Import Churning and Export Performance of Multi-product Firms[1]

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Abstract

This paper analyzes the impact of churning in the imported varieties of capital and intermediate inputs on firm export scope and productivity. Using detailed data on imports and exports at the firm–product level, we document substantial churning both in imports and exports for Slovenian firms in the period 1994-2008. An average firm changes about one quarter of imported and exported varieties every year, while gross churning in terms of added and dropped goods in trade is found to be almost three times higher. We find that a substantial proportion of this product churning is due to simultaneous imports and exports of firms in identical varieties within the same CN-8 product code (so called pass-on-trade). One quarter of all exported varieties and 40 per cent of all newly added exported varieties in the current year comprises varieties, which the same firm has imported previously. We find that the documented churning in imported varieties is far more important for firms' productivity growth and increased export product scope than reduction in tariffs or declines in import prices. While similar in terms of the effects on the export scope, gross churning, however, is found to have a bigger impact on firm productivity improvements by a factor of more than 10 as compared to the net churning effects. Both adding and dropping of imported input varieties thus seem to be of utmost importance for firms aiming to optimize their input mix towards their most valuable inputs. These effects are further enhanced when excluding the simultaneous trade in identical varieties, suggesting that pass-on-trade has less favorable effects on firms' long-run performance than regular trade.

JEL: R10, R15

Key words: multi-product firms, imports, export scope, total factor productivity

1. Introduction

The effect of international trade on firm performance has been widely conjectured and researched. In recent years, an increasing number of papers has started to tease out the microfoundations of this relationship. A small, but growing, number of papers suggest an important role of international trade for within firm reallocation of resources between products. For instance, models with multi-product firms by Bernard, Redding and Schott (2006), Nocke and Yeaple (2006) and Eckel and Neary (2010) demonstrate how either trade participation or trade liberalization affect firms' product scope. Increased import competition or fierce competition in export market push firms to rationalize their product scope towards their best performing products. This in turn improves firms' performance.

Another channel that affects firm performance through trade is the potential of having access to cheaper, better and more intermediate inputs through imports. Amiti and Konings (2007) show how trade liberalization improves firm level productivity mainly through increased imported intermediated inputs. Goldberg, Khandelwal, Pavcnik and Topolova (2010a and 2010b) show how increased imports positively contributes to product innovation. Trade liberalization, hence, enables firms to benefit from static and dynamic gains from trade. Access to cheaper, better and a wider range of imported input varieties leads to important productivity gains in the short and medium run (Broda and Weinstein, 2006). More importantly, though, are the dynamic gains from new varieties of intermediate inputs, which stimulate product innovation and hence firms' long-run growth. Goldberg, Khandelwal, Pavcnik and Topolova, henceforth GKPT, (2010a) find significant static and dynamic gains from trade for Indian firms after trade liberalization both through access to cheaper inputs and through the enlarged scope of imported varieties of intermediate products. Bas and Strauss-Kahn (2010) find also a substantial impact of an enlarged scope of imported intermediate products on firms' productivity and exports for a sample of French firms. In contrast, Klenow and Rodriguez-Clare (1997) and Arkolakis, Demidova, Klenow and Rodriguez-Clare (2008) find only small gains from increased import varieties after trade liberalization in Costa-Rica.

In this paper we analyze the impact of churning in imports on firm performance. In particular, we study the importance of net and gross churning in the imported varieties of capital and intermediate goods on firm export scope and productivity. Using detailed data on imports and exports at the firm-product-market-level, we document substantial churning both in imports and exports for Slovenian firms in the period 1994-2008. An average firm changes about one quarter of imported and exported varieties every year, while gross churning in terms of added and dropped goods in trade is found to be almost three times higher.

Surprisingly, we find that a substantial proportion of products added or dropped on a year-to-year basis consists of identical varieties, i.e. firms simultaneously importing and exporting varieties within the same CN-8 product code. In fact, one quarter of all exported varieties and 40 per cent of all newly added exported varieties in the current year comprises of the same varieties that a firm has imported in the same or in the previous year. This is in line with Bernard, Van Beveren and Vandenbusche (2010), who show that 3/4 of goods exported by Belgian firms consist of products, which they do not produce. They call this phenomenon *carry-on-trade*. They analyze the relationship between domestic production of multiple products and export varieties, but exclude imports. Since we do not have data on domestic production, we can only explore how imports affect export product scope. We find that a substantial fraction of imports is just passed on into exports, which we call passing-on-trade (POT). POT is a widespread phenomena for all firms, although it tends to be larger for firms that are part of a multinational network (i.e. either a firm is an affiliate of a multinational company or it has its own affiliates abroad) suggesting arms-length trade is important. POT, however, is also substantial for small first-time exporters without multinational status. On average, a new exporter has a 20 per cent probability that the exported varieties have been previously imported during the first year of exporting. For a new exporter with a single variety, this probability increases to 30 per cent.

This evidence suggests that POT trade has to be taken into account when considering the gains of trade through an increased number of imported varieties. We find that churning in imported varieties is far more important for firms' productivity growth and increased export product scope than reduction in tariffs or declines in import prices. In particular, we find that both net and gross churning in imported varieties of capital and intermediate inputs have a significant impact on the export scope and productivity gains. While similar in terms of the effects on the export scope, gross churning is found to have a bigger impact on productivity improvements by a factor of more than 10 as compared to the net churning effects. Both adding and dropping of imported input varieties thus seem to be essential for firms aiming to rationalize their product scope towards their best performing products. These effects are further enhanced when excluding the varieties that fall into the POT category.

There may be several possible explanations for this finding. First, firms that extensively participate in POT may be engaged in arbitrage trade between different markets by maximizing the profits from price differences across markets. Second, firms may engage in simple rebranding of cheaper imported goods and exporting them at substantial markups over the import prices. And third, firms may simply pass-on varieties produced in one of the affiliates to another one within the multinational network. In the first two examples, substantial profits may arise for a firm engaged in POT, while in the latter one this is not necessarily the case. Therefore, engaging in POT may improve firms' profitability, but may not necessarily exhibit significant impact on firms' long-run productivity improvements and their export scope.

In the next section, we describe the data we use and document the basic patterns of exports and imports and margins of trade. In section 3 we analyze the relationship between imports and exports and document the extent of pass-on-trade. Section 4 examines the impact of net and gross import churning on firm export scope and productivity gains. We conclude in section 5.

2. Basic patterns of firm – product level exports and imports

2.1. Data

In this paper we exploit matched datasets for Slovenian firms for the period 1994–2008. We use data from three sources. First is the firm–transaction–level trade data provided by Slovenian Customs Administration (CARS) and Slovenian Statistical Office (SORS), which records all foreign trade transactions of firms that are engaged in international trade in products.[2] These transactions are reported at the 8-digit product level defined according to the EU Combined Nomenclature (CN), which distinguishes between 10,108 8-digit product codes in 1994, 10,404 product

[2] Note that for the period 1994-2003 trade data is available for all firms engaged in international trade based on their customs declarations reported monthly to the CARS. After accession to the EU, as of May 1st 2004, trade data for *intra-EU* trade (*Intrastat*) are collected by the SORS directly from firms on statistical forms. Firms liable to report for Intrastat in a given reporting year are those, whose trade flows with EU Member States exceeded the exemption threshold in the preceding year for one or both flows of goods (flow of goods is total dispatches or total arrivals). The exemption threshold is set at a level that ensures that the value of at least 97% of the total dispatches and at least 95% of the total arrivals of Slovenia is covered. In a given reporting year also firms that have exceeded the exemption threshold during the year are included. Firms report only for the flow of goods for which the threshold was exceeded. In practical terms, for the period 2004 and 2005 this threshold was a value of transaction close to 100,000 EUR. In recent years this threshold is a bit higher, but not exceeding 200,000 EUR. For *extra-EU* trade, the international trade data collection remains as before with the CARS for each single trade transaction (http://www.stat.si/doc/metod_pojasnila/24-017-ME.htm).

codes in 2003, and 9,699 codes in 2008. CN product codes have been subject to revisions over the period, with major changes of product lines in 1996, 2002 and 2007. These changes are mostly at the last 2– or 3–digits, with either one-to-one code changes (old code abandoned and a new one established), code mergers (old codes merged to a single new or existing one) or code splitting (old code split into two or more new codes). We accounted for these CN changes by applying year-to-year changes in the code throughout the period.[3] From the original dataset, we extract the following information for each shipment: the value of imported and exported products in EUR currency, the physical quantity in units of output (pieces or kilograms), the corresponding CN code and Broad Economic Categories (BEC) code as well as origin– and destination–country codes. The transaction-level import and export volumes and quantities are then aggregated to create an annual firm–product–market trade dataset that is matched with annual data on firm characteristics.

The second source of data is the Agency of the Republic Slovenia for Public Records and Related Services (AJPES), which covers the balance sheet and income statements of all Slovenian incorporated firms (all limited liability companies and joint stock companies) as well as large sole proprietors with at least 30 employees. This data set includes complete financial and operational information for all firms. In particular, the accounting data contains information on the total domestic and foreign sales, costs of intermediate goods, materials and services, the physical capital, the total value of assets, the number of employees, and the NACE 5-digit industry code.

The third dataset is provided by the Bank of Slovenia (BS) information on inward and outward capital investments of Slovenian firms with non-residents. Specifically, this data is based on compulsory reports of capital investments between residents and non-residents. The data on capital cross-border investments are obtained from reports on credit transactions with the rest of the world and reports of short-term claims and liabilities arising from business with non-residents. This information enables us to construct variables on engagement of Slovenian firms in inward and outward foreign direct investment (FDI) using the common definition of the IMF's Balance of Payments Manual (5th edition, 1993).

The data from all three sources were matched using a common firm identifier, i.e. firm registration number. We restrict our attention to manufacturing firms and

[3] See Table A1 in Appendix for a list of the CN code changes. We use the procedure to account for the CN-8 changes, which is similar to the one developed by Masso and Vahter (2011), but accounts for specific CN-8 changes within the Slovenian code.

exclude all firms with zero employees and zero output. Thus, our sample of firms ranges between 3,295 firms in 1994 and 4,446 firms in 2008.

2.2. Multi-product exporters and importers and margins of trade

Tables 1 and 2 show summary statistics for the margins of trade of exporting and importing firms.[4] We categorize firms according to the number of products they export or import, and report the number of firms, the value of exports (imports), two measures of extensive margins (average number of destination (source) countries and products) as well as three measures of intensive margins (average values of export (import) per product-country, per product and per country of shipments). In 2008, about 75 per cent of manufacturing firms have been engaged in exporting at least one product, whereas the share of importing firms is higher – about 83 per cent. The multi-product exporters and importers constitute the large majority of firms. About 83% of exporting firms are multi-product exporters, accounting for 99.4 percent of total exports, while more than 85% of importing firms are multi-product importers, accounting for 99.8 percent of all imports in 2008. The export numbers are somewhat higher than those reported for other countries. For instance, Bernard, Redding and Schott (2010) report for the US that 58 percent of exporters are multi-product and account for more than 99 percent of exports. For Belgium, 65 percent of all exporters are multi-product and account for more than 98 percent of exports (Bernard, Van Beveren and Vandenbusche, 2010). Similar numbers are found for France (Mayer and Ottaviano, 2008) and India (GKPT, 2010). Further, exports are not only concentrated within the multi-product firms, but also among the firms with the largest number of varieties. In particular, the top 12 per cent of exporters that export more than 50 varieties account for 74 per cent of total exports. This suggests that also for Slovenia there is a small number of top exporters that account for the large majority of exports. Interestingly, comparison of Tables 1 and 2 reveals that multi-product importers show a very similar pattern to exporters. About 20 per cent of all firms that import more than 50 different products account for 83 per cent of total imports. Like the small 'club' of top exporters, also importing firms belong to a small group accounting for the large majority of imports. We will show below that most of the importers in fact belong to the same 'club' as exporters.

[*Table 1 and 2 about here*]

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[4] Exporting (importing) firms are firms that have at least one export (import) transaction annually. In general, we consider both continuing traders and switchers.

Tables 1 and 2 also provide information on extensive margins in terms of number of destinations and source markets. The average number of export destinations is 7.2, while the average number of import source markets is 6.9. But these numbers hide substantial heterogeneity between firms. Firms that export just one product typically ship it to only one market and similarly firms that import just one product only source it from one market. In contrast, firms that export more than 50 products reach on average 37 destinations, while firms that import more than 50 products source them on average from 20 countries. A typical feature of the recent models of multi-product firms is that higher productivity firms have higher volumes of exports due to higher numbers of export products and countries (e.g. Eckel and Neary, 2010; Arkolakis and Muendler, 2010; Mayer, Melitz and Ottaviano, 2010; Bernard, Redding and Schott, 2010). These models, however, do not provide any prediction related to the import pattern we observe, although we find the patterns to look very similar. Furthermore, when matching exporters with importers (not shown in the tables) it becomes clear that in Slovenia both groups of firms almost perfectly overlap. We will explore this issue later in more detail.

As is found in other papers (Bernard, et al. 2010), the intensive margin of exports (average exports per product-country) appears to vary non-monotonically as the number of export products increases. Interestingly, this pattern of non-monotonicity is also found for the intensive margins of importers. Another interesting feature in the data relates to differences in absolute values of intensive margins between exporters and importers. Single product exporters on average ship 70,000 euro per destination, while firms that export more than 50 products ship on average 2,400 euro per product to each market. Again, similar pattern is found for imports. Single product firms on average import 21,000 euro per source country, while firms that import more than 50 products source on average 1,400 euro per product and source country. This indicates that while in general average shipments per product–market both in exports and imports are quite low, the per product–market shipments in exports are larger, suggesting lower costs of importing than exporting.

[*Table 3 about here*]

Finally, we also look into the structure of trade by product types that we use in our analysis. According to Broad Economic Categories (BEC) classification we distinguish between three broad product types: capital, intermediate and consumer products. Table 3 provides information on extensive margins and value shares in total trade for these three types of goods in 2008. The most striking feature is that foreign trade of Slovenian manufacturing firms is dominated by intermediate goods.

