Trade Complexity and Productivity

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This version: March 2009

Abstract

We exploit a panel dataset of Hungarian firms merged with product-level trade data for the period 1992-2003 to investigate the relation between firms' trading activities (importing, exporting or both) and productivity. We find important self-selection effects of the most productive firms, with seemingly larger fixed costs characterising the importing activity. As a result, failing to control for the importing activity leads to overstated productivity premia of exporters. We are able to attribute the larger self-selection effect of imports to the higher complexity of the latter activity. To this extent we construct some new indexes which evaluate for each firm its fixed costs of trading in terms of number of products, distance of destinations and contractual frictions underlying each trade transaction, and relate those to firms' productivity.

JEL classification: F12, F14, L25

Keywords: trade openness, firms' heterogeneity, productivity

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‡**Acknowledgements**: Financial support from the Micro-Dyn project of the EU 6th RTD Framework Programme is gratefully acknowledged. We wish to thank Peter Harasztosi for excellent research assistance and Gabor Korosi for invaluable help in dataset management. Balazs Murakozy provided very helpful insights on an earlier draft, while we thank for their comments Davide Castellani, Stephanie Haller, Gianmarco Ottaviano, as well as seminar participants in IEHAS Budapest, Perugia University, FEEM Milano, ESRI Dublin, IAW Tubingen, KU Leuven, ETSG Warsaw. The entire responsibility for errors and omissions remains on us.

1 Introduction

The positive relationship between trade exposure and aggregate productivity is nowadays well explained by a vast body of theoretical and empirical literature. In particular, capitalizing on the seminal papers of Melitz (2003) and Bernard et al. (2003), researchers have identified and tested a microeconomic channel in which gains in total factor productivity (TFP) are generated by the reallocation of economic activity across heterogeneous firms within industries. Due to the existence of trade costs, only the most productive firms self-select into export markets. As a result, when trade costs fall, industry productivity rises both because low-productivity, non-exporting firms exit (selection effect) and because high-productivity firms are able to expand through exporting (reallocation effect). Under these models, therefore, it is the reallocation of activity across firms, not the intra-firm gains in productivity growth, that boosts industry productivity.

The prevailing empirical evidence is consistent with the latter finding, with exporting activity having been found to have limited direct effects on firms' productivity. According to the literature, therefore, the most productive firms 'self-select' into exporting rather than 'learning' from it.

Recently available data, covering the full spectrum of firms' trade activities (imports and exports) and/or different countries, add to the picture, with evidence of fixed costs not only for exporting but also for importing, thus pointing to a process of self-selection in both export and import markets (Kasahara and Lapham, 2008). Moreover, when analyzing the performance of importers, different studies in different countries have all found similar results: as for the case of exporters, also importers have a variety of positive attributes, being bigger, more productive and more capital-intensive than nonimporters[1]. As a result, both imports and exports appear to be highly concentrated among few firms, and highly correlated. In all the studies considered, there is evidence that the increasing global engagement of firms in terms of traded number of countries and products is associated with better performances. For Belgium and Italy, in particular, two-way traders (i.e. firms that both import and export) appear to be the most productive, followed, in descending order, by importers only, exporters only and non-traders.

Such a new wealth of data opens up new questions in terms of the relationship between trade and productivity: if most exporting firms are also importers, and if firms seem to self-select also in the importing activity, what actually drives the productivity premia of trading firms? The paper aims at tackling the latter question, exploring the potential relationship between the various trading activities of firms and their productivity and explicitly disentangling the high correlation between importing and exporting activity, an issue which, if not properly controlled for, could lead to biased results in terms of productivity premia.

[1] See Bernard et al. (2005 and 2007) for US; Castellani et al. (2008) for Italy; Muuls and Pisu (2007) for Belgium; Andersson et al. (2007) for Sweden; Kasahara and Lapham (2008) for Chile.

To this extent, the paper exploits a dataset matching, for the case of Hungary, information on international transactions of firms at the product level with firm-level balance sheet data over a long time period, from 1992 to 2003. The case of Hungary constitutes an interesting quasi-natural experiment, since our data cover the early years of the transition process of the country, when both trade and foreign investment flows received a major boost induced by the signing of the free trade agreements with the European Union and the other Central and Eastern European countries, followed by later years (after 1999) in which conditions typical of a market economy started to prevail. As such, our data incorporates information on more than 7,000 cases of firms who switched their trade status during the considered period, over a total of some 192,000 firm-level observations.

Overall, in line with the results of Kasahara and Lapham (2008), we find a self-selection effect for both importing and exporting firms. However, we also find that, when taking into account the importing status of exporting firms, the self-selection of exporters is greatly reduced. In other words, failing to control for the importing activity leads to an overstated productivity premia of exporters. As in Bernard and Jensen (1999) for the export case, we find that productivity is a strong predictor of the probability of becoming a trader, with the coefficient higher for imports vs. exports. We also show that it seems to exist a clear ordering of firms in terms of productivity driven by the import, not the export status: firms who never import are less productive then firms switching into imports, who are in turn less productive than firms having always imported. Instead, the effect of exports on productivity tends to be heterogeneous within each of these importing groups[2].

Finally, we provide some rationale for the presence of fixed costs of imports, and the resulting self-selection of firms seemingly driving our results. To this extent, we build an index of complexity of the trading activity, combining for each firm the heterogeneity in terms of number of traded destinations, the distance of each destination as well as its institutional quality, as a proxy for contractual frictions. We find that the latter index, together with alternative measures of complexity, such as the number or variety of products, or the Rauch index of contractibility of the bundle of traded products, tend to be higher for importers than exporters, and strongly correlated to the firm's productivity. The latter evidence thus points to the fact that the strategic choice of importing seems to require a more complex organization of production than the choice of exporting, inducing a stronger self-selection effect in terms of productivity.

The paper is structured as follows. Section 2 presents data and preliminary evidence on trading activity. Section 3 discusses some measures of TFP for trading firms, while Section 4 presents the results of a number of models relating importing and exporting decisions to firms' productivity. Section 5 concludes.

[2] The heterogeneous effect of the export treatment across different groups of firms goes along the same lines of the results obtained by Lileeva and Trefler (2007).

2 Data and preliminary evidence

We use a large and comprehensive panel of Hungarian firms obtained by merging tax and customs data for the period 1992-2003. The first dataset contains accounting and financial data of Hungarian firms. The source of data is the Hungarian Tax Authority (APEH). This database represents more than 90% of Hungarian employment, value added and exports and is almost complete outside the scope of non-trading micro enterprises. To avoid a number of potential problems in the calculation of firms' performance, in this paper we have restricted the analysis to manufacturing data only, with the Appendix reporting the number of firms per year and by NACE2 industry[3].

The APEH dataset has then been merged at the firm-level with a trade dataset, containing transaction-level data as registered by the customs office. The unit of observation in this trade dataset is firm-product-destination. The dataset includes information on both the dollar value of shipments and their physical quantity. In this paper we define the amount of trade as the dollar value of shipments. We have measures of export and import varieties in terms of number of different HS6 category good the firm trades[4]. We also have information on the countries of origins and destinations firms export to or import from.

Finally, the dataset also contains information on a firm's ownership, and thus allows us to control for the presence of multinational firms[5], a critical dimension of our analysis since foreign-owned firms might be trading within their international network, and thus could differ along several dimension from other firms (Feinberg and Keane, 2001). The third table in the Appendix reports how relevant foreign-owned firms are in our dataset.

