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Multi-Product Exporters, Carry-Along Trade and the Margins of Trade*

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Abstract

New empirical and theoretical work has highlighted the importance of multi-product firms in international trade flows. We examine multi-product exporters in the small open economy of Belgium, considering their importance and the relationship between the margins of trade and firm productivity, both across firms and within firms over time. In addition, we employ proxies for trade costs to quantify the extensive and intensive margin adjustments of trade. Linking production and export data at the firm-product level, we discover new and, heretofore, unknown facts about multi-product manufacturing exporters. The large majority of Belgian manufacturing firms export products that they do not produce. More than three quarters of the exported products and more than one quarter of export value from Belgian manufacturers are in goods that are not produced by the firm, so-called Carry-Along Trade (CAT). CAT exports are concentrated in the largest and most productive firms and the value of CAT exports responds differently to variation in firm productivity and trade costs than does the export value of goods that the firm produces.

Keywords: heterogeneous firms, multi-product firms, carry-along trade, productivity, trade costs, intermediation

JEL classification: F12, F13, F14, L11

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1. Introduction

This paper contributes to the small but growing literature documenting the prevalence and importance of multi-product firms. The study of multi-product firms allows for a much more detailed decomposition of exports than was possible in earlier more aggregate research which examined variation in export levels across firms. The recent availability of transaction-based datasets, with exports at the firm-level broken down by product and by destination, allows researchers to consider both the intensive margin of trade, i.e. increases in exports by a firm of a product, as well as several extensive margins including the number of export destinations and the number of products per destination.

Until recently, stylized facts about the role of multi-product firms and the empirical support for new theories of multi-product exporters have mainly been tested on countries such as the US and France with relatively low export to GDP ratios, 11 and 26 percent respectively.[1] In this paper we study multi-product firms in the small open economy of Belgium, a country where exports are over 86 percent of GDP.

We use the empirical predictions of a recent theory model by Bernard, Redding and Schott (2010b) to guide our research on the margins of trade. That model is a static general equilibrium framework and develops predictions on long-run relationships between the margins of trade, firm productivity and trade costs.[2] We consider both steady-state and short-run outcomes using a comprehensive panel of Belgium exports and their products and destinations from 1998-2005 which combines data on firms' exporting activities from the National Bank of Belgium's Trade Database with firm-level characteristics obtained from the Belgian Business Registry of firms. The panel dimension of the data allows us to study the within-firm adjustment of intensive and extensive margins of trade over time in response to productivity shocks and changes in trade costs faced by exporting firms.

The data allow us to examine how changes in firm-level productivity over time affect firms' extensive margins, the number of products exported and the number of destination markets served by each firm, as well as average firm-product-country exports. This within-firm adjustment can usefully be compared to existing studies where the relationship between productivity and changes in firms' extensive and intensive margins of trade were considered

[1] Multi-product exporters are analyzed in the US by Bernard, Jensen and Schott (2009) and Bernard, Redding and Schott (2010b), in France by Mayer, Melitz and Ottaviano (2010), in Brazil and Chile by Arkolakis and Muendler (2010), in Mexico by Iacovone and Javorcik (2010), and in India by Goldberg et al. (2010). The export to GDP ratios of these countries are 11, 26, 15, 41, 27, and 20% respectively.

[2] A dynamic version of the model is presented in the online technical appendix to that paper and is based on the closed-economy multi-product firm framework in Bernard, Redding and Schott (2010a).

in a cross-section (Bernard, Redding and Schott, 2010b; Mayer, Melitz, Ottaviano, 2010).

We measure trade costs in two different ways, through distance and exchange rate movements. The measures of trade costs differ in their degree of variation and level of detail. Distance varies by country but not over time, while exchange rates vary by country and year.

A new feature of the paper is that we develop a link between data on domestic production by firm-product and firm-product-country level trade data for 2005. Domestic production data are collected through the Prodcom survey which is mandatory for a large subset of manufacturing firms and which allows us to compare domestic output with exports at the firm-product level. After concording the production and trade product classifications, we find the surprising fact that a large majority of manufacturing exporters export many products that they do not produce. In addition, a smaller set of the largest manufacturing firms produce goods where they export more than they produce. We refer to these export activities together as Carry-Along Trade (CAT) and in the last sections of the paper we explore its prevalence and relationship to firm characteristics and its role in explaining the importance of the extensive and intensive margins of trade.

Our empirical findings on the full set of multi-product firms confirm the cross-sectional findings of earlier studies. Multi-product firms appear both prevalent and important in exports. Similar to what has been found in other countries, a few large firms, exporting many products, account for the majority of Belgian exports. Firm characteristics such as productivity, employment and capital intensity all correlate positively with the number of products a firm exports.

Following existing empirical work, we decompose export flows both at the country and firm level into extensive and intensive margins. For aggregate Belgian exports to a given country, the extensive margins correspond to the number of firms serving the destination market and the number of products exported to that market, while the intensive margin is associated with the average exports per firm-product. At the level of the firm, extensive margins are the number of destination countries for the firm's exports and the number of products exported, while the intensive margin is the average exports by the firm to a country in a product.

The cross-section results confirm that more productive firms have higher values of export shipments. These greater shipments come in part from the extensive margins of trade, more productive firms reach more countries with more products. The average exports per firm-product-country are also significantly positively related to firm productivity in the cross section and the intensive and extensive margins contribute roughly equally to the overall

increase in firm exports. The findings are robust to alternative measures of firm-level productivity.

Using the panel aspect of the data we confirm the equal contributions of the intensive and extensive margins in response to increased firm productivity. Annual within-firm productivity increases are positively associated with the number of products exported and the number of destination markets served by the firm. Unsurprisingly the magnitudes of the correlations using annual productivity changes are smaller than those in the cross-section results. Results on within-firm productivity over a longer interval confirm the results and have magnitudes roughly in between the annual and cross-section estimates. When firms become more productive over time, they serve more markets and ship more products per destination while at the same time their average shipments become larger. Over a longer interval, firms adjust relatively more along the extensive margin as their productivity rises.

Cross-sectional gravity regressions using distance as a proxy for trade costs confirm prior work on US and French data. Total Belgian exports to a destination country decrease the further away is the destination market. The decomposition of country-level exports shows that distance strongly negatively affects the number of firms per destination and the number of products per destination while average firm exports per destination do not vary with distance. The invariance of average exports to falling distance is driven by greater exports in existing firm-products combined with the arrival of new, marginal firms and products with lower values of exports. Within firm-product groups, export value falls with distance.

For short-run changes in trade costs, we use the admittedly imperfect proxy of annual real bilateral exchange rate changes, while controlling for destination market size differences through GDP. As expected, an appreciation of the destination market's currency boosts Belgian exports. Decomposing exports into the extensive and intensive margins, again we find that a destination market's currency appreciation results in a higher number of Belgian firms exporting a larger set of products and an increase in the shipment value for already-exported products. The adjustment of multi-product firms along the extensive margins is again roughly equal to the intensive margin changes.

As mentioned above, in the sample of manufacturing firms where we have both production and export data for 2005, we find that Carry-Along Trade, i.e exports of goods where the firm exports more than it produces, is widespread and important, occurring at more than 90 percent of exporters, in more than 95 percent of exported products and accounting for more than 30 percent of export value.

While most firms are involved, it is the biggest and most productive firms that are most

heavily engaged in Carry-Along Trade. When we repeat the cross-section firm-level decomposition of exports and look at the relationship to firm productivity, we find that the aggregate value of CAT exports at the firm is more responsive to differences in firm productivity than is the export value of goods actually produced by the firm (regular exports). The higher elasticity is driven by greater responses along the extensive margins of countries and products per destination market.

The cross-country response of Belgian exports to trade costs also differs for CAT and regular exports. CAT exports are more sensitive to distance (and GDP) than are regular exports and again the responses are largely driven by the extensive margins, in particular the number of exported products per firm.

The rest of the paper is organized as follows. In the next section we document the prevalence and importance of multi-product exporters in Belgium. We also examine how firm-characteristics vary with the number of exported products. Section 3 looks at productivity changes across and within firms and their relationship to the margins of trade. Section 4 studies how trade costs affect the decomposition of exports, both at the firm and country level. In Sections 5 and 6, we explore the relationship between domestic production and exports in a sample of Belgian manufacturing firms and introduce the concept of Carry-Along Trade. Section 7 presents several possible explanations for CAT. In sections 8-10, we explore CAT across firms and re-examine the relationship between firm productivity and trade costs and different types of trade by the firm. The final section concludes.

2. Prevalence and Importance of Multi-Product Exporters in Belgium

2.1. Multi-product Exporters

Before discussing the presence of multi-product firms, we point out some facts about the data and about Belgian exports in general. The Belgian export data are obtained from the National Bank of Belgium's Trade Database, which covers the entire population of recorded trade flows. Exactly which trade flows are recorded (i.e. whether firms are required to report their trade transactions) depends on their value and destination. For extra-EU trade, all transactions with a minimum value of €1,000 or weight of more than 1,000 kg have to be reported. For intra-EU trade, firms are only required to report their export flows if their total annual intra-EU export value is higher than €250,000.[3] The export data are recorded

[3]The cutoff for reporting intra-EU trade has increased over time. However, during the period considered in this paper (1998-2005), it has remained constant. NBB estimations indicate that the share of exports accounted for by firms exporting less than €250,000 per year amounts to an average of 1.5 percent of total

at the year-firm-product-country level, i.e. they provide information on firm-level export flows by 8-digit Combined Nomenclature (CN8) product and by destination country.[4]

In the sample used in the empirical analysis below, we exclude transactions that do not involve a "transfer of ownership with compensation". This implies that we omit transaction flows such as the return, replacement and repair of goods, transactions without compensation, e.g. government support, processing or repair transactions, etc. We further exclude two large firms for confidentiality reasons as they dominate exports in particular export product classes. The resulting sample covers 85 percent of total reported export value between 1998 and 2005.

Our data also allow us to study within-firm changes in the extensive and intensive margins of trade over time. For this purpose we use panel data from 1998-2005 during which cutoff values for recorded trade do not change, allowing for consistent data comparison. To construct this panel data we concord the annual changes in the 8 digit Combined Nomenclature (CN8) product classification over time, similar to Pierce and Schott's (2009) concordance of the US 10 digit Harmonized System classification. This is necessary to correctly assess the dynamics in terms of the number of products that firms export, to avoid misinterpreting a product classification change as an adjustment of firms' extensive product margin. More details on the concordance of the CN8 classification over time are provided in the data appendix.

In Table 1 we report some summary statistics on the cross-section sample for 2005.[5] The top panel refers to all exporting firms, while the middle and bottom panels refer to intra-EU and extra-EU exports respectively. We categorize firms according to the number of products they export. In subsequent columns we include the number of firms, the value of exports, the average number of export destinations, average export values of the firm-product-country, firm-product and firm-country for all firms exporting the reported number of products.

In 2005 we have a total of 25,248 exporting firms with a total value of exports of over €215 billion representing more than 900,000 firm-product-country transactions.[6] This sample

exports in each of the years in our sample. Hence, the coverage of the trade database is estimated to amount to about 98 percent of total export flows. We are grateful to Jean-Marc Troch for providing us with this information.

[4]The CN classification can be downloaded from the Eurostat Ramon server: http://ec.europa.eu/eurostat/ramon/ . Unless stated otherwise, our results use the full sample of destinations and are not sensitive to the exclusion of intra-EU destinations (to which the reporting cut-off applies). Results for the sub-samples are available upon request from the authors.

[5]More information on sample selection and the product classification is provided in the Data Appendix.

