retrieved measures of TFP, labour productivity and unit labour costs are reported in Table 4. As can be seen, TFP and labour productivity are positively and significantly correlated at 70 percent, in line with the findings of the literature. More surprising, however, are the relatively small (albeit correctly signed and significant) correlation coefficients between the two productivity measures and unit labour costs, which are below 30 percent. Such a low correlation casts some doubt on the actual meaning of aggregate measures of competitiveness based on unit labour costs.

Table 4. Correlations between measures of firm competitiveness

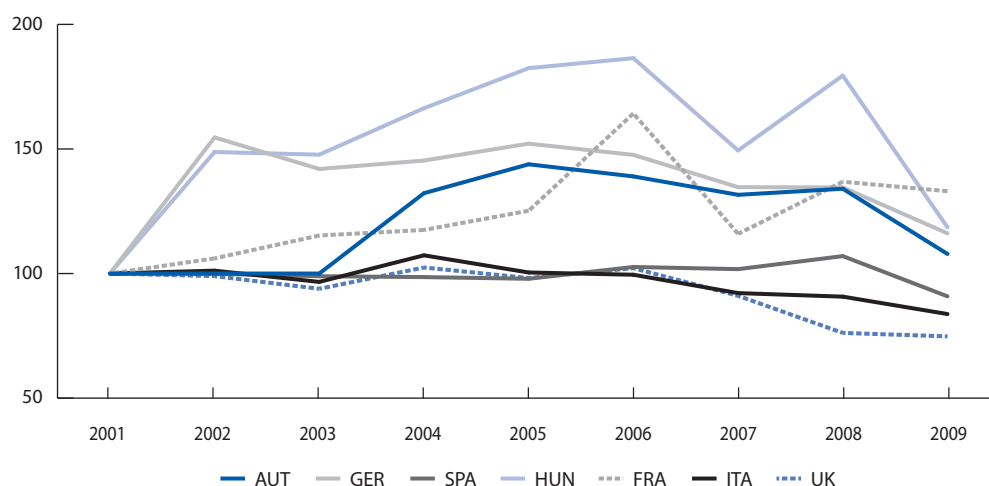
	TFP	Labour productivity
Labour productivity	0.695***	
Unit labour cost	-0.277***	-0.267***

Source: Authors' calculations based on the EU-EFIGE/Bruegel-UniCredit dataset and on the Amadeus dataset

Note: ***denotes statistical significance at the 1-percent level.

Based on the findings in Table 4, we stick to TFP as our ‘preferred’ measure of firm level competitiveness and, to test its aggregation properties in terms of country representativeness, we aggregate the firm-specific information in order to obtain a country-specific TFP index. Specifically, we first compute year/country/sector-specific weighted averages of firm level productivity measures. Then we create an index setting the year-2001 TFP level equal to 100 for each country and sector. Finally, we retrieve the country/year-specific aggregate TFP as the mean across sectors of these indexed TFP measures. The results are depicted in Figure 1.

Figure 1. Aggregate TFP dynamics by country, 2001-2009



Source: Authors' calculations based on the EU-EFIGE/Bruegel-UniCredit and Amadeus datasets

The dynamics of productivity aggregated from firm-level information are comparable to well-known results on aggregate country competitiveness, with Hungary, a transition economy under convergence, displaying the highest gains of productivity in the early 2000s, followed by Germany, France and Austria. The stagnating productivity trends of Spain and Italy are also evident. Somehow surprising at first glance is the dismal performance of the United Kingdom, but this might be explained by the fact that we are looking at the manufacturing sector of an economy with a growing competitive advantage in services. Finally, all countries display a marked decrease in productivity in 2009.

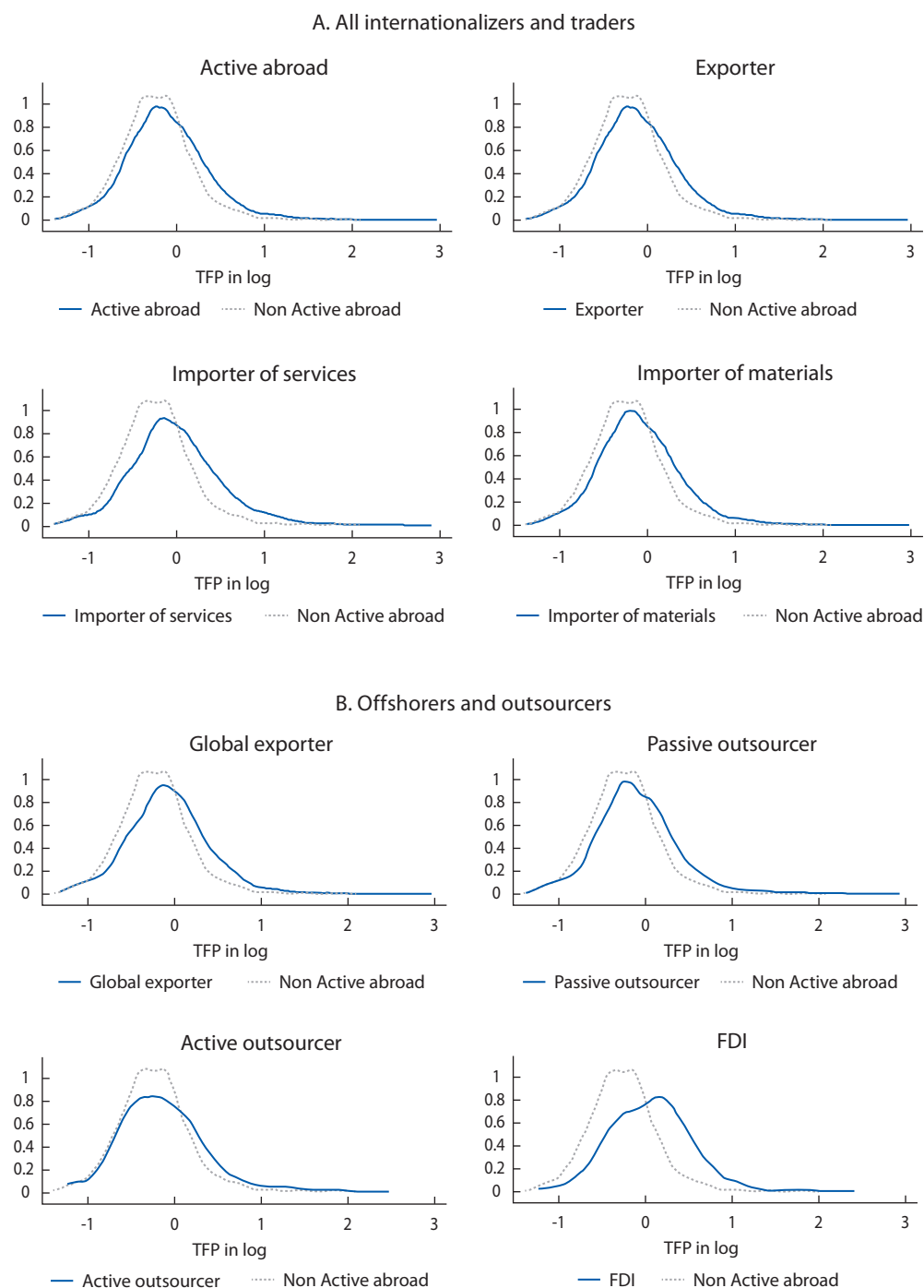
A standard way of showing selection into different internationalization activities is to draw the kernel density estimates of the productivity distribution for firms involved in each of these activities, and compare it with those of firms that are inactive at the international level. A kernel density shows the shares of firms ('density') that attain each productivity level, that is, the probability of picking a firm with a certain productivity level when the firm is randomly drawn from each category of activities. The comparisons are depicted in Figure 2 (panels A and B), where it has to be kept in mind that internationalization categories are not mutually exclusive as firms can be engaged in more than one international activity at a time. Thus, the sample sizes might vary and overlap (see Table 2 for details).

