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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-market level, we document substantial churning in both imports and exports for the Slovenian manufacturing firms in the period 1994-2008. On average, a firm changes about one quarter of imported and exported product-markets every year, while gross churning in terms of added and dropped product-markets is almost three times higher. A substantial share 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). We find that churning in imported varieties is far more important than reduction in tariffs or declines in import prices for firms' productivity growth and increased export product scope. We also find that gross churning has a bigger impact on firm productivity improvements by a factor of more than 10 in comparison to the net churning. 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:*pass-on-trade, multi-product firms, imports, export scope, total factor productivity

1. Introduction

Recent evidence 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 (2010), Nocke and Yeaple (2006) and Eckel and Neary (2011) demonstrate how either trade participation or trade liberalization affect firms' product scope. Increased import competition or fierce competition in export markets push firms to rationalize their product scope towards their best performing products, which 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). Even more importantare dynamic gains from new varieties of intermediate inputs, which stimulate product innovation and hence firms' long-run growth. Goldberg, Khandelwal, Pavcnik and Topolova, (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 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 product-markets every year, while gross churning in terms of added and dropped product-markets is almost three times higher. A substantial part of churning, however, can be attributed to what we call *pass-on-trade* (POT), i.e. a process of simultaneous two-way imports and exports of varieties within the same CN-8 product code. Using the same dataset, Damijan, Konings and Polanec (2012) demonstrate that one-quarter of all exported varieties and 40 percent 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.[2]

This evidence suggests that, in contrast to the recent findings that stress the importance of reduction in tariffs and availability of increased number of imported inputs due to trade liberalization, the process of reallocation (churning) in firms' imported inputs towards their most suitable inputs may have an important impact on firms' performance. In addition, POT has to be taken into account when considering the gains of trade through an increased number of imported varieties. In this paper, 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, 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 10 in comparison to the effect of net churning . Thus, both adding and dropping of imported input varieties 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. This indicates that POT has less favorable effects on firms' long-run performance than regular trade.

In the second section, we describe the data, while in the third section we document the patterns of exports and imports and margins of trade of multi-product firms. Section 4 examines the impact of net and gross import churning on firm export scope and productivity gains. We conclude in section 5.

2. Data

In this paper we exploit matched datasets for Slovenian firms for the period 1994–2008.[3] 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

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[2] This finding is consistent with evidence of 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*.

[3] The data were analyzed in a safe room at the Slovenian Statistical Office.

are engaged in international trade in products. These transactions are reported at the 8-digit product level defined according to the EU Combined Nomenclature (CN). 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 provides 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, among which we use 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. 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 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.[4]

3. Patterns of trade of multi–product firms

3.1. Margins of trade for multi-product exporters and importers

Tables 1 and 2 show summary statistics for the margins of trade of exporting and importing firms.[5] We categorize firms according to the number of products they

[4] For more details on data construction refer to Appendix B1.

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

export or import, and report the number of firms, the average 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 percent of manufacturing firms engaged in exporting at least one product, whereas the share of importing firms is higher – about 83 percent. The multi-product exporters and importers constitute the large majority of firms. About 83 percent of exporting firms are multi-product exporters, accounting for 99.4 percent of total exports, while more than 85 percent of importing firms were multi-product importers, accounting for 99.8 percent of all imports. 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 (Goldberg et al, 2010a). 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 percent of exporters that export more than 50 varieties account for 74 percent 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 reveal that multi-product importers show a very similar pattern to exporters. About 20 percent of all firms that import more than 50 different products account for 83 percent 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 show below that most of the importers in fact belong to the same 'club' as exporters.

[*Table 1 and 2 about here*]

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 recently proposed 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 observed pattern for imports, although they appear similar. Furthermore, when matching exporters with importers (not shown in the tables) it becomes clear that in Slovenia these are nearly the same group of firms. We explore this issue below 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 exported products increases. Interestingly, this pattern of non-monotonicity is also found for the intensive margins of importers. Another interesting feature in the data is related to the differences in the absolute values of intensive margins between exporters and importers. Single product exporters on average ship 70,000 EUR per destination, while firms that export more than 50 products ship on average 2,400 EUR per product to each market. Again, similar pattern is found for imports. Single product firms on average import 21,000 EUR per source country, while firms that import more than 50 products source on average 1,400 EUR 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 products in 2008. The most striking feature is that foreign trade of Slovenian manufacturing firms is dominated by intermediate goods. About 72 percent of total imports in 2008 consists of intermediate products, while in exports this share is roughly 50 percent. In exports, roughly one third of exported value consists of final goods, while in imports this share is much lower (about 11 percent). The remaining 14 (17) percent of exports (imports) consists of capital goods. Accordingly, intermediate goods tend to be the most diversified product group in terms of both dimensions of the extensive margins. A typical exporting firm supplies 17.5 intermediate products to 3.7 countries, while a typical importer sources on average 27.5 intermediate products from 3.8 countries. Figures for capital and final goods are lower by some 50 to 60 percent in terms of number of foreign countries and by 60 to 80 percent in terms of number of traded goods.

