Review of Development Economics
DOI:10.1111/rode.12309

Explaining Export Performance through Inputs: Evidence from Aggregated Cross-country Firm-level Data

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Abstract

Which trade barrier related to intermediate inputs forms a greater burden on the export performance of firms in developing countries? Using aggregated cross-country firm-level data covering 43 mostly developing economies, this paper estimates the marginal importance of the impact of various intermediate input trade cost barriers, namely tariffs, non-tariff barriers (NTBs) and services barriers, on firms' export behavior. In a cross-sectoral setting, this paper takes the firm's export performance in goods as a central focus to study the effects of these different trade barriers through the exporting firm's choice of use of intermediate inputs. The results show that the most significant trade barriers on inputs that impede export performance in developing countries are mainly NTBs and restrictions of services.

1. Introduction

Which trade policy impediment on imported intermediate inputs constitutes a relatively greater burden on the export performance of developing countries? The contribution of both non-tariff and service barriers to the overall level of protection seems to become more important with increasing levels of development [World Trade Organization (WTO), 2012]. This suggests that tariffs would still persist to be a relatively more important obstacle for exporting firms in developing countries. Figure 1 indeed shows that developing countries often impose higher tariffs than richer countries. In today's world where also developing countries are becoming more and more struck by intermediate input trade because of their increased participation in global supply chains, a focus on tariffs is justifiable. Yet, it remains unclear what actually is the relative importance of intermediate input tariffs next to other forms of input trade obstacles such as non-tariff barriers (NTBs) or even trade restrictions in services—all of which are likely to affect a firm's exporting performance.

In this paper I therefore address this question by estimating which trade restrictive measure on inputs forms a marginally greater weight on the performance of exporting firms in developing countries. Generally, the importance of intermediate inputs for the domestic economy for developing countries has been confirmed in the empirical trade literature. Amiti and Konings (2007) for instance show that in Indonesia reducing intermediate input tariffs brings along significant positive productivity outcomes that stem from learning, variety and quality effects, which together are twice as large as reducing tariffs on mere output goods. This should ultimately also have an effect on the performance of those firms engaging in

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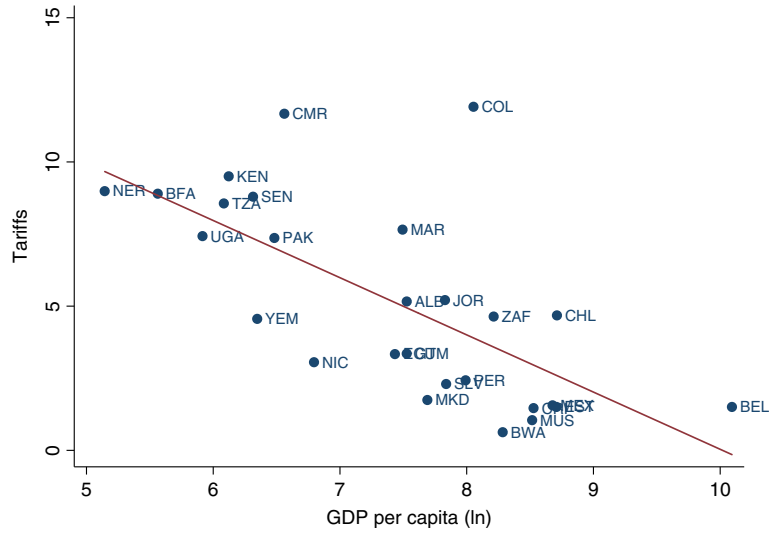

Figure 1. Tariffs in Developing Countries
Note*: Tariffs are the tariff-only OTRI from Kee et al. (2009) as used in regressions.*

exports, particularly because the recent trade literature on firms shows that more productive firms engage in exports. Moreover, abolishing or decreasing policy barriers on inputs reinforces simultaneously the performance of domestic firms stemming from external competition, which could further enhance the performance of firms, including those engaged in exports. In developing countries, however, not only tariffs but also non-tariff measures such as quotas, domestic support measures or regulatory barriers related to services are still very much prevalent, which have shown to distort trade for poor countries to a considerable extent. Yet, the empirical trade literature has paid relatively little attention to the actual marginal importance of each of these policy barriers regarding inputs across developing countries.

Prior work related to non-tariff measures is wide-ranging and mostly investigates each of these barriers independently. Hoekman et al. (2004) is an exception and researches the role of both tariffs, domestic support and export subsidies as a type of NTB for the agricultural sector only in developing countries. Specifically, they assess the relative impact of these barriers on exports, imports and welfare using a large sample of developing and various developed countries. They conclude that tariff reduction matters significantly more in terms of welfare gains.[1] More recent papers have tried to analyze the impact of NTB measures on trade in distinct ways. Using firm-level data, Chen et al. (2006) examine the role of standards on the firm's export performance in terms of export propensity and diversification and found that these are detrimental to exports in developing countries.[2] A paper by Arnold et al. (2016) shows the importance of liberalization of services as inputs that increase the performance of manufacturing firms in India. In this paper I collect data on all these types of barriers together and calculate the marginal extent to which they form an input obstacle for the performance of exporting firms in developing countries in terms of total trade values, the average export of a firm (i.e. intensive margin) as well as the number of firms exporting (i.e. extensive margin) for 2009.

This paper therefore contributes to the above-mentioned literature in the following ways. First, I take a cross-country approach using aggregated data at the industry level, which at its origin is based on firm-level data. This data is unique and recently available from the World Bank. It measures firms' export performance in mostly developing countries whereas the above-mentioned studies usually perform analysis based on firm-level data of one particular country. Second, I collect disaggregated data on a comprehensive list of policy variables together that encompasses all the aforementioned restrictiveness measures for developing countries. As a result, by taking these measures collectively I am able to assess the true relative marginal importance of each barrier for both the intensive and extensive margin of exports as well as for different types of exporters in developing countries, namely entrants, exiters and incumbent firms. Third, this paper uses these restrictions to analyze export performance through the intermediate inputs use of firms (aggregated by detailed industry across countries). By doing so, each trade barrier variable is transformed into an input-linkage (IL) index that measures the extent to which input barrier restrictions for each Harmonized System (HS) 6-digit industry affect the export performance of firms in developing countries. To measure this impact I carry out within-industry estimations in which the identification strategy relies on the assumption that HS 6-digit industries that are more reliant on inputs for their exports are on average more affected by these input-specific barriers. Furthermore, I separate this input reliance into three distinct sectors, namely for inputs of agriculture, manufacturing and services.

The main findings of the paper are that overall both input linkages related to NTBs in manufacturing inputs and restrictions on services as inputs are significantly restrictive compared with input tariffs although input tariffs still seem to play a significant role depending on the specification. These barriers on inputs mainly affect the performance of exporting firms in developing countries along the intensive margin in addition to having an impact on total export values. Moreover, the results also show that agricultural NTB input linkages seem to play an inhibiting role for exports at the extensive margin in the following year.

This paper proceeds as follows. In the next section prior related literature is discussed regarding the effects of particularly NTBs and service barriers on the performance of exports of firms. Section 3 specifies the data and estimation strategy that aims to identify the relative importance of each of these trade impediments as an input barriers to exporting performance in goods. Results of the econometric estimations are presented in section 4. The concluding section provides a summary and implications of the main results.