An internationally active firm is likely to be more productive than an internationally inactive firm.

Both panels of Figure 2 send the same message: a randomly drawn firm that is active internationally is likely to be more productive than a randomly drawn firm that is inactive internationally.

The fact that the productivity densities vary across internationalization categories suggests that the costs associated with international operations might vary across the different activities. To deepen the investigation of this point, we analyze next how the probability that a firm is active in each international activity is associated with the observed level of productivity. In particular, Figure 3 shows the 'extensive margin' (number of active firms over total number of firms) of each internationalization activity for each decile of the productivity distribution.

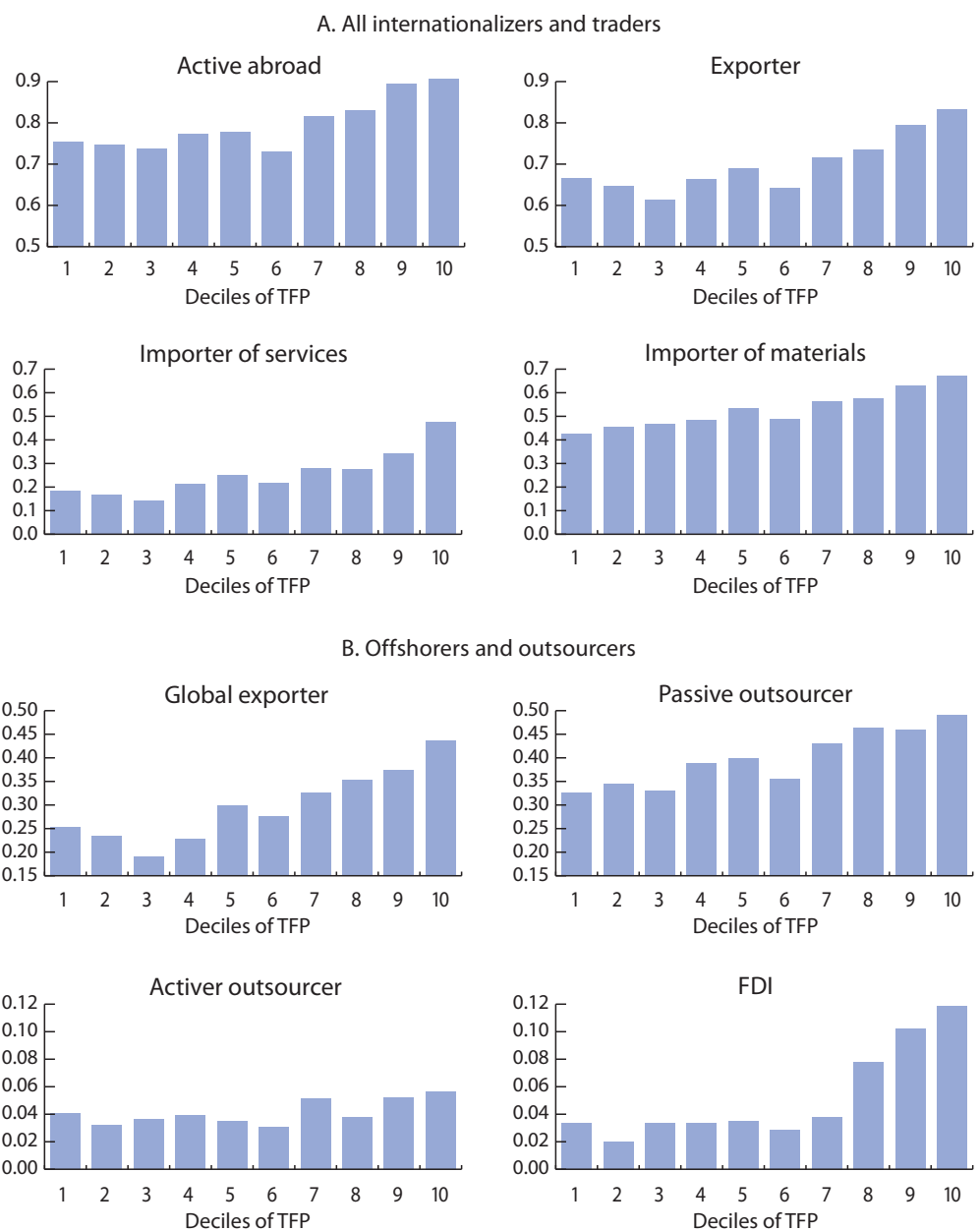
Figure 2. TFP and internationalization



The more productive a firm is, the more likely it is to be involved in some international activity.