3.2. Export and import churning of multi-product firms

A number of recent theoretical papers 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 (Goldberg et al, 2010a and 2010b; Bas and Strauss-Kahn, 2011). 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 – 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 firms tend to have more intense churning in exports (more than 60 percent of goods added and dropped every year), while medium-sized and large firms are relatively more active in churning of imported goods.

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

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 percent 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 percent of firm's total exported or imported goods are 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 SITC 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. They also 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.

A striking feature, evident from Table 4 is that product adding and dropping are taking place simultaneously. In Slovenia it is common that most exporters are also importers. In fact, 58 percent of all manufacturing firms engaged in international trade are both exporters and importers. 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.

Our data allow us to characterize the relationship between imports and exports at the firm-product level in more detail. 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

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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.

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 exactly identify those CN-8 products that are simultaneously imported and exported at the firm level. We call these trade flows *Pass-On-Trade* (POT).[9] The identification strategy is outlined in (1). 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:

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

Table 6 reveals that simultaneous trade within the same CN-8 category (POT) is a widespread and significant phenomenon in Slovenian foreign trade. One quarter of the total number of exported products by the average firm consists of recently imported products, while 42 per cent of all newly added exported goods by each firm have been imported in the same or in the previous year.[10] This pattern of simultaneous two-way trade is widely spread over all 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 6 about here*]

There are several possible explanations for this trade behavior of firms, such as fixed cost of distribution networks, price arbitrage among markets, intermediary trade within the multinational firms' networks, and complementarity between

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[9] 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 the identified exported goods not being produced by the same firms as *carry-along-trade*.
[10] 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 A).

firms' core products with rebranded imported products in export markets.[11] Damijan, Konings and Polanec (2012) provide more detailed information on the evolution of POT in the population of Slovenian manufacturing firms and test some of the potential explanations for this simultaneous two-way trade within the same product categories.

Irrespective of the reasons for this trading behavior, it is important that attempts to study the impact of imports on firm performance take the POT trade into account as it clearly provides a substantial part of firms' total and, in particular, of their added exported products. It is interesting to explore also 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

In the previous section we demonstrate that product turnover, both in export and import markets, is not small. Moreover, the dynamics of intermediate inputs seems to be highly correlated with dynamics 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. In particular, we focus on the effect of imports on firm performance, measured with productivity and export product scope. We explore two main channels through which imports affects performance. The first is through lower prices of intermediate inputs, and the second through improved access to more import varieties, which may facilitate technological spillovers. In this context, we will distinguish between net and gross churning in imported inputs. Following a short discussion of potential mechanisms, we explore a number of empirical specifications that shed more light on the relationship between imports, firm performance and exports.

4.1. Mechanisms

Two recent papers demonstrate that an enlarged scope of imported intermediate products increases firms' product (export) scope (and productivity). Goldberg et al

[11]In a most recent version of their paper on Carry-along trade, Bernard, Blanchard, Van Beveren and Vandenbusche (2012) offer a theoretical model explaining potential reasons for firms exporting products that they do not produce. Among them, demand scopecomplementarity and distribution networks fixed cost seem to be most plausible.