[6]The number of exporters in 2005 is very close to the average number of exporters for the period 1998-2005.

includes firms operating in all sectors including both manufacturing and non-manufacturing firms. Despite the fact that the inclusion cutoff is higher for intra-EU exports, the large majority of Belgian exports, 73 percent, are intra-EU. This can be seen by relating the total export value for "internal" EU trade in the middle panel of €157 billion to overall exports of €215 billion of the top panel.[7]

Table 1 shows that multi-product exporters constitute the large majority of firms. Over 65 percent of all exporters are multi-product (MP) firms, they account for 98 percent of the total export value in 2005. For the US, the numbers are comparable as 58 percent of US exporters are multi-product and account for more than 99 percent of exports (see Bernard et al., 2007). Single-product exporters account for 34 percent of firms but represent only 2 percent of exports. Relatively few firms export more than 20 products but these 12 percent of firms still account for 61 percent of exports. These results are very much in line with what was reported by Bernard, Redding and Schott (2010b) (henceforth BRS (2010b)) for the US, Mayer and Ottaviano (2008) for France and Goldberg et al (2010) for India and confirm the notion of "superstar" exporters where a small club of firms account for the large majority of exports.[8]

The average number of export destinations per firm is 6.73, but this average hides substantial heterogeneity across firms. Firms that export just one product ship it to only 1.58 destination markets whereas firms exporting more than 50 products on average reach 23 different destinations as shown in the top panel of Table 1. This finding is in line with recent theory papers on multi-product exporters where higher firm productivity leads the firm to serve more destinations and export more products per destination.[9]

The average exports per firm-product-country appears to vary non-monotonically as the number of export products increases. Single product exporters on average export €331,000 per destination while firms that export more than 50 products ship on average €140,000 per product to each market. The absence of a positive correlation between the number of exported products and average firm-product-country exports is in line with what has been reported for the US by BRS (2010b). Exports per firm-product also do not vary

[7]The finding that there are more firms exporting extra-EU is most likely driven by the higher reporting cutoff for intra-EU trade. Although NBB estimations suggest that the value of omitted trade due to the reporting cutoff is only 1.5 percent, the percentage of firms excluded is likely to be much higher.

[8]Results are different for Mexico where most exports come from single product exporters (Iacovone and Javorcik, 2010).

[9]Models of multi-product exporters include Eckel and Neary (2010), BRS (2010b), Arkolakis and Muendler(2010), Mayer, Melitz and Ottaviano (2010). A common feature of these models is that higher firm productivity increases total firm exports and the number of products exported.

systematically with the number of products. In contrast exports per country are increasing in the number of products exported; the rise in products per country offsets the lower shipments per product.

Despite the fact that the average firm-product-country export flow is not increasing with the number of exported products, multi-product exporters on average sell more than the average single product firm. Average firm-level exports (column 3 divided by column 1) are increasing in the number of products exported. The increased number of products and destinations more than offset the fall in average shipments.

2.2. Multi-Product Exporters and Firm-Characteristics

In this section we bring together firm-level export data with firm-level balance sheet data to study the link between the number of exported products and indicators of firm-level productivity and size.[10] In Table 2 we report the mean value of a set of firm characteristics (in logs) for total exporters. Firm characteristics include TFP[11], value-added, the number of employees (full-time equivalent units) and capital intensity (defined as tangible fixed assets per employee).

The data confirm that firm productivity, value-added and employment are all higher for firms that export more products, while average capital intensity declines as firms export more products. Firm-level employment, which is generally regarded as an indicator of firm size, reveals that firms exporting over 50 products are about eight times as large as firms exporting a single product. Value-added also rises as firms export more products. The mean value-added for firms exporting 50+ products is about ten times as large as that of single product firms.

2.3. Modelling Multi-Product Firms

The empirical analysis in this paper follows closely the theoretical and empirical work in BRS (2010b). Their approach generalizes Melitz's (2003) single-product, heterogeneous-firm

[10] Selection on availability of firm-level characteristics such as employment, value-added, tangible fixed assets etc. imposes another restriction on the sample selection, i.e. only those firms with positive values for all firm characteristics can be included in the analysis. Compared to total reported exports, the sample of firms with available data on firm characteristics (positive value added and employment) accounts for a share of 54 percent of total export value between 1998 and 2005.

[11] To obtain comparable levels of total factor productivity (TFP) across firms, we apply the Caves et al. (1982) methodology. Hence, TFP is calculated as an index, calculated by comparing each firm to a hypothetical firm, where the hypothetical firm is defined as the average over all firms in a two-digit NACE sector and year.

model of trade to allow firms to produce a set of horizontally differentiated products which are potentially exported to many countries.[12] Firms differ according to their underlying ability and products vary in their profitability across both firms and markets. Firms must pay a country-specific fixed cost to export regardless of the number of products sent to the country as well as a product-country fixed cost for each product in each market.

Increases in firm ability are associated with increased exports of existing products in existing markets, new products exported to exsting markets and new markets for the most profitable products. A reduction in variable trade costs is associated with increased exports of existing products in the market, new products from current exporters, and new firms exporting to the market. BRS (2010b) examine the empirical implications of the model using cross-section US data and find confirmation of the major predictions of the model. We consider the model's predictions in the Belgian data in the cross-section and over time.

3. Firm Productivity and Exports

A common component to many models of multi-product firms and exporting is the relationship between underlying firm productivity and the margins of trade. Increases in actual firm productivity, as opposed to measured productivity, raise exports of existing products to existing markets, allow firms to enter new markets with existing products and make profitable the export of new, previously marginal products. Aggregate firm exports are expected to go up in response to higher firm productivity while the number of markets served and products exported also increase. Measures of average firm exports to a particular destination or average exports per product-destination may or may not rise due to the confounding effects of increasing exports within product-country and the arrival of new, marginal products and countries.

In this section we examine the role of firm productivity in aggregate firm exports and consider the role of both country and product extensive margins as well as the intensive margin of average shipments per product-country. While previous empirical research examined the role of variation in productivity across firms (BRS (2010b)), we are able to consider both the cross-sectional variation in firm productivity as well as within-firm changes over time.

Measurement of "true" firm productivity is problematic both for single-product firms that can choose between products with different production technologies or demand characteristics (Bernard, Redding and Schott, 2009) and for multi-product firms where inputs are

[12] The model allows for products to be produced and exported but not sold in the domestic market. It does not envision exports of goods that the firm does not produce.

measured at the firm- or plant-level rather than per product (De Loecker, 2007). Several measures can be used to proxy for underlying firm productivity. Our preferred measures are value-added-based total factor productivity and value-added per worker (labor productivity).[13]

3.1. Cross-sectional evidence

We follow the empirical strategy of BRS (2010b) and relate the margins of firm trade to proxies for firm productivity. Total firm exports can be decomposed into the number of destination countries served by the firm, C_f, the number of distinct products exported, P_f, a measure of coverage or density which corresponds to the share of the firms exported products sent to the average destination, D_f, and the average exports per product-country served, $\bar{X}_f$,

$$\begin{aligned} X_f &= C_f P_f D_f \bar{X}_f \\ \text{where } D_f &= \frac{o_{cpf}}{C_f P_f} \text{ and } \bar{X}_f = \frac{1}{o_{cpf}} \sum_c \sum_p X_{cpf} \end{aligned} \tag{1}$$

and o_{cpf} refers to the number of positive firm-level export transactions at the product-country level. The measure of density considers how many country-product combinations are being actively served by the exporter. If the firm exports 10 unique products and exports to 10 destination markets then the total possible number of country-product combinations is 100. If, on average, the firm exports two products to each market, the density of export activity for the firm is 0.2.[14]

In Table 3 we report separate cross-section regressions for 2005 of log firm exports and its four constituent components on measures of log TFP (top panel) and log value-added per worker (bottom panel) including fixed effects for the major industry of the firm.

$$\ln Y_f = c + \beta \ln \text{Prod}_f + \delta_i + \varepsilon_f \tag{2}$$

where Y_f refers to the four components of the decomposition given by (1), i.e. C_f, P_f, D_f and $\bar{X}_f$. By construction the specification only examines the relationship of productivity and exports for current exporters.

[13] BRS (2010b) additionally consider the responses of the extensive and intensive margins of trade to other proxies including the number of products exported, exports of the largest product and (for a subset of firms) exports of the 5th largest product. The authors show that these measures are positively correlated with underlying firm productivity in their multi-product firm model where an increase in firm productivity lowers the (constant) marginal cost of production of all products.

[14] Bernard et al. (2009) introduce the idea of density in the context of bilateral US exports across countries.

Column 1 of Table 3 considers the response of log total firm exports to differences in measured productivity across firms. As expected both TFP and value-added per worker are positive and significant; a 10 percent increase in TFP is associated with a 0.7 percent increase in firm exports while a comparable increase in value-added per worker is associated with a 7.6 percent increase in firm exports.

Looking at the extensive margins (columns 2-4), we find that the number of destinations and products are increasing in firm productivity. The density measure falls with productivity as more productive firms export more products and reach more destinations but do not ship every product to every country. The number of products per country, $P_f D_f$, is higher for firms with higher measured productivity. Column 5 of Table 3 reports results where the dependent variable is the average value of firm-level shipments per product-country (in logs). Interestingly, this value is also strongly rising in productivity. Theoretical predictions for average shipments are ambiguous due the positive effect of increasing shipments for a given product to a given country combined with the negative effect of marginal countries and marginal products entering the export mix. In the final column we report the within country-product response to differences in firm productivity. The coefficients for both log TFP and log value-added per worker are positive as expected, higher productivity at the firm is associated with greater shipments of a given product to a given country. The coefficient in the value-added regression is less than the corresponding coefficient on average shipments per product-country which is somewhat surprising as the expectation is that added product-country combinations should have lower sales than existing exported pairs.

If we interpret the cross-firm regressions as a proxy for the steady-state, or long-run, distribution, we find that more than half the aggregate increase in firm exports associated with higher firm productivity comes from the intensive margin.

3.2. Changes in productivity over time

The results of the previous section provide strong evidence that in the cross-section higher firm productivity is associated with increased exports both because of the extensive margins of more destinations and more products per destination and because average shipments per product-destination are higher for more productive firms.

The panel nature of our data allows us to examine a more precise prediction of the multi-product models that within-firm increases in productivity should be associated with increases in total exports and with increases in both the number of destination markets served and the number of products exported. In the top panel of Table 4, we report estimates from a

panel regression of the form

$$\Delta \ln Y_{ft} = \alpha + \beta \Delta \ln \text{Prod}_{ft} + \delta_f + \delta_t + \varepsilon_{ft} \tag{3}$$

where Y_{ft} is a component of the decomposition of firm exports given by (1) and δ_f and δ_t are firm and year fixed effects respectively. This specification is run on firms that export in consecutive years ignoring potential problems related to selection into exporting and firm productivity.

The results confirm the expected positive and significant correlation of measured firm TFP with total firm exports, however the magnitude of the relationship in these annual changes is much smaller than that found in the cross-section regression reported above. Both the product and country extensive margins increase with firm productivity and contribute to the overall increases in exports. Within-firm increases in TFP are correlated with increases in the average value of exports at the firm level and the role of the intensive margin is comparable in magnitude to that of the extensive margin. Again in the final column, within country-product pairs we find the expected positive and significant coefficient.

The second panel of Table 4 reports results of a specification in long differences, 1998-2005 for the same set of dependent variables. This regression is limited to firms that exported in both 1998 and 2005. Here, we find a stronger relationship between productivity growth and increases in export value. Again both the extensive and intensive margins contribute equally, although unlike the annual changes, stronger effects on both the number of countries and the number of products are offset by a decline in the density of product-country coverage by the firm. The within country-product export growth is strongly positively correlated to changes in productivity.

