Exports vs. Foreign Direct Investments: evidence from cross-country industry data*

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Abstract

The process of globalization has been characterized by the simultaneous increase in arms-length trade and foreign direct investments (FDIs), but the connection between the two market entry modes is not obvious. Recent advances in trade theory trace back different patterns of internationalization to innate differences in productivity levels between firms, and predicts a productivity ordering of firms according to their degree of participation in international activities. In this paper we use a very large data set on bilateral exports and FDIs (proxied by Mergers and Acquisitions) for 25 domestic countries, 91 counterparts and 57 industries to test the relative incidence of trade and FDIs with respect to two major characteristics: (i) the presence of large firms in a sector, – and (ii) average sector productivity. We find sound evidence that sectors with a higher number of large firms are more likely to access foreign markets using FDIs flows. Further, we show that more productive sectors on average have a relatively higher incidence of trade relative to FDIs. We were also able to shed some light on the empirical linkages between internationalization choices and a variety of economic variables, such as tariffs, number of common partners in trade or FDIs, wage levels, capital intensity, and regulation costs.

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1. Introduction

An interesting feature of the recent process of globalization is the simultaneous increase in arms-length trade (exporting) and foreign direct investment (FDIs). Indeed, multinational firms account for two-thirds to three-quarters of world exports, more than a third of world exports are between affiliated firms (UNCTAD, 1999) and global FDIs inflows are expected to rise to US$1.3-1.5 trillion in 2011 (UNCTAD, 2010).

The connection between trade and FDIs is not obvious. When a firm decides to sell its goods in a foreign country it faces two options: (i) expand domestic production and export, or (ii) duplicate the same production process abroad and sell directly in the foreign market (horizontal FDIs). In this respect, trade and FDIs are therefore substitutes. On the other hand, a key aspect of globalization has been the fragmentation of production across countries (vertical FDIs), a process leading to complementarities between trade and FDIs.[1] While there is ample and detailed empirical evidence on the alternative ways in which FDIs may occur, i.e. vertically and horizontally (Helpman, 1984; Markusen, 1984; Markusen and Maskus, 2002; Alfaro and Charlton, 2009)[2], only recently the relationship between trade and FDIs has been analyzed with a specific focus on industry characteristics (Brainard, 1997; Helpman, Melitz and Yeaple (2004, henceforth, HMY); Oldensky, 2010).

In this paper we study the relationship between different ways of foreign market entry across sectors and countries, focusing on the role of the number of large firms in a sector and average industry productivity on the patterns of internationalization through trade and FDIs. For this purpose, we build an index of relative specialization in the spirit of the literature on revealed comparative advantages (Michaely, 1967; Laursen, 1998) in order to shed some light on the determinants of the choice to export and/or invest abroad.

A recent strand of theory initiated by Melitz (2003) and Bernard et al. (2003) has been able to explain firm heterogeneity with respect to foreign trade in a formal framework. Heterogeneity is traced back to innate differences in productivity levels, which are modeled as draws from a common distribution function. HMY (2004) extend the framework of Melitz (2003) to incorporate the possibility that firms engage in FDIs. One of the key predictions of their model is a productivity ordering of firms related to their patterns of participation in international commerce.

[1] Complementarities come from the fact that countries need to export inputs and re-import (partially or totally) final goods to be sold in the domestic market.
[2] For a review of this literature, see Barba Navaretti and Venables (2004).

While theoretically attractive, and thus far the only theoretical explanation of firm heterogeneity with respect to both trade and investment, the HMY model still lacks a solid empirical foundation. The scarcity of comprehensive empirical evidence so far may be due to the fact that data with records on export behavior and outward foreign investment at a disaggregated level are not readily available. Our analysis differs from the existing literature in that it, unlike HMY and other existing studies that focus only on US, uses bilateral flows of trade and FDIs from 25 countries towards more than 90 counterparts.

Our analysis is conducted at the country-sector level. However, bilateral data on FDIs at sector level are available only for few countries. For this reason we use information on mergers and acquisitions (M&As) as a proxy for FDIs. Indeed, although FDIs may also take alternative forms, such as greenfield investment, cross-border M&As (where a foreign firm purchases an existing firm in the host country) are by and large the most widely used (Herger et al., 2008). UNCTAD (2001) documents that in 2000, the average share of M&As in the total value of world FDIs exceeded 80%, and was even higher among developed countries. Moreover, cross-border M&As volumes have grown from around US$100 billion in the early 1990s to US$1.3 trillion in 2006, though there was some decline in the early 2000s (Hyun and Kim, 2010).

In line with the findings of HMY regarding the US, our results confirm that a higher number of large firms in a sector is associated with stronger incidence of FDIs relative to trade. In addition, we also find that industries with higher *average* productivity tend to have a relatively higher incidence of exports than FDIs.

The rest of the paper is organized as follows. Section 2 briefly reviews the relevant literature for our analysis. Section 3 discusses the hypotheses and presents the empirical model used to test them. Section 4 describes the data used in the analysis. Section 5 presents the results and Section 6 concludes.

2. Related literature

This paper is related to the various streams of literature dealing with the organization of international activities and, in particular, with the decision to serve foreign markets through exports or FDIs. As a matter of fact, when firms sell goods to foreign consumers they have two options: (i) produce at home for export or (ii) invest in the destination market (FDIs). Given these two foreign market penetration modes, the models identify a set of firm and industry characteristics – such as firm and plant scale economies, and heterogeneity in productivity levels – and a set of country characteristics – such as market size, trade and transport costs, taxation, production costs and factor intensities – that interact to

determine the structure of international commerce (Barba-Navaretti and Venables, 2004, chapter 6). For instance, the *knowledge-capital model* (Carr et al., 2001) of the multinational enterprises incorporates two motives for firms to engage in FDIs. First, open up an affiliate in the destination market and produce locally to avoid costs associated with international trade (horizontal FDIs). Second, produce in multiple countries in order to locate production activities where the factors used intensively in these activities are cheap (vertical FDIs).[3]

In terms of the econometric tools used in this context, firms' internationalization choices have been modeled by multiple-choices models. Benfratello and Razzolini (2008) as well as Bougheas and Görg (2008) demonstrate empirically the relevance of considering a wide set of internationalization forms. Unfortunately, multiple-choice models become cumbersome for a large number of internationalization forms because the different forms can be combined and each combination defines a choice.

Another stream of the most recent empirical work on FDIs has been addressed to identify the determinants of FDIs relative to other forms of international economic activity. More specifically, this literature focuses on the subset of horizontal FDIs sales relative to exports of final goods. Considering a measure of FDIs relative to trade as dependent variable helps to control for factors that affect the extent of total international commerce in final goods (Yeaple, 2003; Oldenski, 2010).

Concerning economies of scale, the hypothesis from the proximity-concentration theory (Krugman, 1983; Brainard, 1993) is that firm-level economies of scale are likely to promote FDIs, whereas plant-level economies of scale are likely to promote exports. From an empirical point of view, Brainard (1997) shows that foreign production becomes less convenient when scale economies at the plant level relative to the corporate level create incentives for firms to agglomerate in one location. Indeed, the existence of the proximity-concentration trade-off has been confirmed by showing that the share of exports on total sales is increasing in scale economies and decreasing in trade costs and foreign market size. As a matter of fact, the results obtained in the empirical literature (Ekholm, 1998; Oldenski, 2010) suggest that firms are more likely to substitute FDIs for exports in serving foreign markets when those markets are large (making it easier to recover the fixed costs of setting up a local affiliate branch). This finding is consistent with models of horizontal FDIs, where large markets make local production more attractive in the presence of fixed shipping costs (Yeaple, 2003).

