Trade Frictions and Market Access of Developing Countries: A Product-Level Empirical Investigation

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Abstract

This paper examines the effects of trade frictions on export market access at the product level and the role these frictions have on the ability of developing countries to access world markets. We find distance and trade frictions are determinants of the probability of success in entering foreign markets. We examine whether there are any systematic biases from these frictions that further limit market access for exporters from developing countries. Our results suggest that developing countries are not differentially impacted by these factors.

Keywords: Trade Frictions, Market Access, Extensive Margin, Economic Development
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1 Introduction

One of the persistent features of international trade patterns is the predominance of industrialized countries in international trade. Industrialized countries, as a group, are responsible for a large majority of world exports and represent principal markets for world imports. Indeed, well over half of all world trade is accounted for by trade among developed economy countries. To illustrate this point, Figure 1 provides detail on world market shares for developed countries (North) and developing countries (South) over the years 1980-2005. As shown in the figure, North-North trade has consistently accounted for well more than half of all world commerce, although this share has been falling in recent years due, in particular, to the rise of China as a leading world exporter.[1]

The low participation of developing countries in international trade has been studied for some time. Over twenty five years ago Markusen and Wigle (1990, hereafter MW) reported findings from an empirical study aimed at understanding why trade between South and North accounts for such a small share of trade. They focused on two particular explanations for existing trade patterns, differences in protection levels in the North and South and differences in the sizes of Northern and Southern economies. They worked with a computational general equilibrium (CGE) model that allowed them to consider the impact of several hypothetical experiments. In the first, estimates from their model showed that trade would double between North and South if all tariff and non-tariff barriers to trade were eliminated.[2] In the second they considered the impact of expanding resources in the South so that the Southern economies would have roughly the same purchasing power as Northern economies. In that case, their model predicted that South-South and North-South trade would both more than double.

More recently a variety of studies, mostly using gravity equations to explain trade at the aggregate level, have focused on effects of trade frictions on the extensive and intensive margins of export (e.g., Helpman, Melitz, and Rubinstein (2008, hereafter HMR)). That paper argues that the volume of exports at the intensive margin, especially from developing countries depends crucially on productivity changes at the firm level that enable more firms to enter the export market. One issue that has received very little attention in the literature is whether the effects of market ac-

[1] Husted and Nishioka (2013) document the growth of Chinese exports and show that it has largely come at the cost of reductions in export market shares of the United States, Japan, and several EU countries.

[2] Recent studies that examined non-tariff barriers include Kee et al. (2009). While their paper focuses on the measurement issues of trade barriers, we examine the role of trade frictions on the number of trade partners for each exporter country.

cess barriers, as observed in the data, are different for exporters from developing versus developed countries accessing the same destination market. In a recent paper, Waugh (2010) argues that to reconcile bilateral export and price data across countries, trade frictions for developing countries must be systematically different from developed countries, with developing countries facing higher frictions than developed countries.

In this paper, we study a question related to the low participation of developing countries in international trade, the role that various trade frictions play in prohibiting exporters from these countries to enter new foreign markets. Studies that use gravity equations necessarily focus on the volume of trade. Whether or not developing countries can overcome the hurdles to enter foreign markets is a necessary precondition for trade to take place. Over the years, multilateral trade talks at the World Trade Organization (WTO) have focused on reducing government imposed barriers to market access. But even as barriers have been reduced, developing country participation in trade continues to languish. In this paper, we study the extensive margins of exports for a broad set of countries and goods. Our focus is on identifying those factors that enable or hinder the expansion of new markets, and we study, in particular, whether those factors have differential impacts on exporters located in developing economies. In our empirical analysis we consider both tariffs as well as a variety of measures that proxy for various types of trade costs. The fact that we use bilateral product level data in our analysis is one of the innovations of this paper and serves as a justification for studying the market access question at the product level. To our knowledge, this paper is the first to look at a broad set of frictions at the product level. We also study how hypothetical reductions in trade frictions might impact on the number of destination markets.

To carry out our analysis, we employ a heterogeneous firm model of trade developed by HMR that has some advantages suited for our purposes. Focusing on the first stage of their framework, we are able to embed fixed and variable trade costs into the HMR model and test for their effects on the extensive margins of exports. According to the nature of the heterogeneous firm model of Melitz (2003), whether producers from a country succeed to export to a destination market depends only on the most productive firm in that country. Given its productivity, that firm's success in entering a certain market depends on fixed and variable costs of trade. We use the first stage equation of the HMR model but apply to the product-level data of the extensive margins of exports. The product-level estimation enables us to investigate if developing countries face more difficulty than developed country counterparts in exporting certain products to foreign markets.

In contrast to the previous simulation results that emphasize the role commercial policies have in reducing the volume of trade (e.g., MW), the counterfactual exercises in our paper suggest that tariff elimination does not greatly improve the number of new markets for developing countries might be able to access, although we cannot determine to what extent the volume of trade might expand in existing markets. On average across low-income countries, the elimination of tariffs would create less than one percentage of new export destinations, which is even smaller than the expected average gains in the number of new destination markets for high-income countries. The difficulties for developing countries relative to developed countries to increase the number of new markets are persistent even for other trade friction variables such as distance, language, and trade infrastructure. Since producers in developing countries are not productive enough to cover fixed costs of global trade, the elimination of tariffs has only a minor effect on the extensive margins of exports.[3] Similarly, our results also indicate that lowering transportation costs and improving trade efficiency would have little impact on market expansion for developing countries, although in all cases high- and middle-income countries would see greater market growth than low-income countries.

The reminder of the paper proceeds as follows. Section 2 outlines the model for estimating export participation. Section 3 provides an in-depth discussion of our trade data and various measures of fixed and variable costs. Section 4 presents the empirical results of our estimates from product-level data and provides a discussion of our counterfactual results. Section 5 concludes.

2 Firm-Heterogeneity and Market Access

2.1 Firm-Level Decision to Enter Global Markets

In this section we provide a model of the decision by a firm to enter an export market. The theoretical approach we take is essentially that proposed by HMR in their study of bilateral aggregate export flows. We modify it to the product-level so that we can study the product-level characteristics of success in market access.

[3] Clerides et al. (1998) and Das et al. (2007) show that firms are concerned about export costs that are fixed in nature in addition to per unit costs. Firms decide to sink an initial investment to enter export markets only if expected future profits will be sufficient to cover these costs.

Demand in each country l is obtained from a two-tier utility function of a representative consumer (i.e., Hallak, 2006; Chaney, 2008). The upper tier of this function is separable into sub-utilities defined for each product $i = 1, ..., G_l$: $U^l = U[u_1^l, ..., u_i^l, ..., u_{G_l}^l]$. The representative consumer uses a two-stage budgeting process. The first stage involves the allocation of expenditure across products. In the second stage, the representative consumer determines the demand for each variety ω in product i subject to the optimal expenditure (Y_i^l) obtained from the first stage.

The sub-utility index is a standard CES (Constant Elasticity of Substitution) utility function: $u_i^l = \left[\int_{\omega \in B_i^l} \left[q_i^l(\omega)\right]^{\alpha_i} d\omega\right]^{1/\alpha_i}$. Here, $q_i^l(\omega)$ is the consumption of variety ω in product i chosen by consumers in country l, B_i^l is the set of varieties in product i available for consumers in country l, and the product-specific parameter α_i determines the elasticity of substitution across varieties so that $\varepsilon_i = 1/(1-\alpha_i) > 1$. From the utility maximization problem of a representative consumer, we can find the demand function for each variety: $q_i^l(\omega) = \frac{\left[p_i^l(\omega)\right]^{-\varepsilon_i} Y_i^l}{\left(P_i^l\right)^{1-\varepsilon_i}}$ where $P_i^l = \left[\int_{\omega \in B_i^l} \left(p_i^l(\omega)\right)^{1-\varepsilon_i} d\omega\right]^{1/(1-\varepsilon_i)}$.