About 72 per cent of total imports in 2008 consists of intermediate products, while in exports this share is roughly 50 per cent. In exports, only slightly more than one third of exported value consists of final goods, while in imports this share is much lower (about 11 per cent). The rest 14–17 per cent of trade consists of capital goods. Accordingly, intermediate goods tend to be the most diversified product group in terms of both dimensions of the extensive margins. In exports, a typical firm exports 17.5 intermediate products to 3.7 countries, while in imports a firm sources on average 27.5 intermediate products from 3.8 countries. Figures for capital and final goods are lower by some 50 to 60 per cent in terms of number of foreign countries and by 60 to 80 per cent in terms of number of traded goods.

2.3. Multi-product exporters and importers and firm characteristics

A number of papers using data on firm level trade documented that exporting firms are larger in terms of employment and revenues, and more productive. The same pattern is found for both exporters and importers in Slovenia. We extend this analysis further and study firm characteristics in relationship with the extensive margin. The Melitz (2003) model predicts that a certain cutoff size and level of productivity are required for a firm to engage in foreign trade. In a multi-product multi-country context, requirement of additional costs for entry into additional product-market implies that size and productivity are positively related to the extensive margins of trade. Figure 1 clearly confirms this by demonstrating a monotonically increasing relationship between the number of foreign markets that firms serve by exporting and firm size (in terms of employment and value added) and productivity (in terms of labor and total factor productivity (TFP)[5]).

[*Figure 1 about here*]

While this positive relationship between firms' extensive export margins and size and productivity is already documented by Bernard et al. (2007), it is novel to show that a very similar pattern exists for importing firms. Figure 1 demonstrates that sourcing from import markets is associated with similar aggregate per-market trade costs as exporting and that these expand monotonically with the number of markets. Different positions of the curves in Figure 1 suggest that exporters and importers differ in the *level* of the cost associated both with starting to trade and expanding in terms of number of foreign markets. Imports seem to require *lower*

[5] Note that TFP measure used here is an ammended version of Kasahara – Rodrigue (2008) procedure of the Olley – Pakes (1996) algorithm, where in addition to firm's past exports and imports status we also include firm's past FDI status (inward or outward FDI) as state variables (see details in Section 4).

sunk cost and *lower* aggregate per-market trade cost for a small number of source countries. But costs of importing tend to increase at a *higher* rate relative to exports. These cost structures are implied by the steeper curves of importers relative to exporters in all four panels of Figure 1. Furthermore, for sufficiently large number of destination (source) markets, aggregate costs of importing exceed the cost of exporting. The same pattern is observed if we consider the relationship between size and productivity measures on one hand and the number of product-markets on the other (see Figure A1 in Appendix).

2.4. Export and import churning of multi-product firms

A number of recent theoretical papers have started to explore the issue of endogenous within–firm dynamics by studying the heterogeneity at the product level and relating it to international trade (see Arkolakis and Muendler, 2009; Baldwin and Gu, 2009; Bernard et al., 2010; Eckel and Neary, 2010; Feenstra and Ma, 2008; Nocke and Yeaple, 2006; Mayer et al., 2009). However, due to limited access to product-level data only a few papers have been able to document the actual dynamics of product churning within firms. Among them, one group of papers documented the expansion of new exporters in terms of adding of new products (Eaton et al., 2008; Damijan et al., 2011; Halpern and Muraközy, 2011) and churning of export varieties (Iacovone and Javorcik, 2010), while another group of papers studied the impact of an increased number of imported input varieties on firm export scope and productivity improvements (GKPT, 2010 and 2011; Bas and Strauss-Kahn, 2010). Of particular importance is the paper by Bernard et al. (2010), who document that two-thirds of U.S. firms alter their mix of five-digit SIC products every five years. One-third of the increase in real U.S. manufacturing sales in the period 1972 – 1997 is shown to be rooted in the net adding and dropping of products by continuing firms. In particular, they find that product switching contributes substantially to the reallocation of economic activity within firms towards more productive uses.

[*Table 4 about here*]

In what follows, we document large within–firm product–market churning also in international trade.[6] Table 4 shows that, in exports, every year a typical firm on average adds 7.9 and drops 7.5 products, while in imports these figures are double –

[6] Note that in the remainder of the paper we focus on product–markets and refer to it as number of products.

15.0 products added and 15.8 products dropped. These figures account for about half of the total number of existing exported products and about one third of the existing imported goods. In relative terms, micro- and small-sized firms tend to have more intense churning in exports (more than 60% of goods added and dropped every year), while medium-sized and large firms are relatively more active in churning of imported goods.

By applying the standard measures of net and gross churning[7], the churning figures for Slovenian exporting and importing firms are quite large (see Table 5). On average, both for exports and imports net churning amounts to about 0.50, while gross churning is between 1.30 and 1.50. This indicates huge turbulence in exports and imports as about 65–70 per cent of export and import products of a typical manufacturing firm is involved every year in either product adding or product dropping activity. In particular, about 25 per cent of firm's total exported or imported goods is replaced every year). Note also that both net and gross churning in intermediate and final goods decrease with size of firms.

[*Table 5 about here*]

Frequent product adding and dropping in international trade is consistent with the findings of Bernard et al. (2010), who document that a majority of U.S. firms alter at least one five-digit SIC product every five years.[8] Most recently added products and lowest-volume products are more likely to be dropped, confirming a positive correlation between products' add and drop rates. On the other hand, they find that product adding and dropping are positively correlated with firm–level productivity. This suggests that product switching is at the core of a process of within – firm product reallocation towards their best performing goods.

[*Figure 2 about here*]

The same feature, but even more pronounced, can be observed in the trade patterns of Slovenian manufacturing firms. As shown in Figure 2, adding and dropping of products both in exports and imports is highly correlated with firms'

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[7] Net churning: $NC = 2 \cdot |n_{it} - n_{it-1}| / (n_{it} + n_{it-1})$

Gross churning: $GC = 2 \cdot (n_{it}^{a} + n_{it}^{d}) / (n_{it} + n_{it-1})$, $NC, GC \in [0,2]$,

Where n_{it} is firm's total number of products exported or imported, n_{it}^{a} and n_{it}^{d} denote number of products that firm drops or adds in the current year.

[8] Bernard et al. (2010) admit that these estimates of product switching are likely to underestimate the true adjustments in firms' extensive margins as most of the (unobserved) changes in the firms' product mix are made at lower levels of aggregation.

lagged TFP. More productive firms are engaged in more frequent product adding and dropping, where the correlation between product adding and TFP seems to be more pronounced. Another striking feature, evident from both Table 4 and Figure 2, however, is that product adding and dropping are taking place simultaneously. We shed more light on this issue in the next section.

3. Imports, exports and pass-on-trade

The striking finding of previous section is the similarity between exporters and importers, both in terms of the relationship between the number of products that are exported or imported as well as in terms of firm characteristics. It is clear that most exporters are also importers. In fact, 58 per cent of all manufacturing firms engaged in international trade are both exporters and importers. These two-way traders account for 91 and 93 per cent of total employment and value added, respectively, and for 98 and 99 per cent of total exports and imports, respectively.[9] Even more strikingly, however, these two-way traders do not only participate simultaneously in exporting and importing, but seem to be engaged in simultaneous adding and dropping of exported and imported products as well.

This raises a number of issues. First, how are exports and imports related at the firm level, and in particular, whether and how imported products trigger exports. And second, if imports triggers exports, how much of this can be attributed to firms' own newly produced products and how much of them is simply re-exported products. Below we will address these issues in more detail.

3.1. Imports triggering exports

Bas and Strauss-Kahn (2010) and GKPT (2010a) provide evidence for samples of French and Indian firms on how enlarged scope of imported intermediate products impacts firms' product (export) scope and productivity. In India, trade liberalization has enabled firms to get access to new varieties of intermediate inputs and consequently triggered a process of product innovation of Indian firms. In France, this mechanism seems to be even more direct – importing of intermediate inputs increases the scope of exported products.

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[9] At the same time, importers and exporters dominate in every respect the whole manufacturing sector as our sample consists of all manufacturing firms with non-zero employment.

Our data allow us to characterize the relationship between imports and exports in more detail. As a first approach, we relate the newly added imported goods to firms' subsequent innovations in exports. In particular, we make a distinction between final products, intermediate products and capital goods that are exported and imported. Equation (1) summarizes the empirical approach and accounts for whether newly added (lagged and present) imported products trigger new exported products of the same or different product type. In general form, the model can be written as:

$$x_{it}^{s} = f\left[m_{it}^{s}, m_{it-1}^{s}, \mathbf{X}_{it}\right] \qquad s = 1, 2, 3 \tag{1}$$

where x_{it}^{s} is the log number of added exported goods of firm i in the present year t, s is indexing capital goods ($s = 1$), intermediate goods ($s = 2$) and final goods ($s = 3$). m_{it}^{s} and m_{it-1}^{s} denote firm's i log number of added imported goods of type j in the current and lagged year. As it is common in the literature, we define export and import varieties as product–market pairs, i.e. each CN-8 variety can be exported to (imported from) a number of countries (e.g. Feenstra (1994) and Broda and Weinstein (2006)).[10] $\mathbf{X}_{it}$ is a vector of control variables, including firm size (log of number of employees), log of TFP, dummy variables of whether a firm is an affiliate of a foreign multinational firm (IFDI) or whether the firm has own affiliates abroad (OFDI[11]), and NACE 2-digit industry – year fixed effects. The model is estimated using the fixed effects estimator in order to account for all remaining unobserved firm fixed effects.

[*Table 6 about here*]

Table 6 shows that, after controlling for observed and unobserved firm heterogeneity, there is a strong correlation between firms' recently added imported and recently added exported goods. The results in column (3) are of particular interest: firms that started to import new varieties of capital and intermediate goods in the same or in the previous year, have recently started to export new varieties of final goods. Based on theoretical considerations, this is a result that we would expect and is in line with the recent papers by Bas and Strauss-Kahn (2010) and GKPT (2010a). Similarly, column (2) shows that recently imported new

[10] This is a relevant definiton according to Armington's (1969) assumption that products within the same category exported to or imported from different countries can be seen as sufficiently differentiated varieties and do not represent perfect substitutes.

[11] IFDI – inward FDI; OFDI – outward FDI.

varieties of capital goods significantly contribute to firms starting to export new varieties of intermediate goods.

What comes as a surprise, however, are the coefficients on the diagonal, which show that starting to import new varieties significantly triggers firm's exports of new varieties within the same product type. Specifically, new imported varieties of capital goods immediately translate into firm's adding new varieties of capital goods in exports, and similarly for the groups of intermediate and final products. The same pattern can be observed also for a panel of new continuing exporters,[12] indicating that this is a general pattern of trade of Slovenian multi-product firms.

This simultaneity between additions of imported and exported products is largely at odds with what one would typically expect. Firms' production processes are usually considered in the literature to run as specified in column (3). Typically, firms are believed to import capital and intermediate goods as inputs into their production processes, and then export transformed goods, which can be of either type. Hence, obtaining significant coefficients for the diagonal term is clearly at odds with what the standard manufacturing firms' production functions are. These do no entail manufacturing firms that start importing final goods and then passing them on to exports. The same can be claimed for the other two product types, though here the relations are less clear as firms can employ capital and intermediate goods in production of new capital and intermediate goods as well. Manufacturing firms do not typically engage in re-exporting of imported products, and, similarly, manufacturing firms are not supposed to serve as intermediaries in trade with similar goods. This is the role of wholesaler firms that are excluded from our sample.[13] However, results in Table 6, as well as simultaneous adding and dropping of exported and imported products as documented in Figure 2 seem to point in this direction. In next subsection we analyze how much of trade of Slovenian manufacturing firms is being simultaneously traded as exports and imports within the same 8-digit CN product codes.

[12] New continuing exporters are defined as cohorts of firms that started exporting in year t, while not being exporters in the period t – t-3 (i.e. for at least three years before) and that continue exporting for at least 5 years since start.

[13] See Bernard et al. (2010), Ahn, Khandelwal and Wei (2010), Akerman (2010) and Bernard, Grazzi and Tomasi (2010) who document differences between direct and indirect exporters.

3.2. Pass-on-trade

3.2.1. Definition of Pass-on-trade

In order to assess the extent of firms' simultaneous imports and exports in similar products, we match firm-level data on exported and imported products defined at the CN-8 product code and further disaggregated by source and destination countries. We do so for the whole period 1994–2008. This enables us to track exactly the pattern of imports and exports of goods within the same CN-8 category over time and over source and destination countries. Out of these expanded trade data (with about 10 million firm – product – market – trade-type observations) we then identify products that are simultaneously imported and exported at the firm level. We call these trade flows *Pass-On-Trade* (POT).[14] The identification strategy is outlined in (2). POT product is defined as any newly introduced CN-8 category export good *c* that a firm *i* has imported recently (in year *t* or *t-1*) but has not exported it at least one year before the current year:

$$POT_{it}^{c} = 1 \quad if \begin{cases} m_{it}^{c} > 0 \quad or \quad m_{it-1}^{c} > 0 \\ x_{it}^{c} > 0 \quad , \quad x_{it-1}^{c} = 0 \end{cases} , \quad c = CN - 8 \tag{2}$$

In other words, POT products are firms' CN-8 category products previously imported that firms subsequently passed on further to exports.

3.2.2. Patterns of Pass-on-trade

Table 7 reveals that simultaneous trade within the same CN-8 category (POT) is a widespread and significant phenomenon in Slovenian foreign trade. On average, one quarter of the total number of exported products consists of recently imported products and 42 per cent of all newly added exported goods are just re-exported imported goods.[15] This pattern of simultaneous trade is widely spread over all

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[14] Bernard, Van Beveren and Vandenbusche (2010) find similar pattern that Belgian firms export products, which they don't produce. However, they match firms' export data (products at CN-8 classification) and firms' production data (produced products at PRODCOM classification). They label this firms' identified exported goods not being produced by the same firms as *carry-on-trade*.

[15] Note that, similarly to the intra-industry trade, the extent of POT increases with the product aggregation. When accounting for simultaneous POT trade at CN-5 and CN-3 aggregation level, the share of POT trade increases to 31 and 42 of all exported goods (see Table A2 in Appendix).

exporting firms. Even among firms exporting only one good there is 20 and 26 per cent of re-exported total and newly added exported products, respectively. Both shares of POT increase with firms' product differentiation. In other words, firms exporting more than 50 products will on average re-export 26 per cent of their total number of exported products and more than 50 per cent of their all newly added exported products.

