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# Intra-Firm Trade, Exporting, Importing and Firm Performance

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## **Abstract**

This paper examines firm heterogeneity in terms of size, wages, capital intensity, and productivity between domestic and foreign-owned firms that engage in intra-firm trade, firms that export and import, firms that import only, and firms that export only. As previously documented, heterogeneity between different groups of trading firms is substantial. Taking into account intra-firm trade in addition to exporting and importing yields new insights into the productivity advantage previously established for exporting firms: the results presented here show that this premium accrues only to exporters which also import and to exporters which also engage in intra-firm trade, but not to firms which export only. Using simultaneous quantile regressions, the paper illustrates that heterogeneity within different groups of trading firm is equally large. Some of this within-group heterogeneity can be attributed to differences in trading partners.

**Keywords:** intra-firm trade, exports, imports, productivity premia, wages

**JEL Classification:** F14, F23, D24

# 1 Introduction

A substantial body of literature shows that trading firms are larger, more productive, and have higher skill and capital intensity than non-trading firms. One group of trading firms that has received relatively little attention compared to exporters and importers are firms engaged in intra-firm trade. This is in contrast to their importance for economic activity. For example, in the sample of all but the smallest firms in Irish manufacturing examined in this paper, firms that engage in intra-firm trade account for 37% of firms, 57% of persons engaged, close to 50% of turnover and material purchases, and for 50% of export volumes and 45% of import volumes in 2005 (cf. Tables 1 and 2).<sup>1</sup>

In this paper, I examine the implications of treating firms engaged in intra-firm trade as a separate group for results on firm heterogeneity previously obtained for exporting and importing firms only. In particular, I distinguish between foreign-owned and domestic firms that engage in intra-firm trade, firms that export and import, firms that import only, firms that export only, and firms that do not trade. I examine firm heterogeneity in terms of size, average wages, capital intensity and productivity between these different groups of trading firms. In addition to examining heterogeneity between different groups of trading firms, I also investigate whether there is heterogeneity within these groups using simultaneous quantile regressions. Further, I explore whether trading with partners other than the nearby UK/EU confers specific productivity advantages to these firms. Finally, the paper documents transitions between trading statuses and analyses the evolution of firm characteristics and the choice of trade destinations associated with these changes.

The empirical literature on the superior performance of exporting firms that goes back to Bernard and Jensen (1995) has recently been extended to include firms that import. This literature finds that firms which export and import outperform firms that engage in only a single dimension of trade (see Andersson et al. (2008); Kasahara and Lapham (2008); Muûls and Pisu (2009); Castellani et al. (2010); Altomonte and Békés (2009) for firm size, productivity and where considered capital intensity; and Amiti and Davis (forthc.); Martins and Opromolla (2011) for wages). The present paper extends this body of work by identifying firms that engage in intra-firm trade and treating them as a separate group in

the analysis. In the papers mentioned, firms that engage in intra-firm trade are subsumed among the other groups of traders.

Intra-firm traders are a subset of multinational firms, thus the analysis here is related but not directly comparable to papers that show that multinationals are more productive than exporters (for a summary see Section 3 of Greenaway and Kneller (2007)) or more productive than exporters and importers (Tomiura, 2007). To date only a small number of papers directly compare firms engaged in intra-firm trade to other types of traders as it is frequently not possible to identify intra-firm trade in the available data sets.<sup>2</sup> A partial comparison on the input side by Corcos et al. (2009) shows that the propensity of French manufacturing firms to engage in intra-firm trade (purchase intermediates from affiliates abroad) compared to outsourcing (import intermediates from unaffiliated parties abroad through the market) increases with their productivity.

Looking at firm heterogeneity between the different types of traders, my results suggest that in terms of productivity, on average, firms can be ranked from best to poorest performing as follows: foreign-owned firms engaged in intra-firm trade, domestic firms engaged in intra-firm trade, firms that export and import on par with firms that import only, firms that export only, and firms that do not trade. Firms that import only pay higher wages than firms that export and import, and firms that export only are larger both in terms of size and capital intensity than firms that import only, but these differences are not statistically significant. Treating intra-firm traders as a separate group of trading firms renders the productivity premium for firms that export only insignificant. This suggests that the productivity advantage previously attributed to exporting firms accrues only to firms that export and import and to firms that export and engage in intra-firm trade.

Using simultaneous quantile regressions I show that there is substantial heterogeneity not only between but also within the different groups of trading firms. This within-group heterogeneity is in many instances as large and in some instances larger than differences between groups. This is the case especially for firms that export only, firms that import only, and those that export and import. Differences in trading partners are able to explain some of this within-group heterogeneity: in particular importing from countries other than the nearby UK/EU is associated with a productivity advantage. While this is broadly

consistent with recent models of firm heterogeneity a la Melitz (2003) where productivity cut-offs determine whether firms become traders or engage in intra-firm trade after setting up an affiliate abroad, it also highlights the need to account for additional dimensions of heterogeneity. Examples so far include a fixed cost of importing as in Kasahara and Lapham (2008) or differences in contractibility between market and in-house transactions on the input side, e.g. Antràs and Helpman (2004); Grossman et al. (2006). Aspects that have not received sufficient attention in this context are motives for intra-firm exports from multinational parents to their affiliates and for intra-firm trade in both directions.

Much of the debate regarding the superior performance of exporters has been around establishing whether firms are more productive before they start exporting (self-selection hypothesis) or whether their performance improves once they are active in the export market (learning hypothesis). In this paper, I first show that trading status is highly persistent. I examine how firm size, average wages, capital intensity and productivity evolve alongside the six most prominent changes in trading status in the sample: no trade to exporting only, no trade to importing only, exporting only to exporting and importing, importing only to exporting and importing, exporting and importing to also engage in intra-firm trade - which may further be associated with a change from domestic to foreign ownership. The results suggest that whether there are ex-ante and/or ex-post advantages relative to the firms that retain the initial trading status is specific to the type of transition. When adding new dimensions of trade, firms increase trade with partners located further away. This suggests that both firm-specific as well as market-specific effects as modelled for exports in Chaney (2008) are at play not only when firms expand into new markets but also when they add additional dimensions of trade.

The remainder of the paper is structured as follows, Section 2 provides a discussion of the theoretical and the related empirical literature. Section 3 describes the data set and documents the activities of intra-firm traders. Section 4 examines differences in terms of firm size, average wages, capital intensity and productivity between and within different groups of trading firms. Section 5 documents transitions between trading statuses and analyses the evolution of firm characteristics associated with the six most prominent changes in trading status. Section 6 briefly concludes.

## 2 Literature

Motivated by a large empirical literature showing that exporters are more productive than non-exporters Melitz' (2003) model of monopolistic competition rationalises this intra-industry firm heterogeneity. In this model only firms that receive a productivity draw above a certain threshold are able to cover the fixed cost of entering the home and the export market plus the variable cost of exporting and earn higher profits by exporting than by selling at home. In the subsequent theoretical literature similar approaches have been used to determine a firm's sourcing strategy or its degree of involvement in international production and distribution (for a survey see Helpman (2006)). This is because - very broadly speaking - only firms with a higher productivity draw will be able to cover the fixed costs that are associated with one or more of the following dimensions of trade: exporting, importing intermediates, setting up affiliates abroad or outsourcing operations to domestic or foreign suppliers.

Greenaway and Kneller (2007) and Wagner (2007) survey the literature that documents that exporters are more productive than non-exporters; the International Study Group on Exports and Productivity (2008) provides a cross-country comparison based on comparable data. An important question in this debate is whether exporters are already more productive before they start exporting (self-selection hypothesis) or whether their productivity increases as a result of activity in the export market (learning hypothesis). While there is evidence in favour of both explanations the self-selection hypothesis tends to get more support. For importers there is evidence of self-selection (Vogel and Wagner, 2010; Castellani et al., 2010; Altomonte and Békés, 2009) and also indirect evidence that firms learn from importing (Kasahara and Rodrigue (2007) for Chile, Vogel and Wagner (2010) for Germany, Halpern et al. (2009) for Hungary, and Amiti and Konings (2007) for Indonesia).

Kasahara and Lapham (2008) build a model where firms face fixed costs of exporting and of importing. Their model predicts that the lowest productivity firms will import only, firms with higher productivity will export and import and those with the highest productivity will export only. Given that the fixed cost of importing also plays a role, their model allows for overlap of the productivity distributions for firms that export and import and

for firms that export only. Their model also predicts that firms that export only should be more productive than firms that import only. This is not always confirmed by the evidence including the OLS estimates in their own motivating Table 4. Papers by Andersson et al. (2008) for Sweden, Muûls and Pisu (2009) for Belgium, Castellani et al. (2010) for Italy, and Altomonte and Békés (2009) for Hungary, all agree, however, that firms that export and import are larger and more productive than firms that import only or export only.

Productivity is not the only dimension of firm heterogeneity where traders differ from non-traders. Using matched employer-employee data Schank et al. (2007) and Munch and Skaksen (2008) show that exporters pay higher wages in German and Danish firms, respectively.<sup>3</sup> Amiti and Davis (forthc.) and Martins and Oromolla (2011) show that firms that export and import pay higher wages than firms that import only and the latter pay higher wages than firms that export only in Indonesia and Portugal, respectively. Similar observations apply to capital intensity, see Bernard and Jensen (1995) and Bernard et al. (2007) for exporters in the US and Castellani et al. (2010) and Muûls and Pisu (2009) for exporters and importers in Italy and Belgium, respectively.

Recent evidence further shows that the bulk of the firms that trade do so with one or two of the most popular markets, only a small fraction of firms trade with many countries (Andersson et al., 2008; Eaton et al., 2011; Lawless, 2009; Muûls and Pisu, 2009; Castellani et al., 2010; Serti and Tomasi, 2009). For French manufacturing firms, Eaton et al. (2011) show that firm size and productivity increase in the number of countries a firm exports to. Castellani et al. (2010) provide evidence that this is true for the number of export markets as well as for the number of import source countries among Italian manufacturing firms.

As regards intra-firm trade, in the literature on foreign direct investment (FDI) the main motive for trade with affiliates is on the input side (vertical integration). The trade-off is between outsourcing and in-house production where both of these possibilities can also involve suppliers abroad (offshoring) or a subsidiary abroad (Antràs and Helpman, 2004; Grossman and Helpman, 2005). Here the ranking of firms that outsource abroad (giving rise to arms-length imports of intermediates) and those that set up a production affiliate abroad (giving rise to intra-firm imports) depends on the interplay of fixed and variable costs associated with the two alternatives and firm's productivity. Using data for French

manufacturing firms Corcos et al. (2009) find that more productive firms are more likely to vertically integrate.

On the distribution side, in the models of horizontal FDI following Markusen (1984) where the trade-off is between setting up a subsidiary to produce abroad and serving the foreign market via exports FDI is typically trade-replacing. Irarrazabal et al. (2009) extend the Helpman et al. (2004) model which establishes a ranking in terms of productivity for domestic firms, exporters and domestic multinationals to include intra-firm exports of intermediates from the multinational parent to the subsidiary abroad. Their finding of the fixed cost of FDI being much higher in Norwegian manufacturing than the fixed cost of exporting provides implicit evidence that firms engaged in FDI (and possibly trade with affiliates) are more productive than exporters. Nelson (2011) builds an agency cost model where heterogeneous firms sort into exporting, distribution FDI, production FDI and integrated (distribution and production) FDI with increasing levels of productivity. Both distribution and integrated FDI are associated with intra-firm exports from the parent to the foreign affiliate.