We assume that each variety is produced by a firm. A firm ω in country k produces one unit of output with a cost minimizing combination of inputs that costs c_i^k, which is the country and industry specific cost for unit production. $1/a_i^k(\omega)$ is the firm-specific productivity measure (i.e. a firm with a lower value of $a_i^k(\omega)$ is more productive and that with a higher value of $a_i^k(\omega)$ is less productive) whose product-specific cumulative distribution function has a country specific support $[\bar{a}_i^k, +\infty]$.

If this firm sells in its own market, it incurs no transportation costs. If this firm seeks to sell the same variety in country l, it faces two additional costs: one is the fixed cost of serving country l (f_i^{kl} >0) and the other is a variable transport cost ($\tau_i^{kl} > 1$). Since the market is characterized by monopolistic competition, a firm in country k with a productivity measure of $a_i^k(\omega)$ maximizes profits by charging the standard mark-up price: $p_i^k(a_i^k(\omega)) = c_i^k a_i^k(\omega)/\alpha_i$. If the firm exports its good to country l, the delivery price is $p_i^k(a_i^k(\omega)) = \tau_i^{kl} c_i^k a_i^k(\omega)/\alpha_i$.

As a result, the associated operating profit from sales to country l is

$$\pi_i^{kl}\left(a_i^k(\omega)\right) = (1-\alpha_i)\, Y_i^l \left(\tau_i^{kl} c_i^k / \alpha_i P_i^l\right)^{1-\varepsilon_i} \left(a_i^k(\omega)\right)^{1-\varepsilon_i} - f_i^{kl} \tag{1}$$

where profit is a monotonically increasing function with respect to $1/a_i^k(\omega)$ for any pair of an exporter country k and an importer country l.

Since profits are positive in the domestic market for surviving firms, all firms are profitable in home country k. However, sales to an export market such as country l are positive only when a firm is productive enough to cover both the fixed and variable costs of exporting. Moreover, the positive observation of trade in product i from country k to l depends solely on entry of the most productive firm since the expected profit from equation (1) varies only with the firm-specific productivity $(1/a_i^k(\omega))$ in each industry.

Now, we define the latent variable for the most productive firm in country k in product i whose productivity level is $\bar{a}_i^k$:

$$Z_i^{kl}(\bar{a}_i^k) = \frac{(1-\alpha_i)\, Y_i^l \left(\tau_i^{kl} c_i^k / \alpha_i P_i^l\right)^{1-\varepsilon_i} (\bar{a}_i^k)^{1-\varepsilon_i}}{f_i^{kl}}. \tag{2}$$

Equation (2) is the ratio of export profits for the most productive firm to the fixed cost of exporting product i to market l. Positive exports are observed if and only if the expected profits of the most productive firms in industries are positive: $Z_i^{kl}(\bar{a}_i^k) > 1$.

Equation (2) provides the foundation for our empirical investigation. To estimate this equation, we define $f_i^{kl} = \exp(\lambda_i \varphi^{kl} - e_i^{kl})$ where φ^{kl} is an observed measure of any country-pair specific fixed trade costs, and e_i^{kl} is a random variable. Using this specification together with the empirical specification of variable trade costs: $(1-\varepsilon_i)\ln(\tau_i^{kl}) = -\gamma_i^1 d^{kl} - \gamma_i^2 t_i^{kl} - \gamma_i^3 \nu^{kl} + u_i^{kl}$ where d^{kl} is the log of distance between countries k and l, $t_i^{kl}$is the tariff rate, ν^{kl} is the bilateral dummy variable for trade efficiency (more on this in section 3), and u_i^{kl} is a random error, the log of the latent variable $z_i^{kl}(\bar{a}_i^k) = \ln(Z_i^{kl}(\bar{a}_i^k))$ can be expressed as

$$z_i^{kl}(\bar{a}_i^k) = \beta_i + \beta_i^k + \beta_i^l - \gamma_i^1 d^{kl} - \gamma_i^2 t_i^{kl} - \gamma_i^3 \nu^{kl} - \lambda_i \varphi^{kl} + \eta_i^{kl} \tag{3}$$

where β_i^k is an exporter fixed effect that captures $(1-\varepsilon_i)\ln(c_i^k)$ and $(1-\varepsilon_i)\ln(\bar{a}_i^k)$; β_i^l is an importer fixed effect that captures $(\varepsilon_i - 1)\ln(P_i^l)$ and $\ln(Y_i^l)$; $\eta_i^{kl} = u_i^{kl} + e_i^{kl}$ is random error; and the remaining variables are captured in a constant term (β_i).[4]

We now define the indicator variable T_i^{kl} to be 1 when country k exports product i to country l and to be 0 when it does not. Let ρ_i^{kl} be the probability that country k exports product i to

[4] Although Kee et al. (2009) emphasize the significant impacts of non-tariff trade barriers, most of their measures are importer- and product-specific variables, which should be captured by importer fixed effects for the product-level estimations.

country l conditional on the observed variables. Then, we can specify the following logit equation:

$$\begin{aligned} \rho_i^{kl} &= \Pr\left(T_i^{kl} = 1 | \beta_i, \beta_i^k, \beta_i^l, d^{kl}, t_i^{kl}, \nu^{kl}, \varphi^{kl}\right) \\ &= \Lambda\left(\beta_i + \beta_i^k + \beta_i^l - \gamma_i^1 d^{kl} - \gamma_i^2 t_i^{kl} - \gamma_i^3 \nu^{kl} - \lambda_i \varphi^{kl}\right) \end{aligned} \tag{4}$$

where Λ is the logistic distribution function with standard error σ_{η_i}.

Note that equation (4) depends only on the market access decision of the most productive firm. Fixed and variable costs for trade are primary factors of the probability of successful entry into a foreign market after controlling for exporter and importer fixed effects that capture the market size, the most productive firms' productivity levels, unit production costs, and the average price in importing country l.

3 Overview of Data

We obtain bilateral import data for the year 2004 for 95 importer and 169 exporter countries from the UN Comtrade Database at the 4-digit product level of the harmonized system (HS) commodity classification (1996).[5] For the purpose of our empirical analysis, 93 exporter countries with nominal GDP per capita less than \$2,935 are classified as developing countries (i.e., low-income countries in World Development Report (the World Bank, 2006)) otherwise they are considered as developed (middle-income and high-income) countries.[6] The developing countries in the current study account for 24.0% of trade value and 24.5% of the number of non-zero observations in trade (Table 1). There are 1,240 products, of which 313 are agriculture and mining products.[7] Based on the findings reported by MW, the data on tariffs are an essential part of our study.[8] We use

[5] We use data for 2004 because we also have product-level bilateral tariff data for that year.

[6] The results of the current paper do not change due to the alternative cut-off GDP per capita values from the World Bank. For the robustness checks, we define developing countries with the cut-off GDP per capita value of \$3,500 or less, and also we estimate for the subsets of low-income countries (\$2,935 or less) and middle-income countries (\$2,935-\$9,076) as in World Development Report (The World Bank, 2006). See the appendix for the list of countries. Table 1 reports the average GDP per capita for these three subsets of countries. Sub-Saharan Africa forms the highest share of low-income countries followed by countries in the Western Hemisphere and Asia. For high-income countries, European countries form the highest share.

[7] Agriculture and mining products consist of homogeneous and reference goods as identified in Rauch (1999) and Hallak (2006).