Table 8 further shows that POT is not confined to existing multi-product exporters only, but can be observed also for new exporters. On average, in the first year of exporting, the share of POT is 22 per cent, while among first-time exporters with a single product there is a 30 per cent probability that this product is being re-exported. Furthermore, in the second year after starting to export one third of newly added products are likely to be re-exported products. This share increases to 67 per cent up to the tenth year after starting to export. In other words, the expansion pattern of new exporters along the extensive margin is by a large margin based on their previously imported products.

[*Table 7 about here*]

[*Table 8 about here*]

Table 7 also shows that POT is less frequent within the same pair of countries where source and destination countries are the same. This suggests that firms might be engaged in intermediation of products between different countries. Ruling out the option of firms serving as wholesalers (due to the widespread character of POT), one possible explanation for the substantial extent of POT can be firms' engagement in production and trade networks of multinational firms. Foreign owned firms might engage in passing on a number of products from the affiliate in country A to the affiliate in country B. Similarly, firms having affiliates abroad might organize trade flows of the same good between affiliates in different countries for minimizing transaction and trade costs. An important reason for that may be differences in tariff rates and non-trade barriers among countries where affiliates are located. Indeed, Table 9 confirms that firms, which are part of a multinational network, engage in POT more frequently. Firms owned by multinational companies on average simultaneously trade 36 per cent of their total number of exported products and 63 per cent of all newly added products. These shares are a bit lower (25 and 48 per cent, respectively) for firms that have their own affiliates abroad. Yet, though less intensively, also pure domestic firms trade substantial shares of their products simultaneously.

[*Table 9 about here*]

[*Table 10 about here*]

This indicates that POT trade is a widespread phenomenon among Slovenian manufacturing firms and is not restricted to multinational firms only. As shown in Table 10, POT accounts for 25 per cent of number of all exported goods and at the same time for 26 per cent of total exports value. POT trade is less frequent among the same country pair (15 per cent of total bilateral exports only) and even less characteristic for bilateral trade with the country where firms have located their primary owners or primary affiliates (only about 1 per cent).

3.2.3. Explanations of Pass-on-trade

As simultaneous exports and imports within the same product category is a new phenomenon for manufacturing firms, the literature does not provide any explanations for it. There has been some theoretical work on the role of networks in promoting trade (e.g. Rauch, 2001; Rauch and Watson, 2004; Petropolou, 2007) and on the role of intermediaries in trade (e.g. Ahn, Khandelwal and Wei, 2010; Akerman, 2010). However, empirical and theoretical work in this area is based on the assumption that intermediary firms are non-producing, which rules out the case of manufacturing firms. Bernard, Van Beveren and Vandenbusche (2010) offer some likely explanations for the existence of carry-along-trade (CAT), i.e. firms' exports goods that they do not produce. However, CAT trade does not necessarily overlap completely with the observed POT trade. In case of CAT, firms can export any kind of products that they do not produce (either imported goods or goods produced by other domestic firms), while POT trade is restricted only to simultaneous exports and imports within the same product category. Nevertheless, the four possible explanations for CAT trade as outlined by Bernard, Van Beveren and Vandenbusche (2010) can probably serve as a good starting point to explain also a part of POT trade.

The first possible explanation is that firms, once making the decision about starting to export and paying the fixed country-specific entry cost, may expand a set of exported products by passing on part of the imported products. In this case firms behave as trade intermediaries in line with Akerman (2010) by paying the product-country fixed cost and setting price as a markup over the price of imported products. One can think of firms that engage in price arbitrage between different markets by maximizing the profits from price differences within the same product category across markets. In addition, serving as an intermediary within the multinational firms' networks may as well account for a substantial part of simultaneous POT. Both seem to provide a likely explanation for large parts of observed POT.

Other explanations for CAT trade offered by Bernard, Van Beveren and Vandenbusche (2010) relate to firms' re-exports of complementary products to the core exported products and to firms' exports of inputs and parts to their affiliates abroad. These explanations, however, do not apply to POT trade as POT is defined as simultaneous exports and imports *within the same* CN-8 product category. More plausible is the fourth explanation referring to rebranding of imported goods. A firm that has developed its brand equity either as a firm or for its core products can use it for selling a wider range of products not produced by this firm. Importing products, rebranding them and selling them with positive profits net of country– and product – fixed cost of exporting seem to be a viable explanation for a large part of POT.

[*Figure 3 about here*]

To summarize, firms' engagement in POT for one of the reasons mentioned above should be profitable for firms engaging in it. Figure 3 does indeed confirm this. It shows that the extent of POT is positively correlated with any measure of productivity (labor productivity, Olley-Pakes or Levinsohn-Petrin based TFP) as well as with firms' measured financial return on assets (ROA). Firms engaged in POT are more productive and more profitable, and productivity is highly correlated with the extent of POT. Clearly, this is merely a correlation and does not imply causality running from POT to profitability. What is interesting, however, is to explore whether POT affects firms' overall performance and their export scope differently than firms' regular trade. In the next section, we shed more light on this issue.

4. Import Churning, Export Scope and Firm Performance

The previous sections demonstrated that product turnover, both in export and import markets, is not small. Moreover, the net expansion in the scope of especially intermediate inputs, seems to be an important driver of the evolution of the product scope in export markets. This churning of products in international markets likely reflects optimal responses of firms to demand and supply shocks. We therefore explore in this section how product churning is correlated to firm performance. We focus on how more imports have an impact on firm performance, proxied by various measures of productivity, but also on export product scope. Furthermore, we explore mainly two channels how firm performance may be affected. The first is through lower prices of intermediate input factors, and the second through having access to more import varieties, which may facilitate technological spillovers. In this context, we will distinguish between net and gross churning in imported inputs. First, we discuss a number of potential mechanisms, and second we explore a number of empirical specifications that shed more light on the relationship between imports, firm performance and exports.

4.1. Mechanisms

A number of recent papers have demonstrated that the enlarged scope of imported intermediate products impacts firms' product (export) scope (and productivity). GKPT (2010a) show for India how access to new varieties of intermediate inputs due to trade liberalization triggered a process of domestic product innovation. Bas and Strauss-Kahn (2010) show for France that imports of intermediate inputs increase the scope of exported products, as well as productivity. GKPT (2010a) model the total impact of trade liberalization on firms' (domestic) product scope of Indian firms through two channels. Using a Cobb-Douglas production framework, they derive a semi-structural empirical specification where changes in firms' product scope are related to the price of imported inputs and the number of imported inputs (variety). Bas and Strauss-Kahn (2010) adjust the Melitz (2003) model allowing firms to import inputs. In their framework imported intermediate varieties influence TFP through two channels: (1) the variety / complementarity channel and (2) the technology transfer embodied in imported inputs. In addition, they specify the change in firms' export scope as a function of the increased number of imported intermediate varieties working through the firms' revenue function.

The idea of high tech transfer that is embodied in imported inputs is further developed in Damijan and Kostevc (2010).[16] Heterogeneous firms, in terms of productivity, choose between investing in two different levels of technology (low and high) by paying an additional fixed cost of research and development. Technology upgrading can be associated with the use of imported foreign capital and intermediate inputs that embody higher technology. The decision to "dress up" in terms of technology can take place simultaneously with the decision to start importing. Moreover, technology upgrading means that firms will introduce new product or process innovations. This increases firms' product scope and/or their productivity.

Let us now examine how high technology firms gain from trade in this framework. Importers benefit by utilizing cheaper intermediate inputs because the price index of the larger market (domestic and foreign market combined) is lower than that of the domestic market only. This enables importers to benefit from lower marginal costs due to lower costs of intermediate goods relative to non-importers. Importing thus helps reducing the marginal cost of production for all firms that are able to bear the fixed cost of importing. This allows firms to devote a higher share of expenditures in upgrading technology also in the future, which triggers a circle of new product (process) innovations.

The mechanism shows how imports contribute to domestic technology upgrading and to increases in domestic product scope. In addition, a reduction in the price index due to lower prices of imported intermediate inputs reduces the productivity threshold for entering into export markets. This in turn reduces the fixed costs of adding new varieties of existing exporters to their export scope, but also reduces the fixed costs of starting to export for all perspective exporters. Importing status thus improves both the probability of increasing the firms' domestic product scope as well as the probability of increasing their export scope (or starting to export at all). Damijan and Kostevc (2010) provide evidence supporting this mechanism using microdata for Spain.

To sum up, the impact of imports on firm performance and exports can be explained by lower import prices of intermediates, increased access to varieties of inputs and embodied technological upgrading. This mechanism benefits all firms engaged in importing of inputs by enabling them to increase their productivity and their domestic product scope, which results either in their decision to participate in

[16] The model comprises features of Melitz (2003), Yeaple (2005), and Bustos (2011).

exports or in the increased export scope of existing exporters. To empirically tease out these effects, we propose a simple empirical framework next.

4.2. Empirical specification

In the previous subsection we outlined two mechanisms. The first mechanism works through the decreasing imports price index and the increasing import variety index on productivity growth. Import price index decreases with cheaper imported intermediate inputs, while import variety index increases with number of varieties of imported inputs. Both, price and variety channels, are enabled either due to general trade liberalization affecting import prices of existing inputs to decline along the tariff cuts or due to increased globalization of production processes resulting in increased scope of available imported inputs. The latter is not constrained to the increased import variety index alone, but involves also potentially cheaper and/or higher quality inputs from overseas when compared to the previously imported inputs. This implies also the potential technology transfer embodied in imported input varieties. In this subsection, we explore the relative importance of these two channels in channeling the imports churning effects on firms' TFP and export product scope.

4.2.1. Import price effects vs. variety effects

Our analysis extends between 1994 and 2008, a period in which Slovenian firms faced a transition process from a 'Yugoslav' style planned economy to a market economy. In this same period a process of substantial trade liberalization took place. Trade liberalization impacted Slovenian firms through two channels. The first channel was liberalization of import regimes, and in particular of import tariffs, while the second was the access to cheaper and larger variety of imported capital and intermediate inputs. This process took place in accordance with a number of parallel free trade agreements. Until 2001 Slovenia signed free-trade agreements with 33 countries. Most notably, in 1995 Slovenia signed the accession agreement with the EU-15 countries that brought about complete liberalization of bilateral trade by the end of 2001. The only exemptions were agricultural and food products and some sensitive goods, such as steel and textile products, which were only liberalized completely upon Slovenia's entry into the EU by mid 2004. Similar processes of trade liberalization occurred also with other groups of countries (i.e. EFTA, CEFTA) and a number of individual countries. By 2004 about 85% of

Slovenian total imports have been almost completely liberalized with the effective average tariff rate of only 1 per cent, which implied complete trade liberalization for those products.

Despite these extensive changes, the effective reductions of tariffs were in fact pretty low in scope. Damijan and Majcen (2003) report that in 1994 the average unweighted nominal import tariff rate on manufacturing goods amounted to 15.3 per cent, while the average effective (i.e. actually paid) tariff rate on imported manufacturing goods was as low as 7.4 per cent. This is due to the fact that, along with the official export–promotion strategy, a vast number of capital goods and intermediate inputs had been exempted from tariffs if these were used for export-oriented production. As a result of a large number of parallel processes of bilateral trade liberalization, until the end of 2001 the average effective tariff rate declined to only 1.4 per cent, and then was further reduced to less than 0.2 per cent by 2008. Hence, as shown in Table 11, in the period 1994–2008, the effective tariff rates for manufacturing products declined by 7.3 percentage points only, i.e. by about 0.5 percentage points a year.[17] This is a relatively low number when compared for example to India, where the average tariff rates declined by 24 percentage points in the period 1989–1997 (GKPT, 2010a).

[*Table 11 about here*]

Thus, tariff reductions can account for a relatively small portion of the reported vast increase in import scope of Slovenian firms that we describe in section 2. To get a sort of the back-of-the envelope calculation of the impact of tariff reductions on the firms' extensive import margin, we estimate the following equation:

$$\ln\left(n_{ijt}^{s}\right) = \alpha_i + \alpha_j + \alpha_t + \beta\tau_{ijt}^{s} + \varepsilon_{it} \,, \qquad (2)$$

where n_{ijt}^{s} is (log) number of imported products by firm *i* in industry *j* at time *t*, and τ_{ijt}^{s} is firm *i*'s individual effective trade-weighted tariff rate. We estimate the model for the pooled number of products as well as separately for individual product type group *s*. The model includes firm–, industry– and time–fixed effects. We estimate also a variant of the model, where (instead of firms' tariff rates) we include firms'

[17] Note that we dispose with information on actual amount of import duties paid for each single firm–(CN-8) product–market import transaction. Thus the effective rate here is calculated as an average over firms' effective tariff rates for all manufacturing products imported, whereby each firm's effective rate is calculated as a weighted average effective tariff rate with weights being the firms' product-market import shares.

individual import prices defined by trade-weighted unit value index.[18] The coefficient β captures the semi-elasticity of firm import product scope to changes in effective tariff rates on imported products (or alternatively on unit values of imported products).

[*Table 12 about here*]

Table 12 presents the main results for the effect of tariffs in column (1). As expected, the coefficients on tariffs are negative and significant in most cases, most notably for capital and intermediate products. The point estimate for pooled imported products implies that a 10-percentage point decrease in tariffs results in 0.52 per cent expansion of firm's import product scope. Applying the actual decrease in effective tariffs by 7.3 percentage points during the whole period implies that imported product scope could be expanded by only 0.4 per cent. At the annual level, this indicates that trade liberalization could account for about 0.03 per cent of the expansion in imported products per year. The effect on intermediate goods alone is about the same, while the effect on capital goods is about 40 per cent lower than the overall effect. Interestingly, though, the effects of reduced tariff rates on import product scope are substantially lower for newly added import products and for POT, i.e. simultaneously imported – exported products.