2. Related Literature

The literature on the effects of each trade barrier on firm-level export performance is extensive. However, the empirical literature that tries to estimate the relative importance of tariffs to some form of NTB or services policy is rather scarce, particularly for developing countries. Most quantitative studies analyze these trade barriers separately, such as Debaere and Mostashari (2010) regarding tariffs on the extensive margin of trade or Crozet and Koenig (2010) using a structural gravity form. Hoekman et al. (2004) is one exception that examines the marginal effect of both tariffs and NTBs in the agricultural sector such as domestic support and export subsidies for mostly developing countries. Their study shows that a tariff reduction in OECD economies matters significantly more in terms of welfare gains

for developing countries. They estimate that a reduction of 50% in tariffs rather than subsidies in agriculture generates a more significant impact on exports and welfare. Disdier et al. (2008) look at how sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) measures besides tariffs affect agricultural trade for the Organisation for Economic Co-operation and Development (OECD) countries. Their methodology also allows for direct comparison between tariffs and NTB measures since these latter barriers are calculated as *ad-valorem* equivalents.[3] Their results show that similarly both tariffs and NTBs significantly distort trade between developing and OECD countries. In a similar manner, a study close to this paper's line of research is by Hoekman and Nicita (2011), which finds that the relative importance of trade cost barriers are to be found in domestic regulatory or "behind-the-border" policies rather than traditional border barriers.

Works on NTB's are usually measured in a bilateral setting and only for import-competing industries. This means that barriers are measured as trade restrictive for the partner country that exports the same good as the country that imposes the NTB. An earlier work on NTBs using aggregate trade flows is Moenious (2004), which shows that country-specific standards are harmful for imports in the agricultural sector, but not for trade in manufacturing goods. Part of the reason why standards may increase trade for the partner country is that these standards provide information to exporters, which lowers costs to a greater extent than the cost of adapting the product to these new standards.[4] More recent works use firm-level data, such as Chen et al. (2006), which examines how meeting foreign standards affects firms' export performance in terms of export propensity and market diversification. The analysis draws on the World Bank Technical Barriers to Trade Survey database of 619 firms in 17 developing countries. The results indicate that technical regulations in industrial countries adversely affect firms' propensity to export in developing countries. Portugal et al. (2010) have a narrower look on how US firm-level trade in the electronics sector responds to European product standard harmonization. They find a positive net impact for these US firms that export to Europe suggesting that the information effect is greater than the cost effects of standards. Finally, Fontagné et al. (2015) find that SPS concerns that countries express at the WTO as a form of NTB barrier appear to have a negative effect on French exports at the extensive margin rather than at the intensive margin.[5] However, to date no analysis has been performed on how NTBs could also impact a firm's intermediate input use affecting the performance of exports. This paper tries to explicitly make that distinction for developing countries.

The trade literature on services makes the role of inputs of services more explicit. Theoretical foundations for the role of services and its connection to goods are developed by Francois (1990a,b). One aspect of the empirical services' literature documents the link between reform in services and goods trade such as Fink et al. (2005) who show that lower communication costs have a positive impact on trade in non-homogeneous goods. Most empirical analysis using firm-level data investigate the link between services as inputs and the productivity performance of manufacturing firms. Focusing on 10 sub-Saharan African countries, Arnold et al. (2008) show a positive relationship between total factor productivity (TFP) and access to communications, electricity and financial services using the World Bank Enterprise Surveys. A related work by Arnold et al. (2011) studies the impact of liberalization of services in terms of privatization, introducing competition and presence of foreign providers on domestic downstream manufacturing firms relying on inputs of services in the Czech Republic. Similarly, Arnold et al. (2016) establish this link of reform of

services and manufacturing TFP using firm-level information in India. They find that banking, telecommunications, insurance and transport reforms have contributed significantly to the productivity of domestic and foreign goods firms although the relationship tended to be more pronounced among foreign firms.

In relation to this, a notable strand of this literature studying the effect of trade liberalization on inputs on productivity is, for instance, Amiti and Konings (2007). Using firm-level data on Indonesia, the authors show that a decrease in input tariffs causes a gain in productivity for manufacturing plants that is at least twice as high as any increase resulting from tariffs on final goods. Most of the productivity gains from importing cheaper intermediate inputs channels through greater variety, learning and quality effects. Similarly, Goldberg et al. (2009) and Goldberg et al. (2010) assess that trade liberalization has increased access to new imported inputs in India and hence has increased the ability to produce new varieties (i.e. extensive product margin) by these Indian firms for the domestic market.

Finally, the emerging literature on export dynamics focuses on firm's export behavior with a number of works studying the specific effects of policy although without explicitly including the role of inputs.[6] Export patterns of Colombian firms were studied at a very detailed level by Eaton et al. (2007).[7] One conclusion of this work is that in a typical year almost half of the exporters are new, contribute relatively little to overall exports and exit the market in the following year. These conclusions are also largely found by Freund and Pierola (2010) in the case of Peru. All subsequent analysis confirm the concentration in exports of large productive firms exporting multiple products to a range of country destinations. As for the role of policy barriers in this literature, Eaton et al. (2008) use tariffs in their model to simulate market forces in case of an decrease in bilateral protection: whereas total sales of French firms increases, especially in the top-performers, lower-efficient firms see a drop in sales or exit the domestic market. Bernard et al. (2011) develop a model of multiple-product firms exporting to multiple destinations and empirically establish the fact that following the creation of the Canada–USA Free Trade Agreement (FTA) US firms experiencing higher tariff reductions were more induced to concentrate the range of goods production in their most successful products. A second important implication of their empirical strategy entails that higher variable costs proxied by distance and gross domestic product (GDP) lowers aggregate trade plus the extensive margin of trade, but not directly the intensive margin of trade in the USA.[8]

In this paper, I will combine these different sets of the trade literature as described above to study the relative impact of the different border barriers on intermediate inputs on the export performance of firms (aggregated by HS 6-digit industry) in mainly developing countries. In doing so, this paper will focus on an empirical strategy that makes use of a so-called industry-specific intermediate input structure to see how barriers on inputs impact export performance. As such this part will concentrate on the effect of input restrictions on downstream users rather than the direct result of barriers on import-competing firms.

3. Data and Empirical Strategy

To accomplish the empirical analysis, I use three types of information, namely cross-country industry data measuring firms' export performance based on firm-level data recently collected by the World Bank; various recently available cross-country sources of policy barriers on tariffs, NTBs and restrictions of services; plus

6-digit disaggregated information on an industry's dependence on the type of intermediate inputs.

Data

First, to measure export performance the empirical analysis employs the newly developed Exporter Dynamics Database constructed by the World Bank.[9] This database includes trade data for 45 countries of which most are developing economies. All data are based on export-level customs data that were provided as raw firm-level data. The data are primarily for the period between 2003 and 2010 and are initially recorded at HS 8-digit level, but aggregated to higher levels to make the data internationally comparable. Further cleaning and consolidation processes are applied to make the data operative. For instance, a single list of HS codes was developed so as to eliminate country-specific codes, particularly related to HS chapters 99 and 27. The database also takes stock of some of the revisions that have taken place over the years in the HS classifications such as those that have split or merged. Values are measured in US dollars at free on board (FOB) for almost all countries and are checked with aggregate data from the UN Commodity Trade Statistics Database (COMTRADE).

The data allow for different measures of trade such as aggregate exports, the export base (extensive margin) and the average export per firm (intensive margin), sorted by all exporting firms, firms that enter and exit the market, firms that have "survived" the market (survivors) and those that were already in the market (incumbents). Different sets of this data have been built: two sets of aggregated trade flows data, which are specific by country–year and country–destination–year, and three sets of country–year specific trade performance disaggregated by HS 2-digit, 4-digit and 6-digit industry classification. All sets include measures of firm, firm–product and firm–destination dynamics plus concentration and diversification indicators. For this paper, I use the firm–product level for each HS 6-digit industry.

The data on trade barriers are taken from Kee et al. (2009) and Borchert et al. (2012) for tariffs plus NTBs, and services, respectively. The first source of policy data estimates trade restrictiveness indices that are consistent with theory and provides measures that cover different forms of trade protection, i.e. tariffs and various NTBs. The reason why I can directly use their measure of overall trade restrictiveness is because the authors estimate *ad-valorem* equivalents at each tariff line level for all NTBs such as quotas, non-automatic licensing, anti-dumping duties, or technical regulations.[10] Through a meaningful aggregation procedure the authors calculate a theoretically consistent trade restrictiveness indicator that measures the extent to which a uniform tariff imposed by a typical country o, instead of its existing structure of tariff and non-tariff protection, would leave this country's aggregate imports unaffected. In this manner, their indicator covers both tariffs and non-tariff measures in an empirically meaningful way.

