

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

Eugene Bempong-Nyantakyi*, Steven Husted[†] and Shuichiro Nishioka[‡]

June 13, 2014

Abstract

This paper examines the effects of trade frictions, including tariffs and a variety of factors that raise trade costs, on export market access at the product level and, in particular, the role these frictions have on the ability of developing countries to access world markets. We find that a variety of trade frictions do serve to limit market access. We find distance and efficiency in trade facilitation are significant determinants of the probability of success in entering foreign markets. We examine whether 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 factors. In the spirit of an earlier study by Markusen and Wagle (1990), we also conduct a series of counterfactual exercises to see the impact of significant reductions in trade frictions on developing country market access. In contrast to their results, our findings show that reductions in tariffs do not greatly improve the number of new markets for developing countries. ~~Our results suggest a traditional recommendation to resolve the market access problem for developing countries: expansion and diversification of the industrial base and productivity improvements in the handling of exports. Both are vital preconditions to increasing the number of export markets.~~

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

JEL Classification: F12, F14, O19.

*Development Research Department (EDRE-1), African Development Bank Group, Avenue Jean-Paul II-01 BP1387 Abidjan 01, Côte d'Ivoire, Tel: +225(20)20-4527, Email: e.bempong-nyantakyi@afdb.org

[†]Department of Economics, University of Pittsburgh, 4508 WW Posvar Hall Pittsburgh PA 15216, Tel: +1(412) 648-1757, Email: husted1@pitt.edu (corresponding author)

[‡]Department of Economics, West Virginia University, 1601 University Avenue Morgantown WV 26506-0625, Tel: +1(304) 293-7875, Email: shuichiro.nishioka@mail.wvu.edu

1 Introduction

One of 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 years ago Markusen and Wagle (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-

¹Husted 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.

²Recent 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, that is, the extensive margin of trade.

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 market access for a broad set of countries and goods. Our focus is on identifying those factors that enable or hinder the expansion of trade at the extensive margin, 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 extensive margin question at the product level. To our knowledge, this paper is the first to look at this broad a set of frictions at the product level. We also study how reductions in trade frictions 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 market access.³ 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 market access. The product-level estimation enables

³We use market access and extensive margin of export interchangeably. Market access in this paper is identical to product-level extensive margin in HMR.

us to investigate if developing countries face more difficulty than developed country counterparts in exporting certain products to foreign markets.

Our results show that exporters in developing countries suffer, in particular, from inefficient trade facilitation that limits their ability to ship their products to foreign markets. Our results are consistent with Limao and Venables (2001) and Djankov et al. (2010) who find a crucial role of trade infrastructure for trade. 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, although we cannot determine to what extent the volume of trade might expand in existing markets. 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 market access.⁴

The remainder 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.

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 $i = 1, \dots, G_l$: $U^l = U[u_1^l, \dots, u_i^l, \dots, u_{G_l}^l]$. 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

⁴Clerides 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.

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: $u_i^l = \left[\int_{\omega \in B_i^l} [q_i^l(\omega)]^{\alpha_i} d\omega \right]^{1/\alpha_i}$. 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: $q_i^l(\omega) = \frac{[p_i^l(\omega)]^{-\varepsilon_i} Y_i^l}{(P_i^l)^{1-\varepsilon_i}}$ where $P_i^l = \left[\int_{\omega \in B_i^l} (p_i^l(\omega))^{1-\varepsilon_i} d\omega \right]^{1/(1-\varepsilon_i)}$.

A firm 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. $1/a_i^k$ is the firm-specific productivity measure (i.e. a firm with a lower value of a_i^k is more productive and that with a higher value of a_i^k is less productive) whose product-specific cumulative distribution function $G_i(a_i^k)$ has a country specific support $[\bar{a}_i^k, +\infty]$.⁵

We assume that each variety ω is produced by a firm with productivity a_i^k . 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 maximizes profits by charging the standard mark-up price: $p_i^k(a_i^k) = c_i^k a_i^k / \alpha_i$. If the firm exports its good to country l , the delivery price is $p_i^k(a_i^k) = \tau_i^{kl} c_i^k a_i^k / \alpha_i$.