For their sample of US multinationals with affiliates in Canada, Feinberg and Keane (2006) show that 69% of firms do not fall neatly into the horizontal or vertical FDI categories, but rather these firms have intra-firm trade flows from parent to affiliate and vice versa. In addition, both parents and affiliates trade at arm's length as well as being engaged in intra-firm trade. Bernard et al. (2009) also provide evidence on the latter for a more comprehensive set of US multinational parents. Considering only multinational strategies Keller and Yeaple (2008) combine motives for horizontal and vertical FDI giving rise to trade in intermediates that differ in technological complexity between parents and subsidiaries abroad in both directions. In Grossman et al. (2006) heterogeneous firms may become 'complex multinationals': Firms can locate the production of intermediates and assembly of final goods either in their home country, in another Northern country or in a Southern country where labour cost are cheaper. In this setting firms engaged in intra-firm trade are always more productive than firms that export only. Depending on trade cost and the fixed cost of setting up an assembly affiliate abroad multinationals with intermediate levels of productivity may engage in either intra-firm exports or intra-firm imports and arms-



length exports at the same time. However, for highly productive firms horizontal FDI in all countries takes away the motive for arms-length trade when trade cost are taken into account. Empirically, Tomiura (2007) provides an analysis of productivity differences across a large range of internationalisation options in a cross-section of Japanese manufacturing firms; he shows that firms engaged in FDI abroad or in several internationalisation modes are more productive than firms that outsource (import) only and firms that export only.

### 3 Data

The data set used in this analysis is the annual Census of Industrial Production (CIP) for the Republic of Ireland from 1996-2005 conducted by the Central Statistics Office (CSO). The CIP covers all firms with 3 or more persons engaged in the mining, manufacturing and utilities sectors. The analysis here focusses on the core manufacturing NACE Rev 1.1 sectors 15-36 excluding sector 23 (manufacturing of coke, refined petroleum products and nuclear fuel) for confidentiality. The CIP collects information on output, intermediate inputs and trade both at the enterprise and at the local unit (establishment) level.

For this study I use the information collected from enterprises that answered the "full" E or F forms, because only these forms contain information on trade with affiliates. Until 2003 enterprises with 13 or more persons engaged were sent these most comprehensive forms. In 2004 the threshold increased to 20 or more persons engaged. Smaller firms are sent a less detailed form and information on variables that are not covered on the form is imputed by the CSO. In order to make best use of the full forms without compromising data quality with a lot of imputed information, I have chosen to include all firms with a median number of 16 or more persons engaged over their time in the sample in the analysis. I exclude firms with less than 3 observations except if 2005 is the last year they are observed. When firms do not respond or return only incomplete information, CSO impute or estimate missing information. I exclude firms where more than half of the observations over their presence in sample period are imputed/estimated. Finally, firms with many zero entries for crucial variables (output, materials and wages) as well as first or last observations with zero values are dropped. In the resulting sample 4.5% of observations are from firms that answered the

short forms, but only 0.14% of observations are from firms that answered the short form in every period they are observed.

This resulting sample of firms covers 39%(46%) of firms surveyed in the CIP, 80%(78%) of employment and 89%(87%) of turnover in 2005(1996). Typically larger firms are more likely to be engaged in trade, the present sample is no exception. In 2005 the share of exporters in the sample is 71%, whereas it is only 47% in the full CIP. For importers the figures are 80% in the sample compared to 58% in the CIP in the same year. In terms of export and import volumes covered, however, the sample accounts for 97% and 89% in 2005, respectively.

As the focus of this paper is on trading status and firm performance, the firm-year observations are grouped into six mutually exclusive categories: firms that do no trade, firms that export only, firms that import only, firms that export and import, domestic firms that engage in intra-firm trade (ift dom) and foreign-owned firms that engage in intra-firm trade (ift for). Firms are defined as exporters if they report a positive share of turnover exported, and similarly as importers if they report a positive share of materials imported. Further, firms are classified as being engaged in intra-firm trade - irrespective of other trading activities they may engage in - if they (i) report the share of turnover invoiced to affiliates and the share of materials purchased from affiliates to be larger than zero or (ii) report a share of turnover invoiced to affiliates of more than 5% or (iii) report the share of materials purchased from affiliates to be larger than 5% or (iv) if they are classified as an intra-firm trader according to one of the previous definitions in one year and report non-zero values for turnover to affiliates or materials purchased from affiliates in another year. The reason for the definition of intra-firm trade being somewhat more stringent than that for exporters and importers is the presence of a number of questionable once-off observations with small positive shares of turnover invoiced to affiliates or materials purchased from affiliates.

### 3.1 Summary statistics

[Table 1 about here.]

Table 1 shows the evolution of firm’s trading activities between 1996 and 2005. Both the share of firms that do not trade and the share of firms that only export have decreased. In turn the share of firms that import only, firms that export and import and the share of domestic firms that engage in intra-firm trade have increased, with larger increases in the latter two categories. The last two rows of Table 1 show that most domestic firms export and import, the second largest group are domestic firms that do not trade, followed by those that import only, and those that engage in intra-firm trade. Among the subsidiaries of foreign-owned firms the largest group of firms are intra-firm traders followed by foreign-owned subsidiaries that export and import. This demonstrates that not all (foreign-owned) firms that are affiliated with multinationals engage in intra-firm trade. The distribution of the six groups of firms across two-letter NACE industries is given in Table 10 in the Appendix; it is quite uneven.

[Table 2 about here.]

Table 2 shows that firms that export and import and foreign-owned firms engaged in intra-firm trade account for the bulk of economic activity. Foreign-owned intra-firm traders engaged the highest share of personnel (43%) in both periods. While they had the largest shares of turnover, material purchases and export and import values in 1996, in 2005 the first rank goes to firms that export and import. Both groups of firms increased their economic activity in terms of value, however, the exporters and importers saw much larger increases in their turnover and materials purchases. Note that also among the firms that export and import, subsidiaries of foreign multinationals account for 80% or more of sales, materials purchases, export and import volumes in 2005.<sup>4</sup> By 2005 firms that engage in only one dimension of trade are marginalised contributing less than 2% to export and import volumes respectively.

### **3.2 Firms engaged in intra-firm trade and their activities**

As detailed above intra-firm traders are identified based on whether they report a positive share of turnover invoiced to affiliates and/or a positive share of materials purchased from materials. The questionnaire is not specific about the location of these affiliates. Thus, I

cannot fully exclude that some of what is reported as trade with affiliates refers to transactions between headquarters and plants of multi-unit enterprises located in Ireland. This share is going to be small however, because (1) in the questionnaire plants or establishments in Ireland that belong to the same enterprise are referred to as ‘local units’ whereas the question associated with intra-firm trade explicitly refers to ‘affiliates’, (2) the share of domestic (foreign-owned) intra-firm traders that have several plants in Ireland (multi-unit firms) was rather low at 11.3% (7.8%) in 2005 (up by 2.2 percentage points from 1996 in both groups),<sup>5</sup> and (3) most of the multi-unit intra-firm traders fall into the group of intra-firm traders that also report both exports and imports suggesting that only the most globalised firms also have several plants in Ireland. Further, excluding all firms that are ever multi-unit enterprises or all firms that ever fall into the group of firms that only report intra-firm trade but no exports or imports (if only in Table 3 below) does not alter the results of the analysis in Sections 4 and 5 qualitatively. Results are available on request.

[Table 3 about here.]

Table 3 gives an indication of the activities of firms engaged in intra-firm trade. Over 85% of firms are classified as intra-firm traders because they report that they invoice turnover to affiliates. Nearly 60% of foreign-owned intra-firm traders are involved in intra-firm trade on the input as well as on the output side, among the domestic firms this share is lower at 35%. The overall value of turnover invoiced to affiliates is larger than the overall value of materials purchased from affiliates for both domestic and foreign-owned intra-firm traders, for the foreign-owned intra-firm traders the discrepancy is particularly striking. This is in contrast with evidence for the US: Bernard et al. (2009) and Feinberg and Keane (2006) both report higher volumes of imports from affiliates than exports to affiliates.

If firms engage in intra-firm trade with affiliated parties abroad in this data set, they should be recording this both as turnover invoiced to affiliates as well as exports on the output side or on the input side as materials purchased from materials as well as imports. The figures in Table 3 show that this is the case for the vast majority of enterprises. Where this is not the case, closer inspection of the data reveals that the reason is a degree of underreporting of exports and to a lesser extent of imports in firm’s earlier years in the data

- especially among the domestic firms. Where correctly reported exports and imports will cover both arms-length and intra-firm trade: For 61%(54%) of the foreign-owned (domestic) intra-firm traders that report a positive share of turnover invoiced to affiliates and a positive share of materials purchased from affiliates and a positive share of exports and a positive share of imports, their export share exceeds their share of turnover invoiced to affiliates and their import share exceeds their share of materials purchased from affiliates. While there are some significant differences between the 12 groups in Table 3 more so in terms of size, average wages and capital intensity than in terms of productivity, the small number of observations in many of the cells does not warrant further differentiation of the intra-firm traders.<sup>6</sup>

## 4 Trading Status and Firm Performance

### 4.1 Heterogeneity between different groups of trading firms

As discussed in the literature review in Section 2, theoretical reasons have been brought forward as to why firms that are engaged in trade to different degrees may differ in terms of size, capital intensity, wages and productivity. Here I consider firms across the range of different trading statuses, that is intra-firm traders in addition to exporters and importers; and I document heterogeneity between as well as heterogeneity within these groups.

I document heterogeneity in terms of firm size (number of persons engaged), average wages ( $\log(\text{gross earnings}/\text{employee})$ ), capital intensity ( $\log(\text{capital stock}/\text{employee})$ ), labour productivity ( $LP = \log(\text{turnover}/\text{employee})$ ) and total factor productivity (TFP). Definitions and descriptions of all variables can be found in the Appendix. Average wages capture differences in firm's use of skilled and unskilled labour only imperfectly. To account for differences in the employee composition between firms as much as data availability permits, all regressions with average wages as the dependent variable include controls for the share of managerial and technical employees and the share of clerical employees. In the regression with labour productivity as the dependent variable I also control for capital intensity.

The log of TFP is calculated from the following equation

$$\ln TFP_{it} = \ln Y_{it} - \hat{\alpha}_K \ln K_{it} - \hat{\alpha}_M \ln M_{it} - \hat{\alpha}_L \ln L_{it}, \quad (1)$$

where  $Y_{it}$  is deflated turnover,  $K_{it}$  is deflated capital stock,  $M_{it}$  is deflated material purchases, and  $L_{it}$  is the number of employees in firm  $i$  in period  $t$ .  $\hat{\alpha}_K$ ,  $\hat{\alpha}_M$ ,  $\hat{\alpha}_L$  are the estimated coefficients from an OLS a regression where the log of turnover is regressed on the log of the three inputs, year and industry dummies and 2-digit industry-year interactions. In this way, the TFP measure takes out any systematic differences in input use between sectors, across years, and also removes industry trends. Unless otherwise indicated the results are robust to using the productivity measure described by Akerberg et al. (2008), referred to as ACF hereafter. However, as this measure relies on the use of lagged values, it is associated with a loss of 13% of the observations.

[Table 4 about here.]

Table 4 displays means and standard deviations for the different groups of traders in terms of the number of persons engaged, capital stocks, average wages, labour productivity and TFP. The table shows that on average firms that are engaged in intra-firm trade engage most persons, pay the highest average wages, have the highest capital stocks and the highest productivity. Foreign-owned intra-firm traders are larger than domestic intra-firm traders, but differences between the two groups in terms of average wages and TFP are less pronounced at the mean. On most accounts firms that export and import outperform firms that export only and these in turn do better than firms that import only. However, firms that import only pay higher average wages than both - firms that export only and firms that export and import. All types of traders outperform the firms that do not trade according to these measures. The separate rows for all exporters and all importers at the bottom of the table show that the means of these groups are dominated by those firms that engage in more than one dimension of trade.