[3] Evidence on horizontal and vertical FDIs has been well documented (see for example, Krugman (1983), Helpman (1984), Markusen (1984), and Markusen and Maskus (2002)).

Transaction costs, associated with distance between the locations of production and sale, provide a countervailing force towards establishing a production plant closer to the foreign market. Several studies analyze the effect of a set of variables capturing transport costs, tariffs and non-tariffs barriers on the choice of supplying a given market through exports or affiliate sales (see for instance, Brainard, 1997; Carr et al., 2001; Markusen and Maskus, 2002; Yeaple, 2003; HMY, 2004). These studies share a common result: that affiliate production tends to increase relative to exports with the level of transport costs and other trade barriers. Therefore, "there is substantial evidence that trade costs induce firms to undertake FDIs and serve foreign markets through local production rather than through exports" (Barba Navaretti and Venables, 2004, p. 139).

Corporate taxation is not expected to have a clear effect on FDIs relative to exports since low tax rates encourage inward investment, but the impact on exports is not clear. Indeed, the Brainard's study (1997) produces a perverse (although insignificant) effect, with high corporate tax reducing exports relative to affiliate sales. In Yeaple (2003) the level of taxation switches its effect on the ratio of exports on total sales depending on whether the market access variables are considered or not. Similarly, in Oldenski (2010) differences in corporate tax rates between the US and the destination country are not significantly associated with the export to FDIs ratio.

Another possible explanation for production location decisions is that firms prefer to locate production in countries with lower relative labor costs and higher labor endowments. This is generally thought of as a motive for vertical FDIs, but may be relevant also to the extent that firms engage in both vertical and horizontal FDIs (see, for example, Yeaple (2003) and Carr, Markusen and Maskus (2001)). Brainard (1997) includes the absolute value of differences in per-worker GDP between two countries and finds that a large difference in factor endowments is associated with high exports rather than affiliate sales. HMY suggest that capital intensity is a useful predictor of exports relative to FDIs in the sense that more capital intensive sectors export less relative to FDIs sales: these results are interesting, but their theoretical model offers no guidance concerning their interpretation. On the contrary, Oldenski (2010) finds that none of the relative wage measures adopted in the empirical analysis are significant predictors of the export versus investment decision for either manufacturing or service industries.

Recent works introduced firm productivity heterogeneity into models of trade and multinational activity. In a seminal paper, HMY studied the implications of a selection mechanism based on

productivity, such as that of Melitz (2003), for the relationship between trade and FDIs.[4] In their model, firm heterogeneity leads to self-selection in the mode of internationalization, with the most productive firms finding it profitable to meet the higher costs associated with FDIs, firms with intermediate level of productivity serving foreign markets with exports, and lower productivity firms selling only in the domestic market. Moreover, a higher within-industry heterogeneity is associated with a higher incidence of sales by multinational firms producing in foreign markets relative to exports, since a larger share of firms has a sufficiently high productivity to find it profitable to invest abroad. Using data on exports and on foreign sales of US multinational manufacturing firms in 30 countries and 52 industries, HMY find direct firm-level evidence supporting their theoretical prediction (i.e., multinational firms are more productive than non-multinational exporters) as well as indirect industry-level evidence, since higher firm size dispersion is associated with relatively more foreign affiliates' sales relative to exports. Consistent with the results obtained by HMY, Oldenski (2010) finds that greater firm-level heterogeneity significantly increases FDIs relative to exports in an industry: this result holds for both manufacturing and service industries. In the same vein, Tomiura (2007) finds that foreign outsourcers and exporters tend to be less productive than the firms active in FDIs or in multiple globalization modes but more productive than domestic firms: this productivity ordering is robust even when firm size, factor intensity, and/or industry are controlled for.

Finally, Chaney (2011) points out that productivity differences can only account for a fraction of the exposure to international markets and offers a simple explanation for the heterogeneous ability of individual firms to access foreign markets based on the formation of an international social network.

3. The empirical model

According to HMY, higher within-industry firm heterogeneity is associated with a larger number of highly productive firms, that find it more profitable to invest abroad rather than exporting their products. This leads to a negative relationship between heterogeneity and the weight of trade relative to FDIs under the assumption that: (i) the fixed costs to export are lower than those to invest abroad, and (ii) the variable costs of producing abroad are not (much) higher than those of producing domestically. As a matter of fact, if foreign production was less efficient than domestic production, for example because of a less skilled labor force, the most productive firms might find it optimal to export their

[4] In the seminal theoretical model by Melitz (2003), monopolistically competitive firms have different level of productivity, depending on a draw from an exogenous distribution. With fixed costs to export, only the most productive firms reach a sufficient scale to find it profitable to export. The model is therefore capable of explaining the positive link between productivity and export status, with a causality nexus running from the former to the latter.

products, rather than to produce them locally. On the other hand, if the foreign country is small and has lower production costs, it is the least productive firms that locate abroad, while the more productive ones produce at home: this is because low productivity enterprises have a greater incentive to pay the FDIs sunk costs, because they use more intensively the factor whose overseas price is low (Greenaway and Kneller, 2007). For instance, Head and Ries (2003) demonstrate that when there are factor price and market size differentials, the ordering of the productivity distribution between multinationals and non-multinationals can be the opposite of that obtained from the HMY framework.

What effect prevails in reality is therefore an empirical issue. As in the case of HMY, we cannot directly measure the dispersion of intra-industry productivity levels, so we need to construct a measure that takes into account the number of large firms in a sector. Following HMY, we use the sales distribution of firms to construct such a measure. This leads to our main hypothesis, relating the presence of large firms in a sector and the relative incidence of trade and FDIs:

(H1) *A higher number of large firms in a sector is associated with a higher incidence of FDIs relative to trade.*

However, in the theoretical model of HMY, the share of highly productive firms is by construction an increasing function of within-industry firm heterogeneity, but this is clearly a shortcut permitted by the model's assumptions, albeit plausible. In effect, it is each firm's productivity level that determines its exit mode. But in a multi-country framework, once the effect of the presence of a larger share of highly productive firms is controlled for, HMY also predict that industries with a higher average productivity level are in general more likely to enter foreign markets, either through exports or FDIs. This leads to our second hypothesis:

(H2) *Sectors with a higher average productivity are more likely to enter foreign markets through trade rather than FDIs.*

A first issue when testing this hypothesis is how to measure the relative specialization in exports or FDIs. Previous literature adopts the log of the ratio between exports and affiliate or total sales (Brainard, 1997; HMY; Oldensky, 2010). Since we measure FDIs through the value of M&As, using the ratio of the values of exports to that of FDIs would be inappropriate. For this reason, we use a measure of the relative importance of exports on FDIs in the spirit of the literature on revealed comparative advantages (Michaely, 1967; Laursen, 1998). Our index measures the difference between

the share of exports in a given sector of a given country with respect to total country exports and the same share for M&As, our proxy for FDIs:

$$Index_{ij}^{h} = \frac{X_{ij}^{h}}{\sum_{h} X_{ij}^{h}} - \frac{M\,\&\,A_{ij}^{h}}{\sum_{h} M\,\&\,A_{ij}^{h}} \qquad (1)$$

The first term is the share of exports from country *i* to country *j* in sector *h*, with respect to total exports between the two countries; the last term of the expression is the share value of M&As from country *i* to country *j* of sector *h*, with respect to total value of M&As between the two countries. By construction, the index ranges between –1 and +1: it is –1 when sector *h* of country *i* is fully specialized in M&As to country *j*; it is +1 when sector *h* of country *i* is fully specialized in exports to country *j*; the index is equal to zero if sector *h* of country *i* shows the same relative degree of specialization in exports and M&As to country *j*. This index can also be interpreted in terms of similarities between two different entry market modes: 0 indicates the maximum level of similarity; –1 and +1 are opposite cases indicating maximum differences, with FDIs prevailing on trade and trade prevailing on FDIs, respectively.