[8] On trade negotiation tables at the World Trade Organization (WTO), developing countries often express their frustration about the problems faced by their producers in accessing markets in developed countries. In 2001, the WTO published a report titled "Market Access: Unfinished Business-Post Uruguay Round Inventory and Issues," in

HS 6-digit tariff data from 95 importer countries from the World Bank Bilateral Tariff Data,[9] and calculate average bilateral tariff rates at the HS 4-digit level. After incorporating the tariff data, we have 8,866,607 possible bilateral trade relationships,[10] of which 18.4% exhibit positive (non-zero) trades. Thus, approximately 80% of the observations are zeros. This highlights the high presence of zeros in trade data at a detailed level of product disaggregation.[11]

The proportion of zero trade is even higher for exporters from developing countries. For these countries, we have 4,015,111 observations, of which 399,788 (10.0%) have non-zero values, whereas the sample with exporters from high-income countries has 2,955,380 observations for which 928,209 (31.4%) have non-zero values. The reason why developing countries have high presence of zeros depends on the number of products they produce and export. On average low-income countries export 37.3% of the products in our data set to at least one partner country, whereas high-income countries export 75.7% of these products. Industrialization and the diversification of industries are the key factors to understand the proportions of zero-trade observations.[12]

For each bilateral pair of countries, we construct corresponding measures of trade frictions that allow us to capture the effects of variable and fixed trade costs on the extensive margins of exports. First, as is standard in gravity equation estimation, we use geographical distance as a proxy for transport costs. Second, we introduce the ad-valorem tariff rate, a disincentive to trade which has been the main theme of past WTO discussions on expanding market access.

Third, we develop a measure of business-related trade frictions, using data obtained from the World Bank's Doing Business Database (World Bank).[13,14] Recent academic studies show that

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which the structure of tariffs across rich and poor countries is examined.

[9] http://go.worldbank.org/ME6FUPZEF0

[10] We have 15,264 exporter-importer country pairs in the data. The data cover 85.2% of total bilateral trade value (i.e., import-basis) of these country pairs. For 83.0% of 15,264 country pairs, the data cover more than 90% of the corresponding total value of bilateral imports.

[11] See the recent literature on zero trade (e.g., Santos Silva and Tenreyro (2006)). It is well noted that zero observations are pervasive in developing country export flows. Aside from the problem of sample selection bias, gravity models that use only positive trade are not able to account for the extensive margin of exporting. Thus, the coefficient on distance or any other measures of trade costs only captures shipping costs. Exceptions include Baldwin and Harrigan (2011). Using disaggregated US bilateral data and a modified version of the Melitz (2003) model that incorporates a preference for quality, they examined how an importer's market size and bilateral distance explains the spatial patterns of zeros in bilateral trade data.

[12] Dennis and Shepherd (2011) studied the association between the product diversification and the trade facilitation. They estimate the number of eight-digit HS product lines exported in every two-digit category by assuming that the count data follows Poisson distribution. To obtain the detailed product lines, they focus their research on imports of EU countries from developing countries. While they examine the role of trade facilitation in the product diversification, we examine the role of trade frictions on the product-level market access from a broad set of developed and developing countries.

[13] Data are downloaded from the World Development Indicators website.

[14] Empirically, we do not have the product- and importer-exporter-specific variables for trade costs except for tariff.

business costs play an essential role in explaining the success and failure of foreign market access. Our measure of these costs is a dummy variable that takes the value one if both the exporting and importing countries have minor frictions in handling products at border and is set to zero otherwise. In order to develop the dummy variable, we use the following two measures. First, we use an importer's and an exporter's days to ship a product. This measure captures the number of days required for document preparation, inland transport, customs and other clearance, and port and terminal handling. Importantly, international transport time is not included. This measure is designed to capture the efficiency of trade infrastructure. Clearly, shipping time varies with the volume of trade and should likely influence the probability of success in entering markets. Second, we use a trade cost variable using the sum of an importer's import and an exporter's export cost of handling a container. These costs capture the variable costs within border to ship a 20-foot container, which include domestic transport costs, port charges, the resources required for preparing and storing cargo, and the loading and unloading of cargo.[15] The use of a dummy variable rather than a continuous variable to measure these country-specific costs at the product level should mitigate any negative impact from measurement error.[16]

Fourth, we use dummy variables for common legal origin, common language, colonial ties, and common border to capture various fixed costs of trade. These variables are from Head et al. (2010). Since it is difficult to find the exact fixed cost variables, we hope that these measures would capture the resources spent on administrative and regulation procedures, establishing distributive, and contract networks, and following legal requirements in both the importing and exporting countries.

3.1 Development Stages and Trade Frictions

Table 2 provides the average tariff rates for agriculture and manufacturing products for certain combinations of exporter and importer countries as well as specific examples from several importing

Thus, we use the country-level bilateral variables and estimate product-specific marginal effects. As in Hummels (2007), modes of transportation differ due to the characteristics of products. For example, the variable to capture the days to handle containers may not be a perfect indicator for products that ship by air. Although some of the trade variables are not ideal for product-level estimation, the variables we employ are the best available for our purpose.

[15] In particular, if an exporter country has the value less than the 20 percentile value for the exporter's days of handling products or the handling cost of a container, we define that the exporter country is efficient at handling products at border. For example, the 20 percentile value for the exporter's days of handling products is 15 days and that for the handling cost of exports is $690. Thus, most of the middle- and low-income countries as well as some high-income countries such as France (18 days and $1,028) would not be categorized as trade efficient at border. We develop a similar variable for importer countries. The trade efficiency dummy variable is one if an exporter and an importer are both efficient in handling products at the border. Otherwise, it is zero.

[16] We thank the editor for suggesting this point.

countries in each income group. While average tariff rates of high-income countries (as importers) are less than 5% for both agriculture and manufacturing products across all income groups of exporters (e.g., 2.1% for agriculture goods from low-income exporter countries), those of low-income countries are around 10% (e.g., 9.9% for manufacturing goods from high-income countries). Low-income importer countries tend to impose higher tariff rates regardless of product groups, whereas high-income importer countries impose lower tariff rates since these countries tend to have more FTA partners (Table 1). As is well known, tariff rates for agriculture and mining products are higher than those for manufactures. Finally, high-income exporter countries, not low-income exporter countries, face slightly higher tariff rates to access the same destination markets. For example, the average US tariff rate on manufactured goods is 2.1% for high-income exporter countries, which is more than twice the rate charged on manufactured goods imported from low-income exporter countries (0.8%).[17]

Figure 2 examines the correlation between the log of days required to prepare exports for shipping and the log of GDP per capita for 169 exporter countries. As countries develop, the days needed to export decline.[18] Developed countries such as Singapore (SGP), Denmark (DNK), Hong Kong (HKG), the Netherlands (NLD), and the United States (USA) are clustered at the lower right corners, whereas developing countries such as Kazakhstan (KAZ) and Uzbekistan (UZB) are clustered at the upper left corners. This figure suggests that developing countries appear to face higher trade frictions in export facilitation relative to developed countries.[19] Comparing the evidence presented in Table 2, Figure 2 suggests that developing countries face tougher market

[17] In general, developed countries allow preferential market accesses for certain developing countries. One notable example is the law that the United States enacted called the African Growth and Opportunity Act (AGOA). It provides U.S. trade preferences to the sub-Saharan African countries. Table 2 also shows that average tariff rates on agricultural goods set by high-income importer countries are higher for high-income exporter countries (3.4%) than low-income exporter countries (2.1%). The high level of the observed average tariff among high-income countries is driven by high tariff rates on agricultural goods imposed by Switzerland, Norway and Iceland. While these three countries are members of the European Free Trade Association (EFTA), they do not participate in the European Economic Area (EEA). Hence, relative to other countries in the European Union, they keep high tariff rates on agricultural goods irrespective of the importer, but under the Generalized System of Preference (GSP) scheme and other bilateral agreements, they provide low tariff rates for developing countries. For instance, Switzerland reduces tariff rates substantially on imports of tropical fruits, vegetables, seafood and fish from developing countries. Low-income countries are entitled to additional preferences for some agricultural products in the form of 55-75% reductions of the most favored nation (MFN) tariffs (WTO, 2004).

[18] See also Limão and Venables (2001) and Djankov et al. (2010) who find a crucial role of trade infrastructure for trade.