4. Trade Costs and Exports

The basic theoretical frameworks for multi-product exporters consider the effects of symmetric reductions in ad valorem trade costs across countries and products.[15] Unfortunately during the period of availability for detailed trade transaction data, there are relatively few episodes of liberalization. BRS (2010b) and Baldwin and Gu (2009) consider the effects of the 1987 Canada-US Free Trade Agreement. They examine domestic production data for multi-product firms and find confirmation of the major prediction of the multi-product mod-

[15] Eckel and Neary (2010) consider globalization through the addition of new countries increasing potential markets for oligopolistic multi-product exporting firms.

els that firms facing larger tariff reductions implement larger cuts in the range of products and increase the skewness of their output mix.

We approach the question of how firms respond to reductions in trade costs in two ways. First, following BRS (2010b), we look at the response of total exports and the margins of trade to distance in a simple cross-country gravity regression. Next we consider annual changes in the real bilateral exchange rate as a proxy for trade cost changes for Belgian exporters over shorter time horizons.

4.1. Distance and the margins of trade

We start with a simple gravity equation specification to examine the relationship between distance to Belgium and the variation of the extensive and intensive margins of trade. The gravity equation gives something approximating a long-run equilibrium response of exports to trade costs. The coefficient on distance in gravity equation gives us a proxy for the responses of the margins of trade to trade cost changes in the long-run. Following BRS (2010b) we decompose total bilateral exports to a country c (X_c) into components including the number of Belgium firms exporting to the country, F_c, the number of distinct CN8 products exported to the country, P_c, the density of trade defined as the fraction of firm-product combinations with positive exports, D_c, and the average value of exports per firm-product going to the country conditional on positive exports, $\bar{X}_c$,

$$\begin{aligned} X_c &= F_c P_c D_c \bar{X}_c \\ \text{where } D_c &= \frac{o_{pfc}}{C_c P_c} \text{ and } \bar{X}_c = \frac{1}{o_{pfc}} \sum_f \sum_p X_{cpf} \end{aligned} \tag{4}$$

and o_{pfc} is the number of active firm-products in country c. We regress total exports to trade partners, as well as each component of total exports, on the great-circle distance of trade partners from Belgium, obtained from the CEPII database (CEPII, 2010). To control for market size, we also include the log of nominal GDP of the destination market, obtained from the World Development Indicators database of the World Bank (2010),

$$\ln Y_c = \alpha + \beta \ln \text{Distance}_c + \gamma \ln \text{GDP}_c + \varepsilon_c \tag{5}$$

where Y_c is a component of Belgian exports given in equation 4.

Table 5 reports the regression results using 2005 data - results for other years are similar. The first column of Table 5 confirms the long-established result that aggregate bilateral exports are strongly decreasing in distance and increasing in destination market GDP; coefficients on both distance and destination GDP are near one in absolute value.

The next three columns of the table report the effects of distance and GDP on the extensive margins of trade. As found by BRS (2010b), both the number of firms and the number of products increase as trade costs fall across countries while the density of trade is increasing with distance.[16] The combined effect of the extensive margins, seen by adding the coefficients on distance across columns 2-4, almost completely explains the cross-country variation in export value. In the long run, lower trade costs translate into higher exports through an increase in the number of firms serving the destination and an increase in products per firm.

Column 5 reports the effect of distance on the average value of exports per firm-product to the country. In a world where firms export a single product to multiple countries this coefficient would be expected to be negative and significant, i.e. exports of any given product should increase if trade costs are lower. In a world with multi-product exporters, however, the relationship between distance and average shipments per firm-product is ambiguous both because new marginal exporters are able to enter less costly markets and because existing exporters are able to ship lower profit products to closer markets. Our results confirm those of BRS (2010b) in that we find a small, insignificant positive coefficient for distance on average exports.

However, in column 6 we report the results of a gravity-style regression where the dependent variable is the log of firm-product-country exports and we control for firm-product fixed effects. Now distance again plays the expected role; for any given product exported by a firm, the value of exports is decreasing in trade costs as measured by distance to the destination country.

4.2. Exchange rates and the margins of trade

Exchange rates play a complicated role in firm decision-making that links market structure, firm market power and other issues. An extensive literature considers pricing-to-market by firms as well as aggregate implications for the price level and the role of sunk costs in mitigating short-run responses to exchange rate movements (see Goldberg and Knetter, 1997; and Gopinath and Itskhoki, 2010). Here, we abstract from these issues and consider a simple specification relating bilateral exchange rate changes with firm-level responses of Belgian exporters, including both extensive and intensive margin adjustments.

[16] Density is expected to be lower for markets that are served by more firms and that receive more products. As the number of products exported rises, each firm will be exporting a smaller share of the range of the products since firms are active in a limited subset of products and industries.

The base specification is

$$\Delta \ln Y_{ct} = \alpha + \beta \Delta \ln \text{RER}_{ct} + \gamma \Delta \ln \text{GDP}_{ct} + \delta_c + \varepsilon_{ct} \tag{6}$$

where $\Delta \ln Y_{ct}$ represents the annual log change in the components of the decomposition of total exports to country c in year; $\Delta \ln \text{RER}_{ct}$ is the change in the log of the real bilateral exchange rate of the Belgian currency (franc, then euro) expressed in units of foreign currency per unit of Belgian currency; $\Delta \ln \text{GDP}_{ct}$ is the change in the log of the real GDP of the foreign country expressed in constant Local Currency Units (LCU). The real exchange rate (RER_{ct}) is constructed using data on exchange rates and domestic and foreign price evolutions from the International Financial Statistics database (IMF, 2010). Specifically, the real exchange rate is defined as:

$$RER_{ct} = ER_{ct} \left(\frac{CPI_{be,t}}{CPI_{c,t}} \right)$$

where ER_{ct} is the nominal Belgian exchange rate expressed in units of foreign currency per unit of Belgian currency and $CPI_{be,t}$ (CPI_{ct}) refers to the domestic (foreign) consumer price index. GDP data are taken from the World Development Indicators Database (World Bank, 2010).

For this specification we only include countries outside the EU for several reasons: the adoption of the euro by many EU countries complicates exchange rate analysis during the sample period; the extent of real exchange rate variation inside the Eurozone is limited to variations in the price levels; and the cutoff for reported exports to EU countries is different than that for exports to extra-EU destinations.[17]

Table 6 reports results from estimating equation 6 for the different components of the decomposition shown in equation 4.[18] Results reported in Table 6 suggest that a 1 percent depreciation of the euro is associated with a 0.35 percent increase in Belgian exports. Summarizing results, the increase in exports is driven both by changes along the extensive margins in response to depreciation, i.e. increases in the number of firms and the number of products, as well as by an increase in the average exports per firm-product. As with changes in firm productivity the responses are roughly evenly split in magnitude between the intensive and extensive margins. As expected the within firm-product response is strongly increasing as the Belgian currency depreciates. The lower magnitude of the average response across products and countries is driven by the entry of the firm into new, marginally profitable country-product markets.

[17] The ten accession countries in 2004 are also excluded from the analysis.

[18] The addition of year fixed effects removes responses associated with overall annual fluctuations in the Belgian currency and thus reduces the response of each of the components.

5. Manufacturing, Domestic Production and Exports

To this point we have considered all Belgian exporters in our analysis. In this and the following sections, we consider a sample of Belgian manufacturing firms and examine the link between production and exports at the firm-product level for 2005. The desire to focus on manufacturing exporters is driven by the multi-product theory models discussed earlier which are all based on the assumption of a producing or manufacturing firm. In addition, recent work on trade across types of firms by Bernard, Jensen, Redding and Schott (2010), Ahn, Khandelwal and Wei (2010), Akerman (2010), Bernard, Grazzi and Tomasi (2010) highlights the role of non-manufacturing firms in aggregate exports. This literature emphasizes differences between direct and indirect exporters and points out heterogeneity in firm and product characteristics as well as the fact that direct and indirect exports respond differently to destination market characteristics.

The theoretical literature on multi-product exporters is largely related to the joint production and export decisions of the firm and typically does not consider the role of intermediation. The existing empirical literature on multi-product exporters usually examines trade data alone or trade and production data separately.[19] In this section we link Belgian export data to Belgian production data by product and examine the margins of trade at multi-product manufacturing exporters.

The firm-product production data for 2005 come from the Prodcom database.[20] The export data are the same as described earlier. Several special attributes of the Prodcom database are worth noting here. First, two main types of firms are required to declare their domestic production activities at firm-product level and thus are present in the database: firms with a primary activity in manufacturing employing at least ten employees and firms with a primary activity outside manufacturing (but with manufacturing production) employing more than twenty employees.[21] Second, the variable we use to quantify domestic production by product is firm-product sales of produced goods rather than the value of physical production in that year. Third, while trade transactions are reported using the 8-digit CN classification system, domestic production activities are reported in Prodcom

[19] An exception is Iacovone and Javorcik (2010) who consider both production and exports in Mexico. Their data come from a Monthly Industrial Survey and may be unlikely to record exports of goods not produced by the firm.

[20] We examine a single year, 2005, in the remainder of the paper. Creating a panel of linked production and export firm-product data requires both concordances over time for the CN and PC classifications as well as a concordance between the classification systems and is still under construction.

[21] For a detailed description of the Prodcom Database and the selection criteria, see the data Appendix.

8-digit codes (PC8). While there exists a close relationship between the CN8 and PC8 classifications (see the data appendix and Table 9), the level of detail of the PC8 is lower than that of the CN8. In particular, there are 9,157 CN8 codes compared to 4,220 PC8 codes. Out of the 4,220 PC8 codes, 2,558 have a one-to-one match with a single CN8 product. The remaining PC8 codes are mostly many-to-one mappings from CN8 to PC8 (1,612 PC8 codes), with a few one-to-many mappings (3 PC8 codes) or many-to-many mappings (47 PC8 codes). We concord the CN8 trade data to PC8 and henceforth refer to the 8-digit data as PC8. Overall, there are 4,093 PC8 products that feature in our data (either domestically produced or exported).[22]

After linking the export and production datasets we have a sample of 3899 exporting firms with €82.3billion of exports, accounting for 15 percent of Belgian exporters and 38 percent of total Belgian exports. Among firms with a primary 2-digit NACE classification in manufacturing, the Prodcom sample accounts for 58 percent of firms and 83 percent of total exports.[23] Table 7 reports summary statistics for these firms by the number of PC8 products exported. Given the selection criteria, it is not surprising to find that firms in this sample are larger in terms of total exports, average number of destinations and exports per firm-product-country than the broader set of manufacturing firms in Table 1. However, given that the number of PC8 product categories is less than half the number of CN8 categories, it is striking that firms in the sample on average also export more products.

Looking across firms with different numbers of exported products, we find similar patterns to those for the complete set of Belgian exporters considered earlier. Exports per firm (column 3 divided by column 1), the number of destinations, and exports per country all are increasing as the number of exported products rises. Exports per product and exports per product-destination are generally unchanged or slightly falling as the number of export products increases. The positive correlation of the number of exported products and the number of destination countries drives the rising firm-level export value.

However, the most unusual finding from this simple overview comes in column 2 of the top panel of Table 7. Except for the category of single-product exporters, firms in every other

[22] If a single CN8 code maps into two PC8 codes, we aggregate the PC8 codes into a single PC8 product. None of these codes feature in our data. If there is a many-to-many mapping between CN8 and PC8, we put all the CN8 and PC8 codes in a special group. The 47 PC8 codes for which this is the case are combined into 11 special groups. Of these 11 special groups, only 3 feature in the data.