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

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

where profit is a monotonically increasing function with respect to $1/a_i^k$ 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

⁵Tarasov (2012) also introduces a country-specific distribution of productivities.

most productive firm since the expected profit from equation (1) varies only with the firm-specific productivity ($1/a_i^k$) 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 :

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

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 on market access. 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 other bilateral variable costs of trade, 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

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

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).⁶

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

⁶ 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.

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

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).⁷ 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.⁸ 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.⁹ Based on the findings reported by MW, the data on tariffs are an essential part of our study.¹⁰ We use

⁷We use data for 2004 because we also have product-level bilateral tariff data for that year.

⁸The 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.

⁹Agriculture and mining products consist of homogeneous and reference goods as identified in Rauch (1999) and Hallak (2006).

¹⁰On 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 which the structure of tariffs across rich and poor countries is examined.

HS 6-digit tariff data from 95 importer countries from the World Bank Bilateral Tariff Data, 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,¹¹ of which 18.4% exhibit positive (non-zero) trades. Thus, approximately 80% of the observations are zeros. This highlights the high presence of zeroes in trade data at a detailed level of product disaggregation.¹²

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 zeroes 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.¹³

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 market access. 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 two measures of business-related trade frictions, using data obtained from the World Bank's Doing Business Database (World Bank).¹⁴ Recent academic studies show that

¹¹We 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.

¹²See the recent literature on zero trade (e.g., 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.

¹³Dennis 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 extensive margins from a broad set of developed and developing countries.

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

business costs play an essential role in explaining the success and failure of foreign market access. Our first measure of these costs is the sum of 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 inefficiency of trade infrastructure. Clearly, shipping time varies with the volume of trade and should likely influence the probability of success in entering markets. We also develop 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.

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 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

variables are not ideal for product-level estimations, the variables we employ are the best available for our purpose.

is more than twice the rate charged on manufactured goods imported from low-income exporter countries (0.8%).¹⁵

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. 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 [shipping](#) relative to developed countries.¹⁶ Comparing the evidence presented in Table 2, Figure 2 suggests that developing countries face tougher market 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 market access. We estimate two versions of the model. The first is a pooled study where all of the products and exporter-importer trade relationships are used in a single estimation in order to obtain single parameter estimates for each of the exogenous variables. In the second [study](#) we break the data along individual product lines

¹⁵In 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).

¹⁶This 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.

to see how various frictions impact market access 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 inefficiency, which is the log of the sum of days required to export in an exporter country and days required to import in an importer country; (4) a measure of trade costs, which is the sum of an importer’s import and an exporter’s export cost of handling a container, and (5) four variables as proxies for fixed costs: dummy variables for common legal origin, common border, common language, and colonial ties.¹⁷

In Table 3, we report the estimation results of equation (4) for the pooled sample¹⁸ and summary statistics for the parameter estimates obtained from individual logit regressions for each of the 1,188 products. For each product, we have at most 12,248 observations. The median value of observations is 5,066, of which around 15.7% are non-zeroes. 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 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 50% 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., 33.6% for middle-income countries and 23.8% 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,¹⁹ the proportion of marginal effects that have the expected sign, and the proportion of those that are

¹⁷We also estimated equation (4) as a probit model. The results from this were qualitatively identical to those reported here and are available on request.

¹⁸In particular, we estimate

$$\rho_i^{kl} = \Lambda \left(\beta_s + \beta^k + \beta^l - \gamma^1 d^{kl} - \gamma^2 t_i^{kl} - \gamma^3 \nu^{kl} - \lambda \varphi^{kl} \right)$$

where s is the index for 2-digit HS groups.

¹⁹We report the marginal effects for the coefficients at the average values of the independent variables.

statistically significant at the 5% level (one-tail test ~~as~~ 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. From the pooled estimation, we obtain a marginal effect of -0.113. That is, a one standard deviation increase in the log of distance will reduce the probability of market access by 11%. The negative impact of distance is remarkably robust. In the product-level estimations, virtually 100% of the product-level estimates carry negative signs and 99.7% are statistically significant. Similar strong and consistent results are found for common legal origin, common border, common language, and a former colonial relationship.²⁰

Estimated marginal effects on tariff rates are expected to be negative and we found some evidence that tariffs adversely impact market access. The marginal effect of tariffs in the pooled estimation was -0.035. For individual product regressions, almost 80.0% carry negative signs but only 36.6% are statistically significant at the 5% level. The imprecision in these estimates suggests that the existing tariff structure across importing countries ~~only~~ plays 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 market access.