[19] This measure includes the days required for inland transport. The strong correlation partially reflects the remoteness and income differences. Redding and Venables (2004) argue that the geography of market access plays an important role in explaining cross-country differences in income. Very distant countries pay higher export costs as well as higher import costs for inputs and capital equipment.

access conditions not because of the global structure of tariffs but because of their own inefficient trade infrastructures. We turn now to a more formal test of this hypothesis using the theory we built in the previous section.

4 Estimation Results

4.1 Trade Costs and Market Access

We use equation (4) to study the determinants of the extensive margins of exports. Since we are interested in the detailed product-level investigations, we break the data along individual product lines to see how various frictions impact the extensive margins of exports at the product level. The dependent variable for each equation is a binary variable that takes on the value of 1 when trade is observed in that product between an exporter-importer pair and zero otherwise. According to our model, trade will occur between two countries if at least one firm in the exporting country is efficient enough to overcome the fixed and variable costs of entry into a particular market. Consequently, we include the following explanatory variables in our logit model: (1) the log of distance as a proxy for transportation costs; (2) product-level data on the ad-valorem tariff rate measured as $\ln(1+t_i^{kl})$; (3) a measure of trade efficiency, which is the dummy variable that is one if both an exporter and an importer countries are efficient in handling products at border; and (4) four variables as proxies for fixed costs: dummy variables for common legal origin, common border, common language, and colonial ties.[20]

In Table 3, we report the summary statistics for the parameter estimates obtained from individual logit regressions for each of the 1,226 products.[21] For each product, we have at most 12,248 observations. The median value of observations is 4,983, of which around 15.5% are non-zeros. Although we have 15,264 possible country pairs for each product, we have to drop the observations if a country exports that product to all 95 importer countries, imports that product from all 168 countries, or does not export or import the product at all. For example, since low-income countries do

[20]We also estimated equation (4) as a probit model. The results from this were qualitatively identical to those reported here and are available on request.

[21]Although the exporter- and importer-fixed effects could handle the endogeneity of Anderson and van Wincoop's (2003) multilateral resistance terms, it is important to check the robustness of the results. We follow Baier and Bergstrand (2009) and Behar and Nelson (2014) and create the multilateral resistance terms for the log of distance and the log of the latent variable from a first-order log-linear Taylor-series approximation from the GDP shares and estimated probability of market entries from equation (4). We then include these terms and confirm that the results from Table 3 do not change with these approximation terms. These results are available upon request.

not produce and export 62.7% of products on average (Table 1), we cannot estimate the probability of exports for these products since the observed probability is 0%. In fact, we are forced to drop 42.8% of observations for low-income countries (Table 4), which is much higher than the percent of dropped observations for exporters in the other income groups (i.e., 24.8% for middle-income countries and 14.3% for high-income countries). Given the large number of estimates we have for each product, we do not report all the results. Instead, in the table we provide summary statistics for the estimated marginal effects,[22] the proportion of marginal effects that have the expected sign, and the proportion of those that are statistically significant at the 5% level (one-tail tests per the expected signs described in the table).

As discussed extensively by Baldwin and Harrigan (2011), geographic separation helps us to explain the zero export observations. We find that the probability of successful exports from country k to l (ρ_i^{kl}) is negatively related to the log of distance between them. The median value of marginal effects across all products is -0.069. That is, a one standard deviation increase in the log of distance will reduce the probability of market access by 6.9%. The negative impact of distance is remarkably robust. In the product-level estimations, virtually 100% of the product-level estimates carry negative signs and 99.6% are statistically significant. Similar strong and consistent results are found for common legal origin, common border, common language, and a former colonial relationship.

Estimated marginal effects on tariff rates are expected to be negative and we found some evidence that tariffs adversely impact market access. The median value of the marginal effect of tariffs is -0.185. Almost 80.0% carry negative signs but only 34.4% are statistically significant at the 5% level. The imprecision in these estimates suggests that the existing tariff structure across importing countries plays only a limited role in preventing market entry. That is, because tariff rates have already been reduced significantly as a result of the Tokyo and Uruguay Rounds of trade talks, our results are consistent with the conclusion that further tariff reductions would likely have only minor impacts on the extensive margins of exports.

Our coefficient estimates suggest that trade efficiency plays a role in affording market access. Recall that our dummy for efficiency is the combination of an exporter and an importer countries that require less days or less money to ship a product. We find that this variable has an impact on

[22] We report the marginal effects for the coefficients at the average values of the independent variables.

the extensive margins of exports greater than that on tariffs; 90.8% have positive signs and 56.0% are statistically significant at the 5% level. Clearly, the more efficient those countries become in shipping and handling products, the higher probability of successful market entry.

Finally, we report the goodness of fits for equation (4) in terms of actual and predicted success and failure of market access in Table 4. Here, we define the predicted success if the fitted value of equation (3), $\hat{z}_i^{kl}(\bar{a}_i^k)$, is greater than 0 (i.e., $\hat{T}_i^{kl} = 1$) and the predicted failure if that value is less than 0 (i.e., $\hat{T}_i^{kl} = 0$). Equation (4) succeeds to predict 88.9% of the actual market access outcomes, of which 19.0% are actual and predicted successes and 69.9% are actual and predicted failures. The results also indicate that the model correctly predicts market access outcomes for roughly 90% of the observations regardless of whether potential exporters come from developed or developing countries.

4.2 Market Access for Agriculture and Manufacturing Products

In order to understand better the roles that trade frictions and productivity levels play on the extensive margins of exports especially for countries in the South, we divide our product sample into two classes of goods: agriculture and mining, and manufactures.[23] Typically, developing countries specialize in producing and exporting agriculture and mining products. For a variety of reasons, trade barriers on these products tend to be higher than those on manufactured goods, and that is the case with the products in our sample.[24] Based on their HS commodity classifications, we designate 313 goods in our sample as agriculture and mining products, and 927 goods as manufactured products. We then report the individual results from equation (4) for each class of goods. Table 5 summarizes our results.

As was discussed before, distance plays a significant role in reducing market access. For both types of goods, all of the products carry negative signs and virtually all of the estimates are statistically significant. We also find that regardless of commodity type, lower fixed costs of trade, as proxied by common legal origin, common border, common language, and past colonial relationships, act to enhance trade. On average, about 95% of the coefficients on these variables had the correct sign with typically 75% of the coefficients statistically significant.

[23] See Arvis et al. (2013) who examine the development-related bias in trade costs with a gravity approach for an aggregate of agriculture and that of manufacturing.

[24] The average tariff rate on the agriculture and mining products is 8.1% and that of the manufacturing products is 5.9%.

However, when we look at the impact of tariff protection on these goods some differences across product type emerge. Tariffs appear to be more important in reducing trade in agriculture and mining products. Almost 85% of the agriculture and mining products have negative signs and 43.9% are statistically significant at the 5% level (Panel 5.1), whereas 75.6% for manufactured products have negative signs but only 31.3% are statistically significant at the 5% level (Panel 5.2). The results suggest that trade in agriculture products is more sensitive to price changes, since these goods are not purely differentiated goods but are closer to homogeneous goods.

Although we do not have the information required to designate certain goods as time sensitive as is done in Djankov et al. (2010), trade efficiency matters for both types of goods, but especially for a broad range of manufacturing products. These results are not surprising since timeliness is critical for international production and manufacturing networks of manufacturing sector. Multinational firms invest in distribution techniques, requiring efficient and timely delivery of intermediate and final goods. In our logit regressions for manufactured goods, we find that the trade efficiency variable has an expected impact mainly on the extensive margins of exports for manufacturing products. 94.4% of the estimates for the trade efficiency parameter carry the correct sign in product-level analysis for manufactured goods; 62.3% of these are statistically significant at the 5% level (Panel 5.2). Our results suggest that greater efficiency in handling these goods also promotes trade for agriculture and mining products; however, only 36.6% of these estimates are statistically significant at the 5% level (Panel 5.1).