The second source of policy data measures trade restrictiveness barriers in services. This is a database recently developed by the World Bank and provides information on trade policy measures in five sectors of services, namely telecommunications, finance, transportation, retail and professional services. These service barriers are organized along the so-called modes of supply and measure restrictiveness on a scale from 0 (completely open) to 100 (completely closed).[11] The score assignments are done at detailed sub-sector level from which weights by mode, aggregated by sector and country, are applied.[12] A range of restrictions are

taken into account for each sector such as residency requirement and licensing for Mode 3 trade services, or restrictions on conditions of loans or deposits for trade in Mode 1 in financial services. Hence, this database makes public the applied level of trade barriers by country, sector and mode of delivery of each service sector covered. The advantage of using both trade barriers data sets is that the country coverage of the policy data match well with the information on firm exports dynamic for most developing countries.[13]

Moreover, the data from Kee et al. (2009) not only allow for a separation of tariffs and NTBs, but also sets out whether these barriers are prevailing in manufacturing or agriculture. This is interesting information as this sectoral split can be readily compared with the service sector in the regressions, which together broadly form the entire economy. The service trade restrictiveness index (STRI) is furthermore divided into its various modes of delivery and for our analysis we take Modes 1 and 3. The reason for doing so is that according to the literature on services these modes of delivery are the most conventional channels through which the service trade occurs.[14]

Last, although trade data in the Exporter Dynamics Database is collected for several years, the policy information is available only for one year. The data from Kee et al. (2009) has been recently updated for the year 2009. The STRI data is collected over a period of two years, namely 2008 and 2009. Hence, I take the year of 2009 for the export data and use this year as a cross-section. Appendix tables are available online from the publisher—see Supporting Information at the end of the paper for access details.

Empirical Strategy

My estimation methodology to analyze measures of input trade barriers on export dynamics is at detailed HS 6-digit industry level. This strategy only allows for a proper examination on the extent to which trade barriers on input sourcing are detrimental for the export performance of firms using an appropriate identification strategy.

The identification approach relies on the assumption that industries which are more reliant on a certain type of input, and which are restricted by the the aforementioned trade barriers, should be affected to a greater extent in terms of export performance. I therefore calculate each industry's dependency on inputs, or input coefficient, from agriculture, manufacturing and services separately by using information from the US I-O use table for 2002 retrieved from the Bureau of Economic Analysis (BEA). The advantage of using industry information from this US input use table is twofold. First, this table provides a very detailed HS concordance scheme with which I can re-organize each 6-digit I-O commodity code into an HS 10-digit level. Then, in a next step, I aggregate all information on inputs into the HS 6-digit classification using equal weights that match perfectly with the HS 6-digit Export Dynamics Database. Second, since I use the year 2002 rather than a year closer to our year of analysis (i.e. 2009) there is less need to be concerned about the influence of the export performance of a firm (or actual 6-digit industry) on the extent of input usage. A third advantage of using the US I-O use tables is that this information is exogenous: if I were to use national I-O tables, input choices would most likely be endogenous to input barriers, although this may vary from country to country. Admittedly, using only one country I-O input matrix implicitly assumes identical technologies across economies, even though varying by sector. It is true that rich countries are known

to have a markedly different economic structure than developing countries. Yet, collecting detailed I-O tables for all developing countries is challenging. Usually these are very aggregated input matrices (if at all) and are not necessarily internationally comparable. Moreover, aggregated I-O tables would also prevent me from making an exact correspondence between input sectors and the sectors covered under the STRI, which in aggregate tables are often summed up together with other service sectors and which would therefore give a very imprecise measure.[15]

Input reliance data are as said separated into agricultural, manufacturing and services for each 6-digit industry so that three different input coefficients are computed. This fits nicely with the policy data used in this paper that, as explained, also provides these three broad divisions. These input reliance measures form a so-called "weight" for the level of barriers prevalent in the three broad input sectors that an output industry faces. This is done through a multiplication process (i.e. input linkage) as explained below which forms my identification strategy. It means that, for instance, countries in which a particular 6-digit industry shows a greater dependency on services as part of its inputs structure will be more affected by higher trade restriction in services in terms of its export performance. This holds similarly if an industry were to be more reliant on agricultural and manufacturing inputs. The input coefficients are computed beforehand for each 6-digit industry with data from the BEA and then matched with the industries present in the Export Dynamics Database using the BEA's concordance scheme. In this process, only a share of 1.92 is not matched and will be dropped from our regressions owing to unreported sector codes in either data set. In the vast majority of our observations we can therefore neatly compute the input coefficients for almost all industries.

Across all industries that are left after matching I obtain an average input coefficient of 33.6% for manufacturing inputs, 24.2% for service inputs and 3.7% for agricultural inputs. One can see that these figures do not add up to 100%, which is due to personal services such as education, healthcare, arts and entertainment, which are left out. The reason for excluding these sectors is that they are often not provided at market prices. Moreover, various items such as compensation for employees, taxes on production and imports less subsidies, and gross operating surplus are also provided as an input item in the BEA's input matrix and which are also left apart. On average, together they form the remaining 38.5% that would make up of the total input use across all industries.[16]

However, one issue related to the service sector occurs in our data set. That is, the service restrictions from the World Bank's STRI do not cover the entire service sector taken up in our BEA sample. Therefore, I compute the input coefficient of only those sectors that are actually covered in the STRI as stated above. Doing so gives me a much lower service input coefficient of 4.2%.[17]

To complete the identification strategy, each of the three input coefficients from agriculture, manufacturing and services notated together with i, but computed separately for each industry, are interacted with their respective trade barriers. Computing this identification strategy results in three distinct input-linkage indexes (IL) that measure for each HS 6-digit industry k hence the following three separate IL indexes:

$$\mathrm{IL}_{ok}^{agri};\mathrm{IL}_{ok}^{man};\mathrm{IL}_{ok}^{serv}=\sum_{i}\Phi_{ki}\times TB_{oi}. \tag{1}$$

In equation (1), TB_{oi} refers to aforementioned trade barriers in input sector i, namely tariffs, NTBs in manufacturing and agriculture, and the STRI index in

services of country o. Note that subscript i must be seen as a vector that consist of three separate sectors for which IL is individually computed. As such, Φ_{ki} are also three separate input coefficients for agriculture, manufacturing or services, indicated together as sector i. Each of these sectors constitutes a share of all inputs used by industry k. Hence, each trade barrier in agriculture, manufacturing and services is weighted with its respective input coefficient. Note, therefore, that subscript i represents a summary notation for each of these three broad input sectors, although they are calculated for each of them separately and not summed up together. For example, when taking again industry NAICS 311700 as explained in note 16, three sets of IL_{ok} will be computed for this industry, namely IL_{ok}^{agri}, IL_{ok}^{man} and IL_{ok}^{serv}, as it faces three different barriers on its input use from agriculture, manufacturing and services. Hence, these barriers will be multiplied with the total use of each of these input sectors individually.[18]

Together these indexes allow me to analyze simultaneously the tariffs and non-tariff measures for both manufacturing and agriculture as well as services since they are computed, as said again, separately in equation (1). As explained in the previous paragraph, for each HS6-digit industry k the detailed I-O use tables are used to calculate the input reliance from the triple sectoral division. In other words, the input index is the multiplication of country-sectoral trade barriers and disaggregated industry input–output information. Hence, one should note that as a result of this interaction term the input-linkage index varies by country as well as by detailed HS 6-digit industry for agriculture, manufacturing and services separately. By using this index the baseline estimation will be as follows:

$$\ln(\mathrm{X}_{ok}) = \theta_1 \mathrm{IL}_{ok}^{agri} + \theta_2 \mathrm{IL}_{ok}^{man} + \theta_3 \mathrm{IL}_{ok}^{serv} + \theta_4 \mathrm{Tariffs}_{ok} + \delta_o + \sigma_k + \varepsilon_{ok} \tag{2}$$

where both $\ln(\mathrm{X}_{ok})$ and the slope parameters are estimated by country–sector at HS 6-digit level and stand for the different types of trade flows, namely, aggregate exports, the intensive margin of exports (i.e. average export of the firm) plus the extensive margin of exports (i.e. number of firms exporting). Equation (2) will be estimated in cross-section because of our policy data, which is provided for one year, but I will also apply a one-year lead on the dependent variable so that effectively a lag on the trade barrier data is constructed as an additional robustness check for the above-described endogeneity concern. Moreover, since import-competing industry concerns may also influence the input use of firms I correct the so-called within sector effects by including tariffs for each HS6-category as a control variable, which is the import weighted effectively applied tariff taken from WITS as this takes into account the preferences that are an increasingly important phenomenon in South–South trade. Last, δ_o and σ_k stand for the country and sector fixed effects, respectively, that correct for unobserved patterns of export dynamics in our data, and ε_{ok} is a standard error term clustered by country. For all regressions ordinary least squares (OLS) is used.