In our framework a firm can be in one of the following four trading status FZ in a given year: firms that both import and export (two-way traders); firms that either import or export (only importer and only exporter); firms not engaged in any trade activity (no traders). Moreover, a firm can remain permanently into that trade status, or switch from one trade status to another. To attribute each trade status to each firm, for the time being the export/import status is measured as a year-specific dummy equal to one if the value of export and/or import is positive in a given year. The first columns of Table 1 show the number of firms by their trade status.

More than 37.9% of firms export and more than 29.9% import in our dataset, showing the important role international trade plays in life of firms operating in a small and open economy, like Hungary. Also, more than half of trading firms conducts two-way trade, although we

[3] The dataset and features of various types of trading firms is presented in Békés et al (2008).

[4] "Motor cars and vehicles for transporting persons" is an example for a 4-digit category, while "Other vehicles, spark-ignition engine of a cylinder capacity not exceeding 1,500 cc" is an example 6-digit category. The number of varieties ranges in case of import from 1 to 797 and in case of export from 1 to 355.

[5] Throughout the paper, a firm is considered as foreign-owned if at least 10% of its capital is controlled by a foreign owner. We carried out robustness checks on the threshold. Given that most foreign acquistion leads to majority ownership within a few years, results are not at all sensitive to raising the 10% threshold to, say, 25%.

Table 1: Trading activity and firms' characteristics

Trade status	*N. of obs.*	*Firms' characteristics*			
		Sales (a)	Employment	VA (a)	Avg.wage (a)
No traders	101,485	42.25	9.59	12.7	0.55
Exporters	12,074	83.41	17.29	23.56	0.67
Importers	28,627	155.44	17.31	42.33	0.84
Two-way traders	50,162	1409.62	117.43	375.5	0.95

(a) In Million HUF

find a large number of firms in each category, showing the heterogeneity of firms' trade statuses. Table 1 also shows the most important characteristics of firms with a different trading status. Trading firms perform better in all dimensions: they are larger, generate higher value-added and pay higher wages. Two-way traders are the highest performers, followed by only importers and only exporters. The differences are large and significant.

Table 1 provides a static comparison of trading firms. However, looking at the data over time, we find that 32% of our firms have altered their trade status within four years. In order to evaluate the persistency of the import and export status and the transition probabilities from one type of trading activity to the other, we have constructed a transition matrix of the various trade status FZ in which firms are engaged. Table 13 shows the transition matrix of firms observed for two periods: from 1993 to 1997 and from 1998 to 2003. We can see that the dynamics do not differ much among the two periods, thus signalling that the transition process did not seem to alter dramatically the trading strategies of firms throughout our sample[6]. Two features characterize our transition matrixes. First of all, we find evidence of the persistency of the two extremes in the trade status. Looking at the relative magnitude of the figures for non traders or two-way traders along the diagonal of the matrix, it is in fact true that firms who were in one of these two trade statuses at the beginning of the period (1993 or 1998) are likely to remain in the same trade status at the end of the period (1997 or 2003).

Second, similarly to the results of Kasahara and Lapham (2008) for Chile, we find that firms who originally only import or export have a probability of remaining in the same trade status comparable to the one of becoming either two-way traders or non traders[7]. Such persisting turbulence in the off-diagonal part of the transition matrix thus signals the fact that some firms have a transitory experience of trading, then reverting back to a non trading

[6] Additional evidence, available on request, also shows that the presence of switching firms is balanced across sectors. The only relatively significant difference in terms of timing is that no-traders are slightly less likely to remain in the same status in the second period of our analysis, with 79% of firms not engaged in any trade activity in 1993 remaining such in 1997, compared to 68% for the period 1998-2003. The latter findings are consistent with the increasing opening up of the Hungarian economy along the transition to the market.

[7] This is especially the case in the period 1993-1997, and, to a certain extent, also in the period 1998-2003 for exporting firms. The importing status seem to persist more in the 1998-2003 period.

status, while some others, once they start trading, tend to move to the full spectrum of the trading activities, becoming two-way traders (the probability being the same whether they come from an import or export status). It thus seems that -in a small and open economy- importing or exporting only tends not to be a steady state equilibrium strategy for the majority of firms.

The preliminary evidence thus shows that trading firms seem to differ in a number of characteristics from non-traders, but also points to a certain heterogeneity both across the different trade statuses and over time. The next section tries to link these findings to firms' productivity premia.

3 TFP measurement in trading firms

The measurement of firm-level total factor productivity (TFP) for trading firms is subject to a number of econometric problems. In this exercise, we use a modified version of the standard semiparametric TFP measure of Olley and Pakes (1996, henceforth OP). We start from a log-linearized Cobb-Douglas production function of the form

$$y_{it} = \beta_0 + \beta_l \, l_{it} + \beta_k \, k_{it} + e_{it} \tag{1}$$

where the log of output (value-added) of firm i at time t, y_{it}, is a function of the log of labor input l and the log of the capital input k. It is assumed that $e_{it} = \omega_{it} + \epsilon_{it}$, and ω_{it} follows a first order Markov process.

The calculation of TFP as the Solow residual of the estimated Equation 1, with no a priori assumption imposed on the industry-specific returns to scale, is subject under OLS to a well-known simultaneity problem, accruing from the fact that profit-maximizing firms can immediately adjust their inputs each time they observe a productivity shock, which makes input levels correlated with the same shocks.

Moreover, a second endogeneity problem arises from sample selection, induced by the fact that firms leave the market when productivity falls below a certain threshold. Since surviving firms will have a TFP derived from a selected sample, ignoring this selection mechanism may bias estimates of productivity. Finally, given the heterogeneity we have detected in the preliminary analysis, it might be the case that the firm's decision to invest or exit the market is quite different for different types of trading firms, and thus the trade status should not be treated as exogenous when estimating TFP.

In order to tackle all these problems, we follow Amiti and Konings (2007) and measure firms' TFP through an industry-specific two-stage estimation, in which we control for the simultaneity bias induced by the productivity shock, the selection equation of firms' survival and the impact of the firm's trade status (importer, exporter or both) on input choices. In terms of regressors, as it is common in the literature, we have used value added to proxy

output, the number of employees as a proxy for the labour input, and the deflated value of tangible fixed assets as a proxy for capital. In particular, we have deflated our balance sheet data using disaggregated industry price indexes.

However, using national PPIs to deflate balance sheet data does not control for the fact that output and factor prices might be different and/or evolve differently over time for trading firms, which might induce an omitted price variable bias in our estimates. The problem is particularly relevant for importing firms, since, as acknowledged by Amiti and Konings (2007), differentials in TFP across firms might accrue from differences in domestic and (imperfectly measured) import prices, rather than actual changes in the quality of imported inputs. To control for such a price effect in TFP estimation, we have carried on two adjustments to the standard methodology.

First, we have calculated the real value added variable by taking into account two potential sources of inputs, domestic and international ones. Since we do not have a deflator for imported inputs, but we have information on the source of imports, we have used the real exchange rate in order to deflate for trading firms the imported inputs differently from the domestic ones.