4.3 Differential Effects for Developing Countries

While our primary interest is how trade frictions affect success in entering foreign markets, we are also interested in whether there is any systematic bias against the ability of developing countries to be able to access new export markets. We turn now to examine if the coefficients on the trade costs (i.e., d^{kl}, t_i^{kl}, ν^{kl}, and φ^{kl}) differ across developing country and developed country access to the same destination markets. We modify equation (4) by interacting our trade friction measures (i.e., distance, tariff, trade efficiency, and some variables for fixed trade costs) with a dummy variable for exporters from low-income countries (D^k where $D^k = 1$ if an exporter country k belongs to the subset of developing countries with per capita GDP of \$2,935 or less, otherwise $D^k = 0$):

$$
\begin{aligned}
\rho_i^{kl} &= \Pr(T_i^{kl} = 1 | \beta_i, \beta_i^k, \beta_i^l, d^{kl}, D^k d^{kl}, t_i^{kl}, D^k t_i^{kl}, \nu^{kl}, D^k \nu^{kl}, \varphi^{kl}, D^k \varphi^{kl}) \qquad (5) \\
&= \Lambda(\beta_i + \beta_i^k + \beta_i^l - \gamma_i^1 d^{kl} - \gamma_i^{1'} D^k d^{kl} \\
&\quad -\gamma_i^2 t_i^{kl} - \gamma_i^{2'} D^k t_i^{kl} - \gamma_i^3 \nu^{kl} - \gamma_i^{3'} D^k \nu^{kl} - \lambda_i \varphi^{kl} - \lambda_i' D^k \varphi^{kl}).
\end{aligned}
$$

We also created a dummy variable to identify importers from low-income countries (D^l where $D^l = 1$ if an importer country l belongs to the subset of developing countries, otherwise $D^l = 0$). Then, we examine the interactions in a similar manner as in equation (5). Again, we are interested in seeing whether exporters face extraordinary higher costs when selling goods to customers in developing countries.

Table 6.1 shows the logit estimation results for equation (5). We find no apparent evidence that the marginal effects of developing countries are larger in negative signs for distance and tariff. In particular, the probability of negative signs on the interaction terms is no better than a coin toss: 43.7% for the log of distance and 47.6% for tariff. These findings suggest that exporters in developing countries do not face additional challenges in entering new markets.

The situation is slightly different when developing countries import goods. Consider Table 6.2. The results suggest that distance plays a particularly important role for importers in developing countries. 90.7% of product-level interaction terms on distance carry negative signs and 58.4% are statistically significant at the 5% level, indicating that the probability of success in accessing developing country markets declines more with distance than that in accessing those in developed countries.[25]

4.4 Quantifying the Effects of Trade Frictions on the Creation of New Markets

In this section, we discuss the effects of the reductions in trade frictions on the ability of countries to expand the number of new markets. Using the estimation results, we examine how many more

[25] We also estimate the equations similar to equation (5) by replacing the developing (low-income) country dummy variable with the middle-income country dummy variable. The results indicate that the interaction term on log distance and the middle-income exporter dummy turns out to be negatively correlated for 86.5% of products, of which 54.7% are statistically significant. Our results indicate that the distance negatively relates not to importers but to exporters in middle-income countries. The conflicting results of exporters in the middle-income countries and importers in the low-income countries may reflect the imbalance of trade. While low-income countries tend to import more than they export, middle-income countries tend to export more than they import. The imbalance could impact the freight costs in less-traded directions.

markets exporter countries would gain if trade frictions could be reduced. Our intention is similar to that found in MW, who simulated the percentage increase in international trade due to the elimination of all tariffs and non-tariff barriers to trade.[26] The focus of our counterfactual exercises is on how the probabilities of further access to new markets would change in response to a reduction in a variety of trade frictions, while keeping other variables for all other exporter countries constant.[27] In so doing, we make two cautionary points. First, our counterfactual exercise cannot take into account possible changes in multilateral resistance terms or import prices that could result from across the board falls in trade frictions. As such, we ignore potential general equilibrium effects of these changes on trade flows. Second, our exercise is subject to the Lucas critique (Lucas, 1976), and therefore, the results we report in this section are suggestive.

We use the estimated coefficients from equation (4) and examine how the predicted probabilities vary with a change in independent variables. In particular, we examine five counterfactual cases: (1) an exporter country's bilateral distances to their trade partner countries falls by 20%, (2) an exporter country adopts the same language as their importer countries, (3) an exporter country and its trading partners improve efficiency of handling products,[28] (4) an exporter country moves to bilateral free trade with all other countries by setting t_i^{kl} to 0, and (5) all of the four counterfactual changes above occur simultaneously. We examine the fitted probabilities of success in new market access for the five scenarios mentioned above and compare them with the fitted probabilities of equation (4) with the original values of independent variables. We are interested in those case where the reductions in trade frictions alter the predicted values from zero ($\hat{T}_i^{kl} = 0$) to one ($\tilde{T}_i^{kl} = 1$). In other words, we are looking for those cases where exporters are able to enter new markets when trade frictions are eliminated or reduced.

Table 7 summarizes the results from these counterfactual exercises. Overall, we find that large and significant reductions in trade frictions do not greatly improve the number of markets for developing country exporters. In spite of the intense political debates on market access, even if tariffs are eliminated, the success in market access for developing countries increases only for 1.3% of the cases, which is even smaller than our estimate of 1.9% growth in export markets for middle-

[26] However, unlike the exercise conducted by MW who employed CGE modeling, we are unable to control for general equilibrium effects.

[27] See Debaere and Mostashari (2010) for a similar attempt using bilateral U.S. trade data.

[28] In particular, by setting the trade efficiency dummy variable to one, we assume that an exporter country and its trade partners all receive the current advantage of market access for the combination of exporter and importer countries that are efficient in handling products at the border.

income countries and 3.2% growth for high-income countries. To be concrete, 1.3% is the percentage of estimated observations for developing countries (i.e., 2,297,290) that switch from zero ($\hat{T}_i^{kl} = 0$) to one ($\tilde{T}_i^{kl} = 1$) due to the elimination of tariffs. The actual magnitude is probably even smaller than 1.3% for developing countries; we fail to estimate 42.8% of observations because they involve products not exported anywhere by developing countries. Similarly, we find that the reduction in distance and the adoption of a common language do not increase the number of new markets for developing countries significantly.[29]

One counterfactual change that would have an impact more than tariff reductions on increasing market access for countries in the South would be improving trade efficiency. Our estimates suggest that, on average, developing countries can obtain 2.2% more new markets although the potential growth in new markets varies widely across countries: 0.1% for Tonga and 7.2% for Samoa. Our findings on the importance of improving trade efficiency to promote export growth are not as impressive as the previous results in Waugh (2010) and Tarasov (2012) who estimate development-related market access frictions from the general equilibrium theories. The difference in their results versus ours may be due to the fact that our measure of trade efficiency is a binary variable and not a continuous variable.

Finally, when trade frictions discussed independently above (i.e., the counterfactual cases (1) through (4)) are all reduced simultaneously, we can find noticeable gains in the number of new markets. The success in market access for developing countries increases for 10.2% of the cases although the estimate is smaller than that of 14.1% growth in export markets for middle-income countries and 16.8% growth for high-income countries. Our results from the product-level data suggest that the comprehensive efforts to reduce trade frictions are required to improve the number of new markets.