These simple averages do not account for differences in firm size, age, over time, between industries and firm type. In order to account for such differences I estimate equations of

the following form:

$$Y_{it} = a + \sum_{j=1}^4 \beta_j Status\_j_{it} + cControl_{it} + \lambda_I + \lambda_t + \lambda_{It} + \epsilon_{it}, \quad (2)$$

where  $Y_{it}$  represents size, average wages, capital intensity, labour productivity and TFP.  $Status\_j$  refers to the five different groups of traders identified in this paper, i.e. firms that export only, import only, export&import and domestic and foreign-owned firms engaged in intra-firm trade. Firms that do not trade are the omitted category.  $Control_{it}$  is a vector of control variables, namely firm *size* (log number of persons engaged), firm age, a dummy equal to 1 if the firm is *foreign*-owned and a dummy equal to 1 if the enterprise is a *multi*-plant enterprise. When the average wage is the dependent variable, the share of managerial and technical employees and the share of clerical employees is also included. When labour productivity is the dependent variable, capital intensity is also controlled for. The regressions further include NACE 3-digit industry, year, and 2-digit industry-year interaction dummies ( $\lambda_I$ ,  $\lambda_t$ ,  $\lambda_{It}$ ). I estimate equation (2) using ordinary least squares, fixed effects and simultaneous quantile regressions.

The upper part of Table 5 presents results from estimating equation (2) using pooled OLS, the lower part contains the estimates from the fixed effects regressions that control for firm fixed effects, which wipe out all time invariant firm heterogeneity. The coefficients from the OLS regressions can be interpreted as conditional differences in size, wages, capital intensity, and productivity across firms with different exposure to international markets relative to the reference group, that is the industry-year averages of domestic non-traders. The fixed effects regressions in turn estimate a correlation between a change in trading status and a change of the dependent variable as this type of regression captures firm's deviations from their own longer-term average. If time-invariant firm characteristics are correlated with trading status or the probability of switching is higher due to a contemporaneous shock, differences between the two estimation methods may emerge.

[Table 5 about here.]

Even after controlling for industry, year, size, age, and firm type effects, the upper half of Table 5 shows that substantial differences remain between firms engaged in different dimensions of trade. Note that the full effect for the foreign-owned intra-firm traders is printed in the last row of each part of the table; it is obtained by adding the coefficient on the foreign-owned intra-firm traders and the coefficient on the foreign dummy. For all firm characteristics foreign-owned firms engaged in intra-firm trade outperform domestic intra-firm traders which in turn outperform the firms that export and import; in many cases the latter outperform the one-way traders. While firms that export only appear to be larger in terms of size and capital intensity than firms that import only, the coefficients are not significantly different from each other in both cases. Firms that import only and firms that export and import do not differ significantly in terms of the average wages they pay or their productivity. Firms that export only do not pay significantly higher wages than firms that do not trade.

The differences in TFP between firms with different trading status are quite striking; the productivity premia are 6.8%, 6.6%, 11.4% and 17.5% for firms that import only, firms that export and import, domestic firms that engage in intra-firm trade and foreign-owned firms that engage in intra-firm trade, respectively.<sup>7</sup> In this specification the difference between firms that export only and those that do not trade is not significant.<sup>8</sup> The last column of Table 5 shows results from the same regression as in the previous column where the dummies for exporters and importers are defined without taking intra-firm trade status into account. Here the productivity premium for firms that export only retains significance. Thus, ignoring intra-firm trade when comparing exporters and importers results in the estimation of a significant productivity advantage for firms that export only which really only accrues to those exporters that also import and those that also engage in intra-firm trade.

When controlling for firm-specific characteristics that are time invariant in the estimation of equation (2) the differences between firms with different trading status reduce substantially. Note, however that these coefficients are identified only of those firms that switch trading status. As shown in the lower half of Table 5, the premia for firms that export only and firms that import only disappear for nearly all variables. Firm size is an



exception. Firms that export only are larger than firms that import only and do not differ significantly in size from firms that export and import. In terms of productivity, the coefficient for firms that export only is significant at the 10% level for TFP but not for labour productivity (and also not for the ACF TFP measure). The coefficient on firms that export and import is also significant only at the 10% level, but is more consistently estimated across productivity measures. Firms that import only do not differ significantly in terms of productivity from firms that do not trade in this specification. The productivity premia (TFP) for intra-firm traders are considerably lower than in the OLS regression at 3.9% (domestic) and 6% (foreign-owned). The difference between the domestic and foreign-owned intra-firm traders is not statistically significant in this case. When intra-firm trade is ignored in the last column, the productivity premium also shows up for firms that export only and for firms that export and import. This suggests that the differences documented in the OLS regressions are largely due to unobserved firm-specific effects. In particular, firms that export only and firms that import only appear to self-select into their respective trading status based on unobservable time-invariant firm characteristics whereas exporting and importing as well as engaging in intra-firm trade seem to confer advantages to the firms involved that go beyond idiosyncratic effects. We will return to these issues in Section 5.

The results regarding the ranking of firms that export only, firms that import only, and firms that export and import for firm size (employment) is consistent with evidence for Chile (Kasahara and Lapham, 2008), but in Italy (Castellani et al., 2010) and Belgium (Muûls and Pisu, 2009) firms that export only tend to be smaller than firms that import only, though not always significantly so. In their OLS regression Kasahara and Lapham (2008) find that firms which export only and firms which import only pay significantly lower wages than firms that export and import, in their fixed effects regressions these differences also cease to be significant. Regarding capital intensity Kasahara and Lapham (2008); Muûls and Pisu (2009) and Castellani et al. (2010) all find firms that export only to have lower capital intensity than firm that import only in their OLS regressions, but in the fixed effects regressions the order also reverses. Regarding productivity (log turnover per employee, log value added per employee or TFP) nearly all papers (Altomonte and Békés, 2009; Castellani et al., 2010; Kasahara and Lapham, 2008; Muûls and Pisu, 2009) find two-way traders to

be more productive than firms that import only and the latter more productive than firms that export only in their OLS regressions. In many cases firms that import only are more productive than firms that export only in the fixed effects regressions, for Andersson et al. (2008) this is true in their GLS regressions also.<sup>9</sup> In addition, in all of these papers the premia for firms that export only and firms that import only are significant vis-a-vis non-traders for nearly all firm characteristics, this is not the case here. While it could be the case that Irish non-traders perform better than in other countries, the regression reported in the last column of Table 5 suggests that this difference is due to separating out firms engaged in intra-firm trade.

All models that account for intra-firm trade predict that firms engaged in intra-firm trade should have higher productivity than firms that trade at arm's length. My analysis confirms this, however, it is important to bear in mind that in contrast to most models intra-firm trade here covers trade in both directions, i.e. exports to and imports from affiliates. A second caveat, namely that intra-firm traders are a subset of multinational firms, implies that my results complement previous evidence but are not directly comparable: A number of papers have shown that the productivity distribution of multinationals tends to stochastically dominate that of exporters, but that of exporters does not always stochastically dominate that of non-exporters (see Section 3 of the survey by Greenaway and Kneller (2007)). Tomiura (2007) also finds that "integrated" firms (multinationals) are larger, more capital intensive and more productive than firms which export and import and one-way traders, especially if they also export and outsource (import). He does not consider whether these integrated firms engage in intra-firm trade. On the input side Corcos et al. (2009) find that more productive firms in French manufacturing will choose intra-firm trade (intra-firm imports from a production affiliate abroad) over importing from an arms-length supplier abroad (outsourcing).

## 4.2 Heterogeneity within different groups of trading firms

[Figure 1 about here.]

The coefficients in Table 5 all refer to average values and do not account for the fact that these differences may vary across the distribution of the dependent variable. To test for this, I estimate simultaneous quantile regressions as introduced by Koenker and Bassett (1978) and refined by Koenker and Hallock (2001) which allow different slope coefficients to be estimated for the different quantiles of the conditional distribution of the dependent variable. The estimates from these regressions for size, average wages, capital intensity and TFP conditional on the controls specified in equation (2) are plotted in Figure 1. As the different 2-digit industries are not populated densely enough with different traders in every year, these estimations do not include industry-year interaction dummies.

The graphs show that also within the different groups of traders the distribution of the four firm characteristics is by no means uniform. This is particularly the case for firm size. For example, the top 15% of foreign-owned (domestic) firms engaged in intra-firm trade are more than three times (twice) as large as the bottom 15%. The ranking of the different groups of traders in terms of firm size is by and large preserved across the distribution. The size premia for firms that export only and firms that import only largely overlap. At the top of the distribution the premium for firms that export only is larger. Thus, it is these few large firms that bring the overall average of firms that export only above that of the firms that import only. For average wages there is also quite sizeable variation in premia within groups of trading firms between firms at the bottom of the distribution and firms at the top of the distribution. For capital intensity the premia for firms that export only are higher than for firm firms that import only across the distribution, but the difference is not statistically significant. The premia for firms that export and import are not significantly different from those of the domestic intra-firm traders in the bottom half of the distribution and in the top half they do not differ significantly from firms that export only.

The TFP premia for firms that export and import and those that import only overlap between the 2nd and the 8th decile. The premia are indeed somewhat higher for firms that import only than for firms that export and import.<sup>10</sup> There is some overlap between the premia for domestic and foreign-owned intra-firm traders at the bottom of the distribution.<sup>11</sup> Intra-firm traders and in particular foreign-owned intra-firm traders are the only group of

traders that have significantly higher premia across the distributions of size, average wages, capital intensity and TFP than the other groups of traders.

[Table 6 about here.]

A number of studies have documented that not only do few firms engage in trade, but also that only a few large firms trade with a large number of countries/regions whereas the majority of firms trade with only one country (Eaton et al., 2011; Andersson et al., 2008; Lawless, 2009; Serti and Tomasi, 2009; Castellani et al., 2010). Most of these papers also show that productivity tends to increase in the number of destination markets. It may also be the case that only firms which produce high-quality/technology products trade with more distant markets. Thus, I consider differences in trading partners as a potential source of within-group heterogeneity. For Irish firms the most popular market is the UK, more so on the export side than on the import side, more so also for firms that are engaged in fewer dimensions of trade, and more so for domestic intra-firm traders. 12.4%(3.6%) of the foreign-owned (domestic) firms engaged in intra-firm trade both export to and import from countries in all the recorded regions. A detailed representation of the different trader's export and import destinations and source countries is provided in Table 11 in the Appendix.

Table 6 shows productivity differences between firms whose trading partners are all located in the UK and/or the EU only, those that trade with the US (and possibly other countries) and those that trade with the rest of the world and possibly other countries but not with the US (ROW not US). For firms that export only, those that export to the rest of the world but not the US are most productive in the OLS regression whereas it is those that export to the UK and/or EU in the fixed effects regressions.<sup>12</sup> In both cases the differences between the two destinations are not significantly different from each other. For firms that import only, those that also import from overseas are most productive. For firms that export and import, again imports from overseas seem to give the largest boost to productivity especially if they export to the nearby UK/EU only.

Among the domestic intra-firm traders those that export to the rest of the world but not the US are among the most productive; imports from the rest of the world but not the US also seem to confer somewhat of an advantage. In this group the coefficients for

firms that export to the same destinations but import from different destinations or vice versa mostly not differ significantly from each other. Among the foreign-owned intra-firm traders those that import from the US are the most productive within each group of export destinations.<sup>13</sup> Among those that export to the rest of the world but not the US, firms that also import from the rest of the world but not the US are a close second to those that import from the US.

The evidence presented so far suggests that firms that engage in different dimensions of trade are rather heterogeneous in a number of dimensions (size, average wages, capital intensity and productivity). Firms that are engaged in more dimensions of trade tend to have higher premia. However, in many cases the differences between firms that export only, firms that import only and firms that export and import are not significant when within-group heterogeneity across the distribution is taken into account. Some of this within-group heterogeneity can be attributed to differences in trading partners. Overall, the analysis suggests that in particular the productivity premia previously attributed to exporters in Ireland only accrue to a select set of firms that export and import or engage in intra-firm trade and trade and have trading partners overseas.