The first thing to notice is the overall upward slope of the histograms when moving from left to right, that is from low- to high-productivity deciles. In line with the literature, this points out that the higher the productivity decile, the more likely it is for firms to be involved in some international activity. In other words, more productive firms self-select into internationalization status. However, the richness of information in our dataset allows us to go further than that, distinguishing the various internationalization activities in terms of selectivity.

Figure 3. TFP and internationalization: Share of firms active in each international activity by level of TFP



To see this, let us focus on the top decile (10), *i.e.* on the most productive 10 percent of all firms. The top left graph in panel A of Figure 3 reveals that among the firms in that decile, slightly more than 90 percent are internationally active one way or another. Nonetheless, the categories of internationalization activities differ a lot in terms of popularity: slightly less than 85 percent of firms are exporters; two thirds of them are importers of materials; almost 50 percent of firms are importers of services or passive outsourcers; just below 45 percent of firms are global exporters; less than 15 percent are involved in FDI; and just above 5 percent are active outsourcers.

Focusing on the top 10 percent of firms in terms of productivity, almost 85 percent of them are exporters while just above 5 percent are active outsourcers.

These findings reveal a clear ranking of internationalization activities from low selectivity (exporting) to high selectivity (active outsourcing) that hint at a growing degree of complexity when moving from exporting to FDI and active outsourcing. Thus, firms with stronger competitiveness have access to a

larger number of more complex options in designing their international operations. Stronger competitiveness implies having the possibility of exploiting a richer toolbox to deal with the challenges and seize the opportunities of globalization.

4.2 Econometric evidence

The relationship between firm competitiveness and internationalization activities can be further investigated by a cross-sectional econometric exercise, in which we regress the TFP of each firm, as measured in 2008, on the different categories of internationalization activities, controlling for country and industry fixed effects.

The ‘productivity premium’ increases with the complexity of internationalization activities and is highest for FDI and the import of services.

The results obtained through OLS are reported in Column 1 of Table 5. As expected, all coefficients are positive and significant. The ‘productivity premium’ increases with the complexity of internationalization activities. FDI and the import of services are associated with the largest TFP premia, followed by outsourcing activities and finally simple import and export strategies. Not surprisingly, however, ‘complex’ export strategies, as proxied by the ability of firms to export beyond the EU, are associated with higher premia, comparable to the ones derived from outsourcing activities. Indeed, this ranking is already visible in Figure 2 above, where the more complex internationalization categories exhibit thicker density at higher TFP levels.

Table 5. International status and TFP premium

	(1)	(2)	(3)	
Dependent variable: TFP	OLS	OLS	Ordered Probit	Observations
Active abroad	0.0906*** (0.0132)	0.0353*** (0.0128)	0.261*** (0.0290)	7,259
Exporter	0.0999*** (0.0136)	0.0399*** (0.0131)	0.272*** (0.0298)	6,563
Importer of services	0.171*** (0.0171)	0.0626*** (0.0171)	0.620*** (0.0531)	3,334
Importer of materials	0.118*** (0.0142)	0.0449*** (0.0138)	0.394*** (0.0332)	5,320
FDI	0.257*** (0.0329)	0.0980*** (0.0357)	0.750*** (0.0750)	1,862
Passive outsourcer	0.122*** (0.0151)	0.0558*** (0.0150)	0.329*** (0.0342)	4,372
Active outsourcer	0.134*** (0.0309)	0.0477 (0.0306)	0.364*** (0.0755)	1,777
Global exporter	0.156*** (0.0168)	0.0699*** (0.0167)	0.425*** (0.0368)	3,652
Country fixed effects	Included	Included	Included	–
Industry fixed effects	Included	Included	Included	–
Firm size	Excluded	Included	Excluded	–

Notes: Standard errors in parentheses. *** denotes statistical significance at the 1-percent level. One cross-sectional regression for each internationalization characteristic, with sector and country dummies. Column 2 controls also for the size class of firms (10-19; 20-49; 50-249; >=250 employees). The number of observations is given by the number of inactive firms plus the number of firms active in the selected international activity. All regressions control for country and industry fixed effects. Coefficients of the firm size effects included in Column 2 are reported in Table 6.

Competitiveness and size go hand in hand, as more productive firms grow larger than less productive ones.

In Column 2 of Table 5, in addition to country and industry fixed effects, we also control for firm-specific characteristics, in particular the size class of firms measured in terms of employment. While the TFP premia associated with the various internationalization activities are significantly reduced, their ranking is confirmed. The inclusion of firm size shows that competitiveness and size go hand in hand, as more productive firms manage to grow larger than less productive ones (not reported in Table 5).

The role of firm size is further investigated in Table 6, which reports the magnitude of the fixed effects associated with each size class for the different internationalization statuses in the regression of Table 5, Column 2. As can be seen, coefficients tend to grow larger with firm size, although, for a given class of firms, the size premium tends to be smaller in more ‘complex’ international activities such as FDI or outsourcing. This is evidence of tougher selectivity at the top as more complex activities are chosen by firms whose TFPs are above already high thresholds. In other words, size seems to give a bigger boost to productivity within less complex international activities.