Working at a disaggregated level implies the presence of many zero trade and/or investment flows. Since it is not the case that all countries produce all goods, we distinguish between two different kinds of zero-valued flows: national sectors that do not internationalize at all in any of the two modes, and sectors that have zero flows only with respect to a subset of foreign markets. Such a distinction separates flows with exactly zero probability of positive trade or investments from flows with a non-zero trade probability who still happen to be zero. Since firms characteristics cannot possibly influence the first group, in our analysis we only keep national sectors that have at least one export or FDIs flow, assuming that excluded sectors are not produced. This avoids the inclusion of irrelevant information that may bias the estimate.

Even if the reduced database still includes a large number of zero-flows, the index we construct is undefined only in two cases: (i) if total exports (across all sectors) between two countries are equal to zero and/or (ii) total M&As between two countries are equal to zero. In both cases, the denominator of at least one of the two building blocks of our index is equal to zero. Since omitting these observations would lead to a loss of information, we replace all these observations with a value of zero.[5]

[5] For couples of countries that have both trade and FDIs in at least one sector, the index is centered on zero, i.e., the sum of the indices across *h* is by construction equal to zero. This is not the case if the two countries have no trade or FDIs flows

Since the index ranges between –1 and +1, to avoid being forced to use a truncated regression model, we normalize it taking the following transformation:

$$Index\_norm_{ij}^{h} = \ln \frac{\frac{Index_{ij,t}^{h} + 1}{2}}{1 - \frac{Index_{ij}^{h} + 1}{2}} \tag{2}$$

The normalized index ranges by construction between $-\infty$ and $+\infty$ and it is always defined when the original index is defined, even if it takes the value of zero (indeed, in this case, it is also equal to zero). Of course, this transformation precludes any structural interpretation of the estimated parameters.

The second issue is how to measure the presence of large firms. For each sector of each domestic country, we count the number of firms in the first quintile of the world distribution of firms by total sales. This indicator proxies for the incidence in each country of those firms that are large (and productive) enough to overcome the higher fixed costs of expanding abroad through FDIs rather than exports. In addition, we control for the average size of firms in a given sector and country by considering the average level of firm sales.

A third issue, is how to measure average industry productivity. We assumed a constant returns to scale Cobb-Douglas production function:

$$TFP_i^{h} = \frac{Y_i^{h}}{(K_i^{h})^{\alpha}(L_i^{h})^{1-\alpha}} \tag{3}$$

where (omitting indices): Y is the sector value added, K is the stock of capital at the sector level and L is the number of employees in the sector, assuming a capital share of 1/3 and a labor share of 2/3.

Since the theoretical model is quite parsimonious, we add to the main variables of interest a set of controls drawn from the vast literature on trade and M&As (Disdier and Head, 2008; Wang et al., 2010; Herger et al., 2008). Distance directly increases transaction costs because of the transportation costs of shipping products, the cost of acquiring information about other economies, and the cost of finding a partner and contracting at a distance. Similarly, common borders, colonial ties, common language,

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across all sectors. For example, in the case of a country *i* that has no FDIs flows to country *j*, but records trade flows, the sum of the index across all sectors *h* will be positive. An alternative to substituting the ratio with a zero, as suggested in the main text, would be to replace it with 1/*h*, preserving in this way the symmetry of our index. While we have checked that our estimates are unaffected by this choice, we have preferred the more intuitive option of substituting undefined ratios with zero.

common legal system, the number of islands and landlocked countries in each pair are expected to facilitate both trade and investment between two countries. Moreover, we directly control for transaction costs by including bilateral trade tariffs.

Finally, we start from Chaney's (2011) results showing that once a firm has acquired some foreign contacts, it can meet the contacts of those contacts. The possibility to use existing contacts to find new ones gives an advantage to firms with many contacts: in other terms, the more contacts a firm has, the more likely it is to acquire additional contacts. As a consequence, the entry of individual exporters into a given country is influenced by changes in aggregate trade flows between third countries. We quantify this insight following Francois (2010), and we include in our specification two 'network indexes', namely the number of common partners in trade and in M&As between two countries. These indexes are expected to account for the network effects that are not captured by other bilateral characteristics included in the model. They are expected to exert, respectively, a positive and a negative impact on the index of relative specialization. In other words: (i) a higher number of common partners in exports between two countries is likely to increase trade specialization between the same countries and (ii) a higher number of common partners in M&As between two countries is likely to increase the investment specialization between the same countries.

Using the normalized index and the set of controls defined above, we test our main hypotheses using the following empirical model:

$$Index\_norm_{ij}^{h} = \alpha + \beta_1 Number\_large\_firms_i^h + \beta_2 TFP_i^h + \beta_3 X_{ij}^h + \beta_4 Z_i^h + \beta_5 T_{ij} + \\ + \beta_6 DU_i + \beta_7 DU_j + \beta_8 DU^h + \varepsilon_{ij}^h \quad (4)$$

where (omitting indices): *Index_norm* is the measure defined above of the relative incidence of trade vs. FDIs in sector *h* and countries *i* and *j*; *Number_large_firms* is the number of firms in country *i* in the first quintile of the world distribution of firms by total sales in sector *h*; *TFP* is the level of total factor productivity of sector *h* in country *i*; *X* is a set of control variables describing the bilateral relationship between countries in a given sector (i.e., tariffs, number of common partners in trade and FDIs); *Z* is a set of sector specific control variables for the exporting country in each sector (e.g., average size of firms, wage levels and capital intensity); *T* is a set of control variables describing the bilateral relationship between countries (e.g., distance, common religion and common language); and *DU* are three sets of dummies for the domestic country, the foreign country and the industry sector.

4. Data and summary statistics[6]

4.1 Exports

The main statistical source of data on exports is the database UN Comtrade, managed by the Statistical Division of the United Nations, that reports data on the bilateral flows in several industrial sectors. In particular, it contains annual international trade statistics in US dollars, detailed by commodity and partner country, from 1962 to 2009 for many countries. Commodities are classified according to different recognized classifications, such as the Standard International Trade Classification (SITC) and the Harmonized Commodity Description and Coding System (HS). We use the International Standard Industry Classification (ISIC), Revision 3, at the 4-digit level of detail to be able to concord data on export with other data used in the empirical analysis.