Our trade cost variable performs similarly to the tariff rate variable. Almost 70% of the estimated coefficients carry the expected sign. However, only about 20% of them had ~~the~~ expected sign and were significant at the 5% level. Our coefficient estimates suggest that trade inefficiency plays an important role in affording market access. Recall that our proxy for inefficiency is the sum of the number of days that it takes to ship a product in an exporting country and the number of days that it takes to land a product in an importing country. We find that this variable has a significant impact on market access; 77.5% have negative signs and 51.2% are statistically significant at the 5% level. Clearly, the greater the amount of time it takes to ship products from an exporting country, the lower the probability of successful market entry.

Finally, we report the goodness of fits for equation (4) in terms of actual and predicted success

²⁰ Although we have similar results from the 2-digit data for most variables, the marginal effects on tariff differ between the 2-digit and 4-digit data. For the 2-digit level estimations, 93.6% carry negative signs and 62.8% are statistically significant at the 5% level.

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 88.8% of the actual market access outcomes, of which 20.0% are actual and predicted successes and 68.8% 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 came 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 market access especially for countries in the South, we divide our product sample into two classes of goods: agriculture and mining, and manufactures.²¹ 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.²² 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 re-estimate the pooled samples and report the individual results from equation (4) for each class of goods. Table 5 summarizes our results.

As was the case with our entire pooled sample, 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 97% of the coefficients on these variables had the correct sign with typically 75% of the coefficients statistically significant.

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. From the pooled estimation, the marginal effect of a tariff on trade in agriculture and mining goods stands at -0.074, whereas for manufactured products the marginal effect is -

²¹See 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.

²²The average tariff rate on the agriculture and mining products is 8.1% and that of the manufacturing products is 5.9%.



0.015. For product-level estimations, almost 85% of the agriculture and mining products have negative signs and 46.5% are statistically significant at the 5% level (Panel 5.1), whereas 77.3% for manufactured products have negative signs but only 33.5% 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 inefficiency matters for market access 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 inefficiency variable has an expected impact mainly on market access for manufacturing products (marginal effect of -0.201). This pattern of results also holds in the product-level analysis. Almost 90% of the estimates for the trade inefficiency parameter carry the correct sign in product-level analysis for manufactured goods; 59.7% of these are statistically significant at the 5% level (Panel 5.2).

Our pooled regression for agriculture and mining products, suggests that greater inefficiency in handling these goods also retards trade (marginal effect of -0.103), only about half the estimated impact found on manufactured goods. In the individual product regressions, only about half of the product-level trade efficiency coefficient estimates for agriculture and mining goods carry the predicted sign, and only 24.6% 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 foreign export markets. We turn now to examine if the coefficients on the trade costs (i.e., d^{kl} , t_i^{kl} , and ν^{kl}) differ across developing country and developed country access to the same destination markets. We modify equation (4) by interacting our trade costs measures (i.e., distance, tariff, trade efficiency, and trade cost) with the dummy variable of exporters from

developing countries (D^k where $D^k = 1$ if an exporter country k belongs to the subset of developing countries, otherwise $D^k = 0$):

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

We also created a dummy variable to identify importers from developing 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). For the pooled estimation, most of the marginal effects do not change from those shown in Table 3. We find no apparent evidence that the marginal effects of developing countries are larger in negative signs for distance, tariff, and trade costs. Indeed, the point estimates for each of these interaction terms carry the wrong sign. The one exception to these findings is the coefficient on the interaction term involving trade inefficiency. Similar results obtain for the product level estimations. In particular, the probability of negative signs on the dummy variables is no better than a coin toss: 40.1% for the log of distance, 53.7% for tariff, and 26% for the log of trade costs. Moreover, most of the estimated coefficients are statistically insignificant. Again, the one exception are the individual estimates on the dummy variables associated with the log of trade inefficiency. Almost two thirds of these coefficients carry the right sign and this variable also has the highest number of correctly signed and significant coefficient estimates. These findings suggest that if exporters in developing countries do face additional challenges in entering new markets it may be due to problems with internal infrastructure that hinder their ability to get goods to their customers.