Finally, and as said, the policy data enables a split between various trade barriers for each sector so that:

$$\mathrm{IL}_{ok}^{man}; \mathrm{IL}_{ok}^{agri} = \{\mathrm{Tariffs}_{ok} + \mathrm{NTBs}_{ok}\} \tag{3}$$

and

$$IL_{ok}^{serv} = \{Mode1_{ok} + Mode3_{ok}\} \quad (4)$$

which will be used to re-estimate our baseline specification as part of the industry analysis.

4. Results

The results for baseline equation (1) are presented in Table 1. In this table the dependent variable is split into total trade values, $\ln(X_{ok})$; trade along the extensive margin, $\ln(NX_{ok})$; plus trade along the intensive margin, $\ln(MX_{ok})$. Since I use a cross-country data set the last two margins of trade represent the number of firms exporting and the average exports of a firm respectively, as explained before. The table furthermore divides the dependent variables of exporters into existing exporters, entrants and exiters.

For all three types of firms, manufacturing input barriers show a negative and in almost half of the cases a significant coefficient results. This is the case for the export value of exporters in column 1, and for all types of export performance in columns 4, 5 and 6. The results appear to be strongest for the total value of exports and exports at the intensive margin where the coefficients are significant at the 1% level. For instance, it implies that a 10% point increase of input linkages in manufacturing is associated with a lower mean export performance of firms across all industries by 0.4%. However, none of the outcomes on the agricultural input-linkage index are significant, which may be surprising with the fact that most developing countries are heavy exporters in this sector and would therefore be more reliant on agricultural inputs. Regarding the service input linkages, surprisingly, these are mostly positive but insignificant albeit in column (5) measuring the extensive margin of trade for entrants. Note that some of the insignificant coefficient results for input linkages in agriculture also have a positive sign.

The composition of barriers into the three different sectors may be too broad and could perhaps not successfully pick up the precise distortions on the input side. This seems to be the case as Table 2 shows more meaningful results when splitting up the input linkages into their different types of barriers, namely, tariffs and NTBs. In this table, the results on tariffs are insignificant in all cases (i.e. columns 1–9) for both manufacturing and agriculture. This means that variations in input tariffs do not explain significantly the export performance of those industries, which rely heavily on these input commodities. This is somewhat surprising as Figure 1 shows that tariffs in most developing countries are still relatively high. Yet, what seems to explain the effect of input cost frictions on export performance marginally better are NTBs, as can be seen in columns (1) to (6). This is particularly the case for entrants both when measured in total value of exports as well as when measured at the intensive margin (columns 4 and 6). By way of example, a 10% point increase of the manufacturing NTB input linkage is associated with a 0.4% decrease of the mean export value of entrants across each industry detailed. For existing exporters, however, the input linkages of manufacturing NTBs are also negatively significant for the export performance at the extensive margin, which, as column (2) points out as well, is also the case for NTBs on agricultural inputs. Finally, the service input-linkage variables are also split up into different policy environments: one related to restrictions of services in Mode 1 and a second one related to Mode 3. The results

Table 1. Exporters, Entrants and Exiters: Industry Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Exporters			*Entrants*			*Exiters*		
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:									
Manufacturing	−0.0445*	−0.0111	−0.0318	−0.0579***	−0.0155*	−0.0396***	−0.0228	−0.0105	−0.0111
	(0.0235)	(0.00717)	(0.0192)	(0.0185)	(0.00814)	(0.0123)	(0.0212)	(0.00838)	(0.0130)
Agriculture	0.00308	−0.0150	0.0140	−0.000461	−0.0156	0.0118	0.0139	−0.0135	0.0229
	(0.0367)	(0.0110)	(0.0277)	(0.0377)	(0.0149)	(0.0254)	(0.0345)	(0.0136)	(0.0234)
Services	0.0613	0.0992	0.00110	0.0110	0.135*	−0.0905	0.176	0.0906	0.123
	(0.161)	(0.0728)	(0.140)	(0.175)	(0.0752)	(0.124)	(0.166)	(0.0658)	(0.143)
Sectoral effects:									
Tariffs (w)	0.000355	0.00554**	−0.00384	0.000342	0.00557**	−0.00451	−0.00168	0.00509*	−0.00596
	(0.00614)	(0.00257)	(0.00467)	(0.00500)	(0.00249)	(0.00339)	(0.00655)	(0.00266)	(0.00479)
FE δ_o	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,319	49,929	38,319	35,798	43,950	35,798	35,910	44,074	35,910
R^2	0.346	0.462	0.314	0.273	0.434	0.253	0.262	0.437	0.235
RMSE	2.585	1.087	2.099	2.379	1.010	1.917	2.389	1.007	1.926

Notes: Robust standard errors clustered by country in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Table 2. Exporters, Entrants and Exiters: Industry Analysis and Policies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Exporters			*Entrants*			*Exiters*		
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:									
Tariffs man	−0.0511	0.00236	−0.0340	−0.0676	−0.0320	−0.0183	−0.114	−0.0397	−0.0667
	(0.0921)	(0.0377)	(0.0606)	(0.0837)	(0.0413)	(0.0480)	(0.0812)	(0.0373)	(0.0471)
Tariffs agri	0.0521	0.0408	0.0101	0.0375	0.0426	−0.00843	0.0746	0.0410	0.0246
	(0.0857)	(0.0312)	(0.0613)	(0.0588)	(0.0302)	(0.0387)	(0.0602)	(0.0281)	(0.0473)
NTBs man	−0.0390*	−0.0105*	−0.0291	−0.0513***	−0.0105*	−0.0404***	−0.00413	−0.00449	0.000149
	(0.0209)	(0.00599)	(0.0199)	(0.0172)	(0.00584)	(0.0138)	(0.0190)	(0.00547)	(0.0129)
NTBs agri	−0.0106	−0.0314*	0.0155	−0.0109	−0.0330	0.0179	−0.00414	−0.0304	0.0218
	(0.0605)	(0.0170)	(0.0451)	(0.0519)	(0.0195)	(0.0348)	(0.0430)	(0.0188)	(0.0276)
Services M1	−0.0693	−0.00834	−0.0741	−0.129***	−0.00416	−0.127***	−0.0770	0.0111	−0.0885**
	(0.0712)	(0.0224)	(0.0618)	(0.0451)	(0.0265)	(0.0324)	(0.0484)	(0.0269)	(0.0389)
Services M3	0.0302	0.0614	−0.000598	−0.0802	0.0859	−0.132*	0.0527	0.0500	0.0408
	(0.132)	(0.0564)	(0.115)	(0.118)	(0.0649)	(0.0721)	(0.106)	(0.0563)	(0.0938)
Sectoral effects:									
Tariffs (w)	0.000183	0.00520**	−0.00365	0.000264	0.00524**	−0.00423	−0.00184	0.00475*	−0.00573
	(0.00597)	(0.00244)	(0.00461)	(0.00483)	(0.00238)	(0.00333)	(0.00636)	(0.00254)	(0.00469)
FE δ_o	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,319	49,929	38,319	35,798	43,950	35,798	35,910	44,074	35,910
R^2	0.346	0.463	0.314	0.273	0.435	0.253	0.263	0.438	0.236
RMSE	2.585	1.087	2.098	2.378	1.009	1.916	2.388	1.006	1.926

Notes: Robust standard errors clustered by country in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

show particularly that the input-linkage variable of Mode 1 is negative and significant for the export performance of entrants. Again, this is most pronounced for exports measured in total value and for exports measured at the intensive margin as shown in columns (4) and (6). Note that the coefficient size more than triples for exports at the intensive margin whereas this more than doubles when measured in total values. Finally, regarding Mode 3 input linkages, these are also negatively yet slightly significant in the case of entrants' mean export performance (column 6).