4.2 M&As

Data on M&As are sourced from the SDC Platinum *Global Mergers and Acquisitions* database of *Thomson Financial Securities Data* that records any deal involving a change in ownership of at least 5 per cent over the period 1985-2009.[7] The Thomson data set allows us to analyze M&As for a large range of countries and years. This source records two related aspects of cross-border acquisitions: the number of acquisitions and their value. For the purpose of our analysis, we draw data on the value of M&As.[8] The database also contains information on target and acquirer profiles, such as primary industry and location, that are used in our empirical analysis. In particular, we identify cross-border deals in manufacturing Standard Industry Classification (SIC) codes at 4-digit level. Note that cross-border M&As with acquirer and target located in the same country are possible, for example when an American firm takes over another American firm that is active abroad. We excluded them from the sample, as well as undisclosed and incomplete M&As for which the value of transaction is not available.

It is worth noting that HMY measure FDIs through foreign sales. This is a natural choice for pure models of horizontal FDIs, because these models typically posit that exports and FDIs are substitutes.[9] Our data do not allow to distinguish horizontal from vertical FDIs, and this implies that we

[6] Table A provides a description of all the variables used in the empirical analysis and their sources.
[7] Thomson gathers information on M&As exceeding 1 million US dollar.
[8] The main sources of information of data on M&As are financial newspapers and specialized agencies like Bloomberg and Reuters. It should be kept in mind that until the mid-1980s Thomson focused very much on M&As for the USA only, and it is only for about the last 20 years that (systematic) M&As data gathering took place for other countries (Brakman et al., 2005).
[9] On the contrary, when firms fragment their production process in different countries (vertical FDIs), exports and foreign

are not able to draw conclusions about the substitutability/complementarity (between trade and FDIs) debate.

4.3 Total factor productivity

Total factor productivity (TFP) at the national sector level was calculated from data on capital and labour drawn from the UNIDO (Indstat4, 2008 version) database that uses the ISIC classification (Revision 3) at 4-digit level and using our estimates of total capital, as reported in equation (3).

Each sector's capital stock has been estimated from information on investment, using the inventory method proposed by Bernanke and Gurkaynak's (2001) and Isaksson's (2007). In particular: (i) for each country, we calculated each sector's share of investment using flow information for the first five years of data available; (ii) we used investment shares to divide information on each country's total capital provided by UNIDO's World Productivity Database across sectors; (iii) we used the estimates of the country and sector specific initial stock of capital obtained as described above as the starting point to apply the inventory method, i.e., adding each year's value of real term investment and applying a sector specific rate of depreciation to account for obsolescence.

4.4 Other controls

Data on firm's sales are drawn from the Worldscope database that includes financial statement of about 29,000 active companies, listed in developed and emerging markets, representing approximately 95% of the global market capitalization. Data are classified according to the SIC classification at 4-digit level.

Data on bilateral characteristics are drawn from the dataset provided by the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII).[10] Data on tariffs are from TRAINS database. Even though TRAINS contains data disaggregated at the HS 6-digit level, we use tariffs at the 4-digit level of ISIC classification in order to make data comparable to other data used in the analysis.[11]

Data on common religion and regulation costs are obtained from Helpman et al. (2008).[12] More specifically, data on the regulation costs of firm entry are measured via their effects on the number of

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investments are tipically complements. Indeed, there exist many empirical analyses, both at the industry-level and at the firm-level, finding positive relationship between trade and FDIs (Lipsey and Weiss, 1981, 1984; Clausing, 2000; Head and Ries, 2001).

[10] The CEPII follows the great circle formula and uses latitudes and longitudes of the most important cities (in terms of population) to calculate the average of distances between city pairs. Data on distances are available at: http://www.cepii.fr/anglaisgraph/bdd/distances.htm. We also adopted distances between capitals as an alternative measure and the results remain unchanged.

[11] Tariffs used in the empirical analysis are obtained as simple average of tariffs at the HS-6 level.

[12] These data are downloadble at: http://www.economics.harvard.edu/faculty/Melitz/HMR_Notes.

days, the number of legal procedures, and the relative cost (as a percentage of GDP per capita) for an entrepreneur to legally start a business.

Average wages in US dollars at sector level are obtained from UNIDO (Indstat4, 2008 version).[13] From the same source, we construct a measure of capital intensity defined as the ratio between capital and number of employees at sector level.

Finally, data on the number of common partners is built from our information on trade and FDIs.

4.5 Sample and estimation

To conduct the empirical analysis we construct an original database that associates bilateral trade and FDIs flows in a common classification for a sample of developed as well as developing countries.

In our sample, industries including finance and utilities were excluded, along with wholesale and retail trade, because of the non tradable nature of these activities. Ideally, the full set of industries should be included, with the extent of tradability reflected in transport costs (Brainard, 1997). In practice, however, data on transport costs are only available for industries in which trade exists. We excluded also agriculture and primary sectors (i.e., mining and oil and gas extraction) due to the lack of data on TFP. As a result, we focus on manufacturing sectors i.e., sectors with an ISIC code between 1511 and 3720.

Since our measures of M&As and sales dispersion are available in the SIC classification, we made a connection between the manufacturing sectors identified by the SIC code and data classified according to the ISIC code, both at the 4-digit level of detail, using the concordances produced by Statistics Canada, as in Brakman et al. (2005).[14] To take into account that at the 4-digit level of disaggregation we have a large number of empty cells, both in exports and in M&As, we aggregate data available at 3 digits of ISIC classification. Matching different datasets yields data on 25 domestic countries and 91 foreign countries, covering 57 manufacturing industries at the 3 digits ISIC level from 1994 to 2004.

As shown by many theoretical and empirical studies (e.g., Caballero and Engel, 1999), investment dynamics are lumpy. This is even more true in the case of FDIs and M&As (see, for instance, Brakman et al., 2005). For these reasons, although our sample covers 11 years, we estimate our empirical model on data averaged over the entire sample, to smooth time-series variability.

[13] Raw data on wages are expressed in current US dollars. To convert into real dollars, wages have been deflated by using the US consumer price index (base year 2000).
[14] The concordances used are available at: http://www.macalester.edu/research/economics.

4.6 Summary statistics

Table 1 presents the descriptive statistics for the variables used in the estimations. It shows substantial variation in all our key variables.

From Table 1 it can be inferred that the dependent variable (*Index_norm*) has an average value of 0.051 and a standard deviation of 0.188, with values ranging from -0.884 to 7.058. The second index, that takes into account only observations for which both trade and M&As exist, has an average value of -0.016 and a standard deviation of 0.132, with value ranging from -0.884 to 0.684. Positive values of these indexes are associated to country pairs presenting higher exports share than M&As share in a given sector, while negative values are for country pairs presenting higher M&As shares than exports shares in a given sector.

Comparing the two indexes, it appears that trade specialization is (on average) stronger, consistently with the lower fixed costs assumption, but when both modalities are present, FDIs shares get the upper hand. As it could be expected, given the reduced number of observations, the second index distribution features a lower variability.

Considering domestic country characteristics, the average number of firms in the first quintile of the world distribution of firms by total sales is 16 with a high within sample variability (values range from 0 to 529). The TFP levels range from 1.614 to 7.785 (average value: 5.073) and the sectors presenting (on average) the highest values are: Refined petroleum products, Tobacco products, Motor vehicles and Automobiles. It is also worth noting that wages present a much higher variability than capital intensities.