Second, we have introduced some changes to the semi-parametric estimation algorithm currently used in the literature. Amiti and Konings (2007, henceforth AK) have already proposed that import and export decisions at time $t-1$ should be treated as additional state variables, together with productivity and capital, in the firm's investment demand function. Formally, AK rewrite Equation 1 as:

$$y_{it} = \beta_l \; l_{it} + \Phi_{it}(I_{it}, k_{it}, FM_{it}, FX_{it}) + \eta_{it} \tag{2}$$

where they exploit the fact that the investment demand function of the firm I_{it} can be written as a function of four states variables: capital k_{it}, productivity ω_{it}, the import status (FM) and the export status (FX). The latter, once inverted, gives an expression for productivity as a function of investment, capital and the trade status[8]. Since productivity is incorporated in the error term e_{it} of Equation 1, by substituting its expression as a function of the state variables yields Equation 2. The latter, once estimated through semi-parametric procedures and a survival equation, allows to recover consistent estimates of the input coefficients, and thus obtain an unbiased TFP measure.

As shown in Eq. 2, the AK algorithm incorporates two dummy variables, one for importing firms and one for exporting firms in the investment equation. However, given that productivity may be differently affected by the characteristics of the imported goods, and that the latter are likely to be correlated to the factor intensities / institutional environment of the country from which imports are sourced (Nunn, 2007), we have further refined the

[8] The main assumption of the OP technique is based upon the existence of a monotonic relationship between investment and the unobserved heterogeneity at the firm-level.

Table 2: Trading activity, productivity premium and firms' ownership (a)

Trade status	*N. of obs.*	*TFP (b)*			
		LP	OLS	OP-AK	OP-AK(1)(1)
No traders	101,485	0.69	2.44	0.64	0.68
Exporters only	12,074	0.7	2.85	0.83	0.87
Importers only	28,627	1.32	2.79	1.26	1.29
Two-way traders	50,162	1.48	4.15	1.54	1.61

(b) LP: Levinsohn-Petrin (2003) semi-parametric algorithm;

OP: modified version of Olley-Pakes (1996) algorithm as in Amiti and Konings (2007).

OP1: modified version of Amiti and Konings (2007) with different import dummies

estimation algorithm by including two separate dummies for firms importing the largest part of their inputs from low vs. high-wage countries, thus in principle better discriminating between labor-intensive, low-priced imports and high-quality, capital intensive ones. Hence, the investment demand equation in our estimation algorithm incorporates three state variables related to the trade status of the firm[9].

$$y_{it} = \beta_l \; l_{it} + \Phi_{it}(I_{it}, k_{it}, FML_{it}, FMH_{it}, FX_{it}) + \eta_{it} \tag{3}$$

where the import status is now split into import from low wage (FML) as well as high wage (FMH) countries.

By treating imported inputs differently from domestic ones, and by considering where imports originate as well as their presence, the risk of picking up a price effect in our estimated TFP for imported firms should be reduced.

Table 2 reports the average TFP for the different groups of trading firms in our sample. In particular, consistently with the analysis of firms' characteristics discussed in the previous section, the data show that shows that two-way traders are almost twice as productive as non-trading firms. Moreover, the difference between non-traders and exporters is relatively small, while the productivity of only importers is closer to that of two-way traders. For robustness, we present in Table 2 the results with TFP calculated following OLS, the standard semi-parametric estimation suggested by Levinsohn and Petrin (2003), the AK procedure and our refined algorithm for the measurement of TFP, denoted as AK1. Results are robust across all methods, with TFP measures slightly differing in the point estimates, but a significant difference in terms of trade status always confirmed.

Graph 1 confirms the ranking of productivity not only for the mean firm, but also in

[9] Three dummy variables measuring if a firm imports from a low-wage vs. high-wage economy, or if it exports. Relative low-wage economies were defined as having no more than 50% higher wages than the destination country, Hungary. Relative high-wage economies were defined as having more than 50% higher wages than Hungary. Relative capital intensive economies are basically from Western Europe, North America and Japan. All Central and Eastern Europe and most of Asia belongs to the other category.

Table 3: Trading activity, productivity premium and firms' ownership (a)

Trade status	*All*	*Domestic*	*Foreign-Owned*
No traders	0.68	0.68	0.69
Exporters only	0.87	0.88	0.84
Importers only	1.29	1.22	1.49
Two-way traders	1.61	1.44	1.77
Average	1.07	0.94	1.42

(a) TFP retrieved from modified version of Amiti and Konings (2007) with different import dummies.

terms of dominance of the cumulative distribution of (log) TFP, using both our modified AK algorithm and the Levinsohn-Petrin (2003) measure as robustness check. The same ranking remains constant within each industry of our dataset[10]. In terms of variation over time, the ranking is constant across the years, but the size of the different premia varies. In particular, Graph 2 shows that while importers have a roughly constant TFP premium over time, the exporter-only premium is shrinking and the TFP gains for two-way traders grows.

[Graphs 1 and 2 about here

The ranking of productivity by trade status is also confirmed when partitioning our sample according to ownership, as shown in Table 3. For both domestic and foreign-owned firms, two-way traders are the most productive group, followed by importers, exporters and non traders. Simple TFP averages reveal that foreign-owned firms are more productive than domestic ones, consistently with the theory. When disentangling this information across the trade status, domestic and foreign-owned firms do not differ much in terms of productivity when they are either non trading or exporting only[11], while foreign-owned firms become significantly more productive than domestic ones if they are importer or two-way traders.

All these results consistently show that the importing activity seems to be more strongly associated with higher productivity levels than exporting. The latter might imply that the selection process of firms is different for exporting and importing, an issue to which we now turn.

[10] The only slight deviations have been detected in industry NACE-19 (leather) with exporters slightly more productive than importers, and NACE-26 (metals), where exporters and non traders showed a very similar TFP. These are however sectors accounting for less than 7% of total firms in our sample, as reported in Table 2.

[11] A closer look at the productivity distribution of these firms for those two trade status reveals that the least productive firms are domestic non-traders, and the most productive ones are foreign-owned exporters, consistently with the theory. Some slight deviations from the log-normal distribution of TFP then lead to simple means becoming quite similar.

4 Trading activities and productivity

4.1 Importers vs. Exporters

With respect to the previous evidence, some unobserved firms' characteristics, associated to both TFP and the trade status, might induce a spurious correlation between the trading activity and productivity. For instance, we have seen that foreign ownership affects productivity a great deal and the share of foreign firms is higher among traders than non-traders. As a result, we need to validate these results via a multi-variate regression. To this extent, we have estimated the following Equation 3:

$$\omega_{it} = \beta_0 + \beta_1 FZ_{it} + \beta_2 X_{it} + a_z + a_t + \varepsilon_{it} \tag{4}$$

where the level of TFP of each firm ω_{it} is regressed against a dummy indicating the trade status of the firm FZ at time t, a number of firms' characteristics X ((such as firm size (log annual employment), foreign firm (ownership dummy: foreign if foreign equity above 10%), and Firm age, proxied by time spent in the sample), industry and time dummies.

The results, presented in Table 4, show that, when considering exporters, as it is standard in the literature (Column 1) we retrieve the usual positive correlation with TFP, even when controlling for firms' characteristics typically associated with productivity. However, recalling our results on the importing activity of firms, such a model specification overlooks the fact that some of those exporters might also be involved into importing activities, and thus, to the extent that import and exports activities take place jointly, the productivity premium of exporters might actually derive from their import, rather than export, status. In fact, if we add the import status in our regression (Column 2), we find that also the importing activity is positively and significantly correlated with productivity and, most importantly, that the inclusion of the import dummy lowers the magnitude of the productivity premium for exporters by more than 50%.