(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 an increase in imports of intermediate inputs increases the scope of exported products, as well as productivity. Goldberg et al (2010a) model the total impact of trade liberalization on firms' (domestic) product scope of Indian firms through two channels. In 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 varieties. Bas and Strauss-Kahn (2010) adjust the Melitz (2003) model by 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 technology transfer that is embodied in imported inputs is further developed in Damijan and Kostevc (2010).[12] 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. Technological upgrading can be associated with use of imported foreign capital and intermediate inputs that embody better technology. The decision to "dress up" by investing in technology can take place simultaneously with the decision to start importing. Moreover, technology upgrading means that firms 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

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

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

4.2. Empirical estimations

In the previous subsection we outlined two mechanisms that relate import price reduction and an increase of imported varieties to 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 reductions and greater availability of imported varieties may be a result of general trade liberalization. The latter is not limited 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 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 greater variety of imported capital and intermediate inputs. This process took place along a number of bilateral or multilateral 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 2000. The rare 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 percent 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. Damijan and Majcen (2003) report the average unweighted nominal import tariff rate on manufacturing goods around 15.3 percent in 1994, while the average effective (i.e. actually paid) tariff rate on imported manufacturing goods was as low as 7.4 percent. 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 they 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 percent, and then was further reduced to less than 0.2 percent by 2008. Hence, as shown in Table 7, in the period 1994–2008, the effective tariff rates for manufacturing products declined by only 7.3 percentage points, i.e. by about 0.5 percentage points a year.[13] This is a relatively low number if compared for example to India, where the average tariff rates declined by 24 percentage points in the period 1989–1997 (Goldberg et al, 2010a).

[*Table 7 about here*]

Thus, tariff reductions can account for a relatively small portion of the vast increase in imported varieties of Slovenian firms. To get a sort of the back-of-the

[13]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.

envelope calculation of the impact of tariff reductions on the firms' extensive import margin, we estimate the following equation:

$$\ln\left(n_{ijt}^{s}\right) = a_i + a_j + a_t + bt_{ijt}^{s} + e_{it}, \tag{2}$$

where n_{ijt}^{s} is the number of imported products by firm *i* in industry *j* at time *t*, and t_{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' individual import prices defined by trade-weighted unit value index.[14] The coefficient b 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 8 about here*]

Table 8 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 percent 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 percent 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 percent 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 7 suggests that instead of tariff reductions, availability of cheaper varieties of intermediate inputs may contributed far more to the boost 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 percent. Import prices of intermediate inputs decreased even more, by 42 percent,

[14]We calculate unit values from paid net of import duties.

while unit values of imported capital goods increased on average by 15 percent. 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 superior technology, 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 8 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 product groups are even larger. Using the same back-of-the-envelope approach as above, we can infer that a 10 percent decrease in import unit values results in an increase of imported product scope by 1.9 percent. The actual average decrease in unit values by 36 percent during our sample period thus implies an increase in the product scope of imports by 6.7 percent. Furthermore, the estimated coefficients for newly added import products and for POT imports (see columns (5) and (6) in Table 8) 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 9 about here*]

We now can provide a rough estimate of the impact of tariff reductions and decreases in import prices on the product scope of imports.[15] Table 9 reveals that manufacturing firms expanded their import product scope on average by 30 percent between 1994 and 2008.[16] Our estimates thus imply that reduction of import tariffs accounted for 1.2 percent (0.004   0.30), while import price reductions contributed about 22 percent (0.067   0.30) of the observed expansion in firms' import product scope. The remaining 77 percent 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. It 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 use these insights for analyzing the impact on firm productivity.

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[15]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.

[16]Table 9 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 percent). On the other side, the variety of imported capital goods has even decreased over the period by 21 percent, 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.

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 (3) as:

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

where ω_{it} is firm's *i* unobserved heterogeneity shock. $\overline{M}_{ijk}^{\gamma_j}$ is a 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 effects of price reductions and import scope on TFP.[17] 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:

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

where *m* and *s* denote imports and product type, respectively. Again, n_{ijt}^{s} is the 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 for affiliates of foreign multinational firm (inward FDI) and for own affiliates abroad (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 first differences and firm level fixed effects estimator in order to account for all remaining unobserved firm fixed effects.

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[17]Note that our approach deviates from the approach of Goldberg et al (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.

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.

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 firm multinational status as additional state variables.[18] 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 the 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 deal with this bias, we also estimate the model using the Blundell–Bond GMM estimator.

4.2.3. Imported inputs and export scope

While the first channel that we describe translates lower import prices into firms' productivity through lower marginal costs, the second channel relates higher productivity to more innovations, resulting in an increased domestic product scope and in turn results in an improved product scope in exports. As in Goldberg et al (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 (measures of net and gross churning). Hence, we 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 $n_{ijt}^{x,s}$ denotes the number of exported products by firm *i* in industry *j* at time *t*. The right-hand side variables are the same as in equation (4). We estimate the model separately for each individual product type group *s*. The model is estimated

[18]Note that including firms' multinational status to the OP algorithm in order to control for firm survival is a novelty, as most of the papers controlled only for export status (DeLoecker, 2007) or export and import status (Amiti and Konings, 2007; Kasahara and Rodrigue, 2008; Van Biesebroeck, 2005).