These results suggest that tariff reduction can only account for a small portion of the increased import product scope of Slovenian manufacturing firms. Table 11 suggests that instead of tariff reductions, availability of cheaper varieties of intermediate inputs may have provided a larger impact on the strong increase in firms' import product scope that we documented in previous sections. Over our sample period, the trade-weighted import unit values of all imported products declined on average by 36 per cent. Import prices of intermediate inputs decreased even more, by 42 per cent, while unit values of imported capital goods increased on average by 15 per cent. The declining trend in import unit values could be caused by many factors, such as increased international competition between suppliers or exchange rate changes. The fact that unit values of imported capital goods increased could reflect better technology that is embodied in capital goods. The observed evolution in unit values of imports may thus provide a much larger impact on the firms' extensive margin of imports. The results in Table 12 seem to confirm this. The coefficient on all imported products in column (4) is almost four-times larger than the respective coefficient on tariffs in column (1), while the differences in the estimated coefficients with respect to the coefficients on tariff rates for other

[18] Note that we calculate unit values using net of import duties paid.

product groups are even larger. Using the same back-of-the-envelope approach as with tariffs, we can infer that a 10-percentage point decrease in import unit values results in 1.9 per cent expansion of firm's import product scope. The actual average decrease in unit values by 36 per cent during our sample period thus implies an increase in the product scope of imports by 6.7 per cent. Furthermore, the estimated coefficients for newly added import products and for POT imports (see columns (5) and (6)) are larger than for total trade, implying that changes in import prices may account for a sizeable portion of the variation in firms' import extensive margin.

[*Table 13 about here*]

We now can provide a rough estimate of the impact of tariff reduction and of declined import prices on the increased product scope of imports.[19] Table 13 reveals that manufacturing firms expanded their import product scope on average by 30 per cent between 1994 and 2008.[20] Our estimates thus imply that reduction of import tariffs accounted for 1.2 per cent (0.004 × 0.30) and declined import prices for 22 per cent (0.067 × 0.30) of the observed expansion in firms' import product scope. The remaining 77 per cent of the increased product scope in imports is hence not related to price or tariff changes. We refer to this non-price related increase in import varieties as a globalization effect. This suggests that most of the evolution in firms' product scope in exports is due to increased churning in the number of imported input varieties related to globalization. Next we will use these insights for analyzing the impact on firm productivity.

4.2.2. Imported inputs and firm productivity

Similarly to Bas and Strauss-Kahn (2010), we can express firm total factor productivity (A) using the production function in equation (5) as:

$$A_{ijt} = \frac{y_{ijt}}{L_{ijt}^{\alpha} K_{ijt}^{\beta} \sum_{j} \overline{M}_{ijk}^{\gamma_j}} = \omega_{it} \cdot \sum_{j} (n_{ijk} p_{ijk} m_{ijk})^{\frac{\gamma_j}{1-\sigma_j}} \tag{3}$$

[19] We measure increased import (export) product scope by calculating import (export) variety indices, which account for changes in average number of imported (exported) product–markets per firm.

[20] Table 13 shows that the increase in import variety of intermediate goods is close to the average figure, while increased variety of imported final goods is much larger (amounting to 113 per cent). On the other side, the variety of imported capital goods has even decreased over the period by 21 per cent, which is most likely related to the increased unit values of capital goods in the same period. At the same time, variety of exported products increased by a much larger margin amounting on average to 121 per cent.

where ω_{it} is firm's *i* unobserved heterogeneity shock. $\overline{M}_{ijk}^{\gamma_j}$ is firm specific index of imported input varieties in industry *j* from country *k*. The import variety index can be decomposed into respective number of varieties (n_{ijk}), prices (p_{ijk}) and quantities (m_{ijk}) of inputs.

Firm's TFP is hence a function of a firm's unobserved heterogeneity shock, a firm-specific import price index and a firm-specific variety of imported inputs. This specification allows us to separate the various channels, in particular, (1) import price effects and (2) import variety effects on firm TFP.[21] In accordance with the preceding subsection, the price change can be decomposed into the tariff change and (net of tariff) import unit value change. Rewriting and log-differencing (3) then yields our empirical model:

$$\Delta \ln tfp_{ijt} = \alpha + \beta_1 \Delta \ln \tau_{ijt}^{m,s} + \beta_2 \Delta \ln P_{ijt}^{m,s} + \beta_3 \Delta \ln n_{ijt}^{m,s} + \delta \mathbf{X}_{it} + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{it}, \tag{4}$$

where *m* and *s* denote imports and product type, respectively. n_{ijt}^{s} is (log) number of imported products by firm *i* in industry *j* at time *t*. $\tau_{ijt}^{m,s}$ and $P_{ijt}^{m,s}$ are firm's *i* individual effective trade-weighted import tariff rate and respective trade-weighted unit value index, both aggregated to the product type *s*. The model includes a vector of control variables $\mathbf{X}_{it}$, which includes the log number of firm import product-markets, firm size (log number of employees), dummy variables of whether a firm is an affiliate of a foreign multinational firm (IFDI) or whether the firm has own affiliates abroad (OFDI[22]). The model includes NACE 2-digit industry– and time–fixed effects. We estimate the model separately for each individual product type group *s*. The model is estimated in log-first differenced main variables and using a firm level fixed effects estimator in order to account for all remaining unobserved firm fixed effects.

Predictions for empirical estimations are thus as follows: the larger the reductions in tariffs and import prices and the larger the increases in range of imported input varieties (both due to trade liberalization and globalization), the larger will be firms' gains in terms of TFP improvements.

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[21] Note that our approach deviates from the approach of GKPT (2010a) and Bas and Strauss-Kahn (2010), who estimate the price and variety effects on TFP and product scope by applying the conventional input price index and variety index, both aggregated to the industry level. In this approach, we rather exploit the rich firm level information on tariff rates, import prices and varieties.

[22] IFDI – inward FDI; OFDI – outward FDI.

We obtain estimates of TFP by applying the Olley and Pakes (1996) algorithm, but in which we include the decision to import, the decision to export and whether the firm is foreign owned as additional state variables.[23] We explain the estimation procedure in more detail in the appendix.

Potential source of bias in equation (4) arises from potential simultaneity between TFP and a number of imported inputs. In anticipation of positive exogeneous demand shock firms may decide to increase a number of imported inputs. This potentially affects also the measures of tariffs and unit values, which are calculated using the individual firm's trade weights. As a consequence, the variables on the RHS of equation (4) are potentially correlated with the error term. To account for this bias, we estimate the model also using the Blundell–Bond GMM estimator as an additional robustness check to our base results obtained with the fixed-effects estimator.

4.2.3. Imported inputs and export scope

While the first channel that we describe translates lower import prices into firm's productivity through lower marginal costs, the second traces how increased productivity triggers more innovations, resulting in an increased domestic product scope and in turn results in an improved product scope in exports. As in GKPT (2010a) we disentangle the price effect into an effect that can be attributed to tariff reductions and a pure price effect (net of tariffs). The second channel is modeled by the growth in the number of imported product varieties (net and gross churning). So we can write our empirical model as:

$$\Delta \ln n_{ijt}^{x,s} = \alpha + \beta_1 \Delta \ln \tau_{ijt}^{m,s} + \beta_2 \Delta \ln P_{ijt}^{m,s} + \beta_3 \Delta \ln n_{ijt}^{m,s} + \delta \mathbf{X}_{it} + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{it}, \qquad (5)$$

where $n_{ijt}^{x,s}$ and $n_{ijt}^{m,s}$ are (log) number of exported and imported products by firm *i* in industry *j* at time *t*, respectively. $\tau_{ijt}^{m,s}$ and $P_{ijt}^{m,s}$ are firm's *i* individual effective trade-weighted import tariff rate and the trade-weighted unit import value, respectively both aggregated to the firm – product type *s*. $\mathbf{X}_{it}$ is a vector of control variables including the log number of firm import product-markets, firm size (log number of employees), dummy variables of whether a firm is an affiliate of a foreign multinational firm (IFDI) or whether the firm has own affiliates abroad (OFDI[24]).

[23] This has also be done in other work, e.g. Amiti and Konings (2007), Kasahara and Rodrigue (2008), Van Biesebroeck (2005).
[24] IFDI – inward FDI; OFDI – outward FDI.

The model includes NACE 2-digit industry– and time–fixed effects. We estimate the model separately for each individual product type group *s*. The model is estimated in log-first differenced main variables and using firm level fixed effects estimator in order to account for all remaining unobserved firm fixed effects.

Again, number of imported and exported varieties in equation (5) are potentially endogeneously determined resulting in the potential correlation between the variables on the RHS of equation (5) and the error term. We account for this possible bias using also the GMM estimator as an additional robustness check.

Predictions for empirical estimations of (5) are thus as follows: reductions in tariffs and import prices and increases in the range of imported input varieties will increase firm's productivity and consequently lead to an increased domestic product scope, and finally to a larger number of exported products. The latter will increase both due to new exporters starting to export and due to existing exporters increasing their exported products sets.

In the next subsection we provide empirical results of estimating (4) and (5).

4.3. Results

Above we document substantial churning in the number of imported products in our sample, both in terms of net churning and in terms of gross churning. Next we provide two separate sets of results. The first set of results identifies the impact of net churning in imported inputs and the second set identifies the impact of gross churning. In addition, we also account to what extent the presence of POT products affects the results.

4.3.1. The impact of net churning in imported inputs

We account for net churning in imported inputs by defining the import variety variables in first differences of the log of number of imported inputs.[25] Thus we regress annual changes in import tariffs, import unit values and net changes in firms' number of imported (capital, intermediate and final) goods on changes in TFP, and in addition also on net changes in the number of exported varieties. The coefficients can thus be interpreted as elasticities.

[25] Note that the variables used are net changes in number of imported products and not the coefficients on net churning as presented in Table 5.

Results for the impact of net churning in imports on TFP and export scope are reported in Table 14. The left-hand panel reports the results for all products, including the POT products, while the right-hand panel shows results when POT products are excluded. Columns (1) and (5) report the results for estimating equation (4), the impact on TFP, while the other columns tune in on various specifications of equation (5), the impact on the number of exported products, distinguishing between capital, intermediate and final products. We start by discussing the results when POT is included.

From column (1) it is clear that the price effect is working mainly through the decline in unit import values, not through the import tariff. The import tariff has a positive coefficient and is not significantly different from zero. In contrast the impact of declining unit values has a positive effect on TFP growth. These results are in line with our findings in the previous subsection, showing much larger declines in unit values as compared with the tariff cuts. The elasticity, though, remains rather modest. A 10 percent decline in unit values is associated with a 0.1 percent increase in total factor productivity. Also increased access to more import varieties contributes positively to TFP growth. In particular net churning in capital goods and intermediate inputs has a positive impact on firms' TFP and its magnitude is comparable, while imports of final goods do not seem to have an impact on TFP.[26] This makes sense, as final goods are likely to be less important as inputs in the production process, while intermediate and capital goods are part of the production process and may embody new and more up-to-date technology. The point estimates, albeit statistically significant, are relatively low. One reason for the relatively low point estimates could be due to the inclusion of POT products in our estimation.

When accounting for POT products (e.g. by subtracting them from the firms' total number of imported and exported products), the results for the price effects remain almost unaffected in terms of the size and significance of the coefficients (see Column (5)). However, the effects of net churning in imported capital and intermediate inputs on TFP growth, becomes much larger in scope. Both coefficients increase by a large margin. In particular, a 10 percent increase in imported capital goods is associated with an increase of 0.1 percent in TFP, while a 10 percent increase in imported intermediate products results in an increase of 0.4 percent in TFP. This indicates that net churning in imported inputs driven by POT products

[26] As a robustness check, we also use two alternative measures of TFP (Levinsohn-Petrin measure and the residual TFP from using the value added per employee as a measure of labor productivity). Both alternative measures confirm that only lower unit values contributed to the productivity growth over the period (see Tables A3 and A4 in Appendix).

does not seem to contribute to firm productivity growth. This is not surprising as POT is mere re-exports of previously imported varieties that do not enter firm's production process.

[*Table 14 about here*]

Columns (2) – (4) of Table 14 report the results of estimating equation (5), allowing for POT products. Net changes in the number of imported capital and intermediate inputs have a significant positive impact on net changes in the number of exported products in all three categories. This is consistent with the idea that the increased availability of imported inputs embody new technology triggering innovation that results in more exports. Reductions in import tariffs seem to have an impact on exported capital and intermediate goods, but changes in unit values do not contribute to explaining the export margin. When we compare these results with those without POT products (see Columns (6) – (8)), we obtain similar conclusions. There are, however, two notable differences. First, the impact of reduction of unit values on increased number of imported capital inputs now becomes significant, with a large coefficient, -0.096. And second, the effects of churning in imported capital goods on increased export scope of intermediate and final products now becomes insignificant. The latter implies that firms might be engaged more intensively into POT of capital goods that do not enter their production process. In contrast, churning in imported intermediate inputs remains to have quite strong effects on increased export scope for all three types of exported products.

As a robustness check we also estimate the models (4) and (5) by using the Blundell-Bond (1998) system GMM estimator. As noted before, with the GMM estimator we account for potential simultaneity between the increases in number of imported varieties, TFP and number of exported varieties. The GMM results confirm the robust relationship between net churning in imported varieties on increased export scope. The magnitude of estimated coefficients using GMM is expectedly larger than for those obtained with FE estimation due to the downward bias of the FE estimator. On the other side, the price effects (both for tariffs and unit values changes) have mostly disappeared (see Table A5 in Appendix).

This confirms that it is mostly net churning in imported input varieties (in particular the intermediate inputs) that significantly contributes to increased export product scope. Declines in import prices either due to trade liberalization or due to cheaper inputs had only a limited effect on exports of intermediate or final products. These results are in line with the findings of GKPT (2010a) who find for

India that increased variety in imported intermediate inputs contributed most to the increased scope of domestic products, while the large reduction in tariffs played only a minor role.[27] These results also match the results obtained by Bas and Strauss-Kahn (2010) who find a strong effect of imported inputs on TFP and export scope, but a very limited effect of price.

Our results show that net changes in the number of imported inputs have a systematic impact on both firms' TFP growth and year-to-year changes in firms' export scope. But, as documented earlier, behind the *net* growth in imported inputs there is far more churning of product varieties going on. For instance, a firm may have a 2 percent net growth in imported products, which could be the result of adding 2 percent new products and dropping no imported inputs from their import markets. But this could also be the result of an increase of 10 percent in newly imported input products and a drop of 8 percent of their existing imported inputs. The latter would also result in a net growth of imported inputs of 2 percent. Clearly, the amount of restructuring or *gross* churning in the latter case is much larger, which may have an important impact on productivity. As shown by Bernard, Redding and Schott (2011) and Mayer, Melitz and Ottaviano (2011), a tougher competition due to trade liberalization induces firms to skew their sales towards their best performing products. Accordingly, in a process of trade liberalization Slovenian firms had an opportunity to optimize the mix of their imported inputs by dropping least valuable and replacing them with more advantageous inputs. This optimization of the mix of imported inputs, however, shows up only when exploring the gross churning in imported inputs. We therefore explore next whether our results hold up when accounting for the effects of gross churning in imported inputs.