The situation is slightly different when developing countries import goods. Consider Table 6.2. From the pooled estimates the results suggest that trade frictions of all types lower import levels for those countries. The individual product level results suggest that distance plays a particularly important role. 92.7% of product-level interaction terms on distance carry negative signs and 62.4%

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.

4.4 Quantifying the Effects of Trade Frictions on Extensive Margins

In this section, we discuss the effects of the reductions in trade frictions on the ability of countries to expand at the extensive margin of trade. Using the estimation results, we will examine how many more 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. The focus of our counterfactual exercises is on how the probabilities of further market access would change in response to a reduction in a variety of trade frictions.²³ In so doing, we note that this exercise is subject to the Lucas critique (Lucas, 1976), and therefore, the results we report in this section are at best 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 four counterfactual cases: (1) bilateral distances between each pair of countries falls by 50%, (2) all countries adopt the same language, (3) all countries increase their export efficiency to the most efficient level (i.e., 5 days to export for Denmark and Singapore) by replacing $\ln(eday^k + iday^l)$ to $\ln(5 + iday^l)$,²⁴ and (4) all countries move to free trade by setting t_i^{kl} to 0. We examine the fitted probabilities of success in market access for the four 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 market access at the extensive margin for developing country exporters. In spite of the intense political debates on market access, even if all countries eliminate tariffs, the success in market access for developing countries increases

²³See Debaere and Mostashari (2010) for a similar attempt from the US bilateral trades.

²⁴ $eday^k$ is exporter country k 's days to ship a product and $iday^l$ is importer country l 's days to handle a product. We keep constant the number of days for import efficiency to focus on the exporter-side factor.

only for 1.3% of the cases, which is even smaller than our estimate of 1.9% growth in export markets for middle-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., 2,297,292) 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 benefit developed countries more than developing countries.

One counterfactual change that would have a significant impact on increasing market access for countries in the South would be improving export efficiency. As shown in Figure 2, efficiency in exporting is tightly associated to the development level of countries. Thus, if all the countries obtain the efficiency level of Denmark and Singapore in handling exports, developing countries can improve their market access more than developed countries. Our estimates suggest that, on average, developing countries can obtain 8.5% more new markets although the potential growth in market access varies across countries: 2.4% for Honduras and 25.2% for Chad. Our findings on the importance of improving trade efficiency to promote export growth are consistent with Waugh (2010) and Tarasov (2012) who analyze development-related market access frictions. Although policy debates on market access at the WTO concentrate on tariff levels, improvements in trade infrastructure might be a more powerful tool to solve the market access problem of developing countries.

The results from our counterfactual exercises are somewhat counter-intuitive for policy discussions in international trade. However, they are consistent with the previous literature on market access 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 only a minor impact on market access. In other words, even if trade frictions are greatly reduced, there are only limited opportunities for producers from developing countries in foreign markets. Therefore, improvement in productivity is a critical precondition to improve 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 trade.

5 Conclusion

This paper has examined the effects of trade frictions on market access 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 efficiency in trade facilitation are significant determinants of the probability of success in entering foreign markets for a broad range of products. Our results are consistent with Limao and Venables (2001) and Djankov et al. (2010) who find the crucial role of trade infrastructures for trade. 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. In contrast to the results in MW, 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 market access. In other words, even if trade frictions are reduced, there are limited opportunities for developing countries in accessing foreign markets. ~~Our results suggest a traditional recommendation to resolve the market access problem for developing countries: expansion and diversification of the industrial base and productivity improvements in the handling of exports. Our study suggests that both are vital preconditions to increasing the number of trade partners for developing countries.~~

Acknowledgement

We thank participants in seminars at the European Trade Study Group (ETSG) at Copenhagen, the Brixen Workshop on International Trade and Finance, the Yokohama Conference on Empirical Issues of International Trade and Firms, and the Western Economic Association International 88th Conference. This research is supported by a West Virginia University Faculty Senate Research

Grant (2013).

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), 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.