Clearly, a possible explanation of this finding is that the import and export dummies might be correlated, to the extent that the majority of our firms are two-way traders. The latter correlation would then be driving both results. To clarify things, in Column 3 we have thus partitioned our sample in mutually exclusive categories (only importers, only exporters, two-way traders), always controlling for firms' characteristics and keeping non traders as the control group. As it can be seen, every trade activity is positively and significantly associated to productivity, with our ranking of productivity premia by trade status confirmed. In particular, two-way traders are on average 62% more productive than non-traders, followed by importers (46%), while being only an exporter adds 15% to TFP.

As a further check, in Columns (4) and (5) we have run the import and export dummies on the restricted sample of exporting firms and importing firms (thus excluding non traders): again, we find that the premium in terms of TFP accruing to two-way traders is larger when

Table 4: Productivity level, firm characteristics and trading activity

Sample		Full sample		Exporters	Importers
Dep var: TFP (a)	(1)	(2)	(3)	(4)	(5)
FZ= Exporter	0.362***	0.157***			0.149***
	[58.17]	[22.96]			[15.73]
FZ= Importer		0.463***		0.450***	
		[69.42]		[40.34]	
FZ= Importer only			0.461***		
			[55.94]		
FZ= Exporter only			0.152***		
			[15.20]		
FZ. Two-way trader			0.621***		
			[87.04]		
Firm age	0.0453***	0.0449***	0.0449***	0.0442***	0.0447***
	[36.57]	[36.83]	[36.83]	[24.06]	[25.37]
Firm size	0.163***	0.141***	0.141***	0.131***	0.139***
	[69.77]	[60.07]	[59.58]	[38.99]	[44.11]
Foreign firm	0.209***	0.142***	0.142***	0.239***	0.258***
	[30.89]	[21.30]	[21.20]	[28.38]	[31.54]
dummy: sector	yes	yes	yes	yes	yes
dummy: sector	yes	yes	yes	yes	yes
dummy: sector	yes	yes	yes	yes	yes
Constant	0.0135	0.11	-0.0642	-1.076***	-0.651***
	[0.0698]	[0.572]	[-0.332]	[-17.19]	[-13.32]
Observations	149797	149797	149797	56695	69822
R-squared	0.25	0.275	0.275	0.295	0.236

Value of t statistics; ** significant at 5%; *** significant at 1%

(a) log of level TFP retrieved from modified version of Amiti and Konings (2007) with different import dummies.

it comes from exporters adding the importing activity, rather than importers which add export and become two-way traders, always controlling for firms' characteristics.

These results may also depend on our definition of a trading firm, which insofar follows the standard in the literature: a year-specific dummy equal to one if the value of export and/or import is positive in a given year. Such a definition actually entails two problems: the size of trade exposure varies across firms, with e.g. some firms exporting 90% of their output while others only 5%; and the timing of the trade exposure, with quite a good deal of firms trading only in some years, and then reverting back to a non trading status, as confirmed by our analysis of the transition matrix.

As a robustness check, we have therefore run our specification including as additional firm-specific control the share of export to sales and the share of import to sales. Moreover, we have also employed a more restrictive definition of trading firms, considering as exporters (importers) those firms who have exported (imported) at time t at least 0.5% of their sales for more than 50% of the time between t and exit/end of sample[12]. In both cases, the results, available on request, have confirmed the prominence of importers, rather than exporters in terms of productivity premia, with the size of the premia very similar to the ones reported in Table 4.

Once endowed with this evidence on the relation between imports and firms' performance, we are interested in exploring the possible channels leading to the import vs. export decision. To this extent, we have followed Bernard and Jensen (1999) estimating a linear probability model of starting a trading activity of the form

$$T_{it} = \alpha + \beta_1 \omega_{it} + \beta_2 X_{it-1} + \gamma T_{it-n} + \Phi + \varepsilon_{it} \tag{5}$$

where T is a dummy variable taking value 1 if a firm is an exporter (importer) and 0 otherwise. TFP is denoted by ω_{it} and plant characteristics, such as such as firm size (log annual employment), firm wage level (log firm level average gross wage) and foreign firm (ownership dummy: foreign if foreign equity above 10%) are included in the vector X, while Φ is a vector of industry, region and time fixed-effects. Regressors are lagged one year to reduce possible simultaneity problems.

The results reported in Columns (1) and (2) of Table 5 for the average exporter and importer, respectively, show that the trade activity is highly persistent (the variable T_{-n} is always positive and significant), and associated to similar firm's characteristics as above (foreign ownership, size). Most importantly for our goals, we find that productivity is a much stronger predictor of the probability of becoming an importer (0.25) than an exporter (0.18).

Once again, as a robustness check we have run again our specification on the more

[12] This is the definition employed by Mayer and Ottaviano (2007) in their study of EU trading firms.

Table 5: Probability of being a trader

VARIABLES Dep. var: Probability	exporter	VARIABLES	importer
TFP	0.179***	TFP	0.245***
	[34.81]		[44.33]
exported $(t-1)$	1.699***	$(t-1)$	1.638***
	[187.5]		[185.7]
exported $(t-2)$ not $(t-1)$	0.387***	imported $(t-2)$ not $(t-1)$	0.377***
	[25.45]		[26.53]
Firm size	0.236***	size (log of employment)	0.189***
	[70.02]		[58.09]
Firm wage	-0.0102**	log (avg. wage.)	-0.0111***
	[-2.313]		[-3.156]
Foreign firm	0.435***	dummy: foreign owned	0.479***
	[44.15]		[48.88]
dummy: county	yes	dummy: county	yes
dummy: year	yes	dummy: year	yes
dummy: sector	yes	dummy: sector	yes
Constant	-2.019***	Constant	-1.169***
	[-33.50]		[-18.95]
Observations	149041	Observations	149041
Pseudo R-squared	0.438	Pseudo R-squared	0.417

restrictive definition of trading firms, finding virtually identical results, reported in Columns (3) and (4) of Table 5.

All the above evidence is thus consistent with the conclusion that exporters are relatively more similar in terms of productivity to non-traders, while importers and two-way traders are much more productive. In other words, there is evidence consistent with a possible self-selection effect of importers and the associated productivity premium, an effect larger than the one entailed by exports. Failing to control for the importing activity within the exporting firms might thus lead to an overstated productivity premia of exporters, a finding insofar largely neglected by the literature.

4.2 Switching firms

Data reported in Section 2 showed that about one-third of firms have altered their trade status within four years, with many firms switch from being a non-trader to importing or exporting activity. A small but not negligible group of firms switches from no trade to two-way trade in the same year. Focusing on switching firms allows to inspect how adding a trade activity alters the performance of the firm with respect to its pre-switch productivity, thus deriving insights on the potential self-selection of firms into the same trade activity.