## 5 Transitions between trading statuses

Transitions between trading statuses offer the possibility to study whether firms exhibit superior characteristics already before switching (self-selection hypothesis) or whether their characteristics improve after the switch (learning hypothesis). As noted in the literature review in Section 2 there is evidence for self-selection of both exporters and importers, limited evidence for learning from exporting and somewhat more evidence for learning from importing. According to the theories discussed in Section 2 domestic firms will set up their own distribution affiliates or suppliers of intermediate products abroad when transactions through the market are too costly or too risky. Given that a productivity advantage is required to do so, we would expect to see self-selection and, to the extent that this changes their operations at home, possibly also learning effects. In this section my aim is to examine

whether changes in trading status are associated with changes in firm characteristics and with changes in trading partners.

Table 7 shows transition probabilities for the periods from 1996 to 2000 and from 2001 to 2005. These transition matrices indicate that trading status is highly persistent as shares are highest along the main diagonal for all groups of traders. Between 16 and 25% of firms switch from exporting only or importing only to exporting and importing, between 9-10% of firms switch from exporting and importing to become domestic intra-firm traders and 4-6% of firms engaged in exporting and importing are bought up by foreign owners and start to also engage in intra-firm trade. The share of firms that switch from not trading to importing only is also noteworthy, it is nearly 8% between 1996 and 2000 and over 13% from 2001 to 2005. While there are firms that reduce the dimensions they trade in, firms from all groups and in both periods are more likely to exit the sample than to engage in fewer dimensions of trade. Entry is highest to the group of firms that do not trade and to the group that export and import. In the first period there was also substantial entry to the group of foreign-owned intra-firm traders.<sup>14</sup> Unreported probit regressions on the determinants of future trading status confirm that last year's trading status is the strongest predictor of this year's trading status for all five groups of traders (results are available on request).

[Table 7 about here.]

In the following I examine in detail how firm characteristics and trading patterns evolve when firms change trading status. The five most prominent changes in my sample are no trade to importing only (48 cases), exporting only to exporting and importing (39 cases), importing only to exporting and importing (54 cases), exporting and importing to domestic intra-firm trader (55 cases), and exporting and importing to foreign-owned intra-firm trader (36 cases). I also consider firms that switch from not trading to exporting only as this has been prominent in the literature even though there are only 19 cases in my sample. For firms to be considered for this exercise they must have had the same initial trading status for a minimum of two years before the change and their new trading status must not change for a minimum of two years after the change.<sup>15</sup>

Typically the self-selection hypothesis is tested by comparing productivity levels of firms that are going to switch trading status to firms that do not switch 2-3 years before the switch. In turn, the learning hypothesis is analysed by comparing productivity growth in the period from the time of the switch to 2-3 years after the switch. I prefer to identify each point in time from two years before the switch to two years after the switch in order to reduce reliance on specific points in time as follows

$$Y_{it} = \sum_{t=t-2}^{t+2} \alpha_t sw_{it} + Control_{it} + \lambda_I + \lambda_t + \lambda_{It} + \epsilon_{it}. \quad (3)$$

$Y_{it}$  is as before in turn firm size, average wages, capital intensity, labour productivity and TFP; where appropriate I also consider export and import volumes.  $sw_{it}$  labels the type of switcher examined at each point in time.  $Control$  includes firm age and firm size (except when size is the dependant variable), multi and foreign ownership (where applicable) dummies, and  $\lambda_I$ ,  $\lambda_t$ ,  $\lambda_{It}$  are year, industry, and year-industry interaction dummies. Each group of switchers is compared to the group of firms that retains the initial trading status of the switchers over the 5-year period.

[Table 8 about here.]

[Table 9 about here.]

Table 8 presents the results from estimating equation (3) for firm size, average wages, capital intensity and productivity around the time of switching trading status for the six groups of switchers identified above. Firms that switch from exporting and importing to become domestic intra-firm traders appear to be the only group in this sample where there is convincing evidence of self-selection in terms of size, capital intensity, and productivity. These firms also enjoy ex-post advantages compared to firms that continue to export and import only. Starting to trade confers an ex-post productivity advantage on firms that start to import only, the labour productivity measure also points to an ex-ante advantage. Firms that start to export enjoy an ex-post size advantage over firms that continue not to trade; firms that switch from not trading to importing only enjoy both an ex-ante and an ex-post size advantage. The transition from engaging in only one dimension of trade to exporting

and importing appears to be a rather natural one as there is little evidence of ex-ante or ex-post advantages. Much of the reasoning behind foreign takeovers and also some of the evidence would imply ex-ante (cherry-picking) effects and possibly but not necessarily also ex-post improvements in performance for the acquired firms (e.g. Harris and Robinson (2002)). There is some evidence of this here as (domestic) exporters and importers that are bought up by a foreign owner to then become foreign-owned intra-firm traders have higher productivity ex-ante and to a certain extent also ex-post.<sup>16</sup>

The results for trade volumes in Table 9 suggest that firms which switch to exporting and importing have higher trading volumes than firms that continue to engage in only one dimension of trade and they increase trade with the EU; while imports from the UK are higher before the switch for those that switch from importing only. Firms that become domestic intra-firm traders have higher export and import volumes both before and after the switch than firms which continue to export and import only that. In particular they have above average trade with the UK and above average exports to the US. After the switch imports from the US and the rest of the world also increase, but not significantly so. Exporters and importers that are bought up by a foreign owner and as a result start to also engage in intra-firm trade have higher import values from the US after the switch, this is entirely driven by US acquirers and is likely to be due to transfer pricing issues.<sup>17</sup>

Using Hungarian data Altomonte and Békés (2009) also find firms that switch from not trading to exporting only not to enjoy an ex-ante productivity advantage, however, they do find an ex-ante productivity advantage for firms that switch from not trading to importing only. The absence of evidence for self-selection for export starters is in contrast to earlier work by Ruane and Sutherland (2005) who also include the smaller firms in the CIP in their analysis, but in line with the results for the Republic of Ireland in the International Study Group on Exports and Productivity (2008) study were a slightly higher size threshold on the sample of firms applies. The analysis here differs from earlier research in that it explicitly takes into account other potential initial trading activities, i.e. in earlier work export starters could have included firms that did not trade at all, firms that imported and/or even firms that engaged in some dimension of intra-firm trade before starting to export. This may explain some of the differences. The results on the trade destinations are



in line with those in Section 4 and show that a switch in export/import market orientation is typically associated with adding another dimension of trade: typically away from nearby markets to countries further away.

## 6 Discussion and implications for theory and policy

This paper contributes to the literature on firm heterogeneity and trading status. It confirms results from earlier research that firms engaged in more dimensions of trade outperform their less globally engaged counterparts in terms of size, average wages, capital intensity and productivity. In many instances the differences between firms that export only, firms that import only and firms that export and import are not significant. The paper further establishes that once firms engaged in intra-firm trade are considered separately from exporters and importers, firms that export only are no longer significantly more productive than firms that do not trade. Thus, the productivity premium previously estimated for exporters applies only to exporters that also import and to exporters that also engage in intra-firm trade.

Simultaneous quantile regressions reveal that there is substantial heterogeneity in terms of firm size, average wages paid, capital intensity and productivity also among firms that have the same trading status. Some of this within-group heterogeneity is associated with differences in trading partners. Firms that import only, firms that export and import and domestic intra-firm traders are more productive if they import from outside the UK/EU. For the foreign-owned intra-firm traders this is the case also if they export to outside the UK/EU. Self-selection and learning effects are observed only for firms that start to import and for those that add intra-firm trade to exporting and importing. Adding additional dimensions of trade is associated with a diversification of exports and/or imports from nearby markets to markets further away.

The findings on heterogeneity between different groups of traders are broadly consistent with the productivity thresholds that determine whether firms trade or set up affiliates abroad in recent models of intra-industry firm heterogeneity a la Melitz (2003). However, the amount of within-group heterogeneity and the lack of significant differences between the

groups of traders that engage in only a few dimensions of trade suggest that productivity as a single dimension may not be sufficient to fully account for firm's selection into a certain trading status. Some models already include additional dimensions. For example, Kasahara and Lapham (2008) add also a fixed cost of importing. The models by Antràs and Helpman (2004) or Grossman et al. (2006) combine productivity thresholds with contract theory to model the decision between in-house production (in a foreign subsidiary) and outsourcing. In addition, the results regarding trading partners imply that both firm-specific as well as market-specific effects as modelled for exports in Chaney (2008) are at play not only when firms expand into additional markets but also when they add further dimensions of trade.

Regarding intra-firm the paper highlights again that in many instances trade between headquarters and subsidiaries abroad flows in both directions and on top of this these most globally engaged firms also trade at arm's length. To date few models combine motivations for intra-firm trade on the input side with motivations for intra-firm trade on the output side; Keller and Yeaple (2008) are an exception. A promising avenue for future research might be to integrate their approach into heterogeneous firm models.

For policy, the results presented here suggest that assisting firms merely to enter a nearby export market is not sufficient. Support with identifying suppliers abroad is equally if not more important for improvements in firm performance. Moreover, continuous assistance that helps firms expand their sales to existing markets as well as a choice in terms of the new markets they expand into or source from is bound to be more successful than identifying specific new target markets. Once firms are able to sustain a presence abroad, engaging in new dimensions of trade or setting up affiliates abroad appears to be a natural way of expansion.

## References

- Akerberg, Daniel A., Kevin Caves, and Garth Frazer (2008) 'Structural identification of production functions.' mimeo, UCLA
- Altomonte, Carlo, and Gábor Békés (2009) 'Trade complexity and productivity.' Discussion Paper MT-DP 2009/14, Institute of Economics, Hungarian Academy of Sciences

- Amiti, Mary, and Donald R. Davis (forthc.) ‘Trade, firms, and wages: Theory and evidence.’ *Review of Economic Studies*
- Amiti, Mary, and Jozef Konings (2007) ‘Trade liberalization, intermediate inputs and productivity: Evidence from Indonesia.’ *American Economic Review* 97(5), 1611–1638
- Andersson, Martin, Hans Lööf, and Sara Johansson (2008) ‘Productivity and international trade: Firm level evidence from a small open economy.’ *Review of World Economics (Weltwirtschaftliches Archiv)* 144(4), 774–801
- Antràs, Pol, and Elhanan Helpman (2004) ‘Global sourcing.’ *Journal of Political Economy* 112(3), 552–580
- Bernard, Andrew B., and J. Bradford Jensen (1995) ‘Exporters, jobs and wages in US manufacturing: 1976-1987.’ *Brookings Papers on Economic Activity, Microeconomics* pp. 67–119
- Bernard, Andrew B., J. Bradford Jensen, and Peter K. Schott (2009) ‘Importers, exporters, and multinationals: A portrait of firms in the U.S. that trade goods.’ In *Producer Dynamics: New Evidence from Micro Data*, ed. T. Dunne, J.B. Jensen, and M.J. Roberts (University of Chicago Press)
- Bernard, Andrew, J. Bradford Jensen, Stephen Redding, and Peter K. Schott (2007) ‘Firms in international trade.’ *Journal of Economic Perspectives* 21(3), 105–130
- Castellani, Davide, Francesco Serti, and Chiara Tomasi (2010) ‘Firms in international trade: Importers’ and exporters’ heterogeneity in Italian manufacturing industry.’ *The World Economy* 33(3), 424–457
- Central Statistics Office (2009) *Estimates of the capital stock of fixed assets* (Dublin: Stationary Office)
- Chaney, Thomas (2008) ‘Distorted gravity: the intensive and extensive margins of international trade.’ *American Economic Review* 98(4), 1707–21