The results from our counterfactual exercises are somewhat counterintuitive for policy discussions in international trade. However, they are consistent with the previous literature on the extensive margins of exports and global trade. First, because producers from developing countries are not productive enough to cover fixed costs of trade, reductions in trade frictions alone have

[29] Behar and Nelson (2014) simulate the impact of reductions in trade frictions on the extensive and intensive margins of trade by extending HMR model with the multilateral resistance terms. Their simulation focuses on the volume of trade by fixing the number of actively trading country pairs. They find that a 10% reduction in distance has no effect on the number of new trading partners. We instead use the detailed product-level data and show that consistent with their discussion even a 20% reduction in distance does not create the significant number of new markets.

only a minor impact on the extensive margins of exports. In other words, even if trade frictions are greatly reduced, there are only limited opportunities for producers from developing countries to expand sales into new foreign markets. Therefore, improvement in productivity is a critical precondition to expand at the extensive margin of trade. Second, countries in the South tend to be highly specialized in a small number of export products (Hanson, 2012). As in Table 1, on average only 40% of products are produced in and exported from developing countries. Without the expansion and diversification of the production base, the benefits of reductions in trade frictions would be minor in terms of expanding the extensive margins of exports.

5 Conclusion

This paper has examined the effects of trade frictions on the extensive margins of exports at the product level and, in particular, the role these frictions have on the ability of developing countries to access world export markets. We find that a variety of trade frictions do serve to limit market access. Consistent with many previous papers, we find distance and trade frictions are significant determinants of the probability of success in entering foreign markets for a broad range of products. We tested and rejected the hypothesis that there are any systematic development-related biases from these frictions that further limit market access for exporters from developing countries. Our results suggest that developing countries are not differentially impacted by these frictions. In the spirit of an early study by MW, we then conducted a series of counterfactual exercises to see the impact of significant reductions in trade frictions on developing country market access. Our findings suggest that reductions in trade frictions do not greatly improve the number of new markets for developing countries. Since producers in developing countries are not productive enough to cover costs of global trade, reductions in trade frictions, particularly the elimination of tariffs, have a minor effect on the extensive margins of exports. In other words, even if trade frictions are reduced, there are limited opportunities for developing countries in accessing new foreign markets.

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Appendix

We mark * for 76 developed countries (i.e., middle- and high-income countries in the World Development Report 2006) and " for 95 importer countries. The 169 exporter countries are Afghanistan (AFG), Albania (ALB"), Algeria (DZA"), Angola (AGO), Antigua and Barbuda (ATG*), Argentina (ARG*"), Armenia (ARM), Australia (AUS*"), Austria (AUT*"), Azerbaijan (AZE), the Bahamas (BHS*), Bahrain (BHR*"), Bangladesh (BGD"), Belarus (BLR"), Belgium (BEL*"), Belize (BLZ*), Benin (BEN), Bhutan (BTN), Bolivia (BOL"), Bosnia-Herzegovina (BIH), Botswana (BWA*), Brazil (BRA*"), Brunei (BRN*"), Bulgaria (BGR*"), Burkina Faso (BFA"), Burundi (BDI), Cambodia (KHM), Cameroon (CMR"), Canada (CAN*"), Cape Verde (CPV), Central African Republic (CAF), Chad (TCD), Chile (CHL*"), China (CHN"), Colombia (COL"), Comoros (COM), Congo (COG), Costa Rica (CRI*"), Cote d'Ivoire (CIV"), Croatia (HRV*), Czech Republic (CZE*"), Denmark (DNK*"), Djibouti (DJI), Dominica (DMA*), Dominican Republic (DOM), Ecuador (ECU"), Egypt (EGY), El Salvador (SLV"), Equatorial Guinea (GNQ*), Eritrea (ERI), Estonia (EST*"), Ethiopia (ETH"), Fiji (FJI*), Finland (FIN*"), France (FRA*"), Djibouti (DJI), Gabon (GAB*), Georgia (GEO), Gambia (GMB), Germany (GER*"), Ghana (GHA"), Greece (GRC*"), Grenada (GRD*), Guatemala (GTM"), Guinea (GIN), Guinea-Bissau (GNB), Guyana (GUY), Haiti (HTI), Honduras (HND"), Hong Kong, China (HKG*"), Hungary (HUN*"), Iceland (ISL*"), India (IND"), Indonesia (IDN"), Iran (IRN), Iraq (IRQ), Ireland (IRL*"), Israel (ISR*), Italy (ITA*"), Jamaica (JAM*), Japan (JPN*"), Jordan (JOR"), Kazakhstan (KAZ"), Kiribati (KIR), South Korea (KOR*), Kuwait (KWT*), Kyrgyz (KGZ"), Lao Republic (LAO), Latvia (LVA*"), Lebanon (LBN*"), Lesotho (LSO), Liberia (LBR), Lithuania (LTU*"), Luxembourg (LUX*), Macedonia (MKD), Madagascar (MDG"), Malawi (MWI"), Malaysia (MYS*"), Maldives (MDV*), Mali (MLI"), Marshall Islands (MHL), Mauritania (MRT), Mauritius (MUS*"), Mexico (MEX*"), Micronesia (FSM), Moldova (MDA"), Mongolia (MNG), Morocco (MAR"), Mozambique (MOZ"), Namibia (NAM*), Nepal (NPL), the Netherlands (NLD*"), New Zealand (NZL*"), Nicaragua (NIC"), Niger (NER), Nigeria (NGA), Norway (NOR*"), Oman (OMN*"), Pakistan (PAK"), Palau (PLW*), Papua New Guinea (PNG"), Paraguay (PRY"), Peru (PER"), the Philippines (PHL"), Poland (POL*"), Portugal (PRT*"), Russian Federation (RUS*"), Rwanda (RWA), Samoa (WSM), Sao Tome and Principe (STP), Saudi Arabia (SAU*"), Senegal (SEN"), Seychelles (SYC*), Sierra Leone (SLE), Singapore (SGP*), Slovak Republic (SVK*"), Slovenia (SVN*"), South Africa (ZAF*"), Spain (ESP*"), Sri Lanka (LKA"), St. Kitts and Nevis (KNA*), St. Lucia (LCA*), St. Vincent and the Grenadines (VCT*), Sudan (SDN"), Suriname (SUR*), Swaziland (SWZ), Sweden (SWE*"), Switzerland (CHE*"), Syria (SYR), Tajikistan (TJK), Tanzania (TZA"), Thailand (THA"), Togo (TGO), Tonga (TON), Trinidad and Tobago (TTO*"), Tunisia (TUN*"), Turkey (TUR*), Uganda (UGA"), Ukraine (UKR"), United Arab Emirates (ARE*), United Kingdom (GBR*"), USA (USA*"), Uruguay (URY*"), Uzbekistan (UZB), Vanuatu (VUT), Venezuela (VEN*"), Viet Nam (VNM"), Zambia (ZMB") and Zimbabwe (ZWE"). Since IMF data is not available for Marshall Islands and Micronesia, we drop these two exporter countries for Figure 1.