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 varieties in equation (5) is likely endogeneously determined, which results in the potential correlation between the variables on the RHS of equation (5) and the error term. We deal with this bias using also the GMM estimator as a robustness test.

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 estimates of equations (4) and (5).

4.4. Results

In line with documented substantial churning in the number of imported products in our sample, both in terms of net churning and in terms of gross churning, 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.

4.4.1. 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.[19] 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 or semi-elasticities.

The results for the impact of net churning in imports on TFP and export scope are reported in Table 10. The left-hand panel reports the results for all products, including the POT products, while the right-hand panel shows results when POT

[19]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.

products are excluded. Columns (1) and (5) report the results for equation (4), the impact on TFP, while the other columns contain 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 with POT products 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 insignificant coefficient. In contrast, the reduction of unit value has a positive effect on TFP growth. However, the elasticity remains rather modest. A 10 percent decline in unit values is associated with a 0.1 percent increase in total factor productivity. Also an increase in the number of 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.[20] 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.

Excluding POT products (e.g. by subtracting them from the firms' total number of imported and exported products) does not change the results as the coefficients for the unit price 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 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 10 about here*]

[20] 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).

Columns (2)–(4) of Table 10 report the results of estimation 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. The results without POT products (see columns (6)–(8)) again yield 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 test we also estimate the models (4) and (5) by using the Blundell-Bond (1998) system GMM estimator. As noted above, 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. Reductions of 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 Goldberg et al (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.[21] These results also match the results obtained by Bas and

[21] One should bear in mind, however, two notable differences between our approach and that of the Goldberg et al (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

Strauss-Kahn (2010) who find a strong effect of number of imported inputs on TFP and export scope, but a very limited effect of import prices.

4.4.2. The impact of gross churning in imported inputs

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 number of 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 inputs 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.

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 of gross product churning that occur at the firm level year by year.[22] Again, the left panel of Table 11 presents the results including the POT trade, while the right

by estimating the models at the industry level as they do not have information on firm level number of products imported, produced or exported.

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

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 choice 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 of 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 become 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 11 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 11), 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 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, provide such positive effects on TFP or export scope as are attributed to the regular (non-POT) imported inputs. Over the past 15 years, due to globalization, 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 product categories. As indicated by Damijan, Konings and Polanec (2012), POT may have contributed to firms' overall profitability, but as shown in this study 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. This implies that POT trade has to be taken into account when accounting for the gains of trade through the channel of imported varieties.

Using a number of empirical tests, we show that churning in imported varieties is far more important for firms' productivity growth and the 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. of Total (%)	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. of Total (%)	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 product-markets 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: Product-market additions and droppings (mean values), by firm size class, 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: Net and gross churning measures, by firm size class and product type, 1995-2008

Net churning

	Exports			Imports		
Size class	Capital goods	Intermed. goods	Final goods	Capital goods	Intermed. goods	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 export and import products-markets, n_{it}^{a} and n_{it}^{d} denote number of product-markets that firm drops or adds in the current year.

Source: CARS, SORS, AJPES; own calculations.

Table 6: 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 7: Changes in import tariffs and unit values, 1994-2008

	Tariff rates[1]		Unit Values[2]	
	Mean	Median	Mean	Median
All products	-7.3	-3.3	-35.7	-41.8
Capital	-5.6	-2.3	15.1	13.0
Intermediate	-6.0	-3.3	-41.8	-44.9
Final	-9.1	-5.4	-29.7	-38.9

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 8: 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) onfirm-leveltrade-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 9: 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 firmin 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 10: 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 11: 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 OFDIas 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.

Appendix

Appendix A

Tables

Table A1: Impact of corrections for changes in CN-8 classification on number of exported products, period 1994-2008

	Uncorr. CN-8 (1)	Corr. CN-8 for merged and splitted items (where possible) (2)	Corr. CN-8 as in (2), with CN-6 replacements for multiple changes (3)	CN-8 aggregated to CN-6 (4)
	New exporters			
#Products	5.07	5.03	4.98	4.59
#Product-Markets	8.71	8.65	8.54	7.97
	Continuing exporters			
#Products	17.35	17.16	16.88	15.01
#Product-Markets	41.02	40.67	40.08	36.59

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]
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.