[23] While all the firms in the Prodcom sample report positive manufacturing production, 583 firms have a non-manufacturing sector as their primary NACE 2-digit activity in the annual accounts data. Our results on CAT trade are not affected by the inclusion or exclusion of these firms. Another 2111 firms with positive manufacturing in the Prodcom data are non-exporters.

category report greater numbers of products exported than products produced.[24] Multi-product exporters are also multi-product domestic producers but the number of exported products increases much more rapidly than the number of produced products, see Figure 1.

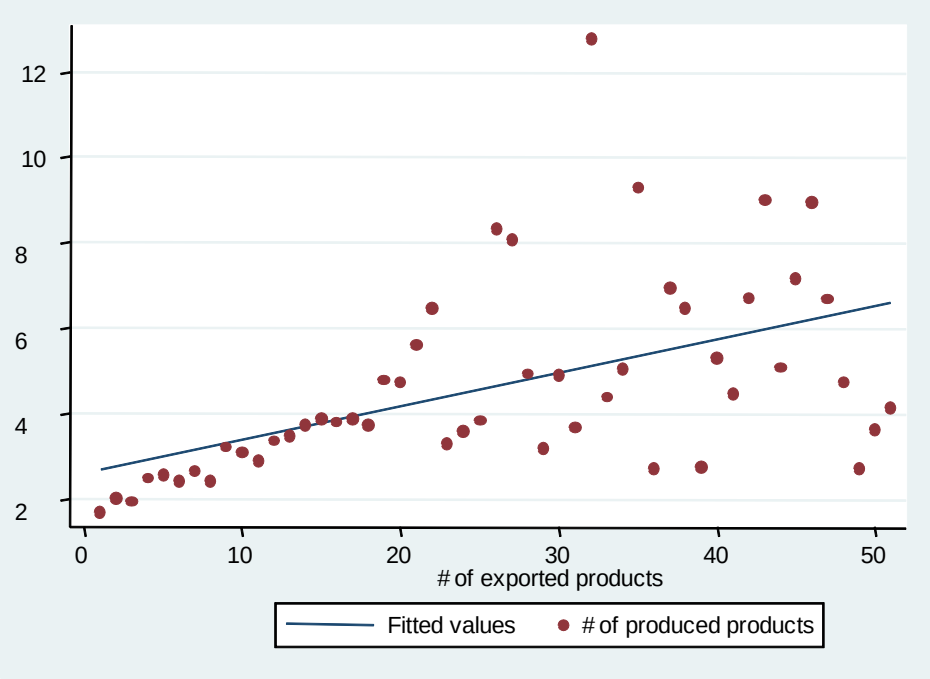

Figure 1: Produced products and Exported Products, 2005

It is this simple fact that firms export more products than they produce that we explore for the rest of the paper. We further develop a set of facts about the relationship between domestic production and exports at the firm-product level, discuss possible explanations including data error, and finally examine the relationship between firm productivity and trade costs on the margins of trade for different types of products: those produced by the firm and exported and those exported but not produced by the firm.

6. Carry-Along Trade

To understand the possibility that manufacturers are exporting products they do not produce, we divide products into three mutually-exclusive categories at the firm-product

[24] Production refers to sales of produced goods rather than the physical creation of the goods. This concept of produced sales corresponds more closely to the recorded export numbers and helps to avoid problems of stockpiling and inventories.

level: (1) *non-exported* firm-products which are reported as produced by the firm but are not recorded as exports; (2) *regular* export firm-products which are products both reported as produced by the firm and exported by the firm *and* where the recorded value of exports is less than or equal to the value of production; (3) *Carry-Along Trade* firm-products are those where the value of exports is greater than the value of production by the firm. *Carry-Along Trade* (*CAT*) firm-products can be further divided into two non-overlapping categories: (a) *pure-CAT* firm-products where the firm export value is positive but there is no recorded production in that product (domestic produced sales$_{fp} = 0$), and (b) *mixed-CAT* firm-products where the firm reports positive production and exports and the value of exports is greater than that of production. The number of exported products for each firm is the sum of types (2)-(3) while the number of produced products is the sum of types (1)-(2),

$$\begin{aligned} \#\text{produced products} &= \#\text{non-exported} + \#\text{regular} + \#\textit{mixed-CAT} \\ \#\text{exported products} &= \#\text{regular} + \#\textit{pure-CAT} + \#\textit{mixed-CAT}. \end{aligned}$$

Exporting firms can be divided into groups as well: *regular* exporters export only regular products while *Carry-Along Trade* (*CAT*) exporters export at least one CAT product. CAT exporters comprise of two mutually exclusive groups: *mixed-CAT* exporters export at least one *mixed-CAT* product (but could also export *pure-CAT* products and/or regular products) and *pure-CAT* exporters export at least one *pure-CAT* product but no *mixed-CAT* products. *Pure-CAT* exporters might also export one or more regular products,

$$\begin{aligned} \#\text{exporters} &= \#\text{regular exporters} + \#\text{CAT exporters} \\ \#\text{CAT exporters} &= \#\text{mixed CAT exporters} + \#\textit{pure-CAT} \text{ exporters}. \end{aligned}$$

Finally, we can split the value of aggregate exports, $X = \sum_f X_f$, by these manufacturing firms into produced exports, PX, and CAT exports, CX. *Produced* exports is the sum of exports of all regular firm-products and the value of mixed CAT exports that are reported produced by the firm. *CAT* exports is the sum of all pure CAT firm-product exports and

the portion of mixed CAT exports that is not reported as production by the firm:

$$\begin{aligned} X &= \sum_f \sum_p X_{fp} \\ &= \sum_f \left(\sum_{p \in \text{regular}} X_{fp} + \sum_{p \in \text{mixed CAT}} X_{fp} + \sum_{p \in \text{pure CAT}} CX_{fp} \right) \\ &= \sum_f \left(\sum_{p \in \text{regular}} X_{fp} + \sum_{p \in \text{mixed CAT}} PX_{fp} \right) + \\ &\quad \sum_f \left(\sum_{p \in \text{mixed CAT}} CX_{fp} + \sum_{p \in \text{pure CAT}} CX_{fp} \right) \\ &= PX + CX \end{aligned}$$

In row 1 of Table 8 we explore Carry-Along Trade at the PC8 level. As mentioned before, we have 3899 exporting firms in the concorded dataset. Of these, 3563 (91.3 percent) are CAT exporters with 722 mixed-CAT exporters and 2841 pure-CAT exporters. 3509 firms export at least one pure-CAT product, i.e. a product where they report no domestic production. CAT products are as pervasive as CAT exporters. Of the 4093 total unique PC8 products (exported + non-exported), 3716 (90.7 percent) are reported as Carry-Along Trade by at least one firm.

While most firms export at least one CAT product and most products are exported as CAT by at least one firm, the share in the total value of exports is somewhat lower. CAT products account for €41.2billion or just over 50 percent of the value of exports at these manufacturing firms. CAT exports (excluding any production of the product by the firm) equal €30.8billion, or more than a third of total exports for these firms. Pure-CAT exports represent the majority of total CAT exports.

If correct, these numbers suggest that the traditional image of an exporting manufacturing firm is far too limited and requires a substantial change as manufacturing exporters are both producers and intermediaries in roughly equal parts. However, the fraction of CAT exporters and the share of CAT products are so large as to be almost unbelievable. In the next section, we attempt to understand potential problems with the data to evaluate the importance of Carry-Along Trade.

6.1. Data Issues

Ideally to compare production and exports at the level of the firm–product, one would like to have data from a single source with both production and exports recorded in a

common classification system.[25] For the combined production and export data, the export information is obtained from a combination of surveys for Intra-EU trade and customs records for exports to non-EU destinations and is based on the CN8 classification system while the firm-product production data comes from an annual survey of manufacturing firms and is based on the PC8 classification system. It is possible that the same product might be classified in different 8-digit codes for the export records and production records. If there is some ambiguity about the correct classification for a product, different individuals filling out the different forms and surveys may choose related but distinct product classifications for the export and product information. Even the same individual faced with different product descriptions might record the same good in two different categories.

This is easily seen in the context of a specific example from the CN and PC Codes and Descriptions for "Sweet Biscuits" in Table 9. Items in the CN6 category of "Sweet biscuits" can be classified into five different CN8 categories depending on whether they are coated with chocolate/cocoa, the weight of the immediate packaging, the level of the milkfat content, and whether or not they are sandwich biscuits. There are two PC8 codes that encompass sweet biscuits based on the chocolate/cocoa covering. The CN8 codes map fairly simply into the PC8 codes but mistakes in classification are still possible.

In such a case a slightly more aggregate view of the data will merge related product codes and eliminate spurious CAT exports. In the remaining rows of Table 8, we examine how the prevalence of CAT trade changes at different levels of aggregation. Row 2 reports the same numbers after having aggregated both the production and the export data to the PC 5-digit level. This represents a substantial reduction in the number of categories as there are now only 534 "products".[26] Even at this more aggregate level we find that CAT firms and products are pervasive. 86 percent of firms export at least one CAT product and 85 percent of products are exported as a CAT product by at least one firm. Aggregating the product categories does reduce the value of CAT trade by more than a third to €19.7billion or 23 percent of total exports at these firms. Our conclusion from this exercise is that product misclassification might play a role in some CAT exports but the phenomenon is widespread across firms and products and represents a substantial fraction of exports by manufacturing

[25] The preferred data are often administrative data which are collected in the normal course of business, e.g. records developed for social security payments are useful sources of wage and employment information at the establishment, as well as whether or not the establishment is in operation. Export values by product, firm and destination are often administrative data as they are collected from mandatory customs forms.

[26] This level of aggregation more closely resembles the typical industry-level analysis of US production data. There are 474 6-digit NAICS industries in North American manufacturing in the current system and 459 4-digit 1987 SIC codes in the previous US industrial classification.

firms.

Aggregating further to the 4-digit (240 "products") or 2-digit level (24 "products") continues to reduce the number of CAT firms and the value of CAT exports. However, even with extremely aggregated 2-digit categories, 2728 firms (70 percent) report exporting in a category where they report no production and the value of CAT exports is more than 15 percent of total export value.

As an additional check of the effect of the concordance on the prevalence of Carry-Along Trade, we consider only products with a one-to-one concordance between the two systems. The fractions of CAT exporters and CAT products and the CAT share of export value remain largely unchanged. Similarly, we drop firms with either a primary or secondary activity in wholesaling and the results are not altered. In addition, dropping multinational and foreign-owned firms does not affect the totals, nor does eliminating firms that are part of domestic groups.[27]

The possibility remains that some fraction of CAT trade appears in the data due to misreporting or other measurement issues. However, our own initial skepticism about the pervasive nature of CAT among exporting firms and exported products has been largely dispelled. In the next several sections we discuss possible explanations for the existence of CAT, report characteristics of regular and CAT exporters and examine the relationship between firm productivity, trade costs and regular versus CAT exports.

7. Theories of Carry-Along Trade

To our knowledge, the phenomenon of manufacturing firms exporting goods they do not produce themselves is not present in either the theoretical or empirical literatures on international trade. While there has been work on the role of networks in facilitating trade, e.g. Rauch (2001), Rauch and Watson (2004) and Petropoulou (2007), and the presence of intermediaries in trade, e.g. Ahn, Khandewal and Wei (2010) and Akerman (2010), the typical assumption in recent empirical and theoretical work is that the intermediary is a non-producing firm. In this section, we assume that the presence of CAT is robust to data and measurement issues and discuss several possible approaches to modelling CAT. Since the primary focus of this paper is empirical, we leave the formalization of the frameworks to later research. We recognize that these explanations are potentially related and that firms

[27] Multinational and foreign-owned firms are defined using the FDI survey (cfr. Data Appendix). Domestic groups are identified using ownership information from the Belfirst Database (BvDEP, 2006). Results of these exercises are available upon request from the authors.

may undertake one or all of them.[28]

7.1. Pure Intermediary

Perhaps the simplest theory of CAT is one where the firm is first and foremost a producer and only becomes a CAT exporter after having made the export decision about its own products.[29] In this framework the firm evaluates the production and export possibilities for a range of products in a range of destinations. Positive profit opportunities net of country and product-country fixed costs of exporting lead a firm to export one or more of its own products as in the single-product model of Melitz (2003) or the multi-product extension in Bernard, Redding and Schott (2010b).