- Corcos, Gregory, Delphine Irac, Giordano Mion, and Thierry Verdier (2009) ‘The determinants of intra-firm trade.’ CEPR Discussion Papers 7530, Centre for Economic Policy Research
- Eaton, Jonathan, Samuel Kortum, and Francis Kramarz (2011) ‘An anatomy of international trade: Evidence from French firms.’ *Econometrica* 79(5), 1453–1498
- Feinberg, Susan E., and Michael P. Keane (2006) ‘Accounting for the growth of MNC-based trade using a structural model of U.S. MNCs.’ *American Economic Review* 96(5), 1515–1558
- Greenaway, David, and Richard Kneller (2007) ‘Firm heterogeneity, exporting and foreign direct investment.’ *Economic Journal* 117(517), F134–F161
- Grossman, Gene M., and Elhanan Helpman (2005) ‘Outsourcing in a global economy.’ *Review of Economic Studies* 72(1), 135–159
- Grossman, Gene M., Elhanan Helpman, and Adam Szeidl (2006) ‘Optimal integration strategies for the multinational firm.’ *Journal of International Economics* 70(1), 216–238
- Halpern, László, Miklós Koren, and Adam Szeidl (2009) ‘Imported inputs and productivity.’ CeFiG Working Papers 8, Center for Firms in the Global Economy
- Harris, Richard D., and Catherine Robinson (2002) ‘The effect of foreign acquisitions on total factor productivity: Plant-level evidence from U.K. manufacturing, 1987-1992.’ *Review of Economics and Statistics* 84, 562–568
- Helpman, Elhanan (2006) ‘Trade, FDI, and the organisation of firms.’ *Journal of Economic Literature* 44(3), 589–630
- Helpman, Elhanan, Marc J. Melitz, and Stephen Ross Yeaple (2004) ‘Export versus FDI with heterogeneous firms.’ *American Economic Review* 94(1), 300–316
- International Study Group on Exports and Productivity (2008) ‘Understanding cross-country differences in exporter premia: Comparable evidence for 14 countries.’ *Review of World Economics (Weltwirtschaftliches Archiv)* 144(4), 596–635

- Irarrazabal, Alfonso, Andreas Moxnes, and Luca David Opmollà (2009) ‘The margins of multinational production and the role of intra-firm trade.’ CEPR Discussion Paper 7145, Centre for Economic Policy Research
- Kasahara, Hiroyuki, and Beverly Lapham (2008) ‘Productivity and the decision to import and export: Theory and evidence.’ University of Western Ontario, mimeo
- Kasahara, Hiroyuki, and Joel Rodrigue (2007) ‘Does the use of imported intermediates increase productivity? Plant-level evidence.’ *Journal of Development Economics* 87(1), 106–118
- Keller, Wolfgang, and Stephen R. Yeaple (2008) ‘Global production and trade in the knowledge economy.’ NBER Working Paper 14626, National Bureau of Economic Research
- Koenker, Roger W., and Gilbert Bassett (1978) ‘Regression quantiles.’ *Econometrica* 46(1), 33–50
- Koenker, Roger W., and Kevin F. Hallock (2001) ‘Quantile regression.’ *Journal of Economic Perspectives* 15(4), 143–156
- Lawless, Martina (2009) ‘Firm export dynamics and the geography of trade.’ *Journal of International Economics* 77(2), 245–254
- Markusen, James (1984) ‘Multinationals, multi-plant economies, and the gains from trade.’ *Journal of International Economics* 16(3–4), 205–226
- Martins, Pedro S., and Luca David Opmollà (2011) ‘Why ex(im)porters pay more: Evidence from matched firm-worker panels.’ mimeo, Research Department, Banco de Portugal
- Melitz, Marc J. (2003) ‘The impact of trade on intra-industry reallocations and aggregate industry productivity.’ *Econometrica* 71(6), 1695–1725
- Munch, Jakob Roland, and Jan Rose Skaksen (2008) ‘Human capital and wages in exporting firms.’ *Journal of International Economics* 75(2), 363–372
- Muûls, Mirabelle, and Mauro Pisu (2009) ‘Imports and exports at the level of the firm: Evidence from Belgium.’ *The World Economy* 32(5), 692–734

- Nelson, Benjamin D. (2011) ‘Agency costs, multinational firms and the mode of foreign entry.’ Bank of England, mimeo
- Ruane, Frances, and Julie Sutherland (2005) ‘Export performance and destination characteristics of Irish manufacturing industry.’ *Review of World Economics (Weltwirtschaftliches Archiv)* 141(3), 442–459
- Schank, Thorsten, Claus Schnabel, and Joachim Wagner (2007) ‘Do exporters really pay higher wages? First evidence from German linked employer-employee data.’ *Journal of International Economics* 72(1), 52–74
- Serti, Francesco, and Chiara Tomasi (2009) ‘Firm heterogeneity: do destinations of exports and origins of imports matter?’ In *Multinationals and Local Competitiveness*, ed. Lucia Piscitello and Grazia D. Santangelo (Milan: Edizioni Franco Angeli)
- Tomiura, Eiichi (2007) ‘Foreign outsourcing, exporting, and FDI: A productivity comparison at the firm level.’ *Journal of International Economics* 72(1), 113–127
- Vogel, Alexander, and Joachim Wagner (2010) ‘Higher productivity in importing German manufacturing firms: Self-selection, learning from importing, or both?’ *Review of World Economics (Weltwirtschaftliches Archiv)* 145(4), 641–665
- Wagner, Joachim (2007) ‘Exports and productivity: A survey of the evidence from firm-level data.’ *The World Economy* 30(1), 60–82

## Notes

<sup>0</sup>lead footnote: Stefanie Haller is also affiliated with Trinity College Dublin. This work makes use of data from the Central Statistics Office (CSO). The possibility for controlled access to the confidential micro data set on the premises of the CSO is provided for in the Statistics Act 1993. The use of CSO data in this work does not imply the endorsement of the CSO in relation to the interpretation or analysis of the data. This work uses a research dataset which may not exactly reproduce statistical aggregates published by the CSO. I thank Kevin Phelan of the CSO for support with the data and the clearing of files. I am grateful for financial support for this research from the Irish Research Council for the Humanities and Social Sciences. I thank seminar participants at the Economic and Social Research Institute, the 3rd ISGEP workshop in Dublin, ETSG Rome, the University of Stirling, the DIME-ISGEP workshop in Nice and CAED London as well as two anonymous referees for helpful comments and suggestions. All remaining errors are my own responsibility.

<sup>1</sup>Bernard et al. (2009) document that in 2000 firms that trade with related parties account for nearly 80% of export and import volumes in the U.S.

<sup>2</sup>Bernard et al. (2009) treat firms that trade with related parties as a separate category in their characterisation of US traders, they do not assess differences in performance between different types of traders, however.

<sup>3</sup>Schank et al. (2007) also provide an extensive survey of the firm level literature on wages in exporting firms.

<sup>4</sup>In 1996 the distribution of activity between domestic and foreign-owned exporters and importers was still more balanced.

<sup>5</sup>For comparison the share of domestic multi-unit enterprises among the firms that do not engage in intra-firm trade was 3.9% in 2005 (8.3% for the foreign-owned firms that are not intra-firm traders).

<sup>6</sup>Note also, there are no significant differences between firms engaged in intra-firm trade in only one direction and those that both invoice turnover to affiliates and purchase materials from affiliates except for the one-way intra-firm traders being smaller. Results are available on request.

<sup>7</sup>Standardised coefficients in text calculated as  $100(\exp^{\beta_j} - 1)$ .

<sup>8</sup>When the ACF TFP measure is the dependent variable it is significant at the 10% level.

<sup>9</sup>According to the model Kasahara and Lapham (2008) firms that export only should be more productive than firms that import only and also as productive or more productive than firms that export and import.

<sup>10</sup>This is reversed for LP and for the ACF TFP measure, but the distributions also do not differ significantly in both cases.

<sup>11</sup>Altomonte and Békés (2009) and Castellani et al. (2010) plot cumulative distributions of the residuals of productivity regressions that suggest stochastic dominance in the following descending order for, respectively, Hungarian and Italian manufacturing firms: firms that export and import, firms that import only, firms that

export only, firms that do not trade. As the cumulative density plots do not come with standard errors the results are not directly comparable, however.

<sup>12</sup>Ruane and Sutherland (2005) look at exporting only, they find that firms that do not only export to the UK are more productive than firms that export to the UK only.

<sup>13</sup>This result also holds when all firms that are ever owned by a US multinational are excluded from the analysis.

<sup>14</sup>Given the way the data is collected it cannot be fully excluded that firms may have been in operation for a year or two before they are first captured by the survey. This is the case in particular if they have been setting up, but not producing any output during this period yet.

<sup>15</sup>There are other types of switches that are equally interesting and important, however, in all of those groups there are fewer than 25 cases of switchers - too few to warrant reliable inference.

<sup>16</sup>The ACF TFP measure does not confirm this effect.

<sup>17</sup>Results available on request.



## A Appendix

### Variable definitions<sup>18</sup>

*age<sub>it</sub>* One plus the difference between the current year and the year the firm it was first established or it was first recorded on the CSO's business register or the year of the first observation - whichever is smallest.

*average wage* Log(gross earnings in 1000EUR deflated with the consumer price index/ $L_{it}$ ).

*capital intensity*  $\ln(K_{it}/L_{it})$ .

*foreign<sub>it</sub>* Dummy equal to 1 if the firm's ultimate beneficial owner is located outside Ireland.

$K_{it}$  Capital stocks. Capital stocks are calculated based on capital investments using the perpetual inventory method, where firm  $i$ 's stock of capital asset  $x$  at time  $t$  is obtained from investments  $I$  and depreciation  $\delta_x$  as:

$$CS_{xit} = (1 - \frac{\delta_x}{2})[I_{xt} + (1 - \delta_x)I_{xt-1} + (1 - \delta_x)^2 I_{xt-2} + \dots]. \quad (4)$$

Assets are buildings, machinery and equipment, transport equipment and other assets. From 1999 other assets are further broken down into software, computer equipment and other assets. Asset lives, implied depreciation rates and deflators are those underlying CSO's calculations of industry level capital stocks (Central Statistics Office, 2009). Total capital stock for each firm is the sum over individual assets. Capital stocks are calculated from 1985 onwards to make sure that they are driven as much as possible by firm's capital acquisitions rather than by starting stocks. The sampling frame in the Census of Industrial Production was different until 1990, however, for the mostly larger firms that are still in operation after 1991 the data are comparable. Starting stocks in 1985 and for firms that entered after 1985 are obtained by breaking down the previous year's end of year industry level capital stock obtained from CSO to the firm level using the firm's share in industry-level fuel use.<sup>19</sup>

$L_{it}$  Number of employees.

$LP_{it}$  Labour productivity defined as  $\ln(Y_{it}/L_{it})$ .

$M_{it}$  Total purchases of materials in 1000EUR deflated with the wholesale price index for intermediate industries except energy.

$multi_{it}$  Dummy equal to 1 if the firm is a multi-unit enterprise, i.e. has several local units in Ireland.