These results tell us that (i) it is important to separate tariff barriers on inputs from non-tariff measures on inputs for NTBs as well for services, and that (b) within services, barriers applied on service inputs have different negative effects on firms' export performance depending on the mode of delivery, at least in developing countries. Together the significant effects of NTBs in manufacturing and barriers in services illustrate that in developing countries trade costs in these two sectors have an important impact on the export performance of industries when firms are much more reliant on the use of manufacturing and service inputs. This result manifests itself notably for entrants along the intensive margin. As such, this outcome is somewhat in contrast with previous work (i.e. Amiti and Konings, 2007; Goldberg et al., 2009, 2010) in the way that the focus of these papers is merely on (input) tariffs in which significant results are obtained. Here, I include NTBs and inputs and regulations on input services next to input tariffs and find that the former two factors have marginally more meaningful results. This result is in line with Arnold et al. (2016) in the sense that barriers on input services matter significantly while their variables of input and output tariffs, which are used as control variables, come out with an insignificant result.

A further result of the model specification is, surprisingly, the positive correlation between within-sector tariffs and export performance. Although this variable is only a control variable and not of main interest, it does pose the question of why. One potential explanation is that import-competing industries play a double-role by at the same time not only supplying foreign markets but also the domestic market. The positive and significant sign may reflect the result of lobbying efforts by these industries. Without these tariff barriers, exporting firms in developing countries would disappear as a result of competitive forces.

Controls and Endogeneity

Although fixed effects at the level for industries as well countries are applied, some concern may duly exist in our baseline regression about whether this strategy sufficiently controls for unobserved external influences and endogeneity. Endogeneity may arise for a variety of reasons, including omitted variable bias or reverse causality. Regarding the former type of endogeneity, including additional trade-related controls in the regressions may therefore be warranted. In this case, these control variables should vary at the level of "country–HS 6-digit sector" as time-invariant industry and country effects are in each case independently wiped out in the regressions. Finding controls outside the Exporter Dynamics Database at this disaggregated level of industry and for so many countries is a difficult task. It is possible, however, to include some control variables. In their seminal work on input tariff barriers in Indonesia, Amiti and Konings (2007) use the Herfindahl concentration index, being the sum of the squared market shares in each disaggregated sector, to account for any other influences on their dependent

variable of productivity. They also include one additional control in their baseline regressions, which is the exit of firms defined as a dummy equal to one if the Indonesian firm exited in a following year. Fortunately, the Exporter Dynamics Database provides similar variables in the sense that an export-based Herfindahl–Hirschman (HH) measure is provided together with the yearly exit rate of firms, which is calculated as the number of exiting firms in year t divided by the number of exporters in year $t - 1$. Both variables are included as controls in the regressions for all types of exporters of which the results are shown in Table 3. One can see that including them does not alter the results so that both the input linkages of manufacturing NTBs as well as the Mode 1 input linkages of services remain unaffected in terms of significance and coefficient size. The firm exit rate variable has mixed results as it shows positive as well as negative significant signs as an outcome result. In most instances and in particular for exporters this variable remains negative, but flips around for entrants and exiters. The Herfindahl index shows in most cases a negative and significant coefficient result indicating that on average higher concentration levels for export shares correlates with lower export performance.[19]

The results have been repeated by replacing the Herfindahl index with a variable measuring the share of the top 5% of exporters in total exported value that is also given in the Exporter Dynamics Database. The results are shown in Table 4. Interestingly, although most variables that were significant in Table 3 also remain significant with the right coefficient sign in Table 4, some other variables become negatively significant in addition, in particular, input linkages on manufacturing tariffs for all entries, plus the input linkages for barriers of Mode 3 services. The former makes sense and is in line with previous research papers that assess the productivity results from tariff liberalization on the input side such as Amiti and Konings (2007) and Goldberg et al. (2009, 2010). The latter findings are new and show that barriers on input services related to foreign presence (i.e. Mode 3) are as burdensome, if not more so, for the export performance of firms (or industries) at the intensive margin. For instance, a 10 percentage point increase in the input linkages of Mode 3 service barriers is associated with a 4.5% loss in firms' mean export value for all exporters (column 3), 4.7% for entrants (column 6) and finally 2.5% for exiters (column 9). The top 5% concentration index itself has a positive and significant coefficient in almost all columns meaning that exporters belonging to this category have on average a better export performance. This resonates with the recent theoretical and empirical trade literature on firm-level trade in a manner that shows that these firms are often bigger, more productive and therefore share a so-called export premium (Melitz, 2003; Eaton and Kortum, 2002; Eaton et al., 2008; Eaton et al., 2007). One should note, however, that the number of observations drops by approximately one-third, which indicates substantial selection bias.

However, adding these control variables will not yet solve the issue of reverse causality. I also try to tackle this issue as much as possible in addition to having already used an I-O table, which lies a long way ahead of the actual year of analysis, i.e. 2009. Since the Exporter Dynamics Database shows export performance until 2010, I can use this latest year as an additional robustness check to control for any further potential reverse causality. Simultaneously, one can check for some (short) dynamic implications stemming from the various barriers on inputs on export performance. Table 5 repeats the results for Table 3 and shows that indeed some important differences occur. Although the top 5% of firms as a

Table 3. Exporters, Entrants and Exiters: Industry Analysis and Controls incl. HH

	(1) Exporters	(2)	(3)	(4) Entrants	(5)	(6)	(7) Exiters	(8)	(9)
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:									
Tariffs man	−0.0867	−0.0293	−0.0574	−0.0874	−0.0536	−0.0339	−0.122	−0.0504	−0.0681
	(0.0939)	(0.0319)	(0.0652)	(0.0730)	(0.0398)	(0.0429)	(0.0766)	(0.0404)	(0.0485)
Tariffs agri	0.0613	0.0384*	0.0229	0.0247	0.0383*	−0.0136	0.0586	0.0478**	0.00936
	(0.0718)	(0.0212)	(0.0575)	(0.0457)	(0.0215)	(0.0337)	(0.0513)	(0.0206)	(0.0436)
NTBs man	−0.0420**	−0.00829*	−0.0337*	−0.0478***	−0.0110*	−0.0367**	−0.0183	−0.00596	−0.0101
	(0.0185)	(0.00445)	(0.0171)	(0.0168)	(0.00629)	(0.0153)	(0.0172)	(0.00702)	(0.0134)
NTBs agri	−0.00140	−0.0214	0.0200	−0.00404	−0.0276	0.0236	−0.000917	−0.0257	0.0236
	(0.0530)	(0.0138)	(0.0425)	(0.0449)	(0.0167)	(0.0322)	(0.0424)	(0.0176)	(0.0291)
Services M1	−0.106	−0.00415	−0.102	−0.133***	−0.00849	−0.125***	−0.0716	0.0202	−0.0889**
	(0.0797)	(0.0228)	(0.0655)	(0.0386)	(0.0272)	(0.0317)	(0.0512)	(0.0279)	(0.0417)
Services M3	−0.0719	0.0105	−0.0824	−0.0896	0.0196	−0.109	−0.00573	−0.0301	0.0144
	(0.138)	(0.0517)	(0.106)	(0.0849)	(0.0576)	(0.0754)	(0.120)	(0.0583)	(0.0960)
Sectoral effects:									
Tariffs (w)	0.000605	0.00298*	−0.00237	6.38e-05	0.00401**	−0.00394	−0.00442	0.00373	−0.00735
	(0.00616)	(0.00165)	(0.00497)	(0.00431)	(0.00180)	(0.00327)	(0.00638)	(0.00224)	(0.00499)
Controls:									
Firm exit rate	−3.053***	−0.479***	−2.573***	0.0126	0.294**	−0.281***	1.211***	0.572***	0.107
	(0.257)	(0.118)	(0.168)	(0.153)	(0.105)	(0.0919)	(0.223)	(0.142)	(0.110)
HH index	−1.069***	−2.245***	1.176***	−3.535***	−2.155***	−1.380***	−2.951***	−1.929***	−1.034***
	(0.243)	(0.119)	(0.177)	(0.204)	(0.123)	(0.155)	(0.221)	(0.134)	(0.139)
FE δ_o	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,142	35,142	35,142	34,084	34,084	34,084	31,074	32,675	31,074
R^2	0.409	0.616	0.389	0.367	0.569	0.278	0.329	0.521	0.257
RMSE	2.445	0.815	1.979	2.221	0.844	1.878	2.262	0.919	1.871