Having paid the country fixed costs of entering a market, the firm may now wish to offer intermediation services to other producers as in Akerman (2010). The manufacturing firm acts as a pure intermediary from the perspective of other producers in that it purchases goods on the domestic market, pays the product-country fixed costs of exporting and set prices as markups over the domestic purchase price adjusted for variable trade costs. Any firm that is an exporter of regular goods is likely to also be a CAT exporter and the CAT products will not necessarily have attributes that are correlated with the firm's regular exports unless there are also industry-specific fixed costs of exporting or country-specific differences in demand across products.

CAT products can be produced by other domestic firms or sourced from a firm in another country and ultimately re-exported.

7.2. Complementary Products

In a complementary-products framework, a CAT firm is a producer of a core product, or set of products, but also exports goods that are complements to its core set. A coffee roaster may export not only coffee but also mugs, coffee grinders, or sugar.[30] Two scenarios are possible: one where the original producers could have profitably exported the goods themselves and another where the costs of exporting were prohibitive for the original producers. The CAT exporter is able to increase the total profits of the transaction enough to induce the original manufacturers to export indirectly, perhaps through a reduction in search costs or its ability to lower the country fixed cost per good sold.

[28] We also assume that there are other potential explanations that we have not imagined.

[29] One approach to modelling this would be to allow simultaneous decision about market entry for regular and CAT products.

[30] None of the examples given here are motivated by actual Belgian firms.

7.3. Inputs and Parts

A relatively straightforward form of CAT involves the distribution of parts and inputs through a firm's export network. A manufacturer of tractors may also export tires, brakes, and windshield wipers made by other firms at home or abroad to its overseas distributors for sale as replacement parts. Similarly, a final assembly firm with operations in multiple countries may export inputs made by suppliers to its overseas factories. The former case would most likely involve the produced product and CAT products heading to the same destination while the latter might involve final goods being exported to different destinations than the CAT inputs.

7.4. Branded Products

An alternate approach to understanding CAT exports centers on the brand identity of the firm or one of its product lines. A manufacturing firm may develop brand equity that is profitably used to sell a wider variety of products than the firm itself produces. For example, a specialty shoe producer may decide to export shirts, sunglasses, headphones, watches and airline bags under its brand.[31]

This differs from the complementary product concept in that the products may or may not be consumed together, and it differs from the pure intermediary framework in that the producer's brand equity rather than the country-specific fixed costs are the motivation for CAT.

In this section, we have tried to outline some of the possible explanations for the widespread presence of CAT in Belgian exports. We now explore further the characteristics of CAT exporters and examine if CAT exports and the various extensive and intensive margins respond differently to the measures of firm productivity and trade costs examined earlier.

8. CAT and Firm Characteristics

A complete exploration of CAT would consider the role of firm, product, and country characteristics. We start by focusing on a few firm attributes and how they vary across regular exporters and CAT exporters.

Table 10 reports the means for four types of exporters: all exporters, regular exporters, CAT exporters and mixed CAT exporters. The second and third categories are mutually

[31] All these items are for sale at www.shopadidas.com.

exclusive and span the set of exporting firms. The final category is a subset of CAT firms that produce at least one good where they report more exports than production.

A quick comparison of columns 2 and 3 reveals that the relatively low number of regular exporters are substantially smaller, less export intensive, and less productive than the CAT firms. On average, CAT exporters employ four times as many workers, have produced sales four times larger and export more than eight times as much. However, the much greater export to production ratios at CAT exporters are driven by the CAT exports themselves; produced exports to produced sales ratios are about 0.33 for both regular and CAT exporters even though CAT exporters also export more regular products.

Revenue-based productivity measures, both TFP and value-added per worker, are 10-15 percent higher at CAT exporters who also reach many more export destinations. In addition, CAT firms display different ownership characteristics. CAT exporters are more likely to be part of a Belgian multinational, i.e. a Belgian firm that has at least one foreign subsidiary of which it owns at least 20 percent either directly or indirectly. CAT exporters are also more likely to have a foreign shareholder that directly or indirectly owns at least 20 percent of the firm.

Within the CAT exporters there are differences between mixed CAT exporters and pure CAT exporters. Mixed firms are typically among the largest exporters. These firms report CAT exports in at least one product where they also report production. On average these firms are larger in terms of employment, are more productive, are more export intensive and have higher shares of CAT exports in total firm exports. They export more of every type of product to more destinations. They are also substantially more likely to belong to a Belgian multinational and have foreign owners.

9. CAT, Margins of Trade and Productivity

We now revisit the relationship between the margins of trade and proxies for firm productivity and trade costs in light of the evidence on Carry-Along Trade. One possible explanation for the concentration of exports among the largest and most productive firms is their capacity to export goods made by others. The importance of the extensive margins of countries and products may be highly correlated with the presence of CAT. Similarly the strong correlation of distance and the extensive margins of trade may result from firms' ability to ship CAT products.

Tables 11 and 12 report the relationships between measures of productivity and total exports, as well as the extensive and intensive margins, for the Prodcom firms. Each table

contains four panels of results. From top to bottom they are: all exports, exports of regular products, exports of CAT products (both pure and mixed), and exports of pure CAT products.[32]

For easier comparison with the results on productivity and the margins of trade for all exporting firms in Table 3, we first consider the decomposition of total firm exports in the top panel. The general pattern of findings is unchanged for the Prodcom firms: total exports are increasing in measures of firm productivity as are both the extensive margins of the number of destinations and the number of products. Products per destination are higher for firms with greater measured productivity as is the average value of exports per product-country. The relationship of export value to productivity within product-countries is positive but not significant for the measure of TFP.

While the broad pattern of results matches the predictions of the multi-product theory, the magnitude of the responses is generally much larger. The elasticity of total exports with respect to TFP is more than three times higher for these Prodcom firms than for exporters overall, driven largely by much greater responses of the extensive margins.

One possible explanation for the differences in the overall export response to firm productivity is that there are important differences within firms across CAT and non-CAT products. The second and fourth panels of Tables 11 and 12 estimate the responses of the margins of trade for regular products and pure CAT products. Comparing the firm-level exports of these two types of products allows for the cleanest comparison of firm activity.[33] The results are striking and offer a potential explanation for the differences between the Prodcom firms and the total set of exporters. The elasticity of total exports with respect to productivity is higher for exports of pure CAT products than for exports of regular products, i.e. CAT trade increases more as firm productivity rises.

The source of the differential response to firm productivity is found in the extensive margins of trade. Both the number of countries and especially the number of products per country increase more rapidly with firm productivity for pure CAT products. Conversely the intensive margin response, while still positive, is more muted for CAT products than for regular products. Across manufacturing firms, exports are greater for more productive firms

[32] For consistency, both measures of productivity are created using the same data source as in Table 3. The regressions are run using the PC 8-digit product categories. The results are robust to using more aggregate 5-digit categories - the 5-digit results are available upon request from the authors.

[33] Regular products at the firm level involve no carry-along trade while pure CAT products are those where the firm reports no produced sales. Exports of mixed CAT products, which are combined with pure CAt products in the third panel of the tables, involve both produced and non-produced components.

in part because the most productive firms are exporting greater numbers of non-produced products to more countries.

Numerous studies have found that exports are extremely concentrated in the top decile of trading firms. Part of the explanation of that concentration may be found in a deeper understanding of the factors that drive Carry-Along Trade.

10. CAT and Trade Costs

The previous sections emphasized the differences between regular manufacturing exporters and CAT exporters both in the characteristics of the firms and the response of total exports and the margins of trade to firm productivity. In this section we consider the response of exports across destinations for both regular and CAT products using the familiar gravity specification from Section 4.[34]

Table 13 reports the simple gravity regression for total exports of the Prodcom firms, as well as for the extensive and intensive margins, by type of trade. The top panel includes exports of all products, the second and third panels reports exports by country for regular products and CAT products (both pure and mixed) respectively. The bottom panel repeats the regression for exports of pure CAT products only.

Comparing the top panel (all exports) with the results for all exporters in Table 5, we find a similar overall pattern. However the response of overall exports to trade costs (distance) is somewhat smaller and the response to GDP a bit larger. These differences are driven by larger differences across the margins of trade. The extensive margin response to distance is substantially smaller for the Prodcom firms for both the number of products and especially the number of countries. In contrast the intensive margin is negative and significant for these firms. The results for market size (GDP) mirror those for distance; the extensive margin responses are greater while the intensive is smaller.

To understand the role that CAT trade may be playing in the variation of exports across countries, we compare results from the second and fourth panels of Table 13, exports of regular and pure CAT products respectively. The elasticity of exports with respect to GDP and, especially, distance is greater for pure CAT products than for regular exports. The effect of distance is particular pronounced for products per firm; relative to exports of regular products, exports of pure CAT products decrease more rapidly as distance increases largely because there are fewer products per firm being exported. Although the differences are

[34]The regressions are run using the PC8d product categories. The results are robust to using more aggregate 5-digit categories and are available upon request from the authors.

smaller for GDP, again the stronger response of pure CAT exports to market size is heavily driven by higher products per firm and more firms per country.

These results suggest that further work is needed to understand both the nature of the non-produced goods that are being exported by the firm as well as the characteristics of the destination markets themselves. In results not reported here, we find that responses of total exports and the margins of trade measures to country fixed export costs also vary between regular and pure CAT products.

11. Conclusion

This paper documents the importance of multi-product firms for a small open economy using the universe of Belgian firm-level data with information on products and destination markets. We examine the role of multi-product firms in light of recent theoretical models. In addition we use the unique panel features of the Belgian data to examine the adjustments of the margins of trade in both the short- and long-run both for aggregate Belgian exports and firm-level exports.

Multi-product firms in Belgium constitute 65% of all exporting firms and account for 98% of exports. Relatively few exporting firms account for the majority of Belgian exports and these large exporting firms have greater productivity, number of employees, value-added and numbers of exported products.

Across firms, productivity is positively and significantly associated with the value of firm exports. More productive firms export more products to more countries and also have higher average product-country export flows. The extensive and intensive margins each account for about half of the variation in total firm exports. Country-level Belgian exports decrease as trade costs rise. A decomposition of country-level exports shows that trade costs are negatively correlated with the number of firms exporting to the country as well as the number of products per destination.

For a large sample of Belgian manufacturing firms, we are able to link firm-product data on production and exports for a single year. These combined data yield startling, previously unknown facts about multi-product exporters. We find the large majority of multi-product exporters are exporting goods that they do not produce and some firms export more than they produce of a good. This trade in non-produced goods, which we call Carry-Along Trade (CAT) is widespread across firms, products and destinations and accounts for more than one third of exports at these manufacturing firms. We find that the prevalence of CAT is robust to the level of data aggregation as well as to different sub-samples of firms.

After sketching several possible explanations for the existence of CAT, we reconsider the relationships between trade costs, productivity and the margins of trade for both regular and CAT products. We find the CAT exports are more responsive to cross-sectional differences in firm productivity, especially along the extensive margin of countries and products per country. Similarly CAT exports are more responsive to distance and GDP in a simple gravity regression, again driven by the extensive margin adjustments.