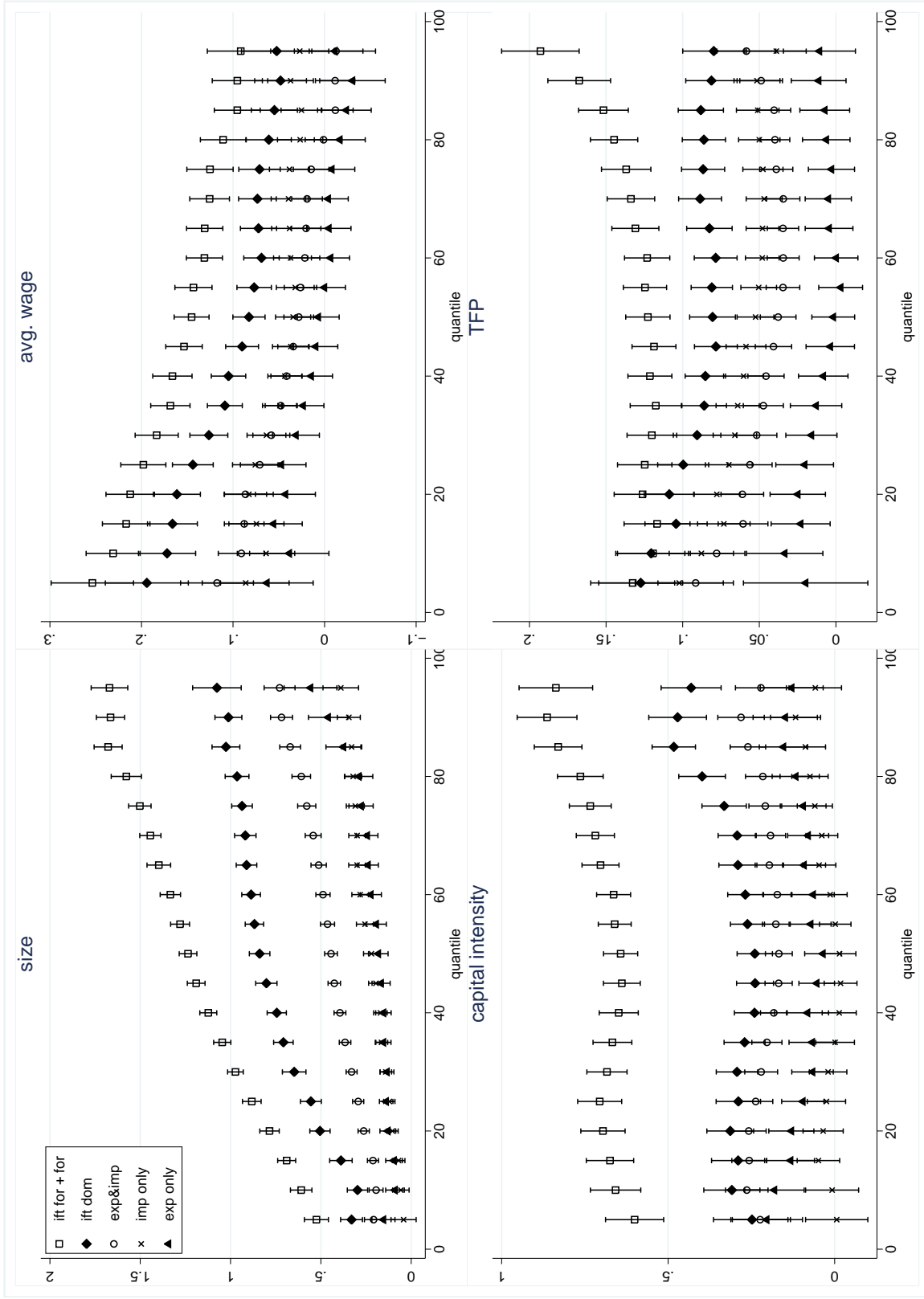
$size_{it}$  Log number of persons engaged.

$Y_{it}$  Turnover (sales) in 1000EUR deflated using wholesale/producer price indices at the 2-3 digit NACE Rev. 1.1 level.

[Table 10 about here.]

[Table 11 about here.]

Figure 1: Graphical representation of results from simultaneous quantile regressions of size, average wages, capital intensity and TFP



Note: Coefficient estimates obtained from simultaneous quantile regressions of equation (2). Controls include firm age, size (except when size is the dependent variable), foreign and multi-plant status, year and industry (3-digit NACE) dummies and a constant. Regressions on average wages also include the share of managerial and technical employees and the share of clerical employees. Confidence intervals are 5% on either side.

Table 1: Trading status over time (% of firms)

year	no trade	exp only	imp only	exp& imp	ift dom	ift for	no. of firms
1996	16.9	8.5	10.9	34.9	8.2	20.5	2003
1997	16.4	7.9	10.6	35.5	9.0	20.6	2110
1998	15.9	7.7	10.5	35.4	10.1	20.3	2172
1999	15.8	7.4	11.1	34.5	11.1	20.2	2162
2000	15.9	6.4	11.1	34.2	11.9	20.7	2105
2001	15.4	6.3	11.6	34.3	11.1	21.3	2076
2002	15.5	6.4	11.6	34.3	11.3	20.9	2053
2003	14.9	5.8	11.7	35.1	12.1	20.5	1977
2004	13.7	5.1	12.2	36.3	12.3	20.4	1841
2005	13.3	4.8	12.7	36.7	11.8	20.8	1722
Tot/Avg	15.4	6.7	11.3	35.1	10.9	20.6	20221
Domestic	20.8	8.2	14.9	41.4	14.7		14952
Foreign	0.3	2.3	1.2	17.1		79.1	5269

Table 2: Firm's shares of persons engaged, turnover, materials, export and import volume by trading status (%)

	persons engaged	turnover	materials	export volume	import volume
1996					
no trade	5.8	3.1	3.7	0.0	0.0
exp only	5.7	7.5	11.5	8.1	0.0
imp only	5.2	4.0	3.5	0.0	3.9
exp&imp	28.2	23.8	23.3	20.2	20.2
ift dom	11.7	9.5	14.9	7.0	6.7
ift for	43.4	52.0	43.1	64.7	69.2
#/Mio EUR	188352	47352	19415	32787	9090
2005					
no trade	4.8	1.0	1.7	0.0	0.0
exp only	3.2	1.6	1.6	1.3	0.0
imp only	5.9	1.6	2.9	0.0	1.9
exp&imp	28.8	45.6	45.0	48.3	52.9
ift dom	14.2	6.1	13.0	2.8	4.3
ift for	43.1	44.1	35.8	47.5	40.9
#/Mio EUR	185659	119812	33696	102448	23381

Note: Monetary values in constant values (base year 2000). Imports refer to material imports only. Where shares do not add up to 100 in a column this is due to rounding.

Table 3: Additional trading activities of intra-firm traders (%)

	t/o to aff	mat from aff	t/o to aff & mat from aff	sum
Foreign-owned intra-firm traders (4168 obs)				
ift only	0.05	0.10	0.05	0.19
ift w exp only	2.16	0.19	0.24	2.59
ift w imp only	0.29	1.27	0.48	2.04
ift w exp&imp	26.32	11.04	57.82	95.18
sum	28.81	12.60	58.59	100.00
Domestic intra-firm traders (2194 obs)				
ift only	3.33	1.69	1.50	6.52
ift w exp only	5.74	1.41	4.56	11.71
ift w imp only	7.70	3.19	3.97	14.86
ift w exp&imp	33.04	8.66	25.21	66.91
sum	49.82	14.95	35.23	100.00

Note: Where shares do not add up to row or column totals this is due to rounding.

Table 4: Differences between different types of traders - means and standard deviations 1996-2005

	N	persons engaged	capital stock	avg. wage	labour productivity	TFP
no trade	3121	35 (39)	3057 (7682)	20.22 (7.33)	4.41 (0.68)	0.94 (0.24)
exp only	1352	70 (201)	6588 (18977)	20.60 (8.01)	4.66 (0.85)	0.98 (0.26)
imp only	2295	49 (75)	4539 (16580)	21.92 (8.25)	4.60 (0.73)	1.00 (0.26)
exp&imp	7091	80 (170)	10903 (50471)	21.71 (7.59)	4.69 (0.74)	0.97 (0.25)
ift dom	2194	126 (202)	15865 (37495)	24.32 (7.69)	5.12 (0.80)	1.08 (0.23)
ift for	4168	216 (339)	41243 (167362)	26.73 (8.68)	5.27 (0.98)	1.07 (0.28)
total	20221	102 (214)	15474 (84079)	22.75 (8.23)	4.80 (0.86)	1.00 (0.26)
domestic	14952	64 (116)	6349 (18982)	21.42 (7.57)	4.65 (0.74)	0.99 (0.24)
foreign	5269	210 (349)	41368 (158758)	26.50 (8.85)	5.24 (1.01)	1.06 (0.29)
exporters	14243	126 (248)	20251 (99483)	23.36 (8.32)	4.91 (0.88)	1.01 (0.26)
importers	15232	118 (235)	18924 (96344)	23.43 (8.31)	4.87 (0.86)	1.01 (0.26)

Note: Capital stocks and wages per employee are in 1000EUR. All monetary values are in constant terms, the base year is 2000.

Table 5: Trading status and firm heterogeneity

	size	log avg. wage <sup>†</sup>	capital intensity	LP <sup>‡</sup>	TFP	TFP ignoring ift
OLS						
exp only	0.258** (0.054)	0.004 (0.021)	0.095 <sup>(*)</sup> (0.054)	0.049 (0.040)	0.019 (0.014)	0.032* (0.015)
imp only	0.229** (0.039)	0.052** (0.018)	0.039 (0.047)	0.178** (0.032)	0.066** (0.013)	0.065** (0.012)
exp&imp	0.467** (0.038)	0.042* (0.016)	0.225** (0.045)	0.150** (0.031)	0.064** (0.012)	0.066** (0.012)
ift dom	0.784** (0.052)	0.109** (0.019)	0.311** (0.057)	0.282** (0.039)	0.108** (0.014)	
ift for	0.700** (0.088)	0.061* (0.026)	0.297** (0.081)	0.282** (0.070)	0.126** (0.024)	
foreign	0.545** (0.077)	0.103** (0.021)	0.422** (0.066)	0.172** (0.057)	0.035 <sup>(*)</sup> (0.019)	0.072** (0.012)
multi	0.969** (0.077)	0.018 (0.019)	-0.055 (0.066)	0.105* (0.050)	0.047** (0.016)	0.046** (0.017)
age	0.007** (0.001)	0.001** (0.000)	0.005** (0.001)	-0.002** (0.001)	-0.001** (0.000)	-0.001** (0.000)
size		0.083** (0.006)	-0.006 (0.020)	0.115** (0.016)	-0.019** (0.006)	-0.015** (0.006)
R <sup>2</sup> -adj	0.40	0.43	0.37	0.51	0.28	0.27
ift for + for	1.244** (0.054)	0.164** (0.020)	0.719** (0.060)	0.454** (0.053)	0.161** (0.017)	
Fixed effects						
exp only	0.104** (0.027)	-0.011 (0.018)	0.020 (0.023)	-0.007 (0.018)	0.022 <sup>(*)</sup> (0.013)	0.027* (0.012)
imp only	0.060* (0.024)	0.010 (0.015)	0.015 (0.022)	0.011 (0.015)	0.000 (0.008)	0.001 (0.008)
exp&imp	0.116** (0.027)	0.027 <sup>(*)</sup> (0.015)	0.009 (0.022)	0.033* (0.016)	0.018 <sup>(*)</sup> (0.010)	0.027** (0.010)
ift dom	0.170** (0.032)	0.041* (0.017)	0.052 <sup>(*)</sup> (0.028)	0.040* (0.017)	0.039** (0.011)	
ift for	0.257** (0.044)	0.038 <sup>(*)</sup> (0.020)	0.100** (0.035)	0.038 <sup>(*)</sup> (0.020)	0.036* (0.015)	
foreign	-0.037 (0.040)	0.035 <sup>(*)</sup> (0.019)	-0.046 (0.033)	0.037 <sup>(*)</sup> (0.020)	0.022 (0.014)	0.026* (0.012)
multi	0.271** (0.046)	0.028 (0.020)	0.009 (0.028)	0.037 <sup>(*)</sup> (0.020)	0.011 (0.013)	0.012 (0.013)
age	0.016** (0.002)	0.031** (0.001)	0.031** (0.001)	0.029** (0.001)	0.010** (0.001)	0.010** (0.001)
size		-0.036** (0.011)	-0.667** (0.017)	0.014 (0.012)	-0.050** (0.007)	-0.050** (0.007)
R <sup>2</sup> -adj	0.05	0.19	0.43	0.18	0.06	0.06
ift for + for	0.220** (0.044)	0.073** (0.022)	0.053 (0.034)	0.075** (0.043)	0.058** (0.016)	

<sup>†</sup> Regression includes controls for the share of managerial and technical employees and the share of clerical employees.