Notes: Robust standard errors clustered by country in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Table 4. Exporters, Entrants and Exiters: Industry Analysis and Controls including Top 5

	(1) Exporters	(2)	(3)	(4) Entrants	(5)	(6)	(7) Exiters	(8)	(9)
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:									
Tariffs man	−0.442***	−0.129**	−0.313***	−0.355**	−0.137**	−0.217**	−0.349**	−0.138**	−0.211**
	(0.154)	(0.0574)	(0.107)	(0.148)	(0.0630)	(0.0940)	(0.145)	(0.0623)	(0.0969)
Tariffs agri	−0.0242	0.0165	−0.0407	−0.0696	0.0258	−0.0953*	−0.0244	0.0219	−0.0463
	(0.0706)	(0.0221)	(0.0519)	(0.0821)	(0.0307)	(0.0534)	(0.0869)	(0.0306)	(0.0588)
NTBs man	−0.125***	−0.0301	−0.0945***	−0.121*	−0.0355	−0.0853**	−0.0663	−0.0394	−0.0269
	(0.0411)	(0.0216)	(0.0266)	(0.0596)	(0.0255)	(0.0362)	(0.0453)	(0.0249)	(0.0256)
NTBs agri	0.0516	0.00813	0.0435	0.0186	−0.0111	0.0297	0.0369	−0.00554	0.0425
	(0.0585)	(0.0127)	(0.0483)	(0.0578)	(0.0136)	(0.0458)	(0.0524)	(0.0137)	(0.0404)
Services M1	−0.109	0.0612	−0.170*	−0.112	0.0684	−0.180***	−0.00338	0.0889**	−0.0923
	(0.0998)	(0.0383)	(0.0925)	(0.0800)	(0.0414)	(0.0563)	(0.0914)	(0.0426)	(0.0714)
Services M3	−0.328	0.123	−0.451***	−0.326*	0.144	−0.471***	−0.130	0.124	−0.254**
	(0.199)	(0.0848)	(0.146)	(0.170)	(0.0943)	(0.116)	(0.190)	(0.0877)	(0.120)
Sectoral effects:									
Tariffs (w)	−0.0159***	−0.00173	−0.0142**	−0.00990*	−0.000118	−0.00979*	−0.0191***	−0.00300**	−0.0161**
	(0.00556)	(0.00160)	(0.00547)	(0.00558)	(0.00160)	(0.00521)	(0.00626)	(0.00143)	(0.00633)
Controls:									
Firm exit rate	−5.769***	−1.574***	−4.195***	−2.346***	−0.271	−2.076***	−0.467	0.693**	−1.160*
	(0.609)	(0.312)	(0.666)	(0.436)	(0.315)	(0.489)	(0.719)	(0.327)	(0.625)
Top 5%	4.698***	1.509***	3.189***	1.763***	1.536***	0.227	1.807***	1.551***	0.256
	(0.354)	(0.147)	(0.225)	(0.314)	(0.148)	(0.202)	(0.342)	(0.144)	(0.219)
FE δ_o	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,650	10,650	10,650	10,614	10,614	10,614	10,575	10,575	10,575
R^2	0.544	0.470	0.575	0.287	0.550	0.393	0.255	0.546	0.327
RMSE	1.648	0.736	1.426	1.698	0.740	1.416	1.812	0.792	1.471

Notes: Robust standard errors clustered by country in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Table 5. Exporters, Entrants and Exiters: Industry Analysis and 2010

	(1) Exporters	(2)	(3)	(4) Entrants	(5)	(6)	(7) Exiters	(8)	(9)
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:									
Tariffs man	−0.463*	−0.0890*	−0.374**	−0.191	−0.0848	−0.106	−0.277**	−0.111**	−0.163*
	(0.209)	(0.0488)	(0.166)	(0.145)	(0.0622)	(0.102)	(0.0948)	(0.0492)	(0.0799)
Tariffs agri	−0.135	0.0168	−0.152	−0.0236	0.0438	−0.0674	−0.129	0.00913	−0.134*
	(0.127)	(0.0245)	(0.105)	(0.0862)	(0.0366)	(0.0644)	(0.105)	(0.0466)	(0.0634)
NTBs man	0.00979	−0.00923	0.0190	−0.0204	−0.0128	−0.00761	0.0130	−0.0327*	0.0366
	(0.0488)	(0.0113)	(0.0405)	(0.0324)	(0.0132)	(0.0269)	(0.0399)	(0.0162)	(0.0307)
NTBs agri	0.0414	−0.0303**	0.0718	−0.00898	−0.0414**	0.0325	0.0281	−0.0536**	0.0683**
	(0.0598)	(0.00989)	(0.0518)	(0.0449)	(0.0135)	(0.0363)	(0.0447)	(0.0186)	(0.0291)
Services M1	−0.0806	0.00990	−0.0905**	−0.0627	0.0258	−0.0884	−0.0444	0.0363	−0.0890*
	(0.0571)	(0.0295)	(0.0337)	(0.0468)	(0.0408)	(0.0494)	(0.0542)	(0.0446)	(0.0427)
Services M3	−0.0749	0.0361	−0.111	−0.0553	0.0599	−0.115	0.141	0.0117	0.120
	(0.123)	(0.0385)	(0.118)	(0.0977)	(0.0502)	(0.110)	(0.161)	(0.0455)	(0.149)
Sectoral effects:									
Tariffs (w)	0.0172***	0.00430*	0.0129***	0.0110***	0.00456*	0.00648**	0.00838*	0.00734**	0.00253
	(0.00507)	(0.00229)	(0.00366)	(0.00312)	(0.00240)	(0.00227)	(0.00411)	(0.00319)	(0.00262)
Controls:									
Firm exit rate	−2.937***	−0.452**	−2.485***	−0.0128	0.338*	−0.351*	1.337***	0.655**	0.0971
	(0.333)	(0.166)	(0.264)	(0.196)	(0.160)	(0.161)	(0.252)	(0.249)	(0.301)
HH index	−1.377**	−2.260***	0.883***	−3.349***	−2.148***	−1.202***	−3.084***	−1.953***	−1.183***
	(0.454)	(0.194)	(0.269)	(0.408)	(0.194)	(0.241)	(0.371)	(0.207)	(0.205)
FE δo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE σk	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,458	14,458	14,458	14,017	14,017	14,017	12,688	13,541	12,688
R^2	0.511	0.638	0.472	0.427	0.534	0.362	0.396	0.471	0.348
RMSE	2.367	0.768	1.914	2.176	0.797	1.851	2.182	0.886	1.817

Notes: Robust standard errors clustered by country in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

control variable perhaps relates better to the empirical firm literature as opposed to the Herdinahl index of export share concentration, we nonetheless replicate Table 3 for the year 2010 as this provides us with substantially more observations and so could potentially avoid any selection bias.[20] Table 5 shows that the effects of the input linkages on manufacturing NTBs lose their significance whereas the ones for agricultural NTBs become significant for the extensive margins of all three types of exporters. Similarly, in Table 5 input linkages on manufacturing tariffs are also significant for the extensive margin for exporters (column 2) and exiters (column 8).