In order to prevent the already discussed phenomenon of 'occasional' traders to bias

Table 6: Switching into different trading activities and productivity (a)

		Num. Firms	TFP (t)	TFP (t-1)	D	D*
New import (t)	Total	3964	1.14	0.84	31.1%	24.2%
	o/w. no trade in (t-1)	3505	1.12	0.82	34.1%	26.6%
	o/w. exported in (t-1)	459	1.27	0.95	18.9%	14.4%
New export (t)	Total	3662	1.19	0.92	20.7%	16.2%
	o/w. no trade in (t-1)	2448	1.01	0.70	20.4%	16.0%
	o/w. imported in (t-1)	1214	1.56	1.30	20.9%	16.4%
New two-way (t)	no trade in (t-1)	1135	1.14	0.67	32.9%	29.7%
Never switchers	Total	26320	1.01			
	o/w. Nontraders	18236	0.71			
	o/w. Importer only	2764	1.40			
	o/w. Exporter only	1022	0.87			
	o/w. Two-way trader	4298	1.63			

(a) TFP retrieved from modified version of Amiti and Konings (2007) with different import dummies.

(b) D=[ln(TFP)t+2+ln(TFP)t+1]-[ln(TFP)t-2+ln(TFP)t-1];

D* is constructed in similar way, with the firm-specific TFP of the switcher

normalized to the industry mean in the corresponding year used in the calculation

upwards our count of firms changing trade status, we define as 'switcher' a firm which in a given year starts to either import or export (or both) at least 5% of its output, and then does not revert back to the previous status in the remaining of the time in which it is present in the data. Thus, consistently with a self-selection hypothesis induced by fixed costs, we only consider 'permanent' switchers.

Table 6 summarizes the characteristics of switching firms in terms of TFP, the latter being always calculated following the AK1 modified semi-parametric algorithm. In particular, Table 6 reports, for every type of switch and for non-switching firms, the average level of TFP in the year t in which the switch has taken place and the TFP at time $t-1$.

As it can be seen, the average ex-ante productivity of non-trading firms who switch into import is significantly higher than the ex-ante TFP of non-trading firms switching into export (.82 vs. .70). However, if we just consider a generic 'export-premium' in terms of productivity, as much of the literature has been doing, we would (incorrectly) claim that switchers into exports are ex-ante much more productive than non trading firms (.94 vs. .68), but this is essentially driven by the fact that, among the switchers into exports, there are very productive importing firms (ex-ante TFP of 1.32). Failing to account for the presence of importers thus largely overstates the relevance of export switching in terms of productivity performance, consistently with previous results.

In order to derive a more complete picture of switching firms we also control for the average growth of productivity around the switch. The TFP growth rate is calculated as $D = [\ln(TFP)_{t+2} + \ln(TFP)_{t+1}] - [\ln(TFP)_{t-2} + \ln(TFP)_{t-1}]$, i.e. the average change in productivity obtained in the two years after the switch with respect to the performance of the two years before the switch. To control for possible common industry and time-specific shocks which, in a given industry/year might affect productivity for all firms (thus including the switchers), we have also constructed a variable D^* where the firm-specific TFP of the switcher has been normalized for the industry mean in the corresponding year used in the calculation. As it can be seen in the last two columns of Table 6, there seems to be a positive correlation between the switch into a new trade activity and productivity growth at the firm level for both importers and exporters: both our variables D and D^* are always positive and very similar[13]. It then follows that the stronger self-selection effect detected for importers does not seem to be driven by some unobserved characteristic according to which only firms switching into importing experience TFP growth rates.

Rather, we find that, when performed jointly, the importing and exporting activities tend to be associated to the largest productivity gains ($D = 35.3\%$), consistently with the idea of Kasahara and Lapham (2008) of a complementarity in the joint performance of the trading activity[14]. However, we do not find robust evidence indicating that adding export (import) when a firms is already an importer (exporter) yields a higher growth in TFP than adding exports (imports) alone from a non-trade status. The latter result thus seems to exclude an optimal sequence of switches in trade status going from importers to exporters or vice versa.

To validate these findings we have run the following multivariate regression:

$$\omega_{it-1} = \beta_0 + \beta_1 \Delta FZ_{it} + \beta_2 X_{it} + a_j + a_t + \varepsilon_{it} \tag{6}$$

where we have regressed the level of TFP of each firm ω_i at time $t-1$ against the switch in the trade status of the firm, measured through a dummy variable ΔFZ taking value 1 if a firm permanently switched to a new status (export or import) at time t and 0 otherwise. In the regression we control for a number of firms' characteristics X (such as firm size (log annual employment), foreign firm (ownership dummy: foreign if foreign equity above 10%), and Firm age, proxied by time spent in the sample), industry and time dummies.

In Columns (1) and (2) of Table 7 we have checked whether firms permanently switching

[13] The latter finding is consistent with some evidence detected for exporting firms by De Loecker (2007) on Slovenia, another small open economy under transition, and for importing firms by Halpern et al. (2005) on similar Hungarian data.

[14] They show that in the Chilean case a firm can save approximately 20 per cent of the per-period fixed costs associated with trade by simultaneously engaging in both export and import activities. We also find that the ex-ante productivity of firms switching into two-way trading (.68) is some 15% below the one of switchers into import or export status alone. However, around 50% of firms switching to two-way trade are part of multinational groups (i.e. they are likely to face lower barriers to internationalisation), while MNE affiliates represent only some 20% of switchers in the import or export-only case.

Table 7: TFP and switching

Trade activity	Exporters	Exporters	Importers	Importers
SAMPLE	NT-EXP	NT-EXP IMP-2way NT-2way	NT-IMP	NT-IMP EXP-2way NT-2way
Switch dummy (FZ)	-0.0269	-0.0336	0.126***	0.0591**
	[-0.809]	[-1.276]	[4.361]	[2.480]
Firm size	0.191***	0.198***	0.191***	0.180***
	[46.18]	[55.50]	[46.29]	[47.21]
Foreign firm	-0.0300**	0.143***	-0.0281**	-0.0410***
	[-2.345]	[13.32]	[-2.200]	[-3.484]
Firm age	0.0557***	0.0561***	0.0554***	0.0551***
	[24.61]	[27.85]	[24.60]	[26.45]
Ex-socialist firm	-0.0177*	-0.0501***	-0.0171*	-0.0206**
	[-1.767]	[-5.537]	[-1.711]	[-2.197]
Controls: region	yes	yes	yes	yes
Controls: sector	yes	yes	yes	yes
Controls: year	yes	yes	yes	yes
Constant	-0.591***	7.385	-0.580***	-0.732***
	[-10.13]	[]	[-9.999]	[-14.13]
Observations	63741	82360	64068	71804
R-squared	0.173	0.185	0.172	0.167

at time t from a no-trade status to the exporting-only vs. the importing-only activity, respectively, are characterized by a productivity level at time $t-1$ significantly higher than non-trading firms. To broaden the scope of our analysis, in Columns (3) and (4) we have included firms switching, respectively, into exporting vs. importing activity from any other trade status, comparing their productivity levels at time $t-1$ to other non-switching firms.

The results show that firms switching into exports-only do not differ ex-ante from non-trading firms, while firms switching into imports-only are ex-ante 12.5% more productive than the average non-trading firm. The results hold controlling for or a number of firms' characteristics, as well as industry, time and regional dummy. The same is true when we consider a more general case of switching into export (import) from any other trade status: in this case, firms switching into imports are ex-ante 6% more productive than the control group.

Thus, we confirm our finding that self-selection of firms into trade seem to be a feature of the importing, rather than the exporting, activity.