References

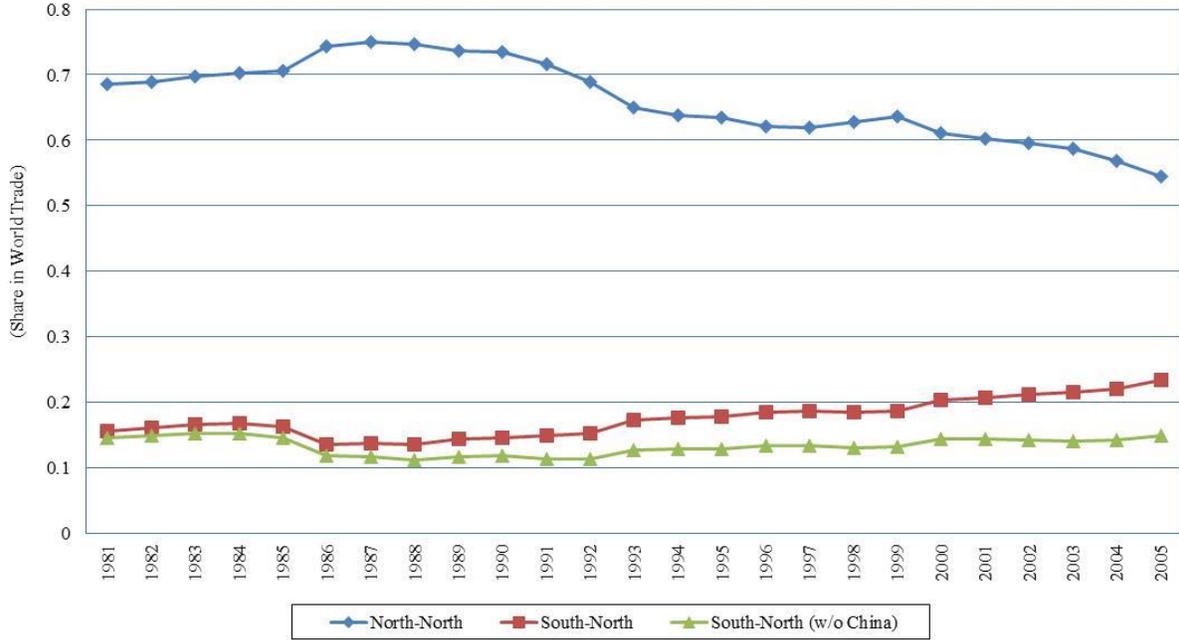
- [1] J. Arvis, Y Duval, B. Shepherd, and C. Utotham. Trade Costs in the Developing World 1995-2010. The World Bank Policy Research Working Paper 6309, 2013.
- [2] R. Baldwin and J. Harrigan. Zeros, Quality, and Space: Trade Theory and Trade Evidence. *American Economic Journal: Microeconomics*, 2: 60-88, 2011.
- [3] T. Chaney. Distorted Gravity: The Intensive and Extensive Margins of International Trade. *American Economic Review*, 98: 1707-1721, 2008.
- [4] S. Clerides, S. Lach, and J. Tybout. Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco. *Quarterly Journal of Economics*, 113: 903-947, 1998.
- [5] S. Das, M. Roberts, and J. Tybout. Market Entry Costs, Producer Heterogeneity, and Export Dynamics. *Econometrica*, 75: 837-873, 2007.
- [6] P. Debaere and S. Mostashari. Do tariffs matter for the extensive margin of international trade? An empirical analysis. *Journal of International Economics*, 163-169, 2010.
- [7] A. Dennis and B. Shepherd. Trade Facilitation and Export Diversification. *The World Economy*, 101-121, 2011.