Table 6. Firm size effects on TFP across internationalization activities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: TFP	Active abroad	Exporter	Importer of services	Importer of materials	FDI	Passive outsourcer	Active outsourcer	Global exporter
Small firms (20-49 employees)	0.162*** (0.0118)	0.156*** (0.0124)	0.168*** (0.0179)	0.160*** (0.0140)	0.144*** (0.0228)	0.154*** (0.0150)	0.137*** (0.0209)	0.180*** (0.0170)
Medium-sized firms (50-249 employees)	0.343*** (0.0157)	0.346*** (0.0165)	0.376*** (0.0240)	0.336*** (0.0182)	0.253*** (0.0363)	0.309*** (0.0199)	0.341*** (0.0344)	0.332*** (0.0227)
Large firms (over 250 employees)	0.639*** (0.0271)	0.635*** (0.0283)	0.647*** (0.0365)	0.634*** (0.0302)	0.572*** (0.0562)	0.553*** (0.0352)	0.576*** (0.0671)	0.644*** (0.0374)

Notes: Standard errors in parentheses. *** denotes statistical significance at the 1-percent level. The coefficients of the internationalisation variables are reported in Column 2 of Table 5 and are not repeated here.

The foregoing OLS results can also be checked for robustness by estimating an ordered probit model, in which the internationalization status is regressed across the decile categories (from the 1st to the 10th) of TFP analyzed in Figure 3. The results are reported in Column 3 of Table 5. The interpretation of the coefficient is slightly different here, but the results are perfectly consistent: the higher the productivity decile, the more likely it is to observe a firm being involved in some internationalization activity. While this is true for all activities, the effect is strongest for FDI, followed by importers of services; it is weakest for exporters only active within Europe.

Although these rankings are broadly consistent with previous results in the literature for individual countries and specific internationalization activities, the EU-EFIGE/Bruegel-UniCredit dataset is the only one that allows comparing, within a homogeneous framework, the productivity premia of firms across a wide range of international activities. The analysis confirms the well-known strongest self-selection induced by FDI. That is, the productivity ‘threshold’ above which firms tend to be active internationally is highest for FDI. It stresses the recently assessed fact that self-selection is stronger for importing than for exporting activities (see e.g. Altomonte and Békés, 2010). It also reveals the previously unnoticed high TFP premium of firms involved in the import of services, possibly due to the complementarity between complex internationalization strategies and sophisticated services exported by selected providers.

Moreover, the EU-EFIGE/Bruegel-UniCredit dataset not only makes it possible to make comparisons across a wide range of internationalization activities. Uniquely, it also allows comparing the performance of international firms across countries. To that extent, we run the same OLS specification as the one reported in Table 5 adding an interaction term (on top of country fixed effects) between a given country and the international status of the firms. The aim is to understand whether firms from a particular country are more productive in a given international status. We consider here Italy, Germany and France.

The productivity difference between internationally active and inactive firms is larger in France than in other countries.

The coefficients of the interaction terms for the three countries are reported in the first three columns of Table 7. The average patterns are confirmed in the case of Italy and Germany as most coefficients are not statistically significant. The only exception concerns importers of materials, whose productivity difference with respect to internationally inactive (domestic) firms is larger in Italy and France than in other countries. France seems to be different with respect to other international activities, too. In particular, the productivity difference of internationally active firms is larger in France than in other countries. This feature holds for traders in all categories (exporters, importers of materials or services, global exporters).

Table 7. Productivity and internationalization: country and industry effects

Dependent variable: TFP	ITA	FRA	GER	Low-wage sector
Active abroad	0.0209 (0.0290)	0.0818** (0.0410)	0.0681 (0.0591)	-0.00581 (0.0264)
Exporter	0.0128 (0.0295)	0.0971** (0.0422)	0.0450 (0.0596)	-0.00688 (0.0270)
Importer of services	0.0405 (0.0374)	0.101** (0.0499)	0.0371 (0.0669)	-0.0612* (0.0336)
Importer of materials	0.0642** (0.0306)	0.0928** (0.0419)	0.0877 (0.0613)	-0.0178 (0.0281)
FDI	-0.0281 (0.0808)	0.0918 (0.0987)	-0.113 (0.0934)	-0.227*** (0.0600)
Passive outsourcer	-0.00690 (0.0334)	0.0698 (0.0450)	0.0373 (0.0628)	0.00487 (0.0295)
Active outsourcer	0.0620 (0.0784)	0.151 (0.0929)	-0.00996 (0.111)	0.0616 (0.0608)
Global exporter	0.0406 (0.0364)	0.169*** (0.0513)	0.0738 (0.0668)	-0.0233 (0.0330)

Notes: Standard errors in parentheses. ***, ** and * denote statistical significance at the 1-, 5- and 10-percent levels, respectively. The table reports the coefficients of interaction terms between internationalization status and country dummy (or low-wage-sector dummy). The results are obtained by including these interaction terms into the OLS model of Table 5, Column 1.

Turning from a country perspective to an industry perspective, in the fourth column of Table 7 the internationalization status is interacted with an industry-specific dummy taking a value of 1 if the industry is characterized by competition from low-wage countries.⁹ The negative coefficients in the

⁹ Following Bugamelli *et al.* (2010) we consider as being affected from low-wage competition those industries in which the world market share of Chinese exports is above the median world market share of Chinese exports.

fourth column show that the productivity difference between internationally active and inactive firms (shown in Table 5) tends to be smaller in low-wage industries, in particular when they undertake FDI or import services. This is striking as we have seen that, in general, these two are the most selective international activities being associated with the highest productivity premia. The negative and significant coefficients may therefore signal the use of these types of complementary international activities as a defensive strategy by European firms in industries subject to tough competition from low-wage countries. Such difference is indeed not present for other internationalization categories, where firms operating in low-wage industries do not display a significantly different TFP premium on international activity compared to firms from other industries.

In low-wage industries, the productivity difference between internationally active and inactive firms tends to be smaller.