<sup>‡</sup> Regression controls for capital intensity. Note: All regressions include 20221 observations from 2457 firms. Standard errors adjusted for clustering at the firm level in parenthesis; \*\*, \*, <sup>(\*)</sup> indicate significance at 1, 5, 10% respectively. All regressions include year, industry (3-digit NACE) dummies and a constant. OLS regressions also include year-industry (2-digit NACE) interaction dummies.



Table 6: Productivity levels by trading activity and destination and source country

	OLS	Fixed effects
exp only (UK,EU)	0.027 (0.014) <sup>(*)</sup>	0.023 (0.012) <sup>(*)</sup>
exp only (US)	-0.039 (0.033)	0.011 (0.025)
exp only (ROW not US)	0.071 (0.037) <sup>(*)</sup>	0.022 (0.022)
imp only (UK,EU)	0.056 (0.015)**	-0.004 (0.008)
imp only (US)	0.096 (0.027)**	0.025 (0.015) <sup>(*)</sup>
imp only (ROW not US)	0.100 (0.026)**	0.011 (0.019)
exp (UK,EU) & imp (UK,EU)	0.062 (0.013)**	0.019 (0.010) <sup>(*)</sup>
exp (UK,EU) & imp (US)	0.113 (0.027)**	0.032 (0.014)*
exp (UK,EU) & imp ROW not US	0.123 (0.022)**	0.030 (0.015)*
exp (US) & imp (UK,EU)	0.023 (0.020)	0.018 (0.013)
exp (US) & imp (US)	0.068 (0.023)**	0.042 (0.017)*
exp (US) & imp (ROW not US)	0.054 (0.037)	0.030 (0.025)
exp (ROW not US) & imp (UK,EU)	0.081 (0.019)**	0.010 (0.013)
exp (ROW not US) & imp (US)	0.062 (0.029)*	0.015 (0.024)
exp (ROW not US) & imp (ROW not US)	0.110 (0.029)**	0.024 (0.020)
ift dom w exp (UK,EU) & imp (UK,EU)	0.121 (0.016)**	0.030 (0.014)*
ift dom w exp (UK,EU) & imp (US)	0.115 (0.037)**	0.073 (0.018)**
ift dom w exp (UK,EU) & imp (ROW not US)	0.186 (0.043)**	0.051 (0.021)*
ift dom w exp (US) & imp (UK,EU)	0.081 (0.036)*	0.043 (0.016)**
ift dom w exp (US) & imp (US)	0.127 (0.030)**	0.061 (0.025)*
ift dom w exp (US) & imp (ROW not US) <sup>†</sup>	0.007 (0.074)	0.064 (0.025)**
ift dom w exp (ROW not US) & imp (UK,EU)	0.164 (0.027)**	0.038 (0.015)*
ift dom w exp (ROW not US) & imp (US) <sup>†</sup>	0.071 (0.041) <sup>(*)</sup>	0.030 (0.026)
ift dom w exp (ROW not US) & imp (ROW not US) <sup>†</sup>	0.130 (0.034)**	0.033 (0.019) <sup>(*)</sup>
ift for w exp (UK,EU) & imp (UK,EU)	0.057 (0.027)*	0.022 (0.021)
ift for w exp (UK,EU) & imp (US)	0.122 (0.033)**	0.025 (0.026)
ift for w exp (UK,EU) & imp (ROW not US)	0.039 (0.040)	0.012 (0.029)
ift for w exp (US) & imp (UK,EU)	0.120 (0.035)**	0.070 (0.022)**
ift for w exp (US) & imp (US)	0.178 (0.029)**	0.089 (0.021)**
ift for w exp (US) & imp (ROW not US)	0.073 (0.041) <sup>(*)</sup>	0.070 (0.021)**
ift for w exp (ROW not US) & imp (UK,EU)	0.136 (0.044)**	0.011 (0.022)
ift for w exp (ROW not US) & imp (US)	0.199 (0.037)**	0.084 (0.026)**
ift for w exp (ROW not US) & imp (ROW not US)	0.177 (0.044)**	0.030 (0.025)
foreign	0.036 (0.019) <sup>(*)</sup>	0.025 (0.014) <sup>(*)</sup>
R <sup>2</sup> -adj	0.29	0.06
Obs/Firms	16523/2431	16523/2431

Notes: Dependent variable is TFP. (US) - ex/imports to the US and possibly other markets, (ROW not US)- ex/imports to ROW and possibly other markets but not the US. Standard errors adjusted for clustering at the firm level in parenthesis; \*\*, \*, (\*) indicate significance at 1, 5, 10% respectively. Regressions include controls for firm age, size and multi-plant status, year and industry (3-digit NACE) dummies and a constant. OLS regressions also include year-industry (2-digit NACE) interaction dummies. Regressions are for 1996-2003 only. Intra-firm traders that do not report exports or imports not included. Groups marked with <sup>†</sup> have less than 85 observations.

Table 7: Transitions between trading statuses 1996-2000, 2001-2005

	no trade	exp only	imp only	exp& imp	ift dom	ift for	exit
1996 \ 2000							
no trade	69.62	5.01	7.67	5.31	4.13	0.00	8.26
exp only	9.36	50.29	0.58	21.05	6.43	2.92	9.36
imp only	5.02	0.46	54.79	21.92	6.85	0.91	10.05
exp&imp	0.57	0.57	4.15	72.25	7.01	3.58	11.87
ift dom	0.61	0.61	3.03	10.30	73.94	1.82	9.70
ift for	0.00	0.00	0.24	4.15	0.24	80.73	14.63
entry	20.18	7.65	15.60	23.85	11.62	21.10	
2001 \ 2005							
no trade	54.86	3.45	13.48	5.33	1.25	0.00	21.63
exp only	6.87	38.93	0.76	25.19	0.76	0.00	27.48
imp only	6.67	0.42	47.92	16.67	3.75	0.42	24.17
exp&imp	0.56	1.40	3.93	65.92	3.37	2.24	22.58
ift dom	0.43	1.30	2.60	9.09	61.04	6.49	19.05
ift for	0.00	0.90	0.23	5.66	2.49	71.04	19.68
entry	23.76	1.98	23.76	25.74	12.87	11.88	

Notes: Read cell no trade\imp only as the share of plants that did not trade in the first year of the transition matrix and that imported only in the last year of the transition matrix. Trading status of entrants is that recorded in the final year of each transition matrix.

Table 8: Size, wages, capital intensity and productivity in firms that switch trading status relative to industry-year mean of non-switchers

	Size	avg. wage	capital intensity	LP	TFP
No trade to exporting only					
t-2	0.121 (0.140)	0.158 (0.060)**	0.032 (0.112)	0.165 (0.151)	0.057 (0.058)
t-1	0.159 (0.112)	0.079 (0.069)	0.001 (0.128)	0.214 (0.151)	0.074 (0.059)
t	0.247 (0.114)*	-0.031 (0.075)	-0.070 (0.140)	0.067 (0.114)	0.034 (0.049)
t+1	0.251 (0.110)*	0.005 (0.071)	-0.104 (0.142)	0.182 (0.113)	0.074 (0.046)
t+2	0.208 (0.112)(*)	-0.046 (0.058)	-0.135 (0.154)	0.192 (0.114)(*)	0.082 (0.045)(*)
R <sup>2</sup> -adj	0.29	0.44	0.48	0.61	0.39
N/Firms/Switchers			2477/309/19		
No trade to importing only					
t-2	0.188 (0.094)*	-0.004 (0.042)	0.020 (0.113)	0.139 (0.065)*	0.052 (0.027)(*)
t-1	0.273 (0.087)**	-0.010 (0.045)	0.021 (0.118)	0.136 (0.073)(*)	0.044 (0.029)
t	0.300 (0.082)**	0.006 (0.036)	0.054 (0.110)	0.147 (0.065)*	0.051 (0.025)*
t+1	0.333 (0.075)**	0.030 (0.036)	0.122 (0.110)	0.170 (0.068)*	0.057 (0.025)*
t+2	0.323 (0.084)**	0.025 (0.041)	0.129 (0.107)	0.185 (0.080)*	0.055 (0.031)(*)
R <sup>2</sup> -adj	0.33	0.44	0.47	0.61	0.40
N/Firms/Switchers			2600/327/48		
Exporting only to exporting and importing					
t-2	0.139 (0.169)	0.086 (0.082)	0.173 (0.148)	0.175 (0.152)	0.031 (0.047)
t-1	0.127 (0.165)	0.087 (0.072)	0.234 (0.147)	0.264 (0.154)(*)	0.044 (0.049)
t	0.181 (0.171)	0.041 (0.073)	0.205 (0.152)	0.095 (0.150)	-0.025 (0.050)
t+1	0.137 (0.166)	0.035 (0.095)	0.228 (0.165)	0.170 (0.157)	-0.002 (0.051)
t+2	0.064 (0.187)	0.145 (0.086)(*)	0.241 (0.182)	0.265 (0.157)(*)	0.038 (0.049)
R <sup>2</sup> -adj	0.31	0.43	0.38	0.56	0.36
N/Firms/Switchers			971/137/39		
Importing only to exporting and importing					
t-2	-0.020 (0.120)	-0.038 (0.073)	0.100 (0.134)	0.037 (0.096)	0.012 (0.035)
t-1	0.047 (0.112)	0.001 (0.054)	0.036 (0.119)	0.022 (0.092)	0.013 (0.031)
t	-0.013 (0.108)	0.087 (0.050)(*)	0.138 (0.113)	0.121 (0.094)	0.050 (0.033)
t+1	-0.006 (0.104)	0.069 (0.043)	0.126 (0.118)	0.104 (0.094)	0.043 (0.033)
t+2	-0.022 (0.106)	0.021 (0.052)	0.071 (0.123)	0.130 (0.098)	0.050 (0.034)
R <sup>2</sup> -adj	0.35	0.41	0.43	0.58	0.42
N/Firms/Switchers			1556/219/54		
Exporting and importing to domestic firm engaged in intra-firm trade					
t-2	0.432 (0.104)**	0.057 (0.040)	0.224 (0.123)(*)	0.113 (0.073)	0.041 (0.027)
t-1	0.497 (0.104)**	0.039 (0.037)	0.253 (0.125)*	0.132 (0.066)*	0.051 (0.024)*
t	0.516 (0.104)**	0.102 (0.034)**	0.313 (0.116)**	0.136 (0.072)(*)	0.053 (0.026)*
t+1	0.530 (0.109)**	0.051 (0.037)	0.344 (0.113)**	0.203 (0.077)**	0.072 (0.026)**
t+2	0.605 (0.112)**	0.056 (0.033)(*)	0.275 (0.116)*	0.195 (0.071)**	0.075 (0.025)**
R <sup>2</sup> -adj	0.34	0.44	0.35	0.47	0.30
N/Firms/Switchers			5586/696/55		
Exporting and importing to foreign-owned firm engaged in intra-firm trade					
t-2	-0.077 (0.188)	0.054 (0.052)	-0.096 (0.177)	0.263 (0.131)*	0.104 (0.042)*
t-1	0.008 (0.169)	0.060 (0.050)	-0.281 (0.194)	0.305 (0.138)*	0.125 (0.044)**
t	-0.101 (0.184)	0.080 (0.047)(*)	-0.299 (0.190)	0.341 (0.148)*	0.142 (0.046)**
t+1	0.006 (0.187)	0.014 (0.046)	-0.330 (0.201)	0.321 (0.155)*	0.137 (0.049)**
t+2	0.006 (0.198)	0.053 (0.054)	-0.253 (0.200)	0.259 (0.161)	0.119 (0.055)*
R <sup>2</sup> -adj	0.32	0.45	0.35	0.46	0.29
N/Firms/Switchers			5509/686/36		

Note: Switchers are required to be in their original trading status for at least two years before the switching and to remain in the new trading status for at least two years after switching, year  $t$  is the first year in the new trading status. Comparison group are firms that retain the switcher's initial trading status over the entire 5-year period. Standard errors adjusted for clustering at the firm level in parenthesis; \*\*, \*, (\*) indicate significance at 1, 5, 10%. All regressions include a constant, controls for foreign ownership (where applicable), multi-unit status, firm age and size (except when size is the dependant variable), year, industry, and year-industry interaction dummies. When avg. wage is the dependent variable, regressions control for the share of managerial and technical employees and the share of clerical employees. When LP is the dependent variable, regressions control also for capital intensity.