- [8] S. Djankov, C. Freund, and C.S. Pham. Trading on Time. *Review of Economics and Statistics*, 92: 166-173, 2010.
- [9] J.C. Hallak. Product Quality and the Direction of Trade. *Journal of International Economics*, 68: 238-265, 2006.
- [10] G.H. Hanson. The Rise of Middle Kingdoms: Emerging Economies in Global Trade. *Journal of Economic Perspectives*, 26: 41-64, 2012.
- [11] K. Head, T. Mayer, and J. Ries. The Erosion of Colonial Trade Linkages after Independence. *Journal of International Economics*, 81: 1-14, 2010.
- [12] E. Helpman, M. Melitz, and Y. Rubinstein. Estimating Trade Flows: Trading Partners and Trading Volumes. *Quarterly Journal of Economics*, 123: 441-487, 2008.
- [13] D. Hummels. Transportation Costs and International Trade in the Second Era of Globalization. *Journal of Economic Perspectives*, 21: 131-154, 2007.
- [14] S. Husted and S. Nishioka. China's Fare Share? The Growth of Chinese Exports in World Trade. *Review of World Economics*, 149: 565-585, 2013.
- [15] H.L. Kee, A. Nicita, and M. Olarreaga. Estimating Trade Restrictiveness Indices. *Economic Journal*, 119: 172-199, 2009.
- [16] N. Limao and A. Venables. Infrastructure, Geographical Disadvantage, Transport Costs, and Trade. *World Bank Economic Review*, 15: 451-479, 2001.
- [17] J.R. Markusen and L.M. Wigle. Explaining the Volume of North-South Trade. *Economic Journal*, 100: 1206-1215, 2000.
- [18] M. Melitz. The Impact of Trade on Aggregate Industry Productivity and Intra-Industry Reallocations. *Econometrica*, 71: 1695-1725, 2003.
- [19] J.E. Rauch. Networks versus markets in international trade. *Journal of International Economics* 48: 7-35, 1999.
- [20] S. Redding and A. Venables. Economic Geography and International Inequality. *Journal of International Economics*, 62: 53-82, 2004.

- [21] J. Silva and S. Tenreyro. The Log of Gravity. *Review of Economics and Statistics*, 88: 641-58, 2006.
- [22] A. Tarasov. Per capita income, market access costs, and trade volumes. *Journal of International Economics*, 86: 28-294, 2012.
- [23] M. Waugh. International Trade and Income Differences. *American Economic Review*, 100: 2093-2124, 2010.
- [24] WTO. “Trade Policy and Practice by Measure -Switzerland and Liechtenstein” *Trade Policy Review*, WT/TPR/S/141, 2004.

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

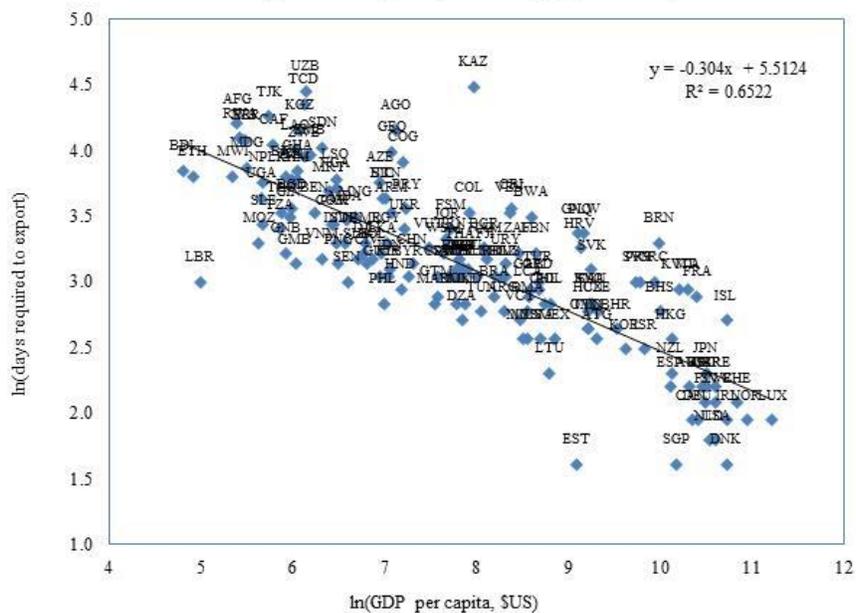


Table 3. Summary Results of Logit Estimates for Pooled and Each of 1,188 Products

	Expected signs	Pooled estimation		Estimation results for each of 1,188 products				
		Coef. (s.e.)	Sign match (%)	Sign match & 5% level (%)	Coefficients			
					Median	Min	Max	St.dev
log(Distance)	-	-0.113 (0.000)	99.9	99.7	-0.070	-0.336	0.000	0.060
log(1+Tariff)	-	-0.035 (0.003)	79.1	36.6	-0.190	-3.426	3.428	0.429
log(Trade inefficiency)	-	-0.186 (0.001)	77.5	51.2	-0.030	-0.345	0.115	0.064
log(Trade cost)	-	-0.104 (0.001)	67.9	20.5	-0.013	-0.271	0.240	0.047
Legal origin	+	0.038 (0.000)	96.5	81.0	0.026	-0.095	0.138	0.025
Common border	+	0.086 (0.001)	96.3	68.5	0.047	-0.050	0.369	0.053
Common language	+	0.066 (0.001)	92.9	72.0	0.035	-0.074	0.390	0.050
Colony	+	0.106 (0.001)	98.7	87.5	0.062	-0.046	0.398	0.066
Observations		5514178			5066	45	12248	2389
% of non-zero observations		0.322			0.157	0.008	0.503	0.093
Pseudo r-squared		0.268			0.512	0.297	1.000	0.054