Finally, as a further check, we replicate the initial exercise of Table 5 on TFP for the two alternative measures of firm competitiveness: labour productivity and unit labour costs. The results are described in Table 8, together with the number of observations available for each measure across internationalization statuses. For ease of comparison, the first two columns of Table 8 repeat the results on TFP already listed in Column 1 of Table 5.

Table 8. International status and alternative measures of competitiveness

Dependent variables	TFP		Labour productivity		Unit labour cost	
	OLS	N	OLS	N	OLS	N
Active abroad	0.0906*** (0.0132)	7,259	0.135*** (0.0145)	7,260	-0.0570*** (0.00960)	9,230
Exporter	0.0999*** (0.0136)	6,563	0.141*** (0.0149)	6,564	-0.0545*** (0.00991)	8,281
Importer of services	0.171*** (0.0171)	3,334	0.202*** (0.0188)	3,334	-0.0682*** (0.0121)	4,246
Importer of materials	0.118*** (0.0142)	5,320	0.162*** (0.0155)	5,321	-0.0703*** (0.0101)	6,800
FDI	0.257*** (0.0329)	1,862	0.226*** (0.0373)	1,862	-0.0927*** (0.0253)	2,392
Passive outsourcer	0.122*** (0.0151)	4,372	0.158*** (0.0169)	4,372	-0.0630*** (0.0111)	5,672
Active outsourcer	0.134*** (0.0309)	1,777	0.182*** (0.0359)	1,777	-0.0666*** (0.0212)	2,330
Global exporter	0.156*** (0.0168)	3,652	0.198*** (0.0184)	3,652	-0.0631*** (0.0122)	4,588
Country fixed effects	Included		Included		Included	
Industry fixed effects	Included		Included		Included	
Firm size	Excluded		Excluded		Excluded	

Notes: Standard errors in parentheses. *** denotes statistical significance at the 1-percent level. One cross-sectional regression for each internationalization characteristic, with sector and country dummies. The number of observations is given by the number of inactive firms plus the number of firms active in the selected international activity.

Table 8 shows that the premia in terms of TFP and labour productivity are fully comparable across international statuses. This is so both in terms of magnitude (with premia ranging between 10 and

25 percent relative to internationally inactive firms) and in terms of ranking (with FDI always being associated with the most productive category of firms, followed by importers of services, outsourcers, importers of materials and simple exporters). These findings are in line with the relatively high correlation previously detected between the two productivity measures.

Not surprisingly given the low correlation with TFP, unit labour costs convey a slightly different message. Internationalization premia are still there and significant with the right sign, showing that internationally active firms have lower unit labour costs compared to local firms. However, magnitudes are smaller as premia range between 5 and 9 percent vis-à-vis internationally inactive firms. The ranking also changes. While firms undertaking FDI are still the most competitive, firms importing materials now stand close to them. Once again, unit labour costs seem to capture something different from productivity. Nonetheless, the fact that all coefficients are significantly negative sends a message of overall consistency across measures of competitiveness.

5. International exposure and industry competitiveness

So far we have taken the point of view of the firm showing that firms with stronger competitiveness have access to a richer variety of more complex options when in designing their international operations. We now move to a higher level of aggregation and ask whether the same can be said for industries: Is higher productivity at the industry level associated with more complex internationalization patterns?

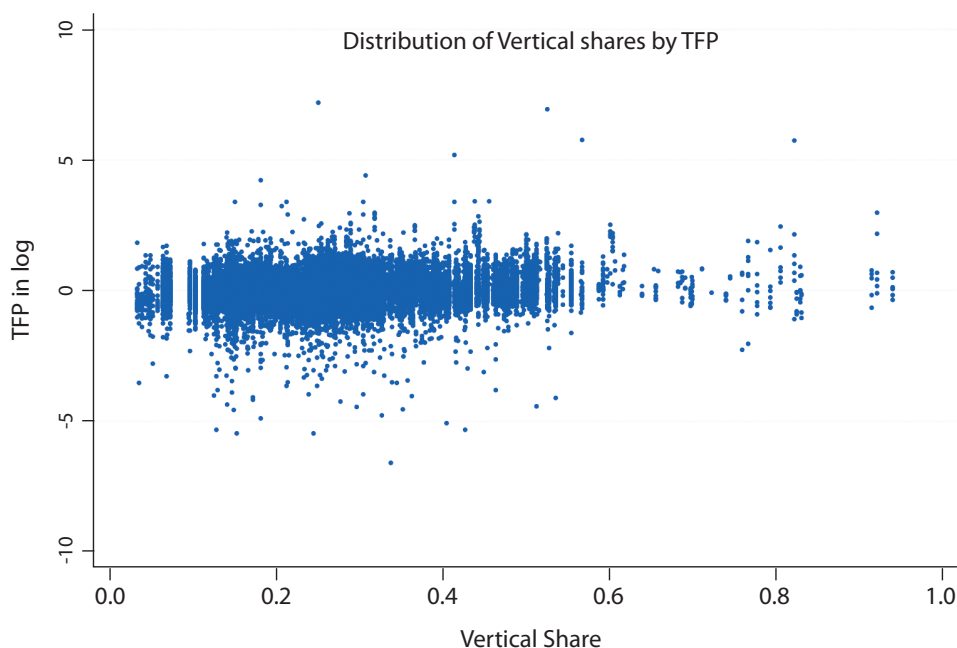
The ‘vertical share’ is the ratio of imported intermediate goods to total output and measures the internationalisation intensity of an industry.

To address this question, we exploit once more the EU-EFIGE/Bruegel-UniCredit dataset that allows operating with a representative sample of firms. We use the associated balance sheet data in a panel format to calculate for each industry a distribution of firm-specific TFP measures from 2002 to 2008. At the same time, we also exploit industry level data to construct for each industry an index of ‘internationalisation intensity’, aimed at capturing both the extent and the complexity of its international exposure. Following Hummels *et al.* (2001), this index measures how much a given industry is vertically integrated with international markets in a country at a certain point in time. For each industry this index of vertical integration (henceforth, ‘vertical share’) is computed as the ratio of the value of intermediate goods imported from abroad over the value of total output. It is based on year- and country-specific Input-Output tables available for each country in our sample for the period 2001-2007. These tables are provided by Eurostat (Economy and finance statistics, ESA 95 Input-Output tables). They are two-way tables that cross data on backward and forward linkages by industry in each country for each year.