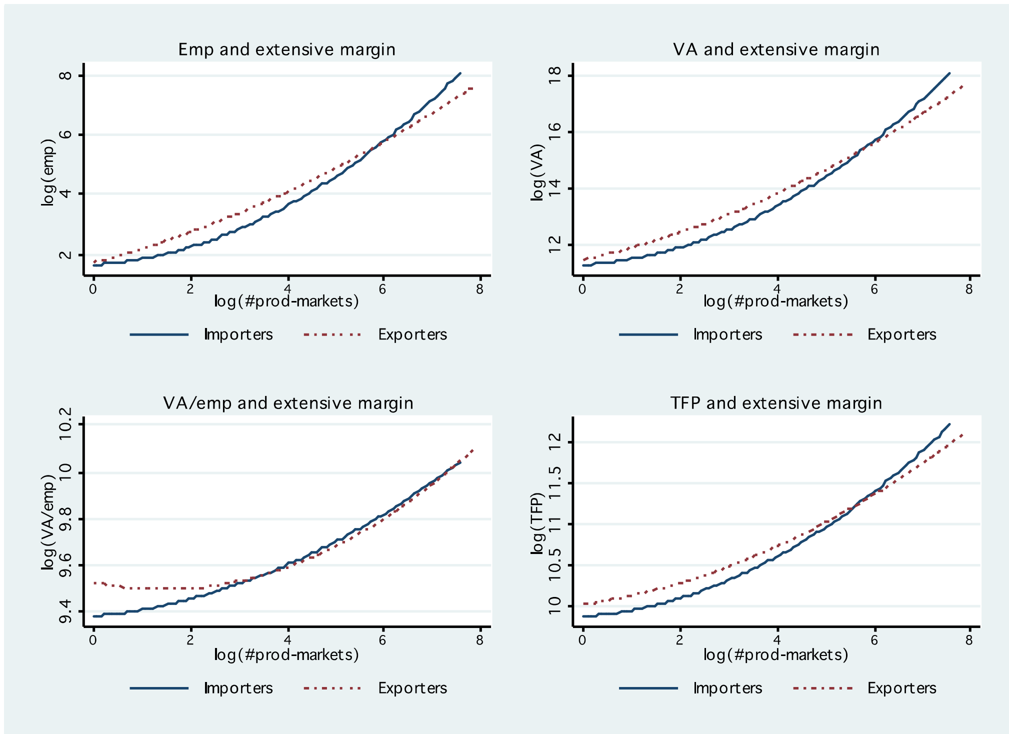
Table A8: Robustness check with GMM: Impact of gross churning of imported products on TFP growth and export scope

	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--markets	0.016	0.000	0.051**	-0.010	0.009	-0.001	0.030	-0.014
	[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

Appendix B1

For this paper we match datasets for Slovenian firms for the period 1994–2008b by using 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.[23] 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 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.[24]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.

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[23]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).

[24]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.See Table A1 inAppendix for an overview how accounting for CN code changes affects the number of products exported per firm.

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 bythe 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 capitalinvestments between residents and non-residents. The data on capital cross-border investments areobtained from reports on credit transactions with therest of the world and reports of short-term claims andliabilities 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'sBalance of Payments Manual (5^{th} 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 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.

Appendix B2

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

$$y_{it} = d + al_{it} + bk_{it} + (h_i + w_{it} + e_{it}), \qquad a + b + g^1 1 \tag{1}$$

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

where l and k are firm's i logs of labor and capital. Of the error components, h_i is an unobserved firm-specific effect, w_{it} is firm's i unobserved auto-regressive heterogeneity shock, and e_{it} denotesthe remainingi.i.d error. Note that both labor and capital inputs are potentially correlated with firm-specific effects (h_i) and with productivity shocks (w_{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 tobe upward biased. To deal with the issues, Olley and Pakes propose a three–step approach. In the first step, the unobserved productivity shocks w_{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),[25] we include four additional state 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 w_{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 w_{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,

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

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 ($\hat{a}$) and capital ($\hat{b}$), which are then used to obtain unbiased estimates of total factor productivity (TFP) as a residual in the consistently estimated production function (1).