Notes: (1) We exclude 52 products of 1,240 total product groups since the estimations for these products do not converge after 100 iterations. (2) We report the marginal effects in the columns "Coefficients" and "Coef.", evaluated at the average values of the independent variables. (3) Pooled estimation includes exporter-, importer-, and 2-digit product dummy variables, whereas product-level estimations do not include product dummy variables. (4) Continuous variables (i.e., log(Distance), log(Trade inefficiency) and log(Trade cost)) are 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)	2,011,679	50.1%	637,821	33.6%	702,929	23.8%	3,352,429	37.8%
Estimated observations (% to total)	2,003,432	49.9%	1,258,295	66.4%	2,252,451	76.2%	5,514,178	62.2%
Actual & predicted success (% to estimated)	232,331	11.6%	189,414	15.1%	680,212	30.2%	1,101,957	20.0%
Actual success & predicted failure (% to estimated)	116,935	5.8%	88,019	7.0%	173,504	7.7%	378,458	6.9%
Actual failure & predicted success (% to estimated)	58,092	2.9%	47,162	3.7%	133,550	5.9%	238,804	4.3%
Actual & predicted failure (% to estimated)	1,596,074	79.7%	933,700	74.2%	1,265,185	56.2%	3,794,959	68.8%

Table 5. Estimation Results for Resource and Manufacturing Sectors

5.1. Agriculture and Mining Products (289 products)

	Expected signs	Pooled estimation		Estimation results for each of agriculture and mining products				
		Coef. (s.e.)	Sign match (%)	Sign match & 5% level (%)	Coefficients			
					Median	Min	Max	St.dev
log(Distance)	-	-0.104 (0.001)	99.7	98.6	-0.048	-0.262	0.000	0.044
log(1+Tariff)	-	-0.074 (0.006)	84.7	46.5	-0.180	-2.715	0.903	0.300
log(Trade inefficiency)	-	-0.103 (0.002)	49.1	24.6	0.000	-0.214	0.115	0.040
log(Trade cost)	-	-0.109 (0.003)	72.0	24.9	-0.013	-0.171	0.110	0.034
Legal origin	+	0.040 (0.001)	94.5	79.5	0.017	-0.010	0.096	0.020
Common border	+	0.076 (0.003)	94.1	70.1	0.031	-0.045	0.192	0.037
Common language	+	0.049 (0.002)	87.9	61.2	0.018	-0.074	0.171	0.032
Colony	+	0.090 (0.003)	96.9	81.3	0.036	-0.019	0.274	0.049
Observations		775046			4795	45	10478	2478
% of non-zero observations		0.231			0.123	0.008	0.393	0.074
Pseudo r-squared		0.298			0.483	0.297	1.000	0.060

5.2. Manufacturing Products (901 products)

	Expected signs	Pooled estimation		Estimation results for each of manufacturing products				
		Coef. (s.e.)	Sign match (%)	Sign match & 5% level (%)	Coefficients			
					Median	Min	Max	St.dev
log(Distance)	-	-0.115 (0.000)	100.0	100.0	-0.083	-0.336	-0.009	0.061
log(1+Tariff)	-	-0.015 (0.004)	77.3	33.5	-0.194	-3.426	3.428	0.463
log(Trade inefficiency)	-	-0.201 (0.001)	86.7	59.7	-0.042	-0.345	0.102	0.065
log(Trade cost)	-	-0.103 (0.001)	66.6	19.0	-0.014	-0.271	0.240	0.051
Legal origin	+	0.038 (0.000)	97.1	81.4	0.029	-0.095	0.138	0.026
Common border	+	0.087 (0.001)	97.0	68.0	0.054	-0.050	0.369	0.056
Common language	+	0.069 (0.001)	94.5	75.4	0.043	-0.031	0.390	0.052
Colony	+	0.109 (0.001)	99.3	89.5	0.069	-0.046	0.398	0.068
Observations		4,739,132			5182	183	12248	2345
% of non-zero observations		0.275			0.171	0.012	0.503	0.095
Pseudo r-squared		0.328			0.521	0.324	0.611	0.049