The idea is to study the pattern of correlation across industries between the distribution of firm level TFPs and international exposure as captured by the vertical share. The fact that we link the vertical shares for 2001-2007 to TFP distributions for 2002-2008 suggests some kind of causality from the former to the latter. Short of a proper test of causality, such causal interpretation should of course not be pushed too far.

Prima facie evidence on correlation can be gauged from Figure 4, which plots the vertical share for every ‘cell’ (industry/country/year) against the (weighted) average TFP of the firms operating in the same cell. The figure reveals the presence of some mildly positive correlation between vertical shares and average levels of productivity. More interestingly, Figure 4 also shows that the heterogeneity of TFP levels is not constant across internationalisation intensities: larger vertical shares are associated with smaller heterogeneity of firm-level TFP. Hence, both the first and the second moments of the TFP distribution appear to be correlated with international exposure.

Figure 4. Vertical shares and average TFP



Note: Vertical shares are computed as the ratio of the value of intermediate goods imported from abroad over the value of total output for each industry. TFP is the (log) total factor productivity of each firm.

Table 9 further explores the correlations across industries between international exposure and the two moments of the TFP distribution. The table reports the results of a panel regression of the vertical share against the mean and the variance of the TFP distributions.

Column 1 shows that, as long as we do not control for country- and industry-specific fixed effects, we find a positive and significant, albeit small, correlation between the vertical share and average TFP. This is in line with what emerges from Figure 4. Adding country fixed effects alone maintains the significance of that correlation (result not reported). Column 2 highlights, however, that, when including both country and industry fixed effects in the regression, the positive correlation between international exposure and average TFP vanishes as the corresponding coefficient loses statistical significance.

Building on the pattern of TFP heterogeneity spotted in Figure 4, Column 3 of Table 9 adds the variance of TFP to the regressors of Column 2, as well as its interaction with average TFP. This is our preferred specification. It reinstates the sign and significance of the correlation between vertical share and average TFP. At the same time, the interaction term bears a negative and significant coefficient. Hence, after controlling for time-invariant country- and industry-specific characteristics, a larger vertical share is associated with higher average TFP but this association is weaker when the variance of TFP is larger. Likewise, if resources are reallocated from less productive to more productive firms, average TFP increases and the variance of TFP decreases, and both are associated with an increasing vertical share according to our empirical results.

The reallocation of resources from less to more productive firms increases average TFP, while decreasing the variance of TFP, and is associated with an increasing vertical share.

Interpreted through the lens of selection effects, these findings suggest that, within industries and countries, international exposure induces a reallocation of resources towards better-performing firms. There is more scope for such reallocation when there is more heterogeneity in performance across firms.

As selection into international activity takes place, heterogeneity is reduced, the scope for reallocation shrinks, and the positive impact of additional international exposure on industry competitiveness weakens. This is consistent with the fact that a higher average and smaller variance of TFP go hand in hand in Figure 4.

Table 9. Vertical share and industry productivity (GLS)

Dependent variable: Vertical share			
Explanatory variables			
TFP mean	0.00177*** (0.000529)	-0.000732 (0.000521)	0.00355* (0.00182)
TFP variance			-0.00810 (0.0137)
(TFP mean)			-0.0191** (0.00883)
* (TFP variance)			
Constant	0.253*** (0.000936)	0.135*** (0.000973)	0.136*** (0.00266)
Industry fixed effects	No	Yes	Yes
Country fixed effects	No	Yes	Yes
Observations	51,427	51,427	51,427
Number of firms	9,036	9,036	9,036

Notes: ***, ** and * denote statistical significance at the 1-, 5- and 10-percent levels, respectively. Generalized-least-squares (GLS) panel estimation. Robust standard errors clustered at the firm level in parentheses.

6. Conclusions and policy implications

Is international production sharing associated with stronger competitiveness? We have addressed this question from the complementary viewpoints of firms and industries. In so doing, we have exploited the unique features of the EU-EFIGE/Bruegel-UniCredit dataset, which offers detailed, statistically representative and comparable information on the international operations of manufacturing firms from key EU countries.

Aggregate competitiveness measures based on unit labour costs are questionable given the poor correlation between firm level unit labour costs and TFP.

We have started by checking the correlations between common alternative measures of firm competitiveness: total factor productivity (TFP), labour productivity, and unit labour costs. The first measure is the one dictated by economic theory as it captures the ability of firms to efficiently use all factors of production. The second measure is highly correlated with the first and, therefore, can be used as a reasonable proxy whenever the computation of TFP is too demanding. By contrast, the third measure is poorly correlated with the others, which casts a shadow on aggregate measures of competitiveness that are typically founded on it. This implies that productivity and unit labour costs measure different things.

Focusing on TFP as the theoretically sound indicator of competitiveness, we have first investigated its relation with internationalization at the firm level. We have found strong evidence of self-selection in the involvement in international activities. The clear positive correlation between the competitiveness of a firm and the complexity of its internationalization strategies reveals the presence of internationalization costs that are increasing in the degree of complexity.

International production sharing is associated with stronger competitiveness not only at the firm level but also at the industry level. This is revealed by the positive correlation across industries between average productivity and international exposure. The correlation holds after controlling for country and industry time-invariant characteristics, provided that one accounts for the dispersion of firm productivity across industries. Hence, at the industry level international exposure goes hand in hand with competitiveness as long as there is enough room to reallocate resources from less to more productive firms.

International production sharing is associated with stronger competitiveness also at the industry level.