4.3.2. The impact of gross churning in imported inputs

We re-estimate the equations (4) and (5) by redefining the measures of churning. Instead of applying simple annual net changes in the number of imported (exported) products, here we account for the gross effects by defining the churning measures as a gross number of added and dropped products every year relative to the lagged total number of products. These measures take into account the ongoing processes

[27] One should bear in mind, however, two notable differences between our approach and that of the GKPT (2010a). First, they estimate the price and variety effects of imported varieties on domestic products scope and not on the scope of exported products. Second, they obtain their results by estimating the models at the industry level as they do not have information on firm level number of products imported, produced or exported.

of gross product churning that occur at the firm level from year to year.[28] Again, the left panel of Table 15 presents the results including the POT trade, while the right panel shows the results when POT products are subtracted from the figures on import and export product scope.

Both in columns (1) and (5) we can note again the significant impact of reduction of unit values on TFP growth, but no statistically significant effect of reduced tariffs. In contrast, gross churning in imported inputs is shown to have much bigger impact on TFP growth than net churning. In particular, churning in imported capital goods seems to lead to TFP improvements. This finding is robust to the use of different measures of productivity, while the impact of gross churning in intermediate inputs is significant only at the 30 per cent confidence level. More strikingly, the effect of gross churning in imported inputs on firms' TFP growth is shown to be bigger by a factor of 10 as compared to the specification of net churning. Firms that restructure more, which can be interpreted as firms that try out more imported inputs in order to find the most suitable complements to their existing inputs, seem to benefit more in terms of TFP. This finding is consistent with the idea that gains in TFP arise through better complementarity of inputs and technology spillovers from better imported inputs. The same pattern emerges when we exclude POT (see column (5)). The coefficients on gross variation in intermediate inputs now also becomes significant at 10 per cent. As with the measure of net churning, this again confirms that POT has less favorable effects on firms' TFP performance than regular trade.

[*Table 15 about here*]

At the same time, gross churning in imported inputs largely contributes to the increased export scope. The estimated coefficients for capital inputs are in the range of the coefficients obtained with the net churning measures, while the coefficients on intermediate inputs are larger by a factor of 3 when compared to the net churning estimates. In addition, variation in imported final goods entering the production of manufacturing firms seem also to contribute positively to the increased scope of exported intermediate and final goods.

When POT products are excluded from the range of imported inputs (see columns (6) – (8) in Table 15), the results remain almost unchanged, which demonstrates that POT products do not contribute to increased export product scope. The most notable changes are reflected only in the impact of imported capital

[28] Note that the variables used do not correspond to the conventional measures of gross churning as presented in Table 5.

and final goods on exported intermediate goods, which coefficients now become insignificant.

As a robustness check, GMM results again fully confirm very robust effects of gross churning in imported varieties on increased export scope, while price effects again mostly become insignificant or get the opposite sign (see Table A8 in Appendix).

These robust results suggest that while POT contributes significantly to the increased scope and variation in both the imported and exported product range of Slovenian manufacturing firms, it does not, however, alter the main picture of Slovenian manufacturing trade. Over the past 15 years, Slovenian firms benefited mainly from the access to a larger range of imported inputs, which enabled them to improve their TFP and to enlarge their scope of exported products. These improvements in TFP and export product scope do not seem to be driven by firms' engagement in the simultaneous POT activities within the same categories of products. As indicated by Figure 3, POT may have contributed to firms' overall profitability, but it is certainly not the decisive force behind the overall reallocations of firms' product scope and the associated productivity improvements.

5. Conclusions

In this paper we study the impact of net and gross churning in the imported varieties of capital and intermediate goods on firm export scope and productivity. Using detailed data on imports and exports at the firm-product (CN 8)-market-level, we document substantial churning both in imports and exports for Slovenian firms in the period 1994-2008. An average firm changes about one quarter of imported and exported varieties every year, while gross churning in terms of added and dropped goods in trade is found to be almost three times higher.

We find, however, that a substantial proportion of products added or dropped on a year-to-year basis consists of identical varieties, i.e. firms simultaneously import and export varieties within the same CN-8 product code. In fact, one quarter of all exported varieties and 40 per cent of all newly added exported varieties in the current year comprises varieties, which the same firm has imported in the same or in the previous year. Since we find that a substantial fraction of imports is just passed on into exports, we call this pass-on-trade (POT). We find that POT is a widespread phenomenon for all firms, but tends to be larger for firms that are part of a multinational network (i.e. either a firm is an affiliate of a multinational company or it has its own affiliates abroad) suggesting arms-length trade is important. POT, however, is also substantial for small first-time exporters without multinational status. On average, a new exporter has a 20 per cent probability that the exported varieties have been previously imported during the first year of exporting. For a new exporter that starts trading only one variety, this probability increases to 30 per cent. Thus POT has to be taken into account when accounting for the gains of trade through an increased number of imported varieties.

This paper further documents an important link between the growth in imported intermediate inputs and the engagement in export markets. We show that churning in imported varieties is far more important for firms' productivity growth and increased export product scope than the reduction in tariffs or declines in import prices. In particular, we find that both net and gross churning in imported varieties of capital and intermediate inputs have a significant impact on the export scope and productivity gains. While similar in terms of the effects on the export scope, gross churning, however, is found to have a bigger impact on productivity improvements by a factor of more than 10 as compared to the net churning effects. Both adding and dropping of imported input varieties thus seem to be important for firms aiming to optimize their input mix towards their most valuable inputs. These effects are further enhanced when excluding the varieties that fall into the POT category. This suggests that POT may contribute to firms' overall profitability, but has less favorable effects on firms' long-run performance than regular trade.

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Tables

Table 1: Summary statistics (mean values) for exporting firms by number of exported products in 2008, in EUR (1994 prices)

No. of products exported	No. of firms	Freq. (%)	No. of employees	Value of exports	Cum. Freq. (%)	No. of export destinat. countries	Value of exports per firm - product - country	Value of exports per firm - product	Value of exports per firm - country
0	1122	25.2	15.8	0	0.00	0	0.00	0.00	0.00
1	565	12.7	13.6	48,348	0.58	1	70,168	70,168	70,168
2	357	8.0	17.2	71,679	0.54	1.59	39,540	57,352	79,080
3	260	5.9	18.5	124,780	0.69	2.06	34,948	62,910	104,843
4	173	3.9	21.9	263,908	0.97	2.48	34,141	70,702	136,565
5	138	3.1	23.3	232,854	0.68	2.96	24,484	59,629	122,422
6-10	398	9.0	39.8	387,860	3.28	4.03	22,874	76,779	164,533
11-20	429	9.7	47.4	667,734	6.09	6.42	13,657	66,420	195,080
21-50	486	10.9	85.4	1,265,407	13.07	12.53	5,657	53,643	178,295
>50	518	11.6	279.9	6,759,066	74.10	36.61	2,357	53,015	268,564
Total	4,446	100.0	59.7	1,059,098	100.00	7.17	20,491	47,136	114,775

Source: CARS, SORS, AJPES; own calculations.

Table 2: Summary statistics (mean values) for importing firms by number of imported products in 2008, in EUR (1994 prices)

No. of products imported	No. of firms	Freq. (%)	No. of employees	Value of imports	Cum. Freq. (%)	No. of import origin countries	Value of imports per firm - product - country	Value of imports per firm - product	Value of imports per firm - country
0	747	16.8	9.2	0	0.00	0	0.00	0.00	0.00
1	559	12.6	8.7	13,507	0.20	1	21,331	21,331	21,331
2	291	6.5	13.4	24,769	0.19	1.46	13,210	18,324	26,420
3	194	4.4	15.1	59,850	0.30	1.82	16,901	28,031	50,702
4	129	2.9	17.5	109,790	0.37	2.34	18,866	42,205	75,463
5	115	2.6	16.8	108,073	0.32	2.71	13,917	31,171	69,586
6-10	355	8.0	19.3	166,403	1.53	3.73	10,641	30,191	81,680
11-20	414	9.3	36.1	249,393	2.67	5.23	4,999	21,094	72,725
21-50	725	16.3	51.2	603,553	11.33	9.20	3,066	22,148	95,098
>50	917	20.6	201.3	3,500,629	83.10	20.21	1,428	22,362	173,817
Total	4,446	100.0	59.9	868,856	100.00	6.89	7,301	19,790	75,265

Source: CARS, SORS, AJPES; own calculations.

Table 3: Extensive margins (mean values) and structure of trade of manufacturing firms, by product types in 2008

	All Goods	Capital goods	Intermediate goods	Final goods
		No. of foreign markets per firm		
Exporters	7.2	1.5	3.7	2.0
Importers	6.9	1.6	3.8	1.6
		No. of traded products per firm		
Exporters	29.5	4.3	17.5	7.7
Importers	39.2	5.6	27.5	6.1
		Share in total value of trade		
Exporters	100.0	13.8	50.5	35.6
Importers	100.0	17.0	71.9	11.2

Source: CARS, SORS, AJPES; own calculations.

Table 4: Statistics of products' adding and dropping, by size classes, per-firm average over 1995-2008

Exports

Size class	$Total_t$	$Added_t$	$Dropped_t$	% Added/ $Total_{t-1}$	% Dropped/ $Total_{t-1}$
emp < 10	2.0	1.3	1.2	0.67	0.63
9 < emp < 50	12.6	7.7	7.0	0.65	0.59
49 < emp < 250	42.8	23.6	22.7	0.56	0.54
249 < emp	185.5	95.2	91.5	0.52	0.50
Total	14.2	7.9	7.5	0.57	0.54

Imports

Size class	$Total_t$	$Added_t$	$Dropped_t$	% Added/ $Total_{t-1}$	% Dropped/ $Total_{t-1}$
emp < 10	13.3	3.6	3.6	0.27	0.27
9 < emp < 50	34.2	16.8	16.9	0.49	0.49
49 < emp < 250	79.3	43.5	45.7	0.53	0.56
249 < emp	277.6	152.7	166.3	0.52	0.57
Total	44.5	15.0	15.8	0.33	0.35

Source: CARS, SORS, AJPES; own calculations.

Table 5: Measures of net and gross churning across by firm size class and product type, per-firm average over 1995-2008

Net churning

Size class	Exports: Capital goods	Exports: Intermed. goods	Exports: Final goods	Imports: Capital goods	Imports: Intermed. goods	Imports: Final goods
emp < 10	0.46	0.50	0.44	0.50	0.50	0.50
9 < emp < 50	0.48	0.50	0.50	0.52	0.44	0.46
49 < emp < 250	0.50	0.42	0.46	0.52	0.34	0.46
emp > 249	0.54	0.34	0.40	0.42	0.24	0.34
Total	0.50	0.46	0.46	0.50	0.44	0.46

Gross churning

Size class	Exports: Capital goods	Exports: Intermed. goods	Exports: Final goods	Imports: Capital goods	Imports: Intermed. goods	Imports: Final goods
emp < 10	1.48	1.36	1.36	1.48	1.34	1.32
9 < emp < 50	1.54	1.36	1.40	1.50	1.36	1.40
49 < emp < 250	1.54	1.32	1.42	1.50	1.34	1.40
emp > 249	1.50	1.26	1.38	1.54	1.34	1.36
Total	1.52	1.34	1.40	1.50	1.34	1.38

Notes: Net churning: $NC = 2 \cdot |n_{it} - n_{it-1}| / (n_{it} + n_{it-1})$

Gross churning: $GC = 2 \cdot (n_{it}^{a} + n_{it}^{d}) / (n_{it} + n_{it-1})$, $NC, GC \in [0,2]$,

where n_{it} is firm's total number of products exported or imported, n_{it}^{a} and n_{it}^{d} denote number of products that firm drops or adds in the current year.

Source: CARS, SORS, AJPES; own calculations.

Table 6: Impact of added imported products on introduction of new exported products by product type, period 1995-2008, fixed effects estimations

	All exporters			New exporters		
	#Add. Exp. Capital$_t$	#Add. Exp. Intermed.$_t$	#Add. Exp. Final$_t$	#Add. Exp. Capital$_t$	#Add. Exp. Intermed.$_t$	#Add. Exp. Final$_t$
	(1)	(2)	(3)	(4)	(5)	(6)
#Add. Imp. Capital$_t$	0.063***	0.021***	0.023***	0.048***	0.013	0.011
	[9.85]	[3.07]	[3.83]	[2.74]	[0.70]	[0.71]
#Add. Imp. Capital$_{t-1}$	0.027***	0.012*	0.017***	0.007	0.041**	0.022
	[4.39]	[1.87]	[2.80]	[0.44]	[2.34]	[1.25]
#Add. Imp. Intermediate$_t$	0.006	0.028***	0.017**	0.033*	0.042*	0.045**
	[0.95]	[3.29]	[2.29]	[1.70]	[1.78]	[2.11]
#Add. Imp. Intermediate$_{t-1}$	-0.005	0.023***	0.007	-0.010	-0.009	0.014
	[-0.75]	[2.85]	[1.07]	[-0.52]	[-0.42]	[0.72]
#Add. Imp. Final$_t$	0.019***	0.038***	0.043***	0.017	0.027	0.040**
	[3.17]	[5.93]	[6.39]	[1.06]	[1.45]	[2.07]
#Add. Imp. Final$_{t-1}$	0.011*	0.026***	0.041***	0.039**	0.044**	0.046**
	[1.87]	[3.88]	[6.48]	[2.34]	[2.28]	[2.54]
Log Employment$_t$	0.770***	0.999***	1.013***	0.658**	0.899***	1.242***
	[7.98]	[10.17]	[10.59]	[2.26]	[3.29]	[5.01]
Log TFP$_t$	0.360***	0.393***	0.366***	0.266	0.588***	0.335
	[4.81]	[4.99]	[5.05]	[1.17]	[2.99]	[1.55]
IFDI$_t$	-0.088	0.483	-0.006	0.128	0.589	-0.957
	[-0.23]	[1.59]	[-0.01]	[0.11]	[0.55]	[-0.85]
OFDI$_t$	0.894***	1.012***	1.310***	2.067	2.595*	1.076
	[2.88]	[3.97]	[4.36]	[1.50]	[1.79]	[0.92]
Constant	-12.174***	-10.632***	-14.778***	-12.980***	-9.750***	-12.064***
	[-14.26]	[-11.85]	[-17.98]	[-5.36]	[-4.58]	[-5.04]
Industry – Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,992	33,992	33,992	4,784	4,784	4,784
R-squared	0.027	0.027	0.034	0.028	0.029	0.035

Notes: 1/ Dependent variables are defined as logs of number of added exported (capital, intermediate, final) goods in year *t*. 2/ Major explanatory variables are defined as logs of number of added imported goods in year *t* and *t-1*. 3/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Extent of POT trade as a share in overall exports, measured at CN-8 product level, per-firm average over 1995-2008

Number of products exported	N	Share in no. of all exported goods	Share in no. of newly added exported goods	Share in no. of total exported goods from same country
1	565	0.20	0.26	0.11
2	357	0.20	0.31	0.10
3	260	0.20	0.33	0.11
4	173	0.21	0.36	0.11
5	138	0.22	0.35	0.11
6-10	398	0.24	0.41	0.12
11-20	429	0.26	0.48	0.14
21-50	486	0.26	0.49	0.15
>50	516	0.26	0.51	0.15
All	3,322	0.25	0.42	0.14

Source: CARS, SORS, AJPES; own calculations.