I also regress information on export of incumbents on trade barriers. The results of this exercise are presented in Table 6 and show that no significant effect for most coefficients is found except for input linkages on manufacturing NTBs for both the total value of exports and the intensive margin, but again not for the extensive margin of exports.[21] This result appears to echo the results found in Table 3 insofar as manufacturing input NTBs are harmful for the export performance of exporters and entrants. Furthermore, when including the year 2010 instead of 2009 for the dependent variable in this specification, again the same

Table 6. Incumbents

	(1) Incumbants	*(2)*	*(3)*
	$ln(X)_{ok}$	$ln(NX)_{ok}$	$ln(MX)_{ok}$
Input linkages:			
Tariffs man	−0.124	−0.0382	−0.0860
	(0.111)	(0.0325)	(0.0806)
Tariffs agri	0.0562	0.0302	0.0260
	(0.0957)	(0.0260)	(0.0752)
NTBs man	−0.0686**	−0.00976	−0.0588**
	(0.0282)	(0.00578)	(0.0236)
NTBs agri	−0.000750	−0.0192	0.0184
	(0.0584)	(0.0132)	(0.0472)
Services M1	−0.111	0.0138	−0.125
	(0.107)	(0.0223)	(0.0900)
Services M3	−0.117	−0.00154	−0.115
	(0.194)	(0.0513)	(0.157)
Sectoral effects:			
Tariffs (w)	0.00246	0.00192	0.000544
	(0.00795)	(0.00183)	(0.00655)
Controls:			
Firm exit rate	−2.808***	−1.083***	−1.725***
	(0.359)	(0.196)	(0.200)
HH index	−1.025***	−2.115***	1.090***
	(0.269)	(0.138)	(0.204)
FE δ_o	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes
Observations	29,773	29,773	29,773
R^2	0.336	0.561	0.290
RMSE	2.938	0.917	2.399

Notes: Robust standard errors clustered by country in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

results occur as in Table 5 so that input linkages on manufacturing tariffs become significant, also for export performance at the extensive margin. When including the top 5% of firms as a control variable instead of the Herdindahl index, input linkages on both manufacturing NTBs and manufacturing tariffs, including at the extensive margin, become significant again as in Table 4. This pattern remains even if I take the year 2010.[22]

Therefore, apart from the results in Table 5, NTBs in manufacturing inputs remain throughout as a significant factor in explaining exporter dynamics. In Table 5 the significance of this policy variable is lost and switches signs in some entries, albeit staying insignificant. This difference in results stems from the later year chosen and could point out to the fact that no inter-temporal effects (i.e. dynamics) are present and only static effects can be captured.

Other Dynamics

The Exporter Dynamics Database also allows for further analysis on other forms of export performance such as by firm and destination in addition to export. I therefore use data on the firm's entry and exit rates, plus the share of entrants that enters the market as dependent variables. The latter variable is calculated as the share of exports in total export value. Previous papers such as Roberts and Tybout (1997) and Das et al. (2007) found that exporting firms face substantial entry costs, which are fixed sunk costs that determine entry rates. The aim here is to examine how trade barriers as part of the variable costs structure of the firm react to entry rate and shares, as well as exit rate, which could perhaps modestly be interpreted as firm dynamics as opposed to export performance. Since I interpret these as dynamics I use 2010 for these three dependent variables. Table 7 presents the results. Column 1 shows that input linkages on agricultural NTBs are the main obstacles that affect the firm entry rate in developing countries whereas the coefficients on input tariffs and restrictions of services are insignificant. Similarly, both share of entrants and firm exit rate in columns (2) and (3) respectively are also in large part determined by input NTBs in agriculture. Moreover, as for the firm exit rate, input linkages on manufacturing NTBs are also a significant factor. This outcome is consistent with Table 5 to the degree that these trade barriers on input use are important determinants for entrants and exiters when taking year 2010 for the export performance at the extensive margin. Hence, besides influencing export performance, NTBs on agricultural inputs are also a significant factor in explaining how firms themselves behave. Note that the relative magnitude of the coefficients also point out the particular weight of NTBs. In addition, in this specification the control variable for within-sector tariffs is negative and highly significant.

Finally, I am able to analyze a third type of dynamics, namely that of export destinations of incumbents.[23] In Table 8 the results of this exercise show that the coefficients on NTBs in agriculture have a significant negative impact on the mean destination entry rate (column 1) and the share of new destinations expressed in total export value (column 2). In other words, the results suggest that established firms in developing countries appear to be significantly affected by NTBs on agricultural inputs to enter into additional markets. This is inconsistent compared with the results obtained from these incumbents' export behavior in Table 6 as their NTBs on manufacturing inputs are significantly affected, but not in agriculture. As such, these agricultural input NTBs are not affecting incumbents in

Table 7. Firm Dynamics

	(1)	*(2)*	*(3)*
	Entrants		
	Firm entry rate	*Share of entrants*	*Exiters Firm exit rate*
Input linkages:			
Tariffs man	0.00965	0.0518	0.0164
	(0.0104)	(0.0500)	(0.0154)
Tariffs agri	0.0145	0.0465	−0.00130
	(0.0222)	(0.0542)	(0.0327)
NTBs man	−0.00287	−0.0274	−0.0127**
	(0.00253)	(0.0236)	(0.00524)
NTBs agri	−0.0192***	−0.0473*	−0.0248**
	(0.00566)	(0.0239)	(0.00930)
Services M1	0.00218	0.00950	0.00328
	(0.00725)	(0.0271)	(0.0115)
Services M3	−0.00168	0.0214	−0.0118
	(0.0145)	(0.0442)	(0.0196)
Sectoral effects:			
Tariffs (w)	−0.00137	−0.0161***	−0.00302**
	(0.000829)	(0.00348)	(0.00111)
Controls:			
Firm exit rate	0.942***	3.243***	
	(0.0566)	(0.168)	
HH index	0.0858***	−1.947***	
	(0.0234)	(0.153)	
FE δ_o	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes
Observations	14,017	14,017	18,989
R^2	0.627	0.368	0.406
RMSE	0.285	1.615	0.369

Notes: Robust standard errors clustered by country in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

poor countries in terms of sheer exports (as shown in Table 6), but they do tend to play a significant role in reaching new markets for incumbents. It therefore seems to impact the incumbents' ability to diversify their exports to different destinations. However, there is still room for other factors that could explain firm and destination dynamics since both tables have a relatively low R^2.