From a policy point of view, self-selection into the various internationalization statuses implies that international production sharing is a signal of stronger competitiveness both at the firm and at the industry levels. From the viewpoint of firms, stronger competitiveness gives access to a larger number of more complex options when it comes to the design of international operations. From the viewpoint of industries, stronger competitiveness arises from the possibility of reallocating resources from less to more productive firms. For both firms and industries, stronger competitiveness arises from the possibility of exploiting a richer set of internationalization strategies to deal with the challenges and the opportunities of globalization.

As competitiveness is the cause rather than the consequence of internationalization, EU policies promoting internationalization per se would hardly affect competitiveness. Vice versa, policies that artificially reduce the ability of competitive firms to trade, outsource and invest abroad would also reduce their ability to exploit their full potential. Rather than focusing on firms' internationalization, successful policies should promote healthy industry dynamics, thereby favouring the reallocation of resources from less to more competitive firms. International competition would then guide this reallocation process.

Annex

Descriptive statistics and definitions of variables constructed with the EU-EFIGE/Bruegel- UniCredit dataset

Table A1. Distribution of firms by country and size class

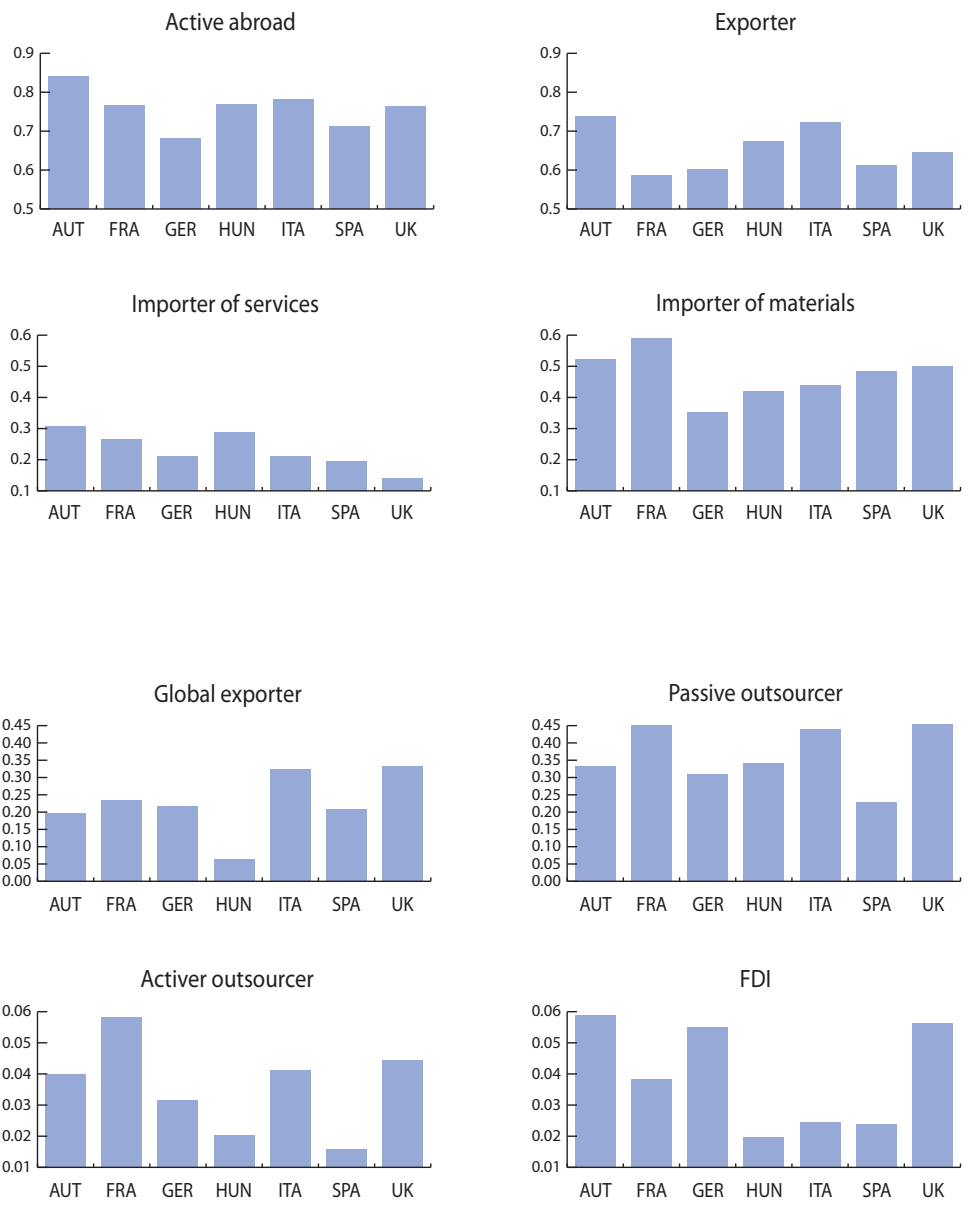
Class size	AUT	FRA	GER	HUN	ITA	SPA	UK	Total
Employees (10-19)	132	1,001	701	149	1,040	1,036	635	4,694
Employees (20-49)	168	1,150	1,135	176	1,407	1,244	805	6,085
Employees (50-249)	97	608	793	118	429	406	519	2,970
Employees(over250)	46	214	306	45	145	146	108	1,010
Total	443	2,973	2,935	488	3,021	2,832	2,067	14,759

Table A2. Distribution of firms by country and sector

Sector	AUT	FRA	GER	HUN	ITA	SPA	UK	Total
15	32	212	350	62	238	463	147	1,504
17	8	118	77	7	196	46	52	504
18	5	55	17	17	109	50	42	295
19	0	32	13	4	115	47	10	221
20	21	93	103	17	88	212	89	623
21	10	83	62	16	71	27	47	316
22	34	148	215	27	105	100	208	837
24	5	102	95	20	108	121	104	555
25	22	226	192	40	169	148	122	919
26	18	153	94	30	167	163	56	681
27	13	68	58	7	76	68	54	344
28	70	839	510	101	611	580	301	3,012
29	48	249	503	68	381	305	208	1,762
31	20	121	134	19	152	66	124	636
32	5	94	56	9	49	25	101	339
33	15	58	192	6	71	25	80	447
34	6	73	41	11	47	64	33	275
35	2	16	20	3	33	42	21	137
36	5	16	172	18	211	258	258	938
Total	339	2,756	2,904	482	2,997	2,810	2,057	14,345