This paper both confirms recent findings about the importance of multi-product exporters and their ability to export many products to many destinations. However, the paper may raise more questions than it answers as we discover a completely new, and quantitatively important activity at manufacturing exporters that suggests the need for a new perspective on the activities of these large and important firms.

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Appendix

The data used in this paper combines data from four different databases, made available by the National Bank of Belgium: (i) Business Registry, (ii) Foreign Direct Investment Survey, (iii) Trade Database, and (iv) Prodcom Database. The Business Registry database includes both annual accounts data and data from the Crossroads bank (data on firms' main activity and legal status). Here we describe the characteristics and inclusion criteria of each of these databases in turn. We also discuss how the different databases have been merged in a consistent way.

Business Registry

The Business Registry covers the population of firms required to file their (unconsolidated) accounts with the National Bank of Belgium. The data combine annual accounts figures with data from the Crossroads bank on firms' main sector of activity and legal status. Overall, most firms that are registered in Belgium (i.e. that exist as a separate legal entity) and have limited liability are required to file annual accounts. Specifically, all limited-liability firms that are incorporated in Belgium have to report unconsolidated accounts involving balance sheet items and income statements. Belgian firms that are part of a group additionally have to submit consolidated accounts where they report the joint group's activities in a consolidated way. However, Belgian affiliates that belong to a foreign group and that do no exist as a separate legal entity in Belgium are not required to report unconsolidated accounts (they are required to file a consolidated account, but these data do not allow us to obtain firm-level characteristics specifically for the Belgian affiliate). This implies that whenever these firms are exporters, they will be included in the analysis when using the full export sample, but they cannot be included in the sample when we combine the trade data with firm characteristics or when we introduce a sample selection based on firms' main sector of activity (since this information is recorded in the Business Registry database, see below).

There are two types of annual accounts: full and abbreviated. Firms have to file a full annual account when they exceed at least two of the following three cutoffs: (i) employ at least 50 employees; (ii) have an annual turnover of more than €7.3million; and (iii) report total assets of more than €3.65million. An important difference between the two types of accounts is that full accounts distinguish between total turnover and total material costs, while abbreviated accounts only report value-added (although firms can report turnover and material costs on a voluntary basis if they choose to do so). Hence, whenever we calculate

firm-level productivity, measured as labor productivity or total factor productivity, we will use value-added as the preferred measure of output. This implies that labor productivity will be defined as value-added per worker and total factor productivity indices are calculated using a value-added decomposition in each year.

Foreign Direct Investment Survey

The Foreign Direct Investment Survey data contain information on firms' foreign shareholders and affiliates. The data are available for the period 1997-2007. Prior to 2000, the survey included all firms that reported FDI transactions in the balance of payment returns. Since 2001, only firms with financial fixed assets of more than €5 million or total equity value of more than €10million or a balance sheet total exceeding € 25million are required to report. We use the FDI survey to identify firms' foreign shareholders and affiliates.

Trade Database

The Trade Database covers the full population of firms that have reported trading activities between 1997 and 2007. The data include both import and export flows, at the firm-product-country level in each year. In addition, the data distinguish between intrastat (intra-EU) and extrastat (extra-EU) trade and between different types of transactions (e.g. transactions with transfer of ownership and compensation, transactions involving repairs and return of goods, transactions before processing and repair, etc.).

Whether firms have to report their export transactions, depends on the value and destination of export flows. For intra-EU trade flows, firms have to report their trade on a monthly basis, using an electronic submission system. Firms are only required to report intrastat trade if their value of trade exceeds a particular cutoff. The participation of firms in the intrastat inquiry (pertaining to the intra-EU trade) is determined by statistical thresholds (selection is based on the VAT returns from the previous year):

- from 1995 to 1997: firms exporting or importing for more than €104,115 a year;
- from 1998 to 2005: firms exporting or importing for more than €250,000 a year;
- from 2006 onwards: firms exporting for more than €1,000,000 a year have to report their export transactions and those importing for more than €400,000 must report their import transactions.

The sample used in this paper will therefore be limited to the period 1998-2005, during which the cutoff value for exports and imports has not changed. Notably, the coverage of intrastat (and consequently extrastat) trade has changed over the sample period considered

due to the accession of ten new EU member countries in 2004. This implies that for the period 1998 until April 2004, export transactions destined for the ten accession countries are recorded as extrastat transactions, while starting in May 2004, they are recorded as intrastat transactions (provided their total export value in the year before amounted to more than €250,000). Estimations performed by the National Bank of Belgium suggest that, in spite of the inclusion criteria for intrastat trade, total trade reported in the Trade Database accounts for more than 98 percent of total actual exports, i.e. the cutoff results in an average loss of about 1.5 percent of total reported trade in a particular year.

For export flows destined for countries outside of the European Union (extrastat trade), data are collected from customs data. Usually these data are collected on a transaction basis, though a few companies are exempted from this. These companies file a monthly declaration with the NBB. The customs declarations are collected on a daily basis and aggregated by the NBB. For extrastat trade, all transactions whose value is higher than €1,000 or whose weight is bigger than 1,000 Kg have to be recorded.

In the sample used in the empirical analysis, we exclude all export transactions that do not involve a "transfer of ownership with compensation". This implies that we omit transaction flows such as the return, replacement and repair of goods, transactions without compensation (e.g. government support), processing or repair transactions, etc. We further exclude two large firms for confidentiality reasons (they dominate exports in particular export product classes, i.e. they account for the majority of exports of all firms exporting a particular amount of products). Our final sample of exporters (not taking into account availability of firm-level balance sheet information and characteristics such as productivity) covers 85 percent of total reported export value and 97 percent of the number of exporting firms in the Trade Database between 1998 and 2005. The final sample contains both intra- and extra-EU export transactions, recorded at the year-firm-product-country level. This implies that each observation represents an export flow (intrastat or extrastat) of a particular 8-digit Combined Nomenclature (CN8) product and by destination country.

To construct panel data we need to concord the annual changes in the product classification (CN8) over time, similar to Pierce and Schott (2009)'s concordance of the US 10 digit Harmonized System classification. The reason for this is that CN8 codes tend to change over time, for various reasons. A change in CN8 codes can be "simple", i.e. a code changes into a new code in the following year or "complex", i.e. one code translates into multiple new codes in the following year (growing families) or multiple codes are collapsed into one new code (shrinking families). Since codes can change more than once during the period

considered, an algorithm needs to be developed to track families over time. The algorithm developed in this paper draws heavily on that developed for the US by Pierce and Schott (2009). By grouping families together over time, we are able to retain all available trade flows in the panel data set, i.e. concording the CN8 codes over time does not result in a loss of observations, though it might lead to a loss in detail (taking into account that different CN8 codes might be grouped together in a single product grouping, rather than being recorded as separate products). Further information regarding the concordance of CN codes over time can be obtained from the authors.

Prodcom Database

The Prodcom Database covers the population of firms that have declared their production activities between 1995 and 2008. The data contain firms' production activities at the firm-product level in each year. Between 1995 and 2007, all firms employing at least 10 people and with primary manufacturing activity were required to report to Prodcom. Firms with primary acitivity outside the manufacturing sector were only required to report if they employed at least 20 people. Firms with less than 10 employees (or less than 20 if their primary activity is outside the manufacturing sector) are only required to report if their turnover exceeds a minimum threshold (which has increased over time). Starting 2008, only firms employing more than 20 people and/or with a turnover of at least €3.5 million were required to declare their production activities. Whether or not firms have to file a Prodcom declaration is based on their social security records of the previous year. The Prodcom survey is obligatory and its underlying regulation is EU-based. All EU member states (and some EFTA countries and future accession countries) are bound by the Prodcom regulation.

In the Prodcom declaration, which has to be filed on a monthly basis, firms are required to record their production activities at an 8-digit level. Products are Prodcom products, i.e. they are part of the European Prodcom List. Eurostat has developed the Prodcom List with two prinipal goals in mind: (i) measure production in the EU member states on a comparable basis and (ii) enable a comparison between production and foreign trade statistics (Eurostat, 2006). In view of the second aim, the Prodcom List has a close relationship with the Combined Nomenclature classification, which is used to record foreign trade statistics. In addition, the Prodcom classification is closely linked to the European NACE and CPA classifications, i.e. the first six digits of the Prodcom codes are CPA codes and the first four digits are NACE codes.

Although there is a close link between the CN and PC classification by construction,

the Prodcom list does not cover all goods listed in the CN classification. The Prodcom List covers Mining and Quarrying, Manufacturing and Electricity, Gas and Water Supply (Sections B, C and D of NACE Rev. 1.1), but it does not cover all industrial services (e.g. dyeing in general is not recorded, but dyeing of fabric is part of the Prodcom List) and it does not cover Recycling and Energy Products. Moreover, the Prodcom committee felt that some CN codes provide too much detail. As a result, the final Prodcom List is based on the CN classification, but with some modifications. Generally, the Prodcom Classification has fewer codes than the CN classification; although there are some instances in which a single CN code maps into multiple PC codes. Specifically for 2005, there are 4220 PC8 codes, while there are 9157 CN8 codes covered by the Prodcom List. Out of the 4220 PC8 codes, 2558 have a one-to-one match with a particular CN8 product. The remaining 1662 PC8 codes are either many-to-one mappings from CN8 to PC8 (6477 CN8 to 1612 PC8 codes), one-to-many mappings (6 CN8 codes to 3 PC codes) or many-to-many mappings (116 CN8 to 47 PC8 codes). In order to merge the domestic production and trade data (cfr. infra), we concord the trade data from CN8 to PC8.

Like the CN8 nomenclature, the PC8 List undergoes yearly revisions. Revisions can be implemented to improve the link between CN8 and Prodcom or they can be due to changes in the underlying CPA or NACE classification. Hence, to obtain comparable panel data on firm-level production, a similar concordance needs to be used as for the CN8 classification (cfr. supra), that keeps track of growing and shrinking families over time.

In addition to their production activities, fims are also asked to report industrial service activities (not at the product level) and subcontracting activities (recorded at the product level if the product is on the prodcom list). For their production activities, firms need to report the physical volume and value of production sold during the survey period at the PC8 level.

Merging data

Firm-level data from the four databases are merged together based on firms' VAT number, which acts as firms' unique identifier in all four databases. In order to merge the Prodcom data (at the firm-Prodcom product level) with the Trade data (at the firm-CN product-destination level), we have relied on the Eurostat concordance between CN8 and PC8 in 2005. The concordance file maps the 9157 CN8 codes for 2005 into the 4220 PC8 codes for 2005. If a single CN8 code maps into two PC8 codes (3 PC8 codes in the concordance), both PC8 codes are considered as a single 8d PC product. None of these codes feature in

our data however. If there is a many-to-many mapping between CN8 and PC8, we group the CN8 and PC8 codes in a special group, i.e. we assign a custom code which groups the relevant CN8 and PC8 codes. The 47 PC8 codes for which this the case are grouped into 11 special groups. Of these 11 special groups, only 3 feature in the data however.

The combined Prodcom-Trade data used in the second half of the paper contain data on all firms that produced at least one product in the Prodcom survey (6110 in 2005), with the exception of one large firm, which is excluded for confidentiality reasons. Of these 6110 firms, 3899 are exporters. In order to merge the trade data with the domestic production data at a comparable level, product-level trade data for these firms were first concorded into the Prodcom classification. Overall, there are 4093 PC8 products that feature in our data (either domestically produced or exported). Of these, only 3 codes are special groups. The concordance only covers products on the Prodcom List, so any CN8 products not covered by the Prodcom List (e.g. Chapter 27: Fuel Products) are not listed in the concordance. These firm-products are necessarily dropped from the data. Once the trading activities of firms are expressed in PC8 codes, the trade data can be merged with the Prodcom data using firms' VAT number and their PC8 codes .The final sample of manufacturing exporters accounts for 38 percent of total Belgian exports in 2005 and 83 percent of total Belgian exports by firms with primary manufacturing activity. The final data thus obtained allow us to directly compare firms' trading and production activities for all their products covered by the Prodcom List.