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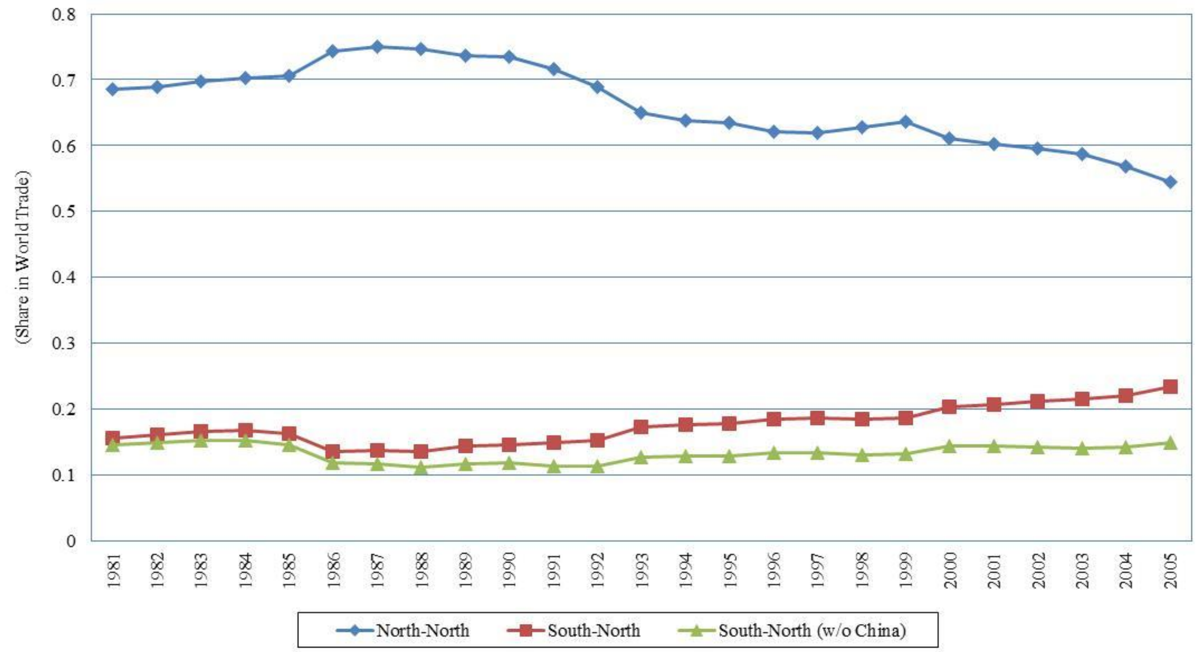
Tables and Figures

Figure 1. Shares of North-North versus South-North Trade in World Trade



Notes: (1) We obtain bilateral import data for the years 1980-2005 for 95 importer and 167 exporter countries from the IMF Direction of Trade Statistics. See the Appendix for a list of countries. (2) For the purpose of our empirical analysis, 93 exporter countries with nominal GDP per capita less than $2,935 are classified as developing countries (i.e., low-income countries in World Development Report (the World Bank, 2006)) otherwise they are considered as developed (middle-income and high-income) countries. Developing countries include China.

Table 1. Summary Statistics by 169 Exporter Countries

	Low-income countries	Middle-income countries	High-income countries	All countries
Number of exporter countries	93	32	44	169
Average GDP per capita ($US, 2004)	1,088	5,012	27,270	8,647
Average distance to 95 importer countries (km)	8,590	8,260	8,353	8,395
FTA with 95 importer countries (% of country pairs)	5.3%	13.5%	20.0%	10.7%
WTO members (% of countries)	68.8%	90.6%	93.2%	79.3%
Exports				
Value ($US, billion)	1,339	878	3,368	5,585
Share across income groups (%)	24.0%	15.7%	60.3%	100.0%
Share of manufacturing goods (%)	74.3%	61.4%	81.2%	76.4%
Average share of non-zero exporting products (% to 1,240 products)	37.3%	57.2%	75.7%	51.2%
Product × Markets (Importers)				
Observations	4,015,111	1,896,116	2,955,380	8,866,607
Non-zero observations	399,788	305,919	928,209	1,633,916
Share across income groups (%)	24.5%	18.7%	56.8%	100.0%
Share of manufacturing goods (%)	78.9%	79.6%	83.9%	81.9%
Ratio of non-zero trades (%)	10.0%	16.1%	31.4%	18.4%

Note: We report the average distance to 95 importer countries (km) weighted by export values.

Table 2. Average Tariff Rates of Selected Countries for Agriculture and Manufacturing Goods across Income Groups

Importers	Agriculture			Manufacturing		
	Exporter countries' income groups			Exporter countries' income groups		
	(Low)	(Middle)	(High)	(Low)	(Middle)	(High)
Low-income	12.6%	13.1%	13.5%	9.4%	9.5%	9.9%
China	11.1%	11.6%	11.5%	9.9%	10.0%	9.8%
Malawi	10.8%	12.9%	14.2%	10.3%	10.4%	11.9%
Middle-income	6.5%	8.2%	10.3%	4.5%	5.7%	7.6%
Brazil	8.7%	7.9%	9.7%	11.8%	10.6%	12.9%
Russia	8.8%	11.1%	11.0%	8.9%	10.8%	10.7%
High-income	2.1%	2.5%	3.4%	0.8%	1.1%	2.1%
France (EU)	1.0%	1.3%	2.7%	0.4%	0.4%	1.3%
United States	0.3%	0.2%	1.1%	0.8%	0.8%	2.1%
All 95 countries	5.5%	6.9%	8.8%	3.4%	4.5%	6.4%

Figure 2. GDP per capita and Shipping Efficiency

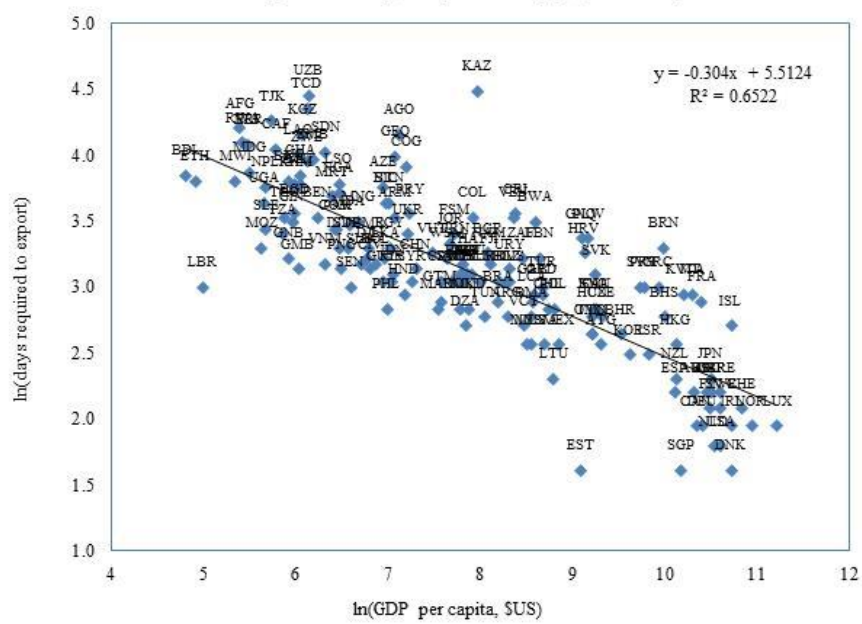


Table 3. Summary Results of Logit Estimates for Each of 1,226 Products

	Expected signs	Estimation results for each of 1,226 products					
		Sign match (%)	Sign match & 5% level (%)	Coefficients/Statistics			
				Median	Min	Max	St.dev
Log(distance)	-	100.0	99.6	-0.069	-0.339	0.000	0.060
Log(1 + tariff rate)	-	78.1	34.4	-0.185	-3.583	3.147	0.434
Trade efficiency	+	90.8	56.0	0.024	-0.075	0.158	0.029
Common language	+	93.1	71.4	0.034	-0.070	0.388	0.050
Legal origin	+	96.1	79.4	0.025	-0.070	0.137	0.025
Common border	+	96.4	68.9	0.047	-0.053	0.386	0.056
Colony	+	98.8	86.5	0.060	-0.036	0.389	0.065
Observations				4983	183	12248	2403
% of non-zero observations				0.155	0.008	0.503	0.092
Pseudo r-squared				0.511	0.297	0.805	0.053

Notes: (1) We exclude 14 products of 1,240 total product groups since the estimations for these products do not converge after 100 iterations. (2) We report the summary statistics from the marginal effects in the columns "Coefficients/Statistics", evaluated at the average values of the independent variables. (3) Log(distance) is normalized (See Baldwin and Harrigan, 2011). (5) Standard errors (s.e.) are based on robust standard errors.