Concerning bilateral characteristics, tariffs show a high variability, with values ranging between 0 and 58.235 and an average level of 11.734. The average number of common partners in trade is 58, with values ranging between 0 and 117, whereas the average number of common partners in FDIs is much lower (0.4) and the range narrower (between 0 and 30). This difference highlights that the two ‘networks’ are quite different and the former is much larger than the latter (consistently with the lower fixed costs assumption, again).

In Table 2 we report the simple correlations among the variables used in the empirical model. The correlation between the normalized index and the number of firms in the first quintile of the world distribution of sales is negative, suggesting that having a larger share of world large firms favours FDIs relative to trade. Further, TFP levels are positively correlated with the relative importance of exports: higher levels of TFP in a given sector determine higher trade compared to M&As flows between two countries. Higher wages in the domestic country are also positively associated with the incidence of

exports, while the contrary is true for capital intensity: the latter result is consistent with the findings of HMY.

Obviously, bilateral correlations may provide a distorted picture, because they do not control for potentially confounding factors. For this reason, in the following we perform a more refined econometric analysis.

5. Results

5.1 Trade vs. FDIs

The first step of our empirical analysis is the estimation of the model described in equation (4), where the dependent variable is the index of relative specialization in trade or FDIs. We estimate this specification on a sample that includes all the 67,911 cases.

The results in Column 1 of Table 3 show that sectors with a higher number of large firms have a stronger incidence of FDIs relative to trade. Indeed, this coefficient, negative and statistically significant at the 99% level, confirms the (H1) hypothesis. On the contrary, sectors with higher average productivity and larger average firms size have a higher relative incidence of trade. Sectors with higher average wages show a lower relative trade specialization. This is consistent with the fact that their products are likely to be less competitive in the foreign markets. As a consequence, firms have a stronger incentive to invest abroad. The same is true for the average capital intensity: these sectors show a lower relative trade specialization, pointing to the fact that capital intensive industries are more likely to exploit economies of scale at the corporate rather than at the plant level.

Among the characteristics of the bilateral relationship, the level of applied tariffs is negative and statistically significant, providing evidence of the "tariff jumping" effect: higher tariffs provide an incentive to switch from trade to investment abroad. The same is true for most of the control variables related to trade costs (e.g., insularity, landlocking, common language and religion) showing a negative and statistically significant coefficient providing evidence that these factors favour FDIs with respect to trade. The opposite is true as far as the distance variable is concerned, and this may be explained by the fact that for some distant countries (fixed) investment costs are higher than (variable) trade costs. However, it should be noted that none of the variables related to the cost of investing abroad (regulation costs, common legal systems) appear to have a significant impact.

An interesting result concerns the impact of the number of common partners in trade and in FDIs. Our results show that: (i) the higher the number of common partners in trade between two countries, the higher is the incidence of trade on FDIs; and (ii) the higher the number of common partners in FDIs

between two countries, the higher is the incidence of FDIs on trade. A less literal interpretation is the following: firms with more foreign contacts are more likely to enter an additional market, and firms benefit from the contacts of their contacts. In other words, if a firm *k* has a contact in country *j'* which itself has a contact in country *j*, then firm *k* is more likely to enter country *j*. Our results show that if exports (investments) from *j'* to *j* increase, firms in *j'* (including *k*) acquire new contacts in *j*. What is (even more) interesting, the trade and investment contacts form different networks and have opposite impacts on the internationalization choices.

5.2 Wage and capital intensity

Columns 2-5 of Table 3 present the results obtained splitting the sample according to the main features of the domestic sectors: the average level of wages and the average capital intensity.

Columns 2 and 3 report the results obtained splitting the sample between sectors with average wages below and above the median. In sectors with low average wages, the coefficient of the number of large firms is positive and statistically significant (Column 2). This result can be explained by the fact that firms operating in sectors with low domestic wages can afford to produce at home and export their goods, instead of investing abroad and produce directly in the foreign market. However, the sign of the domestic wages coefficient is still negative confirming that as wages increase, FDIs tend to be preferred to trade. On the contrary, sectors above the median wage present a negative and much larger (in absolute terms) coefficient for the impact of the number of large firms on the index. These sectors, though, are less sensitive to the labour cost since higher wages are associated with higher trade shares (Column 3).

Columns 4 and 5 present the results obtained splitting the sample depending on capital intensity. The consequences of this split mirrors those obtained in the previous case. As far as the sectors with a low capital intensity are concerned, it is not true that the largest firms are more likely to invest abroad, though it is still true that FDIs become more important as wages and (even more) capital intensities increase (Column 4). On the contrary, in the most capital intensive sectors the HMY model is strongly confirmed as well as the lack of a negative impact of labour costs on the trade specialization. It is also worth noting that trade barriers and trade networks do not affect the firms choice about the internationalization mode, while it is enhanced the role of FDIs networks (Column 5).

5.3 Different groups of countries

In Table 4 we present the findings obtained considering different samples of countries. In particular, we consider the choice between different entry market modes made by sectors operating in countries

belonging to two groups of developed countries: G-10 (Belgium, Canada, France, Germany, Italy, Japan, Sweden, Switzerland, United Kingdom and United States) and OECD.

In Columns 1 and 2 we focus on subsamples of domestic countries and consider their trade and FDIs with the rest of the world. As it could have been expected, the impact of the number of large firms in a sector and of the average level of TFP on the index of relative specialization is higher (in absolute terms) than in the baseline specification, while the sign and the significance of other coefficients remains by and large unchanged. However, it is worth noting that developed countries' firms trading are not negatively affected by labour costs (higher wages have a positive impact on trade choices) and do not benefit from the existence of trade networks; on the contrary, it is confirmed that FDIs networks increase the likelihood of investing abroad. Finally, in Column 3 we analyze the determinants of foreign market entry modes for the subsample of OECD countries towards other OECD members. Restricting the sample of destination countries does not change the overall picture, but trade costs, both in terms of distance and tariffs, are not significant variables in explaining the internationalization choices among developed countries.

5.4 Robustness checks

In Table 5 we provide some robustness tests of our previous results.

First, we verify the presence of nonlinear effects of productivity on our index of specialization, substituting the continuous measure of TFP with a set of four dummies for each quartile level. The positive and statistically significant coefficient of the dummy for sectors in the top quartiles of the within country distribution in Column 1 of Table 5 shows that only very high levels of productivity influence the choice between trade and FDIs. In other words, only the most productive sectors tend to favour exports with respect to foreign investment, while the remaining results are confirmed.

Second, since that our sample includes 67,911 observations with only 3,755 country/sector cases in which both trade and FDIs flows are positive, we also test the impact of the number of large firms and average level of productivity on the extensive margin of foreign entry, estimating the following binomial model for the probability of positive FDIs when exports are positive by a probit specification:

$$Pr(W_{ij}^{h}=1)=\alpha+\beta_1 Number\_large\_firms_i^h+\beta_2 TFP_i^h+\beta_3 X_{ij}^h+\beta_4 Z_i^h+\beta_5 T_{ij}+ \quad (5)$$

$$\beta_6 DU_i+\beta_7 DU_j+\beta_8 DU^h+\varepsilon_{ij}^h$$

where (omitting indices): *W* takes the value of one if sector *h* of country *i* exports and invests in country *j*, and the value of zero if exports and/or FDIs are zero for a sector *h* of country *i*; and all other variables are as defined in equation (4) above.