Table 1: Summary statistics: Cross-section sample for 2005

Total exports

Number of products exported	*Number of firms*		*Value of exports*		*Average number of export destinations per firm*	*Average Exports per Firm-Product-Country (€ 1,000)*	*Average Exports at the Firm-Product Level (€1,000)*	*Average exports at the Firm-Country level (€ 1,000)*
	N	*% of total*	*Value (€ 1,000,000)*	*% of total*				
1	8,596	34.05	4,487	2.08	1.58	331	522	331
2	3,401	13.47	4,157	1.93	3.07	317	611	398
3	2,026	8.02	3,952	1.83	4.44	301	650	440
4	1,392	5.51	4,032	1.87	5.42	327	724	534
5	1,102	4.36	6,764	3.13	6.73	506	1,228	912
6-10	3,187	12.62	21,947	10.17	9.56	326	903	720
11-20	2,483	9.83	38,655	17.92	12.85	375	1,058	1,211
21-30	1,068	4.23	31,483	14.59	15.94	391	1,179	1,849
31-50	899	3.56	28,693	13.30	18.66	261	819	1,710
>50	1,094	4.33	71,591	33.18	23.55	140	526	2,779
Total	*25,248*	*100.00*	*215,761*	*100.00*	*6.73*	*230*	*741*	*1,270*

Intrastat exports

Number of products exported	*Number of firms*		*Value of exports*		*Average number of export destinations per firm*	*Average Exports per Firm-Product-Country (€ 1,000)*	*Average Exports at the Firm-Product Level (€1,000)*	*Average exports at the Firm-Country level (€ 1,000)*
	N	*% of total*	*Value (€ 1,000,000)*	*% of total*				
1	2,694	20.44	6,236	3.95	3.99	580	2,315	580
2	1,430	10.85	5,706	3.62	5.18	556	1,995	770
3	1,029	7.81	5,630	3.57	5.08	619	1,824	1,077
4	874	6.63	6,929	4.39	5.98	662	1,982	1,327
5	670	5.08	3,918	2.48	6.17	395	1,170	948
6-10	2,162	16.40	21,241	13.47	6.86	451	1,279	1,433
11-20	1,848	14.02	22,261	14.11	7.87	297	818	1,530
21-30	867	6.58	18,097	11.47	8.72	296	830	2,393
31-50	710	5.39	19,561	12.40	9.22	246	703	2,988
>50	893	6.78	48,135	30.52	10.10	132	428	5,336
Total	*13,177*	*100.00*	*157,714*	*100.00*	*6.47*	*232*	*712*	*1,850*

Extrastat exports

Number of products exported	*Number of firms*		*Value of exports*		*Average number of export destinations per firm*	*Average Exports per Firm-Product-Country (€ 1,000)*	*Average Exports at the Firm-Product Level (€1,000)*	*Average exports at the Firm-Country level (€ 1,000)*
	N	*% of total*	*Value (€ 1,000,000)*	*% of total*				
1	8,674	44.35	1,353	2.33	1.24	125	156	125
2	3,289	16.81	1,050	1.81	2.22	113	160	144
3	1,764	9.02	1,005	1.73	3.33	118	190	171
4	1,212	6.20	1,029	1.77	4.44	121	212	191
5	872	4.46	813	1.40	5.52	99	186	169
6-10	1,920	9.82	5,213	8.98	8.55	159	362	317
11-20	1,070	5.47	16,254	28.00	13.56	441	1,051	1,120
21-30	333	1.70	13,638	23.49	19.79	599	1,662	2,070
31-50	252	1.29	8,183	14.10	25.90	281	840	1,254
>50	174	0.89	9,510	16.38	37.09	104	445	1,473
Total	*19,560*	*100.00*	*58,047*	*100.00*	*4.33*	*225*	*587*	*686*

Information on sample selection: see Data Appendix. A product is defined as an 8-digit Combined Nomenclature (CN) product.

Table 2: Firm characteristics: Cross-section sample for 2005

Total exports - All firms				
Number of products exported	*ln(Total Factor Productivity)*	*ln(Value added)*	*ln(Employment)*	*ln(Capital intensity)*
1	-0.35	12.74	1.69	10.20
2	-0.12	13.05	1.92	10.15
3	-0.21	13.27	2.11	10.28
4	-0.15	13.39	2.24	10.27
5	-0.14	13.48	2.28	10.24
6-10	-0.14	13.72	2.50	10.23
11-20	-0.07	14.02	2.76	10.17
21-30	-0.08	14.26	2.96	10.21
31-50	-0.03	14.64	3.33	10.10
>50	0.00	15.06	3.78	10.07

Information on sample selection: see Data Appendix. A product is defined as an 8-digit Combined Nomenclature (CN) product. All values are expressed in euros. TFP is calculated using the index number methodology (Caves et al., 1982). Employment is expressed in full-time equivalent units. Capital intensity is defined as tangible fixed assets per employee. Values reported are firm-level sample means, taken over all firms exporting the listed number of products.

Table 3: Firm Productivity and the Margins of Trade in 2005

Using TFP to proxy for firm productivity						
	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(density_f)$	$ln(average\ value_f)$	$ln(value_{fpc})$
Ln(TFP)	0.076**	0.022**	0.027**	-0.013**	0.040**	0.094***
	[0.035]	[0.011]	[0.012]	[0.007]	[0.020]	[0.035]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	16,278	16,278	16,278	16,278	16,278	684,860
R-squared	0.241	0.194	0.143	0.139	0.221	0.405
Using labor productivity (Value added per worker) to proxy for firm productivity						
	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(density_f)$	$ln(average\ value_f)$	$ln(value_{fpc})$
ln(VA/worker)	0.762***	0.199***	0.173***	-0.101***	0.491***	0.309***
	[0.032]	[0.012]	[0.015]	[0.008]	[0.022]	[0.076]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	16,499	16,499	16,499	16,499	16,499	689,269
R-squared	0.267	0.204	0.147	0.146	0.246	0.408

All results are obtained by running OLS regressions at the firm-level, using data on total exports for 2005 (cfr. Data Appendix for sample selection). The dependent variable used is reported at the top of each column. Reported values are coefficients [robust standard errors]. Significance levels: *** < 0.01; ** < 0.05; * < 0.10.

Table 4: Within-firm Productivity Changes and the Margins of Trade

Annual differences					
	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(average\ value_f)$	$ln(Value_{fpc})$
Ln(TFP)	0.005**	0.002***	0.001*	0.002*	0.002
	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
Fixed effects	firm, year	firm, year	firm, year	firm, year	firm-product-country + year
Clustering	no	no	no	no	firm
Observations	135,077	135,077	135,077	135,077	4,686,642
R-squared	0.890	0.890	0.880	0.870	0.890
Long differences (1998-2005)					
	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(average\ value_f)$	$ln(Value_{fpc})$
Ln(TFP)	0.032**	0.012**	0.018**	0.016**	0.073***
	[0.014]	[0.005]	[0.008]	[0.008]	[0.018]
Fixed effects	none	none	none	none	none
Clustering	no	no	no	no	firm
Observations	8,648	8,648	8,648	8,648	165,594
R-squared	0.002	0.002	0.002	0.001	0.002

All results are obtained by running regressions at the firm-level or at the firm-product-country level (final column), using data on total exports between 1998 and 2005 (cfr. Data Appendix for sample selection). The dependent variable used is reported at the top of each column. Reported values are coefficients [robust standard errors]. The top panel reports results of a fixed effects regression (within-firm results). In the bottom panel both the dependent and independent variables are defined as long differences, i.e. the difference between 2005 and 1998. Significance levels: *** < 0.01; ** < 0.05; * < 0.1.

Table 5: Gravity and the Margins of Belgian Bilateral Exports: 2005

	$ln(value_c)$	$ln(\#\ firms_c)$	$ln(\#\ products_c)$	$ln(Density_c)$	$ln(average\ value_c)$	$ln(Value_{fpc})$
Ln($Distance_c$)	-0.966***	-0.777***	-0.679***	0.438***	0.051	-0.390***
	[0.077]	[0.063]	[0.074]	[0.067]	[0.044]	[0.002]
Ln(GDP_c)	0.954***	0.516***	0.528***	-0.429***	0.340***	0.379***
	[0.038]	[0.028]	[0.030]	[0.026]	[0.022]	[0.001]
Fixed effects	none	none	none	none	none	firm-product
Observations	178	178	178	178	178	919,565
R-squared	0.872	0.790	0.783	0.745	0.634	0.739

All results are obtained by running regressions at the country level or at the firm-product-country level (final column), using data on total exports in 2005 (cfr. Data Appendix for sample selection). The dependent variable used is reported at the top of each column. Reported values are coefficients [robust standard errors]. Distance refers to the great-circle distance between the capital of Belgium and country c. GDP is defined as nominal GDP, expressed in euros. Significance levels: *** < 0.01; ** < 0.05; * < 0.1.

Table 6: Exchange rates and the Margins of Trade over time

Annual Differences						
	$ln(value_c)$	$ln(\#\ firms_c)$	$ln(\#\ products_c)$	$ln(density_c)$	$ln(average\ value_c)$	$ln(Value_{fpc})$
ln(Real Exchange Rate)	-0.512***	-0.167**	-0.227***	0.153***	-0.270***	-0.546***
	[0.145]	[0.072]	[0.068]	[0.055]	[0.100]	[0.139]
ln(realGDP)	2.351***	0.810**	1.229***	-0.680*	0.991**	0.742***
	[0.559]	[0.331]	[0.388]	[0.348]	[0.414]	[0.254]
Country dummies	yes	yes	yes	yes	yes	yes
Firm-product FE	no	no	no	no	no	yes
Observations	899	899	899	899	899	558,428
R-squared	0.093	0.092	0.159	0.096	0.083	0.160
Clustering	no	no	no	no	no	country-year

All results are obtained by running regressions at the country level or at the firm-product-country level (final column), using data on total exports between 1998 and 2005 (cfr. Data Appendix for sample selection). The dependent variable used is reported at the top of each column. Reported values are coefficients [robust standard errors]. The dependent and independent variables are defined as annual differences. Significance levels: *** < 0.01; ** < 0.05; * < 0.1.