Table 4. Actual and Predicted Success and Failure of Market Access by Exporter Countries

	Low-income		Middle-income		High-income		All	
	Observation	(%)	Observation	(%)	Observation	(%)	Observation	(%)
Total observations	4,015,111	-	1,896,116	-	2,955,380	-	8,866,607	-
Failure to estimate (% to total)	1,717,821	42.8%	470,443	24.8%	424,052	14.3%	2,612,316	29.5%
Estimated observations (% to total)	2,297,290	57.2%	1,425,673	75.2%	2,531,328	85.7%	6,254,291	70.5%
Actual & predicted success (% to estimated)	257,033	11.2%	206,376	14.5%	723,726	28.6%	1,187,135	19.0%
Actual success & predicted failure (% to estimated)	134,528	5.9%	99,523	7.0%	195,349	7.7%	429,400	6.9%
Actual failure & predicted success (% to estimated)	65,411	2.8%	52,341	3.7%	145,949	5.8%	263,701	4.2%
Actual & predicted failure (% to estimated)	1,840,318	80.1%	1,067,433	74.9%	1,466,304	57.9%	4,374,055	69.9%

Table 5. Estimation Results for Resource and Manufacturing Sectors

5.1. Agriculture and mining products (303 products)

		Estimation results for each of agriculture and mining products					
	Expected signs	Sign match (%)	Sign match & 5% level (%)	Coefficients/Statistics			
				Median	Min	Max	St.dev
Log(distance)	-	100.0	98.3	-0.047	-0.263	0.000	0.044
Log(1 + tariff rate)	-	85.5	43.9	-0.183	-2.781	0.886	0.302
Trade efficiency	+	79.9	36.6	0.011	-0.075	0.120	0.020
Common language	+	88.4	59.7	0.018	-0.070	0.169	0.032
Legal origin	+	93.7	75.9	0.016	-0.011	0.095	0.019
Common border	+	93.4	68.0	0.030	-0.049	0.207	0.038
Colony	+	97.0	80.2	0.036	-0.020	0.275	0.048
Observations				4608	229	10478	2493
% of non-zero observations				0.116	0.008	0.393	0.073
Pseudo r-squared				0.480	0.297	0.805	0.057

5.2. Manufacturing products (923 products)

		Estimation results for each of manufacturing products					
	Expected signs	Sign match (%)	Sign match & 5% level (%)	Coefficients/Statistics			
				Median	Min	Max	St.dev
Log(distance)	-	100.0	100.0	-0.084	-0.339	-0.005	0.062
Log(1 + tariff rate)	-	75.6	31.3	-0.189	-3.583	3.147	0.469
Trade efficiency	+	94.4	62.3	0.029	-0.022	0.158	0.029
Common language	+	94.7	75.2	0.043	-0.031	0.388	0.052
Legal origin	+	96.9	80.6	0.029	-0.070	0.137	0.026
Common border	+	97.4	69.2	0.055	-0.053	0.386	0.059
Colony	+	99.3	88.6	0.068	-0.036	0.389	0.068
Observations				5109	183	12248	2354
% of non-zero observations				0.168	0.012	0.503	0.095
Pseudo r-squared				0.521	0.302	0.610	0.049

Table 6. Interactions with Dummy Variables for Developing Countries

6.1. Interactions for exporters from developing countries

	Expected signs	Estimation results for each of 1,226 products					
		Sign match (%)	Sign match & 5% level (%)	Coefficients			
				Median	Min	Max	St.dev
Log(distance)	-	99.9	99.3	-0.069	-0.349	0.000	0.063
D_ex × Log(distance)	-	43.7	9.4	0.002	-0.061	0.096	0.019
Log(1 + tariff rate)	-	77.8	33.4	-0.188	-3.346	3.262	0.442
D_ex × Log(1 + tariff rate)	-	47.6	10.5	0.011	-2.280	1.141	0.273
Trade efficiency	+	90.3	57.6	0.025	-0.075	0.183	0.032
D_ex × Trade efficiency	+	32.3	3.0	-0.013	-0.216	0.119	0.040
Common language	+	91.8	67.3	0.033	-0.039	0.375	0.051
D_ex × common language	+	55.8	10.4	0.004	-0.274	0.305	0.044
Legal origin	+	96.4	77.7	0.027	-0.088	0.174	0.031
D_ex × legal origin	+	30.6	2.1	-0.010	-0.173	0.088	0.031
Common border	+	96.5	70.0	0.047	-0.058	0.388	0.058
Colony	+	98.7	85.1	0.059	-0.038	0.392	0.066

6.2. Interactions for importers from developing countries

	Expected signs	Estimation results for each of 1,217 products					
		Sign match (%)	Sign match & 5% level (%)	Coefficients/Statistics			
				Median	Min	Max	St.dev
Log(distance)	-	99.8	99.3	-0.062	-0.290	0.006	0.054
D_im × Log(distance)	-	90.7	58.4	-0.017	-0.152	0.030	0.025
Log(1 + tariff rate)	-	70.7	25.3	-0.136	-5.497	17.550	0.725
D_im × Log(1 + tariff rate)	-	63.9	17.0	-0.135	-20.210	34.910	1.876
Trade efficiency	+	81.1	36.8	0.016	-0.070	0.180	0.029
D_im × Trade efficiency	+	77.1	27.0	0.022	-0.154	0.762	0.057
Common language	+	85.5	49.4	0.023	-0.056	0.303	0.045
D_im × common language	+	72.7	21.7	0.016	-0.138	0.283	0.037
Legal origin	+	95.6	67.6	0.022	-0.050	0.143	0.022
D_im × legal origin	+	59.3	15.0	0.004	-0.168	0.172	0.029
Common border	+	96.7	63.6	0.042	-0.054	0.357	0.047
Colony	+	98.8	87.8	0.062	-0.039	0.409	0.071

Table 7. Improvements in Market Access for Five Counterfactual Cases of Trade Liberalization

	Exporter Countries		
	Low-income	Middle-income	High-income
1. 20% reduction in distance			
Overall	1.7%	2.5%	3.2%
Simple average across countries	1.1%	1.7%	2.7%
Std. deviations	0.9%	1.1%	1.3%
Minimum (country)	0.2% (Cape Verde)	0.4% (Botswana)	0.3% (Palau)
Maximum (country)	5.6% (Samoa)	4.0% (Turkey)	4.4% (Belgium)
2. Same language everywhere			
Overall	3.6%	5.2%	6.6%
Simple average across countries	2.2%	3.4%	5.6%
Std. deviations	1.9%	2.9%	2.7%
Minimum (country)	0.1% (Tonga)	0.1% (Belize)	0.2% (St.Kitts)
Maximum (country)	7.5% (Thailand)	9.2% (Turkey)	9.4% (Denmark)
3. Improvement in trade efficiency			
Overall	2.2%	3.0%	3.6%
Simple average across countries	1.6%	2.1%	3.0%
Std. deviations	1.2%	1.5%	1.5%
Minimum (country)	0.1% (Tonga)	0.2% (Fiji)	0.3% (Antigua)
Maximum (country)	7.2% (Samoa)	5.9% (South Africa)	6.2% (France)
4. Tariff eliminations			
Overall	1.3%	1.9%	3.2%
Simple average across countries	0.6%	1.1%	2.6%
Std. deviations	0.8%	1.1%	1.7%
Minimum (country)	0.0% (6 countries)	0.0% (E Guinea)	0.0% (Palau)
Maximum (country)	3.4% (India)	3.7% (Turkey)	5.0% (Netherlands)
5. All of above			
Overall	10.2%	14.1%	16.8%
Simple average across countries	7.0%	9.8%	14.5%
Std. deviations	4.3%	6.6%	6.2%
Minimum (country)	0.8% (Tonga)	2.3% (Fiji)	1.0% (Palau)
Maximum (country)	18.8% (India)	22.4% (Turkey)	22.0% (Greece)

Notes: (1) In this table, we report the shares of observations that are zeros for the predicted and ones in the counterfactual cases in estimated observations. (2) The minimum value (0.0%) for tariff eliminations includes 6 countries (Solomon Islands, Eritrea, Kiribati, Lesotho, Guinea-Bissau, and Samoa).