Having seen the ex-ante relationship, we turn to testing if the probability of adding a new trade activity is affected by TFP, running on the sample of switching firms the following specification:

$$T_{it} = \alpha + \beta_1 \omega_{it-1} + \beta_2 X_{it-1} + \Phi + \varepsilon_{it} \tag{7}$$

Table 8: Probability of adding a new trade function

	0 to export	0 to import	imp to 2-way	exp to 2-way
	Taking up first trade		**Second Trade**	
TFP	0.0521***	0.166***	0.108***	0.230***
	[3.024]	[9.845]	[5.319]	[4.913]
Firm size)	0.0822***	0.0215*	0.103***	0.135***
	[6.152]	[1.860]	[7.578]	[5.541]
Firm wage level	-0.0570***	-0.0801***	-0.0395*	-0.0707
	[-2.634]	[-3.958]	[-1.830]	[-1.370]
Foreign firm	0.0742*	0.0327	0.228***	-0.0266
	[1.753]	[0.875]	[5.557]	[-0.337]
dummy: year	yes	yes	yes	yes
dummy: sector	yes	yes	yes	yes
dummy: county	yes	yes	yes	yes
Constant	-1.597***	-1.882***	-1.009***	-1.581***
	[-8.586]	[-11.04]	[-4.952]	[-3.767]
Observations	70446	70641	19123	7549
Pseudo R-squared	0.0702	0.0771	0.0548	0.0739

where T is a dummy variable taking value 1 if a firm does take up a new trading mode and 0 otherwise. TFP at $t-1$ is denoted by ω_{it-1} and plant characteristics, such as firm size (log annual employment), firm wage level (log firm level average gross wage) and foreign firm (ownership dummy) are included in the vector X_{it-1}, while Φ is a vector of industry, region and time fixed-effects. Regressors are lagged one year to reduce possible simultaneity problems. Results are presented in Table 8. We consider two comparisons: non-trading firms starting to export (Column 1) vs. non trading firms starting to import (Column 2); firms that did import starting to export (Column 3) vs. firms that did export starting to import (Column 4). As usual, regressors are lagged one year to reduce possible simultaneity problems, and we have added controls for firms that switch early in their life (basically those who were established to start exporting right away).

Consistently with the previous results, we find that, for both comparison, productivity is a much stronger predictor of the probability of becoming an importer than an exporter (0.166 vs. 0.0521 and 0.230 vs. 0.108, respectively)

4.3 Self-selection

The relevance of the importing status in self-selecting firms is also evident by looking at Graph 3, where we show the average TFP premium of firms categorized by trade status with respect to the average TFP of the entire sample. As it can be seen, a change in the import status clearly partitions the sample of firms in three sub-groups, ranked in terms of TFP from no importer (whose productivity is 21% below the average firm in the sample)

to new importer (14% more productive) to permanent importer (42%). No such clear-cut selection can be obtained looking at the export status only: as it can be seen, firms who start exporting can be either above or below the average TFP, depending on their import status[15].

[Graph 3 about here]

All the evidence collected insofar is thus consistent with the idea that the actual self-selection of Hungarian firms in international markets takes place via the importing, rather than the exporting, activity; we have also showed that such a self-selection effect seems to derive from features endogenous to the importing activity, rather than to individual firms' characteristics or the timing of their exporting vs. importing decision. In the next section we argue that the latter is due to the inherently higher complexity of the importing vs. the exporting activity.

5 Complexity of trade

We have seen that the trade status partitions firms in terms of ex ante productivity, an effect likely driven by the existence of important fixed costs for both the importing and exporting activities, as shown by Kasahara and Lapham (2008) for Chilean firms. We have also found that these fixed costs, to the extent that they drive self-selection, are not homogeneous across trade statuses, since they seem to be more important in the case of importing and two-way trading firms. We can thus postulate that fixed costs are actually heterogeneous across firms (as already detected by Das, Roberts and Tybout, 2001 in the case of exporting activities) and explore the possible sources of this heterogeneity.

In particular, we test the hypothesis that fixed costs are associated to the degree of complexity of the trade activities undertaken by each firm, itself endogenously driven by the underlying productivity of the firm. Our previous findings would therefore imply that ex-ante more productive firms are active into more complex trade activities. [ref. to Schroder-Jorgensen EER08 and the organization literature]

We employ here three proxies for complexity. The number of HS2 categories ($HS2$) of goods traded by each firm is used as proxy for technological complexity, the idea being that dealing with products pertaining to different HS2 industry entails the use of different technologies and thus potentially lower economies of scale/scope for the firm[16]. The Rauch index

[15] We find changes in the export status to be correlated with the productivity of the considered firm in line with previous empirical evidence (effects grow larger from no exporter, to new exporter to permanent exporter); however, the effects in terms of productivity are of a second-order magnitude with respect to the partitioning generated by the import status. These results are confirmed. These results are confirmed by a multivariate regression, available on request, controlling for a number of firms' characteristics, as well as industry, time and regional dummy and the average growth rate of TFP in the given industry/year.

of product differentiation (*Rauch*), constructed as a weighted average of each bundle of products traded by the firm, is used as a proxy for organizational complexity, the idea being that the more differentiated the traded goods are, the more relationship-specific (thus involving higher sunk costs) the trade transactions are likely to be (Nunn, 2008). Finally, we construct a composite index of complexity (C_Index) encompassing the number of countries the firm trades with (a proxy for the transaction costs), weighted by their geographical distance (a proxy for transport costs) and the quality of their institutions (a proxy of organizational costs), as a broader measure of trade complexity. In particular, the index is constructed for each year t as follows:

$$C\_Index = \sum_i reldist_i * relRoL_i$$

where $reldist$ is the relative distance (in logs) between country i and the closer country to Hungary, while $relRoL$ is the yearly value of the World Bank indicator of institutional quality (Rule of Law) for country i, rescaled on an index ranging from 1 (best institutional system) to 2 (worse)[17]. As a result, if a firm trades only with the closest country to Hungary, which has also the highest level of institutional quality, the C_index of that firm would be 1, which constitutes the natural lower bound of this continuum index of complexity.

Table (9) reports some descriptive statistics on the average value of these three measures of complexity for our different types of trading firms. As it can be seen, importers only tend to have a larger complexity of their trade transactions with respect to exporters only, although the picture gets less straightforward when two-way traders are taken into account. In order to gather some initial insights on the correlation between complexity of the trading bundle and firms' TFP, we first regress TFP on the complexity of the import bundle controlling for the usual firms' characteristics. We add an export dummy to pick up higher TFP of two-way traders together with a cross term of complexity. The same exercise is then repeated for exporting firms. Results are presented in Table (17) of the Appendix. We find that TFP is positively affected by complexity, with the import bundle being a slightly more important determinant.

To shed more light on these issues, Table (10) reports the result of a multivariate regression in which (lagged) TFP of switching firms is regressed against our three measures of complexity plus our firm-specific controls and industry and time dummies: results show that the ex-ante productivity of firms switching into imports is positively and significantly

[16] We have also experimented with the number of HS6 products, obtaining very similar results. However, a broader range of products traded by the firm within the same industry might not proxy necessarily complexity, but rather a love for variety effect.

[17] The original Rule of Law indicator ranges from -2.5 to 2.5. Note that, since the closest country to Hungary is at 114Km, while the furthest at some 18.000Km, taking the ratios of log distances implies that the distance variable ranges from 1 to 2.06. Thus, rescaling the Rule of Law indicator implies that trading with the furthest country is roughly as complex as trading with the country with the worse institutional quality.