Table 9: Export and import volumes by destination for firms that switch trading status relative to industry-year mean of non-switchers

	Total	UK	EU	USA	ROW
Exporting only to exporting and importing (39 switchers) - export volume					
t-2	0.412 (0.277)	-0.205 (0.536)	0.748 (0.560)	0.007 (0.285)	0.039 (0.621)
t-1	0.598 (0.263)*	0.166 (0.567)	0.906 (0.500)(*)	0.317 (0.310)	0.163 (0.601)
t	0.323 (0.251)	-0.052 (0.534)	0.416 (0.545)	-0.038 (0.278)	-0.270 (0.578)
t+1	0.518 (0.273)(*)	0.315 (0.559)	1.240 (0.553)*	-0.290 (0.260)	0.522 (0.637)
t+2	0.570 (0.290)(*)	0.313 (0.628)	1.132 (0.551)*	-0.102 (0.354)	0.679 (0.587)
R <sup>2</sup> -adj	0.71	0.42	0.56	0.27	0.48
N/Firms	971/137	971/137	850/137	971/137	850/137
Importing only to exporting and importing (54 switchers) - import volume					
t-2	0.230 (0.255)	0.767 (0.378)*	0.170 (0.454)	0.453 (0.275)	0.032 (0.245)
t-1	0.220 (0.271)	0.830 (0.405)*	0.185 (0.485)	0.292 (0.283)	0.094 (0.290)
t	0.507 (0.272)(*)	1.138 (0.406)**	0.720 (0.492)	0.415 (0.305)	0.316 (0.323)
t+1	0.580 (0.279)*	0.866 (0.444)(*)	1.280 (0.554)*	0.422 (0.285)	-0.004 (0.315)
t+2	0.512 (0.275)(*)	0.713 (0.441)	1.075 (0.619)(*)	0.401 (0.285)	-0.256 (0.265)
R <sup>2</sup> -adj	0.45	0.25	0.32	0.25	0.24
N/Firms	1556/219	1556/219	1330/219	1556/219	1330/219
Exporting and importing to domestic intra-firm trader (55 switchers) - export volume					
t-2	0.505 (0.139)**	0.730 (0.291)*	0.464 (0.402)	0.662 (0.345)(*)	-0.014 (0.375)
t-1	0.557 (0.143)**	0.603 (0.332)(*)	0.376 (0.407)	0.911 (0.375)*	-0.294 (0.381)
t	0.528 (0.161)**	0.673 (0.309)*	0.363 (0.429)	1.010 (0.400)*	0.086 (0.395)
t+1	0.545 (0.197)**	0.825 (0.319)*	0.623 (0.460)	1.145 (0.420)**	0.454 (0.418)
t+2	0.504 (0.199)*	0.697 (0.335)*	0.528 (0.526)	1.116 (0.415)**	0.143 (0.427)
R <sup>2</sup> -adj	0.58	0.32	0.44	0.30	0.33
N/Firms	5586/696	5586/696	4673/696	5586/696	4673/696
Exporting and importing to domestic intra-firm trader (55 switchers) - import volume					
t-2	0.454 (0.141)**	0.719 (0.273)**	1.025 (0.384)**	0.130 (0.269)	0.124 (0.329)
t-1	0.464 (0.137)**	0.742 (0.304)*	0.603 (0.400)	0.164 (0.287)	0.107 (0.338)
t	0.476 (0.145)**	0.743 (0.308)*	0.295 (0.408)	0.237 (0.298)	0.451 (0.378)
t+1	0.498 (0.147)**	0.800 (0.316)*	0.020 (0.464)	0.557 (0.326)(*)	0.462 (0.387)
t+2	0.459 (0.144)**	0.777 (0.325)*	-0.145 (0.460)	0.530 (0.342)	0.345 (0.401)
R <sup>2</sup> -adj	0.51	0.24	0.23	0.31	0.18
N/Firms	5586/696	5586/696	4673/696	5586/696	4673/696
Exporting and importing to foreign-owned intra-firm trader (36 switchers) - export volume					
t-2	0.214 (0.293)	-0.295 (0.584)	0.447 (0.575)	0.226 (0.613)	-0.646 (0.580)
t-1	0.118 (0.333)	-0.818 (0.679)	-0.190 (0.717)	0.088 (0.652)	-0.786 (0.611)
t	0.080 (0.317)	-0.404 (0.650)	-0.588 (0.664)	-0.119 (0.670)	-0.263 (0.734)
t+1	0.007 (0.325)	-0.187 (0.643)	-0.580 (0.728)	-0.075 (0.665)	0.216 (0.772)
t+2	0.088 (0.325)	-0.077 (0.658)	-0.062 (0.763)	0.088 (0.686)	0.108 (0.934)
R <sup>2</sup> -adj	0.57	0.31	0.45	0.30	0.33
N/Firms	5509/686	5509/686	4599/686	5509/686	4599/686
Exporting and importing to foreign-owned intra-firm trader (36 switchers) - import volume					
t-2	0.199 (0.219)	-0.790 (0.430)(*)	0.856 (0.526)	0.884 (0.475)(*)	0.414 (0.491)
t-1	0.129 (0.265)	-0.375 (0.439)	0.224 (0.563)	0.753 (0.503)	0.259 (0.549)
t	0.234 (0.280)	-0.222 (0.528)	-0.690 (0.567)	1.822 (0.579)**	0.431 (0.592)
t+1	0.234 (0.294)	-0.270 (0.544)	-0.533 (0.625)	1.504 (0.562)**	0.285 (0.678)
t+2	0.231 (0.285)	-0.154 (0.521)	-0.515 (0.827)	1.854 (0.577)**	-0.033 (0.685)
R <sup>2</sup> -adj	0.51	0.24	0.23	0.34	0.18
N/Firms	5509/686	5509/686	4599/686	5509/686	4599/686

Note: Switchers are required to be in their original trading status for at least two years before the switching and to remain in the new trading status for at least two years after switching, year  $t$  is the first year in the new trading status. Comparison group are firms that retain the switcher's initial trading status over the entire 5-year period. Standard errors adjusted for clustering at the firm level in parenthesis; \*\*, \*, (\*) indicate significance at 1, 5, 10%. <sup>42</sup> regressions include a constant, controls for foreign ownership (where applicable), multi-unit status, firm age and size, year, industry, and year-industry interaction dummies. Due to the enlargement of the EU in January 2004, import and export volumes to and from the EU and the rest of the world (ROW) include data until 2003 only.

Table 10: Trading status by NACE-letter industry in % (1996-2005)

2-digit NACE industries		no trade	exp only	imp only	exp& imp	ift dom	ift for	Obs
15,16	Food, Bev., Tobacco	17.6	12.4	8.6	32.6	20.3	8.5	3590
17-19	Textile, App., Leather	5.2	2.8	8.2	61.8	7.9	13.9	1263
20	Wood	26.5	9.3	22.2	26.6	10.4	4.9	837
21,22	Paper, Printing	28.8	13.1	11.5	24.5	11.3	10.8	2445
24	Chemicals	1.1	1.3	5.3	28.3	9.6	54.3	1423
25	Rubber, Plastic	7.5	5.2	14.3	42.4	9.0	21.5	1374
26	Non-met. Mineral	28.9	4.0	14.2	28.6	12.3	12.0	1038
27,28	Metal&Metal prod.	23.4	5.7	17.2	35.5	7.2	11.0	2336
29	Machinery	11.2	3.0	10.3	44.3	6.1	25.1	1482
30-33	Electr. & opt. equipm.	3.4	2.4	6.1	29.8	8.9	49.5	2566
34,35	Transport equipm.	12.5	5.1	12.5	40.9	6.7	22.2	535
36	Other manufacturing	16.0	5.7	16.6	42.6	6.7	12.5	1332
Average/Total		15.4	6.7	11.3	35.1	10.9	20.6	20221

NACE23 excluded.

Table 11: Main export and import destinations and combinations thereof

	no- where	UK only	UK,EU	UK,EU, US	UK,EU, ROW	UK,EU, US,ROW	other comb	total
% of all exporters exporting to:		30.58	14.14	5.71	12.82	19.21	17.54	100.00
% of all importers importing from:		25.10	26.38	11.72	8.90	11.59	16.31	100.00
% of only exporters exporting to:		46.81	12.23	5.18	9.09	5.44	21.24	100.00
% of only importers importing from:		46.44	24.35	4.32	4.00	2.92	17.98	100.00
% of exporters and importers exporting to and importing from:								
exports to \ imports from								
UK only		16.73	12.71	1.68	3.28	0.97	5.51	40.87
UK,EU		3.75	5.77	1.28	1.49	0.57	1.73	14.57
UK,EU,US		1.05	1.78	1.14	0.52	0.71	0.59	5.78
UK,EU,ROW		1.73	2.59	1.43	1.74	1.35	1.19	10.03
UK,EU,US,ROW		1.66	3.61	2.26	1.71	3.14	1.62	14.00
other comb		4.23	3.47	1.42	1.17	1.21	3.23	14.73
total		29.15	29.93	9.20	9.91	7.94	13.87	100.00
% of domestic firms engaged in intra-firm trade exporting to and importing from:								
exports to \ imports from								
nowhere	7.31	4.08	5.95	0.51	0.91	0.23	2.21	21.19
UK only	1.53	7.59	8.22	1.70	1.47	0.51	2.83	23.85
UK,EU	4.19	2.21	2.72	0.51	0.40	0.40	1.30	11.73
UK,EU,US	0.17	0.51	0.62	1.02	0.00	0.51	0.85	3.68
UK,EU,ROW	3.97	1.53	2.61	1.19	2.10	1.36	0.79	13.54
UK,EU,US,ROW	0.79	2.38	2.78	2.27	2.10	3.57	1.81	15.69
other comb	1.93	1.47	1.59	1.02	0.79	0.62	2.89	10.31
total	19.89	19.77	24.48	8.22	7.76	7.20	12.69	100.00
% of foreign-owned firms engaged in intra-firm trade exporting to and importing from:								
exports to \ imports from								
nowhere	0.17	0.73	0.50	0.32	0.06	0.00	0.32	2.10
UK only	0.12	2.74	2.27	0.79	0.35	0.38	0.50	7.13
UK,EU	0.15	0.55	5.30	2.39	1.25	1.11	2.71	13.45
UK,EU,US	0.03	0.23	0.79	1.92	0.58	1.02	1.49	6.06
UK,EU,ROW	0.38	0.38	2.71	4.51	2.42	3.87	2.50	16.77
UK,EU,US,ROW	1.08	0.58	3.29	6.70	2.53	12.38	5.47	32.03
other comb	0.90	1.02	4.19	3.58	2.07	4.43	6.26	22.45
total	2.82	6.23	19.04	20.21	9.26	23.18	19.25	100.00

Note: Covers the period 1996-2003. Countries/country groups are mutually exclusive; other comb(inations) comprises EU only, UK,US, UK,ROW, UK,US,ROW, EU,US, EU,ROW, EU,US,ROW, US only, ROW only and US,ROW. EU refers to EU15 excluding the UK and Ireland (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Portugal, Spain and Sweden).