Table 8: Extent of POT trade among surviving new exporters, per-firm average over 1998-2008

t	No. of all exported goods	No. of POT goods	Share of POT goods	
			All	Added
0	4.73	1.02	0.22	
1	8.66	2.00	0.23	0.34
2	10.33	2.75	0.27	0.43
3	11.38	3.35	0.29	0.43
4	12.69	3.52	0.28	0.43
5	14.57	4.24	0.29	0.45
6	16.94	4.99	0.29	0.49
7	17.40	5.89	0.34	0.51
8	19.63	7.49	0.38	0.59
9	22.06	8.83	0.40	0.65
10	21.79	8.46	0.39	0.67

Notes: 1/ New surviving exporters are defined as those that continue exporting for at least 5 years since start. 2/ *t* is technical time counting years after export start (t=0 is entry year).

Source: CARS, SORS, AJPES; own calculations.

Table 9: Extent of POT trade as a share in total and newly added exported products by ownership type, measured at CN-8 product level, per-firm average over 1995-2008

Ownership type	N	Share in no. of all exported goods	Share in no. of newly added exported goods
Domestic only	67,882	0.21	0.37
Foreign affiliate (inward FDI)	4,740	0.36	0.63
Has affiliates abroad (outward FDI)	3,274	0.25	0.48

Source: CARS, SORS, AJPES; own calculations.

Table 10: Extent of POT trade as a share in total value and number of exported products by type of country, measured at CN-8 product level, per-firm average over 1995-2008

	All countries	Same country[1]	With IFDI country[2]	With OFDI country[3]
Share in total value of exports	0.26	0.15	0.013	0.015
Share in no. of all exported goods	0.25	0.14	0.012	0.014
Share in no. of newly added exported goods	0.42	0.25	0.020	0.027

Notes: 1/ Source and origin countries of POT trade are the same; 2/ Firms' trade with countries of firms' major foreign owners (IFDI = inward FDI); 3/ Firms' trade with countries, where firms have their foreign affiliates (OFDI = outward FDI).

Source: CARS, SORS, AJPES; own calculations.

Table 11: Changes in import tariffs and unit values, 1994-2008

	Tariff rates[1]		Unit Values[2]	
	Mean	Median	Mean	Median
All products	-0.073	-0.033	-0.357	-0.418
Capital	-0.056	-0.023	0.151	0.130
Intermediate	-0.060	-0.033	-0.418	-0.449
Final	-0.091	-0.054	-0.297	-0.389

Notes: 1/ Change in tariff rate in percentage points between 1994 and 2008. 2/ Change in unit value index between 1994 and 2008. 3/ Input tariff rates and import unit value indices are calculated as averages over firm-level trade-weighted figures, i.e. each firm's individual tariff rate for each product type is calculated as weighted average effective tariff rate, where weights are imports shares from individual countries for each CN-8 product within the product group. The same applies for unit value figures. 4/ Import figures are deflated to 1994 prices using the NACE 2-digit PPI indices.

Source: CARS, SORS, AJPES; own calculations.

Table 12: Import extensive margins, tariffs and unit values

	Import tariff			Unit value		
	#Pooled products	#Added products	#POT products	# Pooled products	#Added products	#POT products
	(1)	(2)	(3)	(4)	(5)	(6)
Output tariff applied to:						
All products	-0.052	-0.036	-0.039	-0.187	-0.233***	-0.237**
	[-0.55]	[-0.54]	[-0.64]	[-1.57]	[-2.64]	[-2.42]
Capital	-0.032***	-0.023***	-0.010***	-0.271	-0.415	-0.423*
	[-15.70]	[-12.80]	[-8.71]	[-1.05]	[-1.54]	[-1.84]
Intermediate	-0.053***	-0.036***	-0.024***	-0.158***	-0.174***	-0.154***
	[-10.98]	[-10.01]	[-10.04]	[-6.06]	[-6.96]	[-6.90]
Final	0.014	0.010	-0.005	0.216	-0.045	0.142
	[1.34]	[0.76]	[-1.31]	[1.30]	[-0.17]	[1.55]
Observations	40,050	40,050	40,050	40,050	40,050	40,050

Notes: 1/ Regression of firm-level (log) number of CN-8 imported products (i.e. all, newly added, and POT) on firm-level trade-weighted tariff rate (left panel) and import unit values (right panel) for each product group, period 1995 - 2008. Weights are imports shares from individual countries for each CN-8 product within the product group. 2/ All regressions include firm, industry and year fixed effects. Full results can be obtained upon request from the authors. 3/ Import figures are deflated to 1994 prices using the NACE 2-digit PPI indices. 4/ Identical regressions are done also for the CN-5 products with accordingly computed import tariffs and unit values. Results in terms of coefficients and significance are fairly similar to the presented in table. These results are available upon request. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Variety index of imported and exported products between 1994 and 2008 (1994=100)

	Imports		Exports	
	CN-8	CN-5	CN-8	CN-5
All products	130	122	221	203
Capital	79	74	145	135
Intermediate	137	130	253	130
Final	213	200	229	214

Note: Variety indices account for changes in average number of imported (exported) product–markets per firm. The indices account for the relative contribution of surviving, entering and exiting firms into each trade status. The following formula was used: $\Delta_k \bar{n}_t = \bar{n}_{t+k} / \bar{n}_t = \left(\bar{n}^s_{t+k} + \phi^e_{t+k}(\bar{n}^e_{t+k} - \bar{n}^s_{t+k})\right) / \left(\bar{n}^s_t + \phi^x_t(\bar{n}^x_t - \bar{n}^s_t)\right)$, where $\bar{n}^g_t$ denotes the average number of imported (exported) product–markets per firm in group *g* in period *t*, *k* is the end time period, and ϕ^g_t denotes the share of firms in group *g* in period *t* in total number of firms in period *t*.

Source: CARS, SORS, AJPES; own calculations.

Table 14: Impact of net churning of imported products on TFP growth and export scope (all exporters)

	Including POT products				Excluding POT products			
	ΔTFP (OP)	Δ# exp. capital	Δ# exp. intermed.	Δ# exp. final	ΔTFP (OP)	Δ# exp. capital	Δ# exp. intermed.	Δ# exp. final
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔImport tariff	0.010	-0.026**	-0.027**	-0.013	0.011	-0.030***	-0.020*	-0.002
	[0.85]	[-2.02]	[-2.19]	[-0.84]	[1.31]	[-3.03]	[-1.77]	[-0.24]
ΔImport unit value	-0.013*	-0.018	-0.189	-0.244	-0.014*	-0.096***	-0.035	0.006
	[-1.73]	[-0.24]	[-1.19]	[-0.83]	[-1.85]	[-3.67]	[-0.81]	[0.53]
Δ# imp. capital	0.002***	0.044***	0.026***	0.020***	0.014**	0.031***	0.005	0.004
	[3.49]	[5.83]	[3.61]	[2.83]	[2.40]	[4.15]	[0.55]	[0.54]
Δ#imp. Intermed.	0.002**	0.012	0.041***	0.030**	0.037***	0.018**	0.055***	0.026***
	[2.01]	[1.07]	[2.79]	[2.08]	[4.93]	[2.47]	[5.22]	[3.59]
Δ# imp. final	0.001	-0.000	0.016**	-0.001	-0.003	-0.009	-0.006	0.007
	[1.08]	[-0.01]	[2.20]	[-0.16]	[-0.54]	[-1.25]	[-0.64]	[0.91]
Observations	28,453	11,917	19,342	12,926	28,453	11,917	19,342	12,926
R-squared	0.011	0.002	0.002	0.001	0.013	0.004	0.004	0.002

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are Olley-Pakes (OP) measures of TFP, net changes in (log) number of exported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables (i.e. growth rates). 3/ Explanatory variables include firm specific trade-weighted tariff rate and import unit value, and net changes in (log) number of imported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables. 4/ Control variables (not shown in the Table) include log number of firm import product-markets, log employment, IFDI and OFDI as well as industry, year and firm fixed effects. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1. 6/ Table is constructed from Tables A3 and A4 in Appendix. See full results in Appendix.

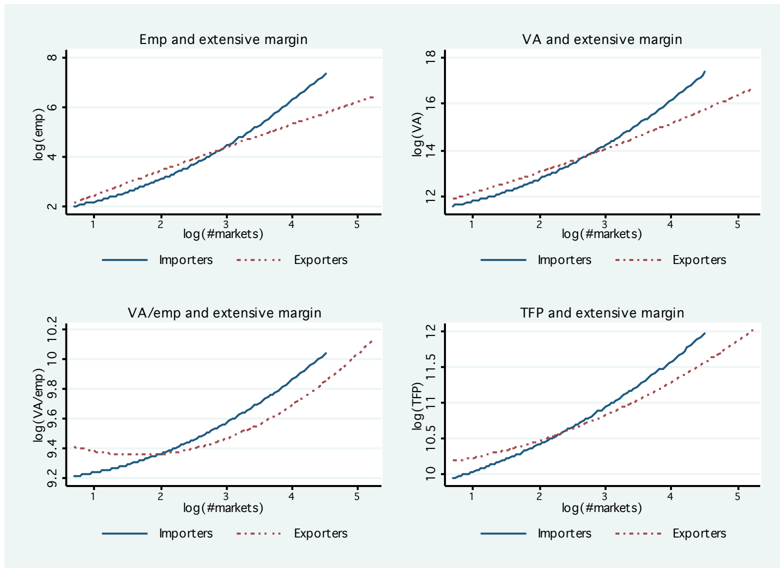
Table 15: Impact of gross churning of imported products on TFP growth and export scope (all exporters)

	Including POT products				Excluding POT products			
	ΔTFP (OP)	Δ# exp. capital	Δ# exp. intermed.	Δ# exp. final	ΔTFP (OP)	Δ# exp. capital	Δ# exp. intermed.	Δ# exp. final
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔImport tariff	0.091	-0.113	-0.070	-0.072	0.091	-0.137*	-0.063	0.006
	[0.81]	[-1.51]	[-1.08]	[-0.66]	[0.81]	[-1.89]	[-0.82]	[0.04]
ΔImport unit value	-0.013*	0.005***	-0.009*	-0.004***	-0.013*	-0.002	-0.006***	-0.005
	[-1.69]	[2.88]	[-1.70]	[-3.10]	[-1.68]	[-1.52]	[-3.57]	[-1.24]
Δ# imp. capital	0.022***	0.056***	0.013**	0.008	0.021***	0.067***	0.009	0.002
	[4.03]	[5.65]	[2.40]	[1.05]	[3.86]	[5.46]	[1.59]	[0.24]
Δ#imp. Intermed.	0.013	0.067***	0.120***	0.084***	0.017*	0.053***	0.138***	0.081***
	[1.29]	[3.77]	[10.43]	[5.08]	[1.76]	[2.91]	[11.20]	[4.65]
Δ# imp. final	0.006	0.009	0.012**	0.044***	0.007	0.002	-0.001	0.032***
	[1.01]	[1.09]	[2.13]	[4.77]	[1.11]	[0.24]	[-0.12]	[3.07]
Observations	28,453	11,917	19,342	12,926	28,453	11,917	19,342	12,926
R-squared	0.011	0.010	0.015	0.010	0.012	0.009	0.017	0.007

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are Olley-Pakes (OP) measure of TFP, gross changes in (log) number of exported capital, intermediate and final goods, respectively. Productivity measures defined as first differences of logged variables (i.e. growth rates). Gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 3/ Main explanatory variables include firm specific trade-weighted import unit values, and gross changes in number of imported capital, intermediate and final goods, respectively. Unit values are defined as first differences of logged variables, while gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 4/ Control variables (not shown in Table) include log number of firm import product-markets, log employment, IFDI and OFDI as well as industry, year and firm fixed effects. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1. 6/ Table is constructed from Tables A6 and A7 in Appendix. See full results in Appendix.