5. Conclusion and Policy Implications

Reducing trade policy barriers in developing countries has traditionally centered around border barriers such as tariffs. Since tariffs in both agriculture and manufacturing are still substantially high for less-developed countries, such a focus is from a policy vantage point unsurprising. At the same time, although the trade field is moving away more and more from this focal point on tariffs, this shift appears to become particularly imperative for countries with higher levels of development. Yet, the trade literature increasingly recognizes that non-tariff measures such as NTBs in agriculture and service trade barriers also contribute to a

Table 8. Destination Dynamics

	(1) Incumbants	*(2)*	*(3)*
	Dest entry rate	*Share new dest*	*Dest exit rate*
Input linkages:			
Tariffs man	0.0344*	0.0666**	0.0480
	(0.0176)	(0.0281)	(0.0306)
Tariffs agri	0.0416	0.0756	0.0219
	(0.0521)	(0.0687)	(0.0461)
NTBs man	0.00190	0.00584	−0.00671
	(0.00936)	(0.0227)	(0.0119)
NTBs agri	−0.0301*	−0.0662**	−0.0246*
	(0.0154)	(0.0224)	(0.0115)
Services M1	0.00545	0.0288	0.0108
	(0.0181)	(0.0269)	(0.0143)
Services M3	−0.0536	−0.0746	−0.0649
	(0.0372)	(0.0463)	(0.0394)
Sectoral effects:			
Tariffs (w)	−0.00699***	−0.0105**	−0.00828***
	(0.00220)	(0.00382)	(0.00209)
Controls:			
Firm exit rate	0.560***	1.016***	0.641***
	(0.0755)	(0.126)	(0.0706)
HH index	0.483***	−0.0778	0.492***
	(0.0899)	(0.104)	(0.114)
FE δ_o	Yes	Yes	Yes
FE σ_k	Yes	Yes	Yes
Observations	8,198	8,198	8,118
R^2	0.145	0.076	0.164
RMSE	0.625	1.268	0.627

Notes: Robust standard errors in parenthesis. ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

significant extent to the development of low-income countries. Using aggregated cross-country firm-level data for each HS 6-digit sector for mainly developing countries, I have tried to contribute to this process by looking into how these trade barriers impact export performance. Particularly, I provide a first attempt to estimate the marginal relative importance of all these barriers for the input use of developing countries.

The results of this paper demonstrate that at least one robust impact of both input NTBs in manufacturing and input barriers of Mode 1 services on the intensive margin of trade for mainly entrants in developing countries. Other results on input linkages on manufacturing tariffs and Mode 3 services depends on the type of controls used. I have furthermore shown that when taking into account year differences so that an input barrier affects export performance in the following year, input linkages of agricultural NTBs become important at the extensive margin of exports for entrants as well as exiters although input linkages on manufacturing tariffs in such a case still have a greater impact at the extensive margin in terms of coefficient size. Finally, when looking at incumbents, I have found that input linkages on manufacturing NTBs also play an explanatory role for export

performance, again at the intensive margin. However, input linkages on agricultural NTBs affect incumbents in reaching new markets. Overall, these results point to the fact that when analyzing the economic effects of the liberalization of inputs, the focus on tariffs may be too narrow as can be seen in previous works. This conclusion does not imply that input tariffs are therefore unimportant. On the contrary, for tariff liberalizations are often accompanied by a moderation of non-tariff measures, including services, and so a broader scope of policy barriers affecting the imports of inputs may be useful in future empirical work when assessing their economic impact.

The theoretical trade literature states that additional new gains from trade can be reached through the aggregation process of productivity gains after exposure to trade as analyzed by Melitz (2003). As for reducing barriers to input use affecting exports of firms, this paper shows mainly that entrants and exiters of an export market are included in this process. Heterogeneous firm models precisely predict that additional trade gains can be reached in this dynamic area. The trade literature further suggests that entrants contribute substantially to a country's export expansion over time once it has survived the export market over a longer period (e.g. Eaton et al., 2007). Unfortunately, data limitations prevent me from analyzing those particular trade barriers that are important for surviving an export market. However, the results of my analysis do show that in any event entering an export market can in large part be explained by non-tariff measures on inputs such as NTBs and restrictions of services in addition to tariffs. A final set of the theoretical and empirical trade literature emphasizes the importance of the extensive margin of trade in reaching welfare gains such as Chaney (2008) and Broda and Weinstein (2006). Agricultural input barriers in the form of NTBs as outlined in this paper have mainly a significant impact on precisely this margin of trade for developing countries.

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Notes

1. One of the main reasons for their result is that these positive welfare effects would come from both tariff peaks in OECD countries and high tariffs in developing countries in industries subject to domestic support and export subsidies.
2. Other works such as Portugal et al. (2010) and Shepherd (2007) use trade data to measure the effects on harmonization of standards in specific sectors such as the electronic sector.
3. Note that they also have information on specific duties, tariff quotas and anti-dumping measures that are calculated on an *ad-valorem* basis at detailed sector levels for OECD countries.
4. Other earlier work on the effects of standards on trade using aggregate data is Swann et al. (1996), which finds a positive relationship for UK imports. Czubala et al. (2009) and Baller (2007) look at the trade effects of international standard harmonization or regional mutual recognition agreements using detailed bilateral data.
5. Using information on WTO members' notifications of SPS and TBT measures Disdier et al. (2008) find a negative effect on OECD imports.
6. Note that owing to the cross-sectional nature of this paper's empirical analysis I do not use the term "dynamics," but make use of the term performance instead. The term dynamics would be more applicable if multiple years are included in the analysis to see firms' behavior over time.
7. Other seminal work on exporting dynamics focusing on developed countries, such as the USA or France, are Bernard et al. (2007, 2011) and Eaton et al. (2008). These works also take stock of the number of products each firm export varying over a range of country destinations.
8. This latter result was also emphasized in Bernard et al. (2007).
9. See Cebeci et al. (2012) for further details.
10. This database also corrects for specific duties when calculating *ad-valorem* equivalents for tariffs. Traditional indexes such as average tariffs or NTM frequency ratios are less applicable since they do not allow for variation of the price–demand elasticities among different products.
11. The services trade encompasses four modes of supply, i.e. cross-border services trade (Mode 1); movement of consumers such as tourism (Mode 2); sales by foreign affiliates with a local presence (Mode 3) and finally movement of people to provide the services (Mode 4).
12. Additional scores are assigned for countries for intermediate openness, i.e. "virtually open but with minor restrictions" (25); "major restrictions" (50); and "virtually closed with limited opportunities to enter the market and operate" (75).
13. Therefore, the World Bank's database is preferable to the OECD's database on restrictions of services as the latter only covers developed and various emerging economies, which would miss out developing economies.
14. One estimate by Magdeleine and Maurer (2008) is that 25–30% takes place through Mode 1; 10–15% through Mode 2; 55–60% through Mode 3, and finally less than 5% through Mode 4. Note that Mode 2 is not covered by the World Bank's STRI.
15. However, one strand of the empirical trade literature only makes use of US I–O tables in the case of cross-country analysis with industry and country interaction terms using both

industry and year fixed effects as the latter should account for some of these time-invariant technology differences. See for instance Levchenko (2007).
16. To give an example, if we take industry NAICS 311700 (i.e. Seafood product preparation and packaging) the input coefficients from agriculture, manufacturing and services are respectively 45.6%, 8.3% and 27.9%. The other two items of personal services take up a share of 1.5% with the remainder of 16.7% providing compensation for employees, etc.
17. The main reason why this percentage input reliance is so low compared with the 33.6% of total service inputs use is because the BEA defines sectors at the very disaggregated 6-digit level, which provides more than 400 different sector codes, of which only 14 input codes fall into the categories of service sectors covered by the STRI. The correspondence is as follows: retail services matches with BEA I-O code 4A0000; transportation with 481000, 482000, 483000 and 484000; telecommunications with 517000; finance with 52A000, 522A00, 523000, 524100, 524200 and 525000; and finally, professional services with 54100 and 541200. Furthermore, business services are generally a large part of the services' input set of firms and therefore HS 6-digit industries in our data, but the STRI only includes two professional services, which actually constitute only a small part of the entire business services sector.
18. Alternatively, one could have presented three different IL linkages for each input sector separately using for instance subscript *man* for manufacturing, *agri* for agriculture and *serv* for services as in equation (2).
19. Note that in Amiti and Konings (2007) the Herdindahl index had also a negative but insignificant coefficient outcome with productivity as a dependent variable.
20. However, results remain more or less the same and can be obtained upon request.
21. The insufficient amount of observations for survivors prevents me from performing any regressions in this category of exporters.
22. Results of the latter robustness checks can be obtained upon request.
23. Data in the Export Dynamics Database is only available for incumbents and survivors for an analysis on destination dynamics. Note that owing to the insufficient amount of data points for survivors I am unable to perform analysis on this group of exporters.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table A1. Country coverage
Table A2. Summary statistics
Table A3. Correlation table: Input linkages
Table A4. Correlation table: Trade barriers