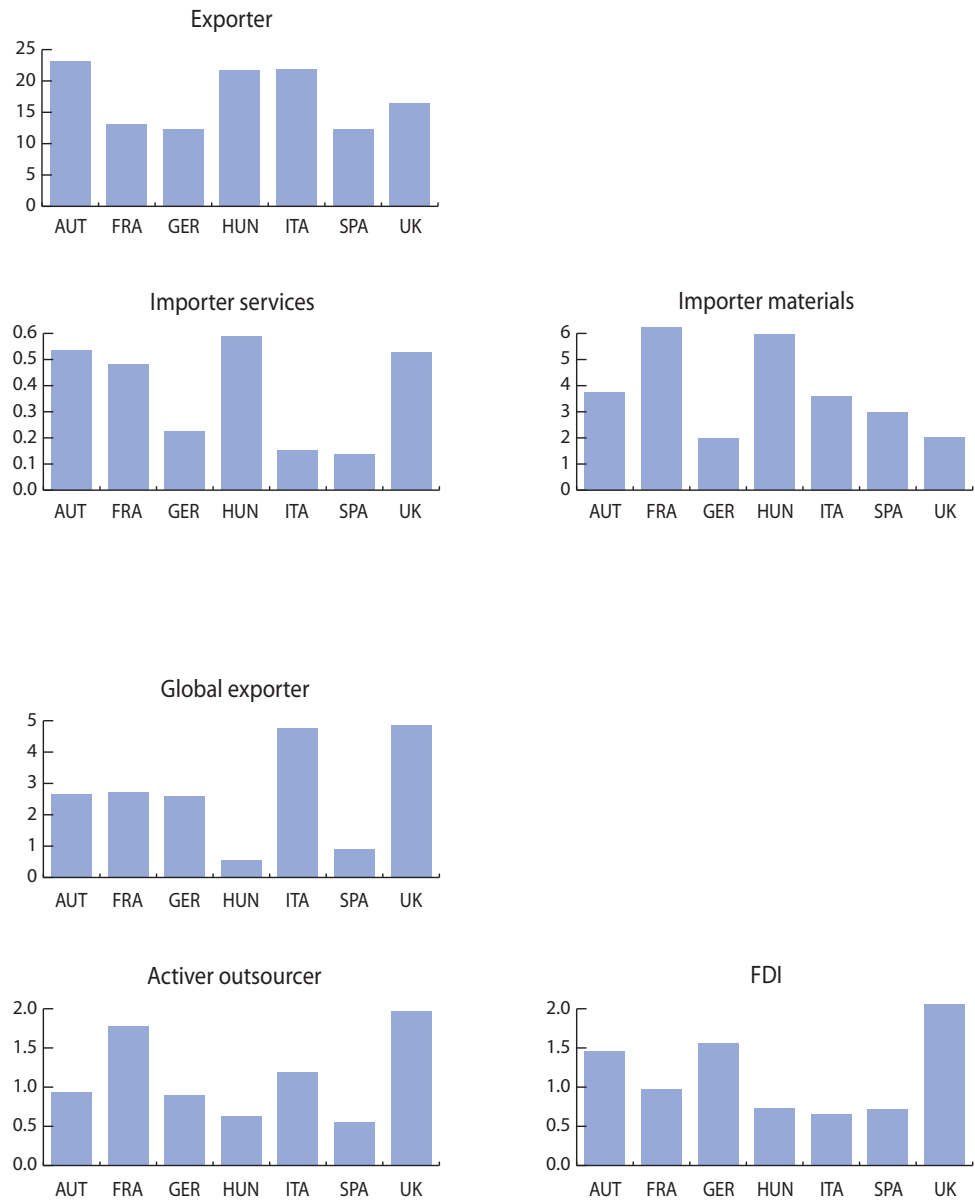
Note: Sector 15 is merged with sector 16 and sector 31 is merged with sector 30.

Figure A1. Extensive margin of trade by international activity and country



Note: The extensive margin is the share of firms active in a given international activity.

Figure A2. Intensive margin of trade by international activity and country (percent)



Note: The intensive margin is the percentage of turnover that firms active in a given international activity derive from that activity.

Table A3. Definition of variables used in the regressions

Variable used	Definition
Exporter	Dummy for exporter - wide definition: firm is direct exporter in 2008 or has been actively exporting in years before 2008.
Importer of materials	Dummy for importer of intermediate goods in 2008 or before
Importer of services	Dummy for importer of services in 2008 or before
Active outsourcer	Dummy for the firm that has production activity contracts and agreements abroad
Passive outsourcer	Dummy for the firm that has sold some produced-to-order goods to foreign clients
Foreign Direct Investor (FDI)	Dummy for firm running at least part of its production activity in another country via direct investments
Global exporter	Dummy for firm exporting to China or India or other Asian countries or to the US or Canada or Central or South America
Active abroad	At least one of the above variables takes value 1.
Total Factor Productivity (TFP)	Solow residual of a Cobb-Douglas production function estimated following the semi-parametric algorithm proposed by Levinsohn and Petrin (2003), at the firm level, 2002-2008
Labour productivity	Value added per employee, at the firm level, 2002-2008 (Amadeus)
Unit labour cost	Labour compensation over value added, at the firm level, 2002-2008 (Amadeus)
Vertical share	Ratio of the value of intermediate goods imported from abroad over the value of total output for each industry, based on country-specific I/O tables, 2001-2007 (Eurostat)

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