The results reported in Column 2 of Table 5 show that also the probability of accessing foreign markets with both exports and FDIs is higher when the number of large firms is higher. On the contrary, we do not find evidence of a significant effect of the average productivity level. Consistently with the insights provided by the literature (Chaney, 2011), the number of common partners in trade or in FDIs play a major role on the decision to enter into a foreign market.

Finally, we also analyze the effect of our key explanatory variables on relative trade specialization considering only those 3,755 cases in which a generic sector *h* of country *i* has positive flows of both exports and FDIs to country *j*. In doing so, we account for the potential sample selection biases induced by the exclusion of the cases in which there is no trade and/or no FDIs by including the Heckman correction term, obtained as the inverse Mills ratio calculated from the previous probit regression (5).[15] In practice, we adopt the following specification:

$$Index\_norm_{ij}^{h} = \alpha + \beta_1 Number\_large\_firms_{i}^{h} + \beta_2 TFP_{i}^{h} + \beta_3 X_{ij}^{h} + \beta_4 Z_{i}^{h} + \beta_5 T_{ij} + \\ + \beta_6 DU_i + \beta_7 DU_j + \beta_8 DU^{h} + \beta_9 Mill\_noTrade\_noFDI_{ij}^{h} + \varepsilon_{ij}^{h} \quad (6)$$

where: *Mill_noTrade_noFDI* is the inverse Mills ratio from the model of equation (5), and all other variables are as defined in equation (4) above.

Column 3 of Table 5 shows that the coefficient of the inverse Mills ratios is statistically insignificant, suggesting that the exclusion of the instances described above does not influence the estimation of the role of trade and FDIs. The negative and statistically significant coefficient of the measure of the number of large firms confirms that a higher presence of large firms in a sector is associated with a higher incidence of FDIs. Also the coefficient of average sector TFP is positive and significant, as in the baseline specification, lending further support to the robustness of our results.

[15] The second Heckman correction term is identified through the exclusion of the measures of regulatory hurdles, common language and religion, and common partners in trade and FDIs, from the second step estimates.

6. Conclusions

The firm choice between exporting at arms' length and foreign direct investment has traditionally been modeled as a proximity-concentration trade-off. Indeed, a large number of factors has a common impact on the probability that a firm exports or that it invests abroad.

In this paper, we have found sound and convincing evidence in favor of two major hypotheses on this issue: (i) that for a given level of average productivity, a higher number of large firms in a sector is associated with a higher incidence of FDIs relative to trade, and (ii) that for a given number of large firms, sectors with a higher average productivity are more likely to enter foreign markets through trade rather than FDIs. Our results show robust support for the prediction from theory: sectors with a higher number of large firms are associated with a higher relative incidence of FDIs, whereas sectors with a higher average productivity are associated with a higher relative incidence of trade.

Moreover, using a large database in a cross-country framework we were able to shed some light on the empirical linkages between internationalization choices and a variety of economic variables. Firstly, the tariff discrimination hypothesis is confirmed: to avoid obstacles in trade, resulting from the imposition of a tariff, foreign investment is undertaken in the country to which it is difficult to export because of the tariff obstacle. However, trade and policy costs are less likely to affect firms' choices within OECD countries.

As far as wages are concerned, most of the literature focused on the role of the host country wages in affecting FDIs. On the contrary, we deal with the role of the domestic country wages showing that they encourage outbound FDIs, but this is true only for sectors paying lower wages and characterized by low capital intensity. On the other hand, our results are consistent with the findings of HMY for the US: more capital-intensive sectors export less relative to FDIs.

Finally, we provided some support to the predictions of the most recent network models providing a theory of the distribution of entry into foreign markets, without the need for *ad hoc* assumptions on firms' productivity distribution. Network-based contacts allow say a French exporter/investor that has acquired a contact in Japan to radiate away from Japan as Japanese firms would. It does so by using its Japanese contacts as a remote hub from which it can expand out of Japan. Interestingly, though, export and investment contacts are substitutes rather than complements: being part of a trade network increases the likelihood of using the same mode of internationalization when entering into another foreign market.

Our empirical findings suggest several extensions and generalizations. The most important would be related to the explanation of the distribution of the number and the geographic location of foreign

markets. Most of the existing models, as a matter of fact, are successful at explaining the intensive margin of trade, but do not provide many insights about the determinants of the extensive margin.

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Table 1 – Summary statistics

Variable	Mean	Median	Standard deviation	Min	Max
Index_Norm	0.051	0.008	0.188	-0.884	7.058
Index_Norm (both trade and FDIs)	-0.016	-0.008	0.132	-0.884	0.684
Number of large firms	16	1	45	0	529
TFP (log)	5.073	5.174	0.705	1.614	7.785
Size (log)	11.283	11.216	1.767	4.824	18.307
Tariffs	11.734	9.295	10.770	0	58.235
Wage (log)	41,389	29,561	43,374	533	284,739
Capital intensity	1.681	1.664	0.178	1.309	2.468
Distance (log)	8.826	9.052	0.742	5.371	9.892
Contiguity	0.021	0	0.143	0	1
Islands	0.417	0	0.570	0	2
Landlocked	0.164	0	0.383	0	2
Common legal system	0.277	0	0.447	0	1
Colonial ties	0.039	0	0.194	0	1
Regulation cost	0.069	0	0.254	0	1
Regulation cost (days and proced.)	0.039	0	0.193	0	1
Common language	0.108	0	0.310	0	1
Common religion	0.197	0.040	0.291	0	0.988
Common partners in trade	58	58	37	0	117
Common partners in FDIs	0	0	1	0	30

Notes. Variables definitions are provided in the text and in Table A. Summary statistics are computed after excluding observations in the 1st and the 99th percentile of the distribution of the dependent variable. *Index_Norm* is the dependent variable including all observations. *Index_Norm (both trade and FDIs)* is the dependent variable after excluding all cases in which sector *h* of country *i* does not export and/or does not invest in country *j*. Wages are in thousand dollars. Summary statistics are calculated on 67,911 observations for all variables apart for *Index_Norm (both trade and FDIs)* that is calculated on 3,755 cases.