Table 9: Complexity indicators and firms' trading activities

	oneway		twoway	
	export	import	export	import
Hs2	1.6	3.25	4.07	3.36
Contract	2.6	4.02	7.67	10.2
Rauch	0.81	0.79	0.79	0.71

associated to higher values of the complexity measure once the importing activity takes place, while the latter is not necessarily true for exporting firms. We thus have preliminary evidence consistent with the idea that different trade statuses entail a different complexity of the traded goods. In particular, we find that firms switching into importing end up being not only ex-ante more productive but also ex-post active into more complex trade activities.

Table 10: Switching firms and Complexity

	Non trader to Importer			**Non trader to Exporters**		
Dependent variable: TFP, lagged	(1)	(2)	(3)	(4)	(5)	(6)
Complexity: HS2	0.0329**			0.0328		
	(0.0130)			(0.0269)		
Complexity: Contractibility		0.0288***			0.0123	
		(0.0108)			(0.0243)	
Complexity: Rauch			0.176**			-0.177
			(0.0851)			(0.108)
Firm size	0.131***	0.130***	0.133***	0.116***	0.0986***	0.0983***
	(0.0259)	(0.0259)	(0.0259)	(0.0325)	(0.0319)	(0.0319)
Foreign firm	0.205**	0.209**	0.218**	-0.101	-0.112	-0.114
	(0.0906)	(0.0905)	(0.0906)	(0.109)	(0.104)	(0.104)
Firm age	0.0512***	0.0525***	0.0503***	0.0911***	0.0936***	0.0948***
	(0.0135)	(0.0135)	(0.0135)	(0.0156)	(0.0156)	(0.0156)
Former SOE	0.112	0.118	0.112	-0.00594	-0.00820	-0.0124
	(0.117)	(0.117)	(0.118)	(0.128)	(0.123)	(0.123)
Constant	-0.430	-0.362	-0.437	-1.178*	-2.156***	-1.976***
	(0.455)	(0.453)	(0.458)	(0.667)	(0.553)	(0.560)
Observations	1424	1424	1424	814	859	859
R-squared	0.134	0.135	0.133	0.246	0.228	0.230
Log likelihood	-2155	-2155	-2156	-1129	-1204	-1203

*** p<0.01, ** p<0.05, * p<0.1

Standard errors in parentheses

Models include time, sector and county dummies

To provide a more robust validation of this intuition, we have used our sample of two-way traders as a sort of natural experiment. If any measure of complexity drives self-selection, we should observe the more productive firms operating the most complex activities. Moreover, if complexity matters more on the importing vs. the exporting side, we should observe,

within two-way traders, the ratio of exported / imported complexity measures decrease with productivity: the more productive you are, the more complex products you import rather than export, thus a negative correlation between a two-way trader TFP and the ratio of exported / imported complexity indexes. Since identification takes place within the same firm (two-way trader), we can exclude that our results are driven by some unobserved firm heterogeneity affecting exporters differently than importers in terms of complexity.

Denote CX the complexity measure of exports and CM, the complexity of imports. Eventually, $CX = 0$ if $z = 0, M$, i.e. if the firm is a non-trader or an importer only; $CX > 0$ if $z = X, XM$, i.e. if the firm is an exporter only or a two-way trader. Mutatis mutandis for exports.

For two-way traders, we define a relative complexity measure, $\Psi_{it|z=XM} = CX/CM$, as the ratio of exports to imports complexity. We then run the following regression:

$$\omega_{it} = \beta_0 + \beta_1 \Psi_{it|z=XM} + \beta_2 X_{it} + a_t + \varepsilon_{it} \tag{8}$$

where we have regressed the level of TFP of each firm ω_i at time t against the ratio of exports to imports relative complexity measure Ψ_{it}, and usual controls.

Table (11) shows the results of this multivariate regression for two-way traders, always controlling for firms' characteristics, industry and time fixed effects. As it can be seen, we always find that the complexity of the imported products increases with productivity proportionally more than the one for exporting products, since the ration between the measures is always negative and significant. Moreover, the relationship tends to be non-linear, with marginally decreasing effects in terms of added import complexity as productivity increases.

Therefore, our intuition that importing firms implement more complex strategies than exporting firms, with the latter endogenously generating a self-selection process of firms, seems to be confirmed. Moreover, the nature of the self-selection seems to be of an inherently different nature than the simple fixed costs approach traditionally associated to the exporting activity.

6 Conclusions

All in all, we thus derive a picture in which importing firms implement more complex strategies than exporting firms. It then follows that the importing strategy per se might generate a selection process of firms of an inherently different nature than the simple fixed costs approach traditionally associated to the exporting activity. In other words, we do not exclude the existence of fixed costs of exports leading to self-selection of firms; however, we find evidence that the strategic choice of importing seems to require a more complex organization of production than the choice of exporting, inducing the detected ex-ante selection in terms

Table 11: Complexity of trade and two-way traders

TWO-WAY					
Dependent variable: TFP	(1)	(2)	(3)	(4)	(5)
Model	OLS	OLS	OLS	FE	RE
CX/CM HS2	-0.150***				
	(0.00891)				
CX/CM HS2, squared	0.00778***				
	(0.000865)				
CX/CM Rauch		-6.16e-05*			
		(3.52e-05)			
CX/CM Rauch, squared		1.27e-09			
		(7.85e-10)			
CX/CM contractibility			-0.0665***	-0.0128*	-0.0252***
			(0.00495)	(0.00662)	(0.00551)
CX/CM contractibility, squared			0.00223***	0.000670***	0.000971***
			(0.000236)	(0.000182)	(0.000173)
Firm size: log employment	0.135***	0.137***	0.138***	0.0406**	0.0890***
	(0.00332)	(0.00325)	(0.00320)	(0.0162)	(0.00747)
foreign ownership dummy	0.253***	0.264***	0.261***	0.108***	0.146***
	(0.00965)	(0.00945)	(0.00934)	(0.0184)	(0.0122)
Firm age (time spent in sample)	0.0496***	0.0497***	0.0499***	0.0477***	0.0462***
	(0.00237)	(0.00239)	(0.00236)	(0.00270)	(0.00448)
Firm age 2 (ex-socialist firm dummy)	-0.0121	-0.00714	-0.00972		-0.0474*
	(0.0122)	(0.0120)	(0.0119)		(0.0268)
Constant	-0.338***	-0.0832	-0.805	0.549***	-0.365***
	(0.0631)	(0.0698)	(15697)	(0.0744)	(0.139)
Observations	37767	38912	40086	40086	40086
Number of groups				7149	7149
R-squared	0.295	0.289	0.286	0.062	

$***p < 0.01$, $**p < 0.05$, $*p < 0.1$
Standard errors in parentheses
Contrability: number of countries*distance*rule of law
Models include time, sector and county dummies

of productivity we have found in our paper.