Table 7: Summary statistics, Prodcom Firms: 2005

# Exported Products	*# Firms*	*# Produced Products*	*Value of Exports (million €)*	*Value of Production (million €)*
1	617	1.67	1,121	4,032
2	407	1.8	1,310	4,412
3	303	1.97	1,582	3,978
4	269	2.35	2,608	5,101
5	220	2.53	4,337	5,850
6-10	805	2.8	11,298	18,056
11-20	636	3.56	15,972	24,545
21-30	264	4.75	12,100	17,032
31-50	207	5.22	9,049	10,278
>51	171	9.01	22,895	25,406
Total	3,899	3.06	82,276	118,689

# Exported Products	*Average # Destinations*	*Average Exports per Firm-Country(€)*	*Average Exports per Firm-Product(€)*	*Average Exports per Firm-Product-Country(€)*
1	3.71	489,315	1,816,891	489,315
2	6.76	476,184	1,609,899	405,966
3	7.84	666,134	1,740,449	477,389
4	9.67	1,003,186	2,424,056	671,546
5	11.11	1,773,946	3,942,999	1,046,898
6-10	14.78	949,604	1,822,321	479,050
11-20	20.28	1,238,185	1,723,971	454,567
21-30	26.53	1,727,616	1,849,057	460,505
31-50	32.15	1,359,609	1,119,164	267,027
>51	44.77	2,990,973	1,360,907	301,480
Total	15.02	1,404,599	1,599,607	388,654

Notes: This table includes all exporters in the Prodcom survey for 2005 that have domestic production for at least one of their products. A product is defined as an 8digit Prodcom (PC8) product. ±

Table 8: CAT Firms, Products and Exports: 2005

	CAT Firms	*Mixed CAT Firms*	*Firms with at least 1 Pure CAT product*	*Total Products*	*CAT Products*
8-digit	3,563	722	3,509	4,093	3,716
5-digit	3,350	647	3,287	534	456
4-digit	3,248	624	3,175	240	224
2-digit	2,820	573	2,728	24	24

	Firm-Products	*CAT Firm-Products*	*CAT Exports (million €)*	*Mixed CAT Exports (million €)*	*Pure CAT Exports (million €)*
8-digit	60,253	45,449	30,693	6,117	24,576
5-digit	37,345	27,660	19,569	6,699	12,870
4-digit	30,797	22,341	16,852	6,887	9,965
2-digit	16,927	10,457	12,675	7,979	4,696

Notes: There are 3899 exporting firms. *CAT Firms*, *Mixed CAT Firms* and *Firms with at least 1 PURE CAT product* are firms that export at least one CAT product, at least one mixed CAT product, and at least one pure CAT product respectively. *Total Products* is the number of unique products either produced and/or exported and *Firm-Products* is the total number of unique firm-product pairs either produced and/or exported. *CAT Products* is the number of products exported as a CAT product by one or more firms and *CAT Firm-Products* is the number of unique firm-product pairs exported as a CAT product. *CAT Exports*, *Mixed CAT Exports*, and *Pure CAT Exports* are the total exports of all CAT/Mixed CAT/Pure CAT firm-products respectively.

Table 9: CN and PC Codes and Descriptions for Sweet Biscuits

CN Code	**Description**
1905 31	Sweet biscuits
1905 31 11	Completely or partially coated or covered with chocolate or other preparations containing cocoa in immediate packings of a net content not exceeding 85 g
1905 31 19	Completely or partially coated or covered with chocolate or other preparations containing cocoa – other
1905 31 30	Containing 8 % or more by weight of milkfats
1905 31 91	Sandwich biscuits
1905 31 99	Other

PC Code	**Description**
10.72.12.53	Sweet biscuits, waffles and wafers completely or partially coated or covered with chocolate or other preparations containing cocoa
10.72.12.55	Sweet biscuits (including sandwich biscuits, excluding those completely or partially coated or covered with chocolate or other preparations containing chocolate)

Notes: The Combined Nomenclature (CN) and Prodcom (PC) classifications are available at ec.europa.eu/eurostat/ramon/ .

Table 10: Characteristics of Regular and CAT Exporters: 2005

	All Exporters	*Regular Exporters*	*CAT Exporters*	*Mixed CAT Exporters*
Employment	127	34	136	220
Produced Sales	30,440,895	8,068,190	32,550,698	66,924,530
All Exports	21,101,767	2,832,827	22,824,574	59,065,974
Regular Exports	10,525,500	2,832,827	11,250,939	22,607,751
CAT Exports	10,576,266	0	11,573,635	36,458,224
ln(TFP)	0.73	0.64	0.74	0.75
ln(VA/worker)	11.05	10.92	11.06	11.10
Multinational	0.14	0.04	0.15	0.25
Foreign Ownership	0.13	0.04	0.14	0.23
# Regular products	1.54	1.32	1.56	3.23
# Mixed CAT products	0.41	0.00	0.45	2.21
# Pure CAT products	11.25	0.00	12.31	19.05
# destinations Regular products	8.92	4.95	9.29	14.46
# destinations Mixed CAT products	3.33	0.00	3.64	17.98
# destinations Pure CAT products	9.23	0.00	10.10	14.64
# destinations Exported products	15.02	4.95	15.97	27.17
# of Firms	3,899	336	3,563	722

Notes: Regular Exporters are firms that export only regular products but no CAT products. CAT exporters export at least one CAT product and may or may not export a regular product. Regular exporters and CAT exporters are mutually exclusive and together equal the total number of exporting firms. Mixed CAT Exporters are a subset of CAT exporters that export at least one Mixed CAT product and may or may not export regular products or pure CAT products. Regular Exports is the value of exports of regular products. CAT exports is the value of exports of CAT products. Regular and CAT exports add up to total exports at the firm-level.

Table 11: Firm Productivity (TFP), Carry-Along Trade and the Margins of Trade: 2005

	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(density_f)$	$ln(average\ value_f)$	$ln(value_{fpc})$
All Exports						
Ln(TFP)	0.278***	0.110***	0.119***	-0.075***	0.125***	0.058
	[0.075]	[0.039]	[0.033]	[0.021]	[0.035]	[0.047]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,686	3,686	3,686	3,686	3,686	202,111
R-squared	0.196	0.245	0.183	0.208	0.182	0.47
Regular Exports						
Ln(TFP)	0.196***	0.068**	0.026***	-0.015***	0.117***	0.074
	[0.066]	[0.033]	[0.009]	[0.005]	[0.038]	[0.074]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	2,581	2,581	2,581	2,581	2,581	50,965
R-squared	0.194	0.233	0.189	0.150	0.192	0.667
CAT Exports						
Ln(TFP)	0.287***	0.140***	0.119***	-0.076***	0.104**	0.128**
	[0.068]	[0.031]	[0.033]	[0.020]	[0.047]	[0.061]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,375	3,375	3,375	3,375	3,375	151,146
R-squared	0.129	0.180	0.167	0.185	0.112	0.507
Pure CAT Exports						
Ln(TFP)	0.302***	0.160***	0.147***	-0.098***	0.094*	0.172***
	[0.085]	[0.033]	[0.030]	[0.020]	[0.050]	[0.066]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,322	3,322	3,322	3,322	3,322	129,971
R-squared	0.125	0.175	0.167	0.191	0.122	0.512

Notes: Regular Exports is the sum of exports of regular products at the firm. CAT exports is the sum of all exports of CAT products at the firm. Pure CAT exports is the sum of all exports of pure CAT products at the firm. The layout of the columns is comparable to that in Table 4.

Table 12: Firm Productivity (VA/Worker), Carry-Along Trade and the Margins of Trade: 2005

	$ln(value_f)$	$ln(\#\ countries_f)$	$ln(\#\ products_f)$	$ln(density_f)$	$ln(average\ value_f)$	$ln(value_{fpc})$
All Exports						
ln(VA/worker)	1.221***	0.453***	0.370***	-0.237***	0.638***	0.475***
	[0.095]	[0.043]	[0.042]	[0.026]	[0.060]	[0.090]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,695	3,695	3,695	3,695	3,695	202,436
R-squared	0.243	0.273	0.198	0.225	0.212	0.473
Regular Exports						
ln(VA/worker)	1.004***	0.307***	0.064***	-0.030**	0.664***	0.751***
	[0.111]	[0.046]	[0.024]	[0.013]	[0.080]	[0.162]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	2,589	2,589	2,589	2,589	2,589	51,070
R-squared	0.230	0.248	0.190	0.150	0.223	0.674
CAT Exports						
ln(VA/worker)	1.117***	0.459***	0.359***	-0.239***	0.538***	0.454***
	[0.108]	[0.045]	[0.046]	[0.028]	[0.070]	[0.092]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,384	3,384	3,384	3,384	3,384	151,366
R-squared	0.156	0.204	0.179	0.201	0.126	0.509
Pure CAT Exports						
ln(VA/worker)	1.104***	0.447***	0.357***	-0.249***	0.549***	0.434***
	[0.105]	[0.044]	[0.046]	[0.028]	[0.069]	[0.088]
Fixed effects	Industry	Industry	Industry	Industry	Industry	Product-country
Clustering	no	no	no	no	no	firm
Observations	3,331	3,331	3,331	3,331	3,331	130,191
R-squared	0.153	0.196	0.176	0.205	0.138	0.514

Notes: Regular Exports is the sum of exports of regular products at the firm. CAT exports is the sum of all exports of CAT products at the firm. Pure CAT exports is the sum of all exports of pure CAT products at the firm. The layout of the columns is comparable to that in Table 4.

Table 13: Gravity, Carry-Along Trade and the Margins of Trade: 2005

	$ln(value_c)$	$ln(\#\ firms_c)$	$ln(\#\ products_c)$	$ln(Density_c)$	$ln(average\ value_c)$	$ln(Value_{fpc})$
All Exports						
Ln(Distance$_c$)	-0.918***	-0.627***	-0.602***	0.427***	-0.126**	-0.342***
	[0.070]	[0.059]	[0.071]	[0.064]	[0.049]	[0.005]
Ln(GDP$_c$)	0.986***	0.567***	0.586***	-0.479***	0.300***	0.393***
	[0.033]	[0.022]	[0.026]	[0.023]	[0.023]	[0.003]
Fixed effects	none	none	none	none	none	product
Observations	178	178	178	178	178	207,977
R-squared	0.893	0.869	0.838	0.812	0.586	0.683
Regular Exports						
	ln(valuec)	*ln(# firmsc)*	*ln(# productsc)*	*ln(Densityc)*	*ln(average valuec)*	*ln(Valuefpc)*
Ln(Distancec)	-0.839***	-0.665***	-0.596***	0.542***	-0.119**	-0.470***
	[0.081]	[0.062]	[0.064]	[0.061]	[0.057]	[0.008]
Ln(GDPc)	0.975***	0.580***	0.568***	-0.532***	0.359***	0.458***
	[0.038]	[0.023]	[0.024]	[0.022]	[0.028]	[0.005]
Fixed effects	none	none	none	none	none	product
Observations	176	176	176	176	176	51,470
R-squared	0.870	0.860	0.843	0.841	0.537	0.532
CAT Exports						
	$ln(value_c)$	$ln(\#\ firms_c)$	$ln(\#\ products_c)$	$ln(Density_c)$	$ln(average\ value_c)$	$ln(Value_{fpc})$
Ln(Distance$_c$)	-0.963***	-0.637***	-0.648***	0.457***	-0.134**	-0.284***
	[0.077]	[0.060]	[0.073]	[0.064]	[0.052]	[0.005]
Ln(GDP$_c$)	1.005***	0.580***	0.602***	-0.502***	0.325***	0.365***
	[0.034]	[0.023]	[0.026]	[0.023]	[0.026]	[0.003]
Fixed effects	none	none	none	none	none	product
Observations	175	175	175	175	175	156,507
R-squared	0.877	0.860	0.835	0.810	0.600	0.692
Pure CAT Exports						
	$ln(value_c)$	$ln(\#\ firms_c)$	$ln(\#\ products_c)$	$ln(Density_c)$	$ln(average\ value_c)$	$ln(Value_{fpc})$
Ln(Distance$_c$)	-1.032***	-0.673***	-0.689***	0.497***	-0.164***	-0.250***
	[0.089]	[0.061]	[0.075]	[0.065]	[0.055]	[0.006]
Ln(GDP$_c$)	1.051***	0.621***	0.641***	-0.546***	0.335***	0.328***
	[0.040]	[0.024]	[0.029]	[0.025]	[0.030]	[0.004]
Fixed effects	none	none	none	none	none	product
Observations	174	174	174	174	174	134,976
R-squared	0.854	0.852	0.825	0.805	0.520	0.692

Notes: Regular Exports is the sum of exports of regular products to the country. CAT exports is the sum of all exports of CAT products to the country. Pure CAT exports is the sum of all exports of pure CAT products to the country. The specifications are comparable to those in Table 5.

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