Table 2 – Correlation matrix

	Index_ Norm	*Index_ Norm (both trade and FDIs)*	*Number of large firms*	*TFP (log)*	*Size (log)*	*Tariffs*	*Wage (log)*	*Capital intensity*	*Distance (log)*	*Contiguity*	*Islands*	*Landlocked*	*Common legal system*	*Colonial ties*	*Regulation cost*	*Regulation cost (days and proced.)*	*Common language*	*Common religion*	*Common partners in trade*	*Common partners in FDIs*
Index_Norm	1																			
Index_Norm (both trade and FDIs)	1	1																		
Number of large firms	-0.016	0.033	1																	
TFP (log)	0.073	0.102	0.233	1																
Size (log)	0.078	-0.062	0.313	0.508	1															
Tariffs	-0.003	-0.077	0.001	0.028	0.060	1														
Wage (log)	0.100	0.084	0.239	0.404	0.336	-0.009	1													
Capital intensity	-0.055	-0.052	-0.113	0.384	0.056	-0.018	0.091	1												
Distance (log)	0.014	0.015	0.072	-0.065	-0.028	0.018	-0.069	-0.097	1											
Contiguity	-0.006	0.000	-0.031	-0.033	-0.038	-0.038	-0.034	-0.015	-0.394	1										
Islands	-0.042	-0.009	0.200	0.181	0.096	-0.062	0.084	0.094	0.067	-0.089	1									
Landlocked	0.013	0.004	-0.022	0.029	0.025	0.016	0.061	0.070	-0.105	0.054	-0.137	1								
Common legal system	0.011	-0.018	-0.081	-0.110	-0.049	0.031	-0.092	-0.084	-0.043	0.123	0.021	-0.071	1							
Colonial ties	-0.018	-0.005	0.002	0.047	0.046	-0.005	0.048	-0.025	-0.031	0.015	0.212	-0.047	0.236	1						
Regulation cost	0.014	-0.040	-0.090	-0.340	-0.190	0.053	-0.218	-0.238	0.020	0.081	-0.189	0.032	0.087	-0.055	1					
Regulation cost (days and proced.)	0.015	-0.053	-0.065	-0.262	-0.107	0.031	-0.148	-0.170	0.043	0.005	-0.085	-0.019	0.098	-0.018	0.360	1				
Common language	-0.011	-0.025	-0.018	-0.014	-0.023	0.021	-0.045	-0.071	-0.102	0.146	0.113	-0.024	0.409	0.323	-0.003	-0.018	1			
Common religion	0.030	0.003	-0.086	-0.045	-0.024	-0.144	-0.066	-0.013	-0.064	0.122	-0.073	0.041	0.279	-0.028	-0.050	-0.012	0.103	1		
Common partners in trade	0.005	0.123	0.020	-0.068	-0.029	-0.230	0.072	-0.122	-0.074	0.055	-0.022	-0.109	-0.108	0.022	-0.156	-0.061	-0.071	-0.010	1	
Common partners in FDIs	-0.028	0.040	0.172	0.091	0.087	-0.171	0.170	-0.019	-0.036	0.024	0.077	-0.054	0.000	0.140	-0.072	-0.054	0.087	0.015	0.334	1

Notes. Variable definitions are provided in the text. Summary statistics are computed after excluding observations in the 1st and the 99th percentile of the distribution of the dependent variable. *Index_Norm* is the dependent variable including all observations. *Index_Norm (both trade and FDIs)* is the dependent variable after excluding all cases in which sector *h* of country *i* does not export and/or does not invest in country *j*. Wages are in thousand dollars. Correlations are calculated on 67,911 observations for all variables apart for *Index_Norm (both trade and FDIs)* that is calculated on 3,755 cases.

Table 3 – Trade vs. FDIs, wages and capital intensity

Variables definitions are provided in the text and in Table A. The dependent variable is *Index_Norm*. Column (1) reports estimates on the whole sample. Column (2) reports estimates on the subsample of sectors with wages below the median level. Column (3) reports estimates on the subsample of sectors with wages above the median level. Column (4) reports estimates on the subsample of sectors with capital intensity below the median level. Column (5) reports estimates on the subsample of sectors with capital intensity above the median level. Standard errors clustered by country pair are reported in parenthesis. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	All sample	Low wages	High wages	Low capital intensity	High capital intensity
Number of large firms	-0.046***	0.051***	-0.176***	0.066***	-0.099***
	(0.013)	*(0.011)*	*(0.033)*	*(0.018)*	*(0.018)*
TFP (log)	0.059***	0.048***	0.061***	0.108***	0.018***
	(0.004)	*(0.004)*	*(0.005)*	*(0.008)*	*(0.003)*
Size (log)	0.008***	0.007***	0.009***	0.011***	0.003***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
Tariffs	-0.001***	-0.001***	-0.001***	-0.001***	-0.000***
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Wage (log)	-0.007**	-0.024***	0.010***	-0.014***	0.013***
	(0.003)	*(0.006)*	*(0.003)*	*(0.005)*	*(0.003)*
Capital intensity	-0.097***	-0.053***	-0.180***	-0.397***	-0.048***
	(0.006)	*(0.007)*	*(0.013)*	*(0.028)*	*(0.007)*
Distance	0.008***	0.005***	0.009***	0.014***	0.001
	(0.001)	*(0.001)*	*(0.002)*	*(0.002)*	*(0.001)*
Contiguity	-0.007*	-0.008	-0.006	-0.015*	0.001
	(0.004)	*(0.006)*	*(0.008)*	*(0.008)*	*(0.005)*
Islands	-0.445***	-0.022	0.025	-0.091***	-0.007
	(0.034)	*(0.014)*	*(0.025)*	*(0.022)*	*(0.018)*
Landlocked	-0.603***	0.044**	-0.156***	0.049**	-0.093***
	(0.039)	*(0.018)*	*(0.017)*	*(0.019)*	*(0.014)*
Common legal system	0.001	0.005**	-0.002	0.005*	-0.004**
	(0.002)	*(0.002)*	*(0.003)*	*(0.003)*	*(0.002)*
Colonial ties	0.001	0.005	-0.005	-0.000	0.002
	(0.004)	*(0.004)*	*(0.006)*	*(0.005)*	*(0.006)*
Regulation cost	-0.003	-0.005	-0.001	-0.005	-0.004
	(0.003)	*(0.004)*	*(0.006)*	*(0.005)*	*(0.003)*
Regulation cost (days and proced.)	0.004	0.008*	0.003	0.004	0.005
	(0.003)	(0.004)	(0.007)	(0.006)	(0.004)
Common language	-0.011***	-0.010***	-0.010**	-0.013***	-0.006**
	(0.002)	*(0.004)*	*(0.004)*	*(0.004)*	*(0.003)*
Common religion	-0.019***	-0.016**	-0.018**	-0.036***	0.006
	(0.004)	*(0.006)*	*(0.007)*	*(0.007)*	*(0.005)*
Common partners in trade	0.001***	0.001***	0.001***	0.001***	0.000***
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Common partners in FDIs	-0.003***	-0.003***	-0.003***	-0.003***	-0.004***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
Observations	67,911	32,383	35,528	35,438	32,473
Adjusted R^2	0.146	0.249	0.183	0.187	0.143