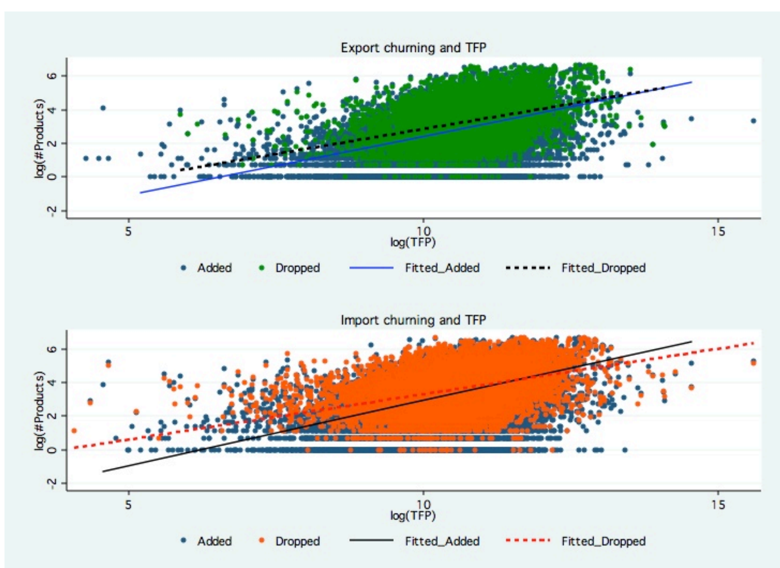
Figures

Figure 1: Firm characteristics and extensive margin (no. of markets) in 2008



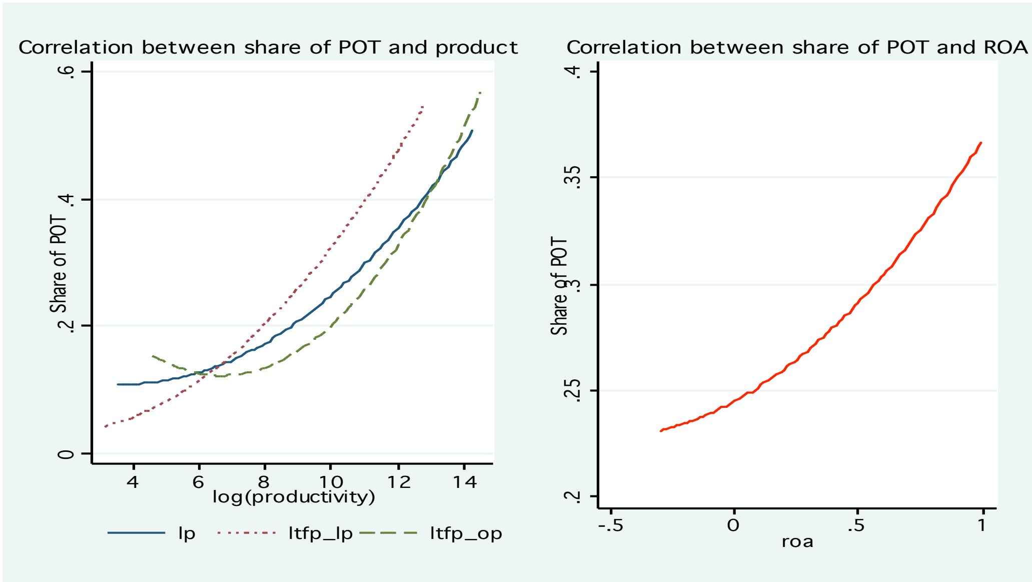
Notes: 1/ Figures are produced using quadratic fit with frequency weights based on firm size (employment). 2/ Emp – number of employees, VA – value added, VA/emp – labor productivity, TFP - Olley-Pakes measure of productivity.

Figure 2: Correlation between export and import churning and lagged TFP, period 1995- 2008



Notes: 1/ Logs of added and dropped products in exports and imports are used as indication of churning. TFP is lagged one period. 2/ Fitted figures are produced using non-weighted linear fit.

Figure 3: Correlation between POT trade, TFP and ROA, period 1995- 2008



Note: 1/ Fitted figures are produced using non-weighted quadratic fit.

Appendix

Appendix A

Tables

Table A1: Changes in CN-8 classification in the period 1994-2008

Year	#Codes created	#Codes deleted	# Total code changes	# Total codes
1994	430	228	658	10108
1995	849	509	1358	10448
1996	1133	1086	2219	10495
1997	279	168	447	10606
1998	310	329	639	10587
1999	144	303	447	10428
2000	109	223	332	10314
2001	50	90	140	10274
2002	780	654	1434	10400
2003	19	15	34	10404
2004	273	503	776	10174
2005	97	175	272	10096
2006	486	740	1226	9842
2007	917	1039	1956	9720
2008	75	96	171	9699

Source: CARS, SORS.

Table A2: Extent of POT trade as a share in total and newly added exported products by level of product aggregation, per-firm average over 1995-2008

	CN-8	CN-5	CN-3
Share in no. of all exported goods	0.25	0.31	0.42
Share in no. of newly added exported goods	0.42	0.55	0.89

Source: CARS, SORS, AJPES; own calculations.

Table A3: Impact of net churning of imported products on TFP growth and export scope (All exporters; including POT products)

	(1) ΔVA/emp	(2) ΔTFP (LP)	(3) ΔTFP (OP)	(4) Δ# exp. capital	(5) Δ# exp. intermed.	(6) Δ# exp. final
ΔK/L ratio	0.157***					
	[16.99]					
ΔInput tariff	0.012	0.015*	0.010	-0.026**	-0.027**	-0.013
	[1.43]	[1.74]	[0.85]	[-2.02]	[-2.19]	[-0.84]
ΔUnit value	-0.012*	-0.013*	-0.013*	-0.018	-0.189	-0.244
	[-1.72]	[-1.71]	[-1.73]	[-0.24]	[-1.19]	[-0.83]
Δ# imp. capital	0.001	0.001**	0.002***	0.044***	0.026***	0.020***
	[1.51]	[2.35]	[3.49]	[5.83]	[3.61]	[2.83]
Δ#imp. interm.	0.001	0.002*	0.002**	0.012	0.041***	0.030**
	[0.87]	[1.73]	[2.01]	[1.07]	[2.79]	[2.08]
Δ#imp. final	-0.000	0.000	0.001	-0.000	0.016**	-0.001
	[-0.09]	[0.51]	[1.08]	[-0.01]	[2.20]	[-0.16]
Δ#imp. product-	0.002	0.002	0.002	0.011	0.020	-0.007
-markets	[0.59]	[0.53]	[0.68]	[0.21]	[0.32]	[-0.11]
Log Employment	-0.113***	-0.082***	-0.112***	-0.100	-0.148*	-0.079
	[-12.20]	[-9.70]	[-12.20]	[-1.20]	[-1.87]	[-0.93]
IFDI	0.062**	0.038	0.035	-0.296	0.556*	-0.778*
	[2.25]	[1.49]	[1.26]	[-0.76]	[1.84]	[-1.94]
OFDI	0.027	0.017	0.021	0.610**	0.344*	0.286
	[1.62]	[1.03]	[1.31]	[2.37]	[1.71]	[1.09]
Constant	0.080***	0.065***	0.086***	0.062	0.063	0.081
	[10.96]	[9.73]	[12.10]	[0.91]	[1.00]	[1.17]
Observations	28,027	28,027	28,453	11,917	19,342	12,926
R-squared	0.046	0.006	0.011	0.002	0.002	0.001

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are labor productivity (VA/emp), Levinsohn-Petrin (LP) and Olley-Pakes (OP) measure of TFP, net changes in number of exported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables (i.e. growth rates). 3/ Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and net changes in number of imported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables. 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Impact of net churning of imported products on TFP growth and export scope (All exporters; excluding POT products)

	(1) ΔVA/emp	(2) ΔTFP (LP)	(3) ΔTFP (OP)	(4) Δ#exp. capital	(5) Δ#exp. intermed.	(6) Δ#exp. final
ΔK/L ratio	0.155***					
	[16.43]					
ΔInput tariff	0.009	0.011	0.011	-0.030***	-0.020*	-0.002
	[1.01]	[1.29]	[1.31]	[-3.03]	[-1.77]	[-0.24]
ΔUnit value	-0.012*	-0.014*	-0.014*	-0.096***	-0.035	0.006
	[-1.76]	[-1.79]	[-1.85]	[-3.67]	[-0.81]	[0.53]
Δ# imp. capital	0.005	0.010*	0.014**	0.031***	0.005	0.004
	[0.79]	[1.64]	[2.40]	[4.15]	[0.55]	[0.54]
Δ#imp. interm.	0.021***	0.033***	0.037***	0.018**	0.055***	0.026***
	[2.87]	[4.59]	[4.93]	[2.47]	[5.22]	[3.59]
Δ#imp. final	-0.005	-0.003	-0.003	-0.009	-0.006	0.007
	[-0.83]	[-0.47]	[-0.54]	[-1.25]	[-0.64]	[0.91]
Δ#imp. product-	-0.002	-0.002	-0.001	0.001	0.006	-0.003
-markets	[-0.38]	[-0.55]	[-0.31]	[0.30]	[0.93]	[-0.81]
Log Employment	-0.112***	-0.081***	-0.113***	-0.009	-0.001	0.008
	[-12.68]	[-9.20]	[-12.57]	[-1.19]	[-0.06]	[1.14]
IFDI	0.063**	0.044	0.054*	-0.047	0.065	-0.061
	[2.11]	[1.57]	[1.94]	[-1.08]	[1.41]	[-1.45]
OFDI	0.026	0.020	0.027	0.079**	0.035	0.016
	[1.54]	[1.19]	[1.61]	[2.44]	[0.94]	[0.51]
Constant	0.073***	0.061***	0.082***	-0.001	-0.005	-0.007
	[11.29]	[9.59]	[12.69]	[-0.27]	[-0.67]	[-1.49]
Observations	28,027	28,027	28,453	11,917	19,342	12,926
R-squared	0.045	0.008	0.013	0.004	0.004	0.002

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are labor productivity (VA/emp), Levinsohn-Petrin (LP) and Olley-Pakes (OP) measure of TFP, net changes in number of exported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables (i.e. growth rates). 3/ Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and net changes in number of imported capital, intermediate and final goods, respectively. All variables defined as first differences of logged variables. 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Robustness check with GMM: Impact of net churning of imported products on TFP growth and export scope

	Including POT products				Excluding POT products			
	ΔTFP (OP)	Δ# exp. capital	Δ# exp. interm.	Δ# exp. final	ΔTFP (OP)	Δ# exp. capital	Δ# exp. interm.	Δ# exp. final
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔImport tariff	-0.223	0.037	0.016	0.067*	0.062	-0.037	-0.169**	-0.032
	[-0.88]	[0.79]	[0.47]	[1.86]	[0.56]	[-0.69]	[-2.12]	[-0.38]
ΔImport unit value	-0.006	0.001	-0.035	0.048	-0.013	0.049*	-0.063	0.121*
	[-0.01]	[0.02]	[-0.55]	[0.94]	[-0.97]	[1.93]	[-1.33]	[1.72]
Δ# imp. capital	0.009***	0.127*	0.159***	0.004	0.015	0.048*	0.028	-0.044
	[2.80]	[1.84]	[2.74]	[0.07]	[0.53]	[1.69]	[0.49]	[-0.72]
Δ#imp. Intermed.	-0.007	0.049	0.305***	0.180*	0.052*	-0.007	0.117*	0.106*
	[-1.21]	[0.37]	[3.32]	[1.71]	[1.95]	[-0.31]	[1.81]	[1.68]
Δ# imp. final	-0.008*	0.121	-0.011	0.152**	0.027	-0.017	-0.067	0.076
	[-1.73]	[1.52]	[-0.19]	[2.07]	[1.08]	[-0.64]	[-1.09]	[1.33]
Δ#imp. product-	0.042***	-0.134	-0.181	-0.131	0.011	0.015	0.026	-0.023
-markets	[3.30]	[-0.56]	[-1.04]	[-0.57]	[1.04]	[1.60]	[1.25]	[-0.95]
Log Employment	-0.026	0.026	-1.943**	2.292	-0.061	0.114*	0.060	0.119
	[-0.27]	[0.01]	[-2.03]	[1.64]	[-0.86]	[1.79]	[0.80]	[1.36]
IFDI	1.028	-17.591	10.982	7.914	0.676**	-0.233	-0.055	-0.191
	[1.36]	[-1.37]	[0.91]	[0.61]	[2.53]	[-0.77]	[-0.18]	[-0.42]
OFDI	0.334	4.541	3.015	3.706	0.193	0.455**	0.052	0.185
	[1.02]	[0.99]	[0.75]	[0.82]	[1.14]	[2.05]	[0.15]	[0.46]
Constant	0.041	-0.543	0.202	-1.035*	0.005	-0.060***	-0.021	-0.025
	[1.22]	[-0.88]	[0.41]	[-1.78]	[0.23]	[-2.81]	[-0.73]	[-1.03]
Observations	28,453	29,326	29,326	29,326	24,592	22,166	20,597	22,097
Hansen	257.2	276.5	254.1	257.8	566.8	267.5	261.1	246.4
Hansen (P-value)	0.363	0.120	0.415	0.354	0.106	0.214	0.302	0.552
AR1	-11.3	-7.3	-7.1	-9.0	-12.3	-8.2	-7.5	-8.8
AR1 (P-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR2	5.1	2.6	2.1	3.9	4.5	3.2	2.6	3.4
AR2 (P-value)	0.00	0.01	0.04	0.00	0.00	0.00	0.01	0.00

Notes: 1/ Blundell-Bond system GMM estimations with robust standard errors. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are Olley-Pakes (OP) measure of TFP, and net changes in number of exported capital, intermediate and final goods, respectively. Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and net changes in number of imported capital, intermediate and final goods, respectively. 3/ Model includes lagged dependent and lagged main explanatory variables (not reported here). 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Impact of gross churning of imported products on TFP growth and export scope (All exporters; including POT products)

	(1) ΔVA/emp	(2) ΔTFP (LP)	(3) ΔTFP (OP)	(4) Δ#exp. capital	(5) Δ#exp. intermed.	(6) Δ#exp. final
ΔK/L ratio	0.157***					
	[16.95]					
ΔInput tariff	0.118	0.144*	0.091	-0.113	-0.070	-0.072
	[1.40]	[1.70]	[0.81]	[-1.51]	[-1.08]	[-0.66]
ΔUnit value	-0.011*	-0.013*	-0.013*	0.005***	-0.009*	-0.004***
	[-1.69]	[-1.68]	[-1.69]	[2.88]	[-1.70]	[-3.10]
Δ# imp. capital	0.010*	0.015***	0.022***	0.056***	0.013**	0.008
	[1.90]	[2.73]	[4.03]	[5.65]	[2.40]	[1.05]
Δ#imp. interm.	0.006	0.012	0.013	0.067***	0.120***	0.084***
	[0.58]	[1.26]	[1.29]	[3.77]	[10.43]	[5.08]
Δ#imp. final	0.003	0.003	0.006	0.009	0.012**	0.044***
	[0.46]	[0.55]	[1.01]	[1.09]	[2.13]	[4.77]
Δ#imp. product-	0.003	0.003	0.005	-0.005	-0.002	0.002
-markets	[0.81]	[1.09]	[1.47]	[-1.48]	[-0.70]	[0.61]
Log Employment	-0.114***	-0.084***	-0.114***	-0.033***	-0.019**	-0.007
	[-12.30]	[-9.82]	[-12.38]	[-2.92]	[-2.35]	[-0.66]
IFDI	0.063**	0.039	0.036	0.002	0.041*	0.055
	[2.27]	[1.53]	[1.30]	[0.06]	[1.79]	[1.47]
OFDI	0.027*	0.017	0.022	0.011	-0.030*	-0.046*
	[1.65]	[1.05]	[1.34]	[0.45]	[-1.69]	[-1.78]
Constant	0.077***	0.060***	0.080***	0.042**	0.029***	0.007
	[10.10]	[8.58]	[10.73]	[2.36]	[2.67]	[0.44]
Observations	28,027	28,027	28,453	11,917	19,342	12,926
R-squared	0.046	0.006	0.011	0.010	0.015	0.010