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Appendix

Table 12: Number of firms in sample per year

Year	N. of firms
1992	11,036
1993	12,832
1994	14,207
1995	15,686
1996	17,741
1997	19,896
1998	20,974
1999	21,063
2000	14,815
2001	14,723
2002	14,889
2003	14,486
Total	192,348

Table 13: Number of firms in sample by NACE2 industry / year

NACE2		1992		1997		2002	
		N.	%	N.	%	N.	%
17	Textiles	465	4.21%	944	4.74%	683	4.59%
18	Clothes	761	6.90%	1155	5.81%	979	6.58%
19	Leather	271	2.46%	411	2.07%	345	2.32%
20	Wood	651	5.90%	1387	6.97%	1096	7.36%
21	Paper	124	1.12%	262	1.32%	258	1.73%
22	Publishing	1545	14.00%	2954	14.85%	1474	9.90%
23	Coke, Petroleum	8	0.07%	18	0.09%	9	0.06%
24	Chemicals	395	3.58%	649	3.26%	523	3.51%
25	Rubber, Plastic	610	5.53%	1141	5.73%	1046	7.03%
26	Non-metallic minerals	455	4.12%	835	4.20%	665	4.47%
27	Basic metals	148	1.34%	235	1.18%	195	1.31%
28	Fabricated metals	1554	14.08%	2895	14.55%	2356	15.82%
29	Machinery	1765	15.99%	2704	13.59%	1848	12.41%
30	Office equipment	117	1.06%	226	1.14%	134	0.90%
31	Electric	452	4.10%	865	4.35%	619	4.16%
32	Audio, Video	374	3.39%	639	3.21%	473	3.18%
33	Medical, precision	488	4.42%	926	4.65%	687	4.61%
34	Motor Vehicles	148	1.34%	246	1.24%	241	1.62%
35	Other transport	75	0.68%	152	0.76%	130	0.87%
36	Furniture	590	5.35%	1139	5.72%	1029	6.91%
37	Recycling	39	0.35%	113	0.57%	99	0.66%
Total		11035	100%	19896	100%	14889	100%

Table 14: Share of foreign-owned firms by NACE2 industry and year

NACE 2		1994	1997	2002
17	Textiles	40%	32%	27%
18	Clothes	39%	29%	25%
19	Leather	42%	41%	37%
20	Wood	28%	27%	20%
21	Paper	42%	35%	29%
22	Publishing	27%	29%	20%
23	Coke, Petroleum	.	.	.
24	Chemicals	42%	43%	32%
25	Rubber, Plastic	37%	33%	28%
26	Non-metallic minerals	42%	38%	25%
27	Basic metals	40%	33%	29%
28	Fabricated metals	29%	26%	22%
29	Machinery	30%	28%	22%
30	Office equipment	34%	28%	22%
31	Electric	31%	30%	30%
32	Audio, Video	32%	31%	30%
33	Medical, precision	32%	32%	23%
34	Motor Vehicles	46%	41%	41%
35	Other transport	39%	34%	20%
36	Furniture	32%	26%	22%
37	Recycling	28%	34%	22%
	mean	33%	30%	24%

Table 15: Transition matrixes of trading activities - 1993-1997

(Transition matrix 1993-1997)

N. of firms	1997				
1993	|No traders	Only Exporter	Only Importer	Two-way traders	N. Firms
No traders	4272	236	462	425	5395
Only Exporter	202	130	30	146	508
Only Importer	552	56	489	400	1497
Two-way traders	274	114	231	1709	2328
N. Firms	5300	536	1212	2680	9728

Percentages

Percentages	1997					
1993	No traders	Only Exporter	Only Importer	Two-way traders	Total	N. Firms
No traders	79%	4%	9%	8%	55%	5395
Only Exporter	40%	26%	6%	29%	5%	508
Only Importer	37%	4%	33%	27%	15%	1497
Two-way traders	12%	5%	10%	73%	24%	2328
Total	54%	6%	12%	28%	100%	9728
N. Firms	5300	536	1212	2680	9728	

Table 16: TFP, complexity for one-way traders

Exporting firms			Importing firms		
Measure of complexity	(a) HS6	(b)HS6/BEC	Measure of complexity	(a) HS6	(b)HS6/BEC
CX: Export comp	0.181***	0.158***	CM: Import comp	0.213***	0.204***
	[10.78]	[9.126]		[10.78]	[25.30]
CX x DM	0.00233	0.00212	CX x DM	0.00233	0.0658***
	[0.133]	[0.116]		[0.133]	[7.013]
DM: Import dum	0.413***	0.434***	DX: Export dum	0.413***	-0.0507***
	[16.95]	[29.82]		[16.95]	[-3.692]
Firm size	0.0810***	0.0967***	Firm size	0.0810***	0.0755***
	[24.71]	[30.07]		[24.71]	[24.65]
Foreign firm	0.187***	0.204***	Foreign firm.	0.187***	0.147***
	[21.33]	[23.32]		[21.33]	[17.65]
Firm age	0.0459***	0.0471***	Firm age	0.0459***	0.0459***
	[22.12]	[22.62]		[22.12]	[24.14]
Ex-socialist firm	-0.00589	-0.0113	Ex-socialist firm	-0.00589	-0.0115
	[-0.545]	[-1.044]		[-0.545]	[-1.131]
Constant	-0.830***	-0.698***	Constant	-0.830***	-0.649
	[-12.23]	[-10.62]		[-12.23]	[-5.34e-05]
Observations	48432	48432	Observations	48432	61087
R-squared	0.323	0.316	R-squared	0.323	0.277

Table 17: Trading firms and Complexity

	Importers			**Exporters**		
Dependent variable: TFP	(1)	(2)	(3)	(4)	(5)	(6)
Complexity: HS2	0.0414***			0.0389***		
	(0.00165)			(0.00588)		
Complexity: Contractibility		0.0299***			0.0244***	
		(0.00113)			(0.00272)	
Complexity: Rauch			0.0597***			-0.131***
			(0.0192)			(0.0283)
Importer for at least 50% of time				0.438***	0.506***	0.453***
				(0.0163)	(0.0145)	(0.0279)
Exporter for at least 50% of time	0.0435***	0.104***	0.229***			
	(0.0123)	(0.0111)	(0.0205)			
Complexity x Dummy	-0.00230	-0.00476***	-0.145***	0.00316	-0.0109***	0.0135
	(0.00175)	(0.00117)	(0.0241)	(0.00599)	(0.00273)	(0.0310)
Firm size	0.0586***	0.0526***	0.135***	0.0888***	0.0717***	0.128***
	(0.00313)	(0.00310)	(0.00291)	(0.00332)	(0.00323)	(0.00299)
Foreign firm	0.125***	0.201***	0.255***	0.192***	0.204***	0.227***
	(0.00834)	(0.00805)	(0.00827)	(0.00901)	(0.00865)	(0.00878)
Firm age	0.0456***	0.0416***	0.0500***	0.0453***	0.0491***	0.0498***
	(0.00190)	(0.00189)	(0.00195)	(0.00209)	(0.00206)	(0.00209)
Former SOE	-0.00906	-0.00231	-0.0351***	-0.0115	-0.0180*	-0.0243**
	(0.0101)	(0.0101)	(0.0104)	(0.0112)	(0.0107)	(0.0109)
Constant	-0.548	-0.530	-0.534	-0.580***	-0.706***	-0.618***
	(12109)	(12043)	(12442)	(0.0673)	(0.0651)	(0.0697)
Observations	61087	61087	61087	45653	48432	48432
R-squared	0.282	0.290	0.241	0.331	0.331	0.307
Log likelihood	-82270	-81933	-83967	-59343	-62741	-63590

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Models include time, sector and county dummies