Table 4 – Groups of countries

Variables definitions are provided in the text and in Table A. The dependent variable is *Index_Norm*. Column (1) reports estimates on the subsample of domestic countries belonging to the group of G-10 countries. Column (2) reports estimates on the subsample of domestic countries belonging to the group of OECD countries. Column (3) reports estimates on the subsample of domestic and foreign countries belonging to the group of OECD countries. Standard errors clustered by country pair are reported in parenthesis. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) G-10 (domestic)	(2) OECD (domestic)	(3) OECD (domestic and foreign)
Number of large firms	-0.138***	-0.119***	-0.069***
	(0.014)	*(0.014)*	*(0.023)*
TFP (log)	0.073***	0.072***	0.051***
	(0.007)	*(0.005)*	*(0.009)*
Size (log)	0.006***	0.008***	0.005***
	(0.001)	*(0.001)*	*(0.001)*
Tariffs	-0.001***	-0.001***	0.000
	(0.000)	*(0.000)*	*(0.000)*
Wage (log)	0.061***	0.044***	0.037***
	(0.005)	*(0.004)*	*(0.006)*
Capital intensity	-0.107***	-0.061***	-0.080***
	(0.010)	*(0.008)*	*(0.014)*
Distance	0.004***	0.006***	0.003
	(0.001)	*(0.001)*	*(0.002)*
Contiguity	-0.001	-0.001	-0.004
	(0.009)	*(0.004)*	*(0.005)*
Islands	-0.031***	-0.004	0.032***
	(0.006)	*(0.011)*	*(0.011)*
Landlocked	-0.020***	0.070***	0.009
	(0.007)	*(0.010)*	*(0.006)*
Common legal system	-0.005	-0.003	-0.009**
	(0.003)	*(0.002)*	*(0.004)*
Colonial ties	-0.000	0.001	0.002
	(0.007)	*(0.006)*	*(0.008)*
Regulation cost	0.000	0.000	0.000
	(0.000)	*(0.000)*	*(0.000)*
Regulation cost (days and proced.)	0.000	0.008	0.000
	(0.000)	*(0.006)*	*(0.000)*
Common language	0.000	-0.002	0.010
	(0.004)	*(0.003)*	*(0.006)*
Common religion same	-0.006	-0.005	0.009
	(0.007)	*(0.003)*	*(0.006)*
Common partners in trade	0.000***	0.000***	0.000*
	(0.000)	*(0.000)*	*(0.000)*
Common partners in FDIs	-0.004***	-0.004***	-0.002***
	(0.001)	*(0.001)*	*(0.001)*
Observations	23,430	41,631	10,453
Adjusted R^2	0.211	0.190	0.183

Table 5 – Robustness checks

Variables definitions are provided in the text and in Table A. Column (1) reports estimates of the non-linear effect of TFP. The dependent variable in Column (1) is *Index_Norm*. Column (2) reports estimates of the probit model. The dependent variable in Column (2) is *W* that takes the value of one if sector *h* of country *i* exports and invests in country *j*, and the value of zero if exports and/or FDIs are zero for a sector *h* of country *i*. Column (3) reports estimates on the subsample including all cases in which sector *h* of country *i* exports and invests in country *j*. The dependent variable in Column (3) is *Index_Norm (both trade and FDIs)*. Standard errors clustered by country pair are reported in parenthesis. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) Non-linearity in TFP	(2) Extensive margin	(3) Intensive margin
Number of large firms	-0.057*** *(0.013)*	0.652* *(0.355)*	-0.070* *(0.043)*
TFP 2nd quartile	0.000 *(0.001)*		
TFP 3rd quartile	0.008*** *(0.002)*		
TFP 4th quartile	0.062*** *(0.004)*		
TFP (log)		-0.037 *(0.060)*	0.038** *(0.015)*
Size (log)	0.008*** *(0.001)*	0.095*** *(0.015)*	0.000 *(0.003)*
Tariffs	-0.001*** *(0.000)*	0.006** *(0.003)*	0.000 *(0.000)*
Wage (log)	0.001 *(0.003)*	0.111* *(0.061)*	0.024* *(0.013)*
Capital intensity	-0.101*** *(0.006)*	0.087 *(0.166)*	-0.107*** *(0.030)*
Distance	0.008*** *(0.001)*	-0.455*** *(0.042)*	-0.003 *(0.005)*
Contiguity	-0.007* *(0.004)*	0.168 *(0.136)*	0.007 *(0.014)*
Islands	-0.458*** *(0.034)*	1.027*** *(0.393)*	-0.333*** *(0.112)*
Landlocked	-0.616*** *(0.039)*	0.677** *(0.327)*	-0.336*** *(0.115)*
Common legal system	0.001 *(0.002)*	-0.010 *(0.089)*	0.003 *(0.007)*
Colonial ties	0.001 *(0.004)*	0.203* *(0.116)*	-0.005 *(0.009)*
Regulation cost	-0.003 *(0.003)*	0.327 *(0.250)*	
Regulation cost (days and proced.)	0.004 *(0.003)*	0.036 *(0.347)*	
Common language	-0.010*** *(0.002)*	0.437*** *(0.121)*	
Common religion same	-0.019*** *(0.004)*	0.463* *(0.263)*	
Common partners in trade	0.001*** *(0.000)*	0.011*** *(0.001)*	
Common partners in FDIs	-0.003*** *(0.001)*	0.134*** *(0.013)*	
Mills ratio			0.006 *(0.011)*
Observations	67,911	48,167	3,755
Adjusted R^2	0.148	0.134	0.256

Table A - Variables description and sources
Description and sources of all the variables used in the empirical analysis grouped in four categories: Exports and FDIs, Total factor productivity, Sales, Other controls.

Definition	Description and Source
	Exports and FDIs
Exports	Value of exports from country *i* to country *j* in sector *h*. *Source*: UN Comtrade
FDIs	Value of mergers and acquisitions from country *i* to country *j* in sector *h*. *Source*: SDC Platinum
	Total factor productivity
TFP (log)	Natural logarithm of the average level of total factor productivity in sector *h* in country *i*. *Source*: UNIDO (Indstat4, 2008 version)
	Sales
Number of large firms	Number of firms in country *i* in the first and second decile of the world distribution of firm sales in a given sector *h*. *Source:* Worldscope Database
Size (log)	Natural logarithm of the average level of firm sales in sector *h* in country *i*. *Source*: Worldscope Database
	Other controls
Tariffs	Tariffs applied from country *j* to country *i* in sector *h*. Source: TRAINS
Wage (log)	Natural logarithm of average wages in sector *h* in country *i*. *Source*: UNIDO (Indstat4, 2008 version)
Capital intensity	Ratio between capital and number of employees in sector *h* in country *i*. *Source*: UNIDO (Indstat4, 2008 version)
Distance (log)	Natural logarithm of the average distance between city *i* and *j* calculated through the great circle formula that uses latitudes and longitudes of the most important cities (in terms of population). *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Contiguity	Dummy variable equal to 1 if country *i* and *j* share common borders. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Islands	Number of countries that are islands in the pair of countries *i* and *j*. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Landlocked	Number of countries that are landlocked in the pair of countries *i* and *j*. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Table A (continued)

Definition	Description
Common legal system	Dummy variable equal to 1 if country *i* and *j* share the same legal system. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Colonial ties	Dummy variable equal to 1 if country *i* and *j* have ever been in colonial relationship. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Regulation cost	Relative cost (as a percentage of GDP per capita) for an entrepreneur to legally start a business. *Source*: Helpman et al. (2008)
Regulation cost (days and proced.)	Number of days, the number of legal procedures for an entrepreneur to legally start a business. *Source*: Helpman et al. (2008)
Common language	Dummy variable equal to 1 if country *i* and *j* share the same language. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Common religion	Dummy variable equal to 1 if country *i* and *j* share the same religion. *Source*: CEPII http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Common partners in trade	Number of partners in trade common to country *i* and *j* in sector *h*. *Source*: UN Comtrade
Common partners in FDIs	Number of partners in FDIs common to country *i* and *j* in sector *h*. *Source*: SDC Platinum