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are labor productivity (VA/emp), Levinsohn-Petrin (LP) and Olley-Pakes (OP) measure of TFP, gross changes in number of exported capital, intermediate and final goods, respectively. Productivity measures defined as first differences of logged variables (i.e. growth rates). Gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 3/ Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and gross changes in number of imported capital, intermediate and final goods, respectively. Price variables defined as first differences of logged variables, while gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A7: Impact of gross churning of imported products on TFP growth and export scope (All exporters; excluding POT products)

	(1) ΔVA/emp	(2) ΔTFP (LP)	(3) ΔTFP (OP)	(4) Δ#exp. capital	(5) Δ#exp. intermed.	(6) Δ#exp. final
ΔK/L ratio	0.157***					
	[16.96]					
ΔInput tariff	0.119	0.144*	0.091	-0.137*	-0.063	0.006
	[1.41]	[1.71]	[0.81]	[-1.89]	[-0.82]	[0.04]
ΔUnit value	-0.011*	-0.013*	-0.013*	-0.002	-0.006***	-0.005
	[-1.69]	[-1.68]	[-1.68]	[-1.52]	[-3.57]	[-1.24]
Δ# imp. capital	0.010*	0.015***	0.021***	0.067***	0.009	0.002
	[1.80]	[2.71]	[3.86]	[5.46]	[1.59]	[0.24]
Δ#imp. interm.	0.010	0.017*	0.017*	0.053***	0.138***	0.081***
	[1.00]	[1.79]	[1.76]	[2.91]	[11.20]	[4.65]
Δ#imp. final	0.003	0.004	0.007	0.002	-0.001	0.032***
	[0.45]	[0.61]	[1.11]	[0.24]	[-0.12]	[3.07]
Δ#imp. product-	0.002	0.003	0.005	-0.005	-0.001	0.006
-markets	[0.76]	[1.00]	[1.41]	[-1.24]	[-0.23]	[1.64]
Log Employment	-0.114***	-0.083***	-0.113***	-0.041***	-0.035***	-0.012
	[-12.26]	[-9.78]	[-12.32]	[-3.10]	[-3.67]	[-1.05]
IFDI	0.063**	0.040	0.038	0.006	0.058**	0.037
	[2.30]	[1.57]	[1.34]	[0.17]	[2.22]	[0.90]
OFDI	0.028*	0.018	0.024	0.044	-0.020	-0.052*
	[1.70]	[1.13]	[1.44]	[1.63]	[-1.04]	[-1.91]
Constant	0.077***	0.060***	0.080***	0.027	0.011	-0.003
	[10.00]	[8.52]	[10.67]	[1.33]	[0.87]	[-0.18]
Observations	28,027	28,027	28,453	11,917	19,342	12,926
R-squared	0.046	0.007	0.012	0.009	0.017	0.007

Notes: 1/ Fixed effects estimations with robust standard errors clustered around industries. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are labor productivity (VA/emp), Levinsohn-Petrin (LP) and Olley-Pakes (OP) measure of TFP, gross changes in number of exported capital, intermediate and final goods, respectively. Productivity measures defined as first differences of logged variables (i.e. growth rates). Gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 3/ Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and gross changes in number of imported capital, intermediate and final goods, respectively. Price variables defined as first differences of logged variables, while gross changes are defined as annual shares of sum (added + dropped products) in total number of products. 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

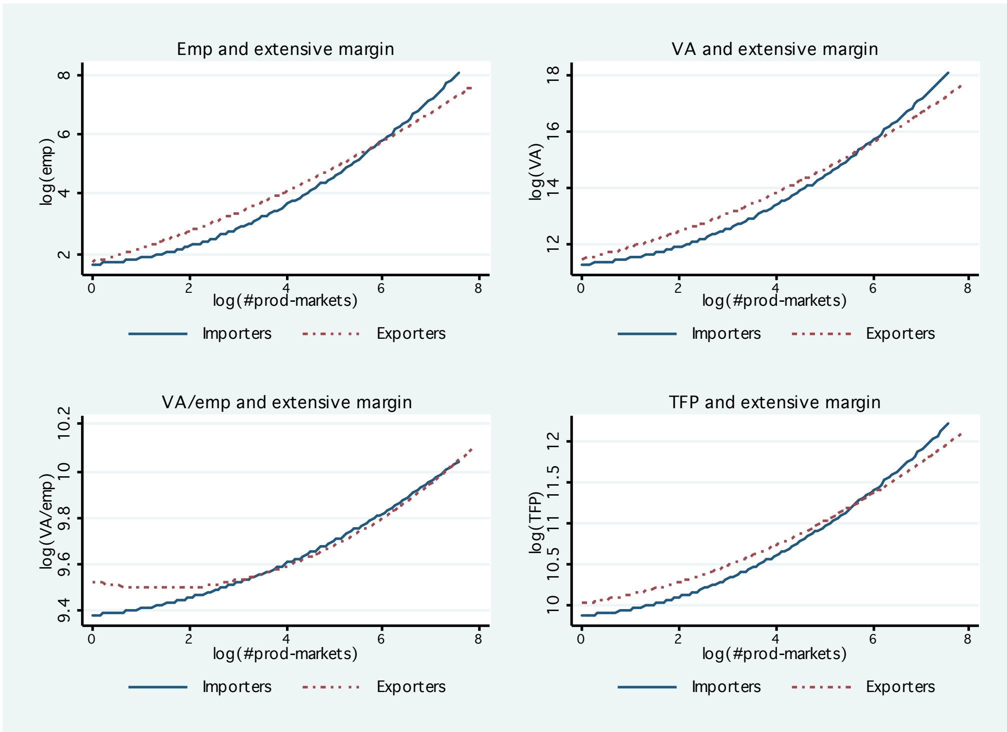
Table A8: Robustness check with GMM: Impact of gross churning of imported products on TFP growth and export scope

	Including POT products				Excluding POT products			
	ΔTFP (OP)	Δ# exp. capital	Δ# exp. interm.	Δ# exp. final	ΔTFP (OP)	Δ# exp. capital	Δ# exp. interm.	Δ# exp. final
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔImport tariff	0.018*	0.023	0.016	0.011	0.019*	0.063**	0.016	0.034
	[1.78]	[0.99]	[0.73]	[0.58]	[1.77]	[2.17]	[0.74]	[1.57]
ΔImport unit value	-0.005	0.007**	0.004	0.009***	-0.005	0.010***	0.005	0.012***
	[-0.48]	[2.25]	[1.18]	[2.83]	[-0.51]	[3.53]	[1.57]	[3.31]
Δ# imp. capital	0.032	0.216***	-0.074	-0.054	0.042	0.140**	-0.069	-0.046
	[1.10]	[3.61]	[-1.59]	[-1.04]	[1.45]	[2.30]	[-1.54]	[-0.95]
Δ#imp. Intermed.	0.056*	0.150*	0.298***	0.255***	0.058*	0.145**	0.166**	0.156**
	[1.73]	[1.85]	[3.76]	[3.08]	[1.85]	[2.12]	[2.48]	[2.25]
Δ# imp. final	0.016	0.030	0.035	0.281***	-0.002	0.030	0.080**	0.230***
	[0.76]	[0.55]	[0.77]	[5.57]	[-0.09]	[0.60]	[2.04]	[4.94]
Δ#imp. product-	0.016	0.000	0.051**	-0.010	0.009	-0.001	0.030	-0.014
-markets	[1.50]	[0.01]	[2.44]	[-0.35]	[0.71]	[-0.03]	[1.29]	[-0.42]
Log Employment	0.110	-0.162	0.143	0.078	0.103	0.008	0.251***	0.075
	[1.45]	[-1.21]	[1.47]	[0.70]	[1.34]	[0.06]	[2.71]	[0.69]
IFDI	0.365*	0.069	0.189	0.010	0.334*	0.223	0.343	0.132
	[1.93]	[0.24]	[0.81]	[0.04]	[1.86]	[0.83]	[1.35]	[0.56]
OFDI	0.116	0.696***	0.296	0.164	0.112	0.401*	0.131	0.518**
	[0.82]	[2.58]	[1.38]	[0.73]	[0.80]	[1.76]	[0.69]	[2.08]
Constant	-0.035	-0.042	-0.347***	-0.383***	0.005	-0.060***	-0.021	-0.025
	[-0.94]	[-0.41]	[-4.10]	[-4.10]	[0.23]	[-2.81]	[-0.73]	[-1.03]
Observations	11,999	6,165	9,544	6,363	11,310	5,704	8,924	5,820
Hansen	266.2	249.8	297.9	267.9	391.9	404.3	436.4	393.7
Hansen (P-value)	0.230	0.492	0.204	0.208	0.276	0.151	0.170	0.255
AR1	-5.7	-3.5	-6.4	-8.4	-8.4	-11.6	-14.0	-12.1
AR1 (P-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR2	3.0	2.3	1.7	3.2	1.6	1.9	2.1	3.0
AR2 (P-value)	0.00	0.02	0.08	0.00	0.12	0.06	0.04	0.00

Notes: 1/ Blundell-Bond system GMM estimations with robust standard errors. All estimations include industry-year fixed effects. Period 1995-2008. 2/ Dependent variables are Olley-Pakes (OP) measure of TFP, and gross changes in number of exported capital, intermediate and final goods, respectively. Main explanatory variables include firm specific trade-weighted tariff rate and import unit value, and gross changes in number of imported capital, intermediate and final goods, respectively. 3/ Model includes lagged dependent and lagged main explanatory variables (not reported here). 4/ Control variables include log number of firm import product-markets, log employment, IFDI and OFDI. 5/ Robust t-statistics in brackets; standard errors are clustered at the industry level; *** p<0.01, ** p<0.05, * p<0.1.

Figures

Figure A1: Firm characteristics and extensive margins (no. of product – markets) in 2008



Notes: 1/ Figures are produced using quadratic fit with frequency weights based on firm size (employment). 2/ Emp – number of employees, VA – value added, VA/emp – labor productivity, TFP - Olley-Pakes measure of productivity.

Appendix B

We obtain estimates of TFP by applying the Olley and Pakes (1996) algorithm. We start with the usual specification of the production function:

$$y_{it} = \delta + \alpha l_{it} + \beta k_{it} + (\eta_i + \omega_{it} + \varepsilon_{it}), \qquad \alpha + \beta + \gamma \neq 1 \tag{1}$$

$$\omega_{it} = \rho \omega_{i,t-1} + o_{it}, \qquad |\rho| < 1 \tag{2}$$

where l and k are firm's i logs of labor and capital. Of the error components, η_i is an unobserved firm-specific effect, ω_{it} is firm's i unobserved auto-regressive heterogeneity shock, and ε_{it} denotes the remaining i.i.d error. Note that both labor and capital inputs are potentially correlated with firm-specific effects (η_i) and with productivity shocks (ω_{it}).

In principle, Olley and Pakes (OP henceforth) approach allows controlling for the two biases that typically arise when estimating (1), e.g. simultaneity bias and selection bias. The biases arise due to problems of potential correlation between input levels and the unobserved firm-specific shocks. The idea is that firms that experience a large positive productivity shock may respond by using more inputs, which violates the OLS assumption of strict exogeneity of inputs and the error term. Another source of simultaneity between inputs and output in the production function approach is the selection issue. Olley and Pakes (1996) demonstrate that firm decisions are made, at least to some extent, on their perceptions of future productivity, which in turn are partially determined by the realizations of their current productivity. Considering only those firms that survived over the entire period, this would imply that a sample is being selected, in part, on the basis of the unobserved productivity realizations. This generates a selection bias in both the estimates of the production function parameters and in the subsequent analysis of productivity.

Using the OLS approach to estimate the firm's productivity is thus inappropriate resulting in coefficients on capital to be downward biased and the labor coefficients to be upward biased. To deal with the issues, Olley and Pakes propose a three–step approach. In the first step, the unobserved productivity shocks ω_{it} in (2) for each firm are estimated using the (firm-specific) investment equation and the dependence of investment on productivity shocks. Following De Loecker (2007) and Kasahara and Rodrigue (2008),[29] we include four additional state

[29] Note that De Loecker (2007) includes firm's exports status, while Kasahara and Rodrigue (2008) include firm's import status as additional state variables.

variables in the OP first step. We include export status, imports status, inward FDI status and outward FDI status, which capture the internationalized behavior of firm as well as its survival probability. These estimates can subsequently be used to control for the unobservable productivity shocks ω_{it} in our estimations of (1). We use a fourth order polynomial in capital and investment (with a full set of interaction terms with the state variables) to approximate ω_{it}. Using the estimates of productivity shocks, the primary production function is estimated to obtain unbiased estimates of the coefficient on labor as well as predicted values of the remaining (residual) part of the production function (1).

The second step of the estimation process involves the determination of the survival probability (the probability that a firm will survive in the local market), which depends on the firm's productivity remaining above the perceived cut-off level. In estimating the survival probability, we use a fourth order polynomial in (k_i, i_t) with industry, additional four state variables (export, import, IFDI and OFDI status) and time dummies (which serve as a proxy for differences in market conditions and time-specific factors that impact survival probability). The third and final step of the estimation procedure utilizes the preceding two steps (whereby the first step estimation results are used to control for simultaneity, while the results of the second step serve to mitigate the selection bias) to estimate an expanded production function and obtain unbiased estimates of the coefficient of capital. The third step of the estimation algorithm is estimated using the nonlinear least squares method with bootstrapped regression coefficients (in line with Pavcnik, 2002). These three steps produce consistent and unbiased estimates of coefficients of labor ($\hat{\alpha}$) and capital ($\hat{\beta}$), which are then used to obtain unbiased estimates of total factor productivity (TFP) as a residual in the consistently estimated production function (1).