Table 6. Interactions with Dummy Variables for Developed Countries

6.1. Interactions for exporters from low-income countries

	Expected signs	Pooled estimation		Estimation results for each of 1,189 products				
		Coef. (s.e.)	Sign match (%)	Sign match & 5% level (%)	Coefficients			
					Median	Min	Max	St.dev
log(Distance)	-	-0.115 (0.000)	99.9	99.3	-0.071	-0.356	0.000	0.063
D_ex × log(Distance)	-	0.000 (0.000)	40.1	8.1	0.003	-0.068	0.097	0.019
log(1+Tariff)	-	-0.082 (0.003)	78.3	34.2	-0.185	-3.418	3.931	0.431
D_ex × log(1+Tariff)	-	0.178 (0.005)	53.7	9.7	-0.014	-1.941	2.294	0.290
log(Trade inefficiency)	-	-0.239 (0.001)	81.4	53.2	-0.036	-0.386	0.118	0.065
D_ex × log(Trade inefficiency)	-	-0.100 (0.001)	62.7	23.4	-0.007	-0.327	0.120	0.035
log(Trade cost)	-	-0.085 (0.001)	69.9	21.8	-0.016	-0.274	0.219	0.047
D_ex × log(Trade cost)	-	0.025 (0.001)	26.0	3.1	0.009	-0.091	0.087	0.020
Legal origin	+	0.036 (0.000)	96.2	80.4	0.026	-0.099	0.137	0.025
Common border	+	0.090 (0.001)	96.5	69.1	0.047	-0.051	0.372	0.055
Common language	+	0.067 (0.001)	93.4	71.7	0.034	-0.073	0.392	0.050
Colony	+	0.105 (0.001)	98.7	87.4	0.061	-0.040	0.395	0.066
Pseudo r-squared		0.323			0.514	0.324	1.000	0.053

6.2. Interactions for Importers from low-income countries

	Expected signs	Pooled estimation		Estimation results for each of 1,186 products				
		Coef. (s.e.)	Sign match (%)	Sign match & 5% level (%)	Coefficients			
					Median	Min	Max	St.dev
log(Distance)	-	-0.102 (0.000)	99.8	99.4	-0.063	-0.285	0.004	0.053
D_im × log(Distance)	-	-0.033 (0.000)	92.7	62.4	-0.019	-0.155	0.038	0.026
log(1+Tariff)	-	0.076 (0.004)	73.2	25.9	-0.147	-4.878	16.160	0.707
D_im × log(1+Tariff)	-	-0.211 (0.005)	64.8	17.5	-0.150	-17.030	15.760	1.044
log(Trade inefficiency)	-	-0.232 (0.001)	80.4	44.0	-0.026	-0.265	0.074	0.052
D_im × log(Trade inefficiency)	-	-0.161 (0.001)	56.5	16.6	-0.004	-0.201	0.275	0.044
log(Trade cost)	-	-0.073 (0.001)	36.0	5.0	-0.010	-0.265	0.238	0.046
D_im × log(Trade cost)	-	-0.021 (0.001)	41.0	8.6	-0.004	-0.123	0.134	0.027
Legal origin	+	0.039 (0.000)	96.4	81.4	0.026	-0.065	0.140	0.025
Common border	+	0.085 (0.001)	96.0	63.4	0.042	-0.052	0.340	0.045
Common language	+	0.063 (0.001)	92.9	71.2	0.032	-0.052	0.374	0.048
Colony	+	0.107 (0.001)	98.8	88.5	0.062	-0.021	0.416	0.068
Pseudo r-squared		0.324			0.515	0.333	1.000	0.052

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

	Exporter Countries		
	Low-income	Middle-income	High-income
1. 50% reduction in distance			
Overall	7.8%	11.0%	13.3%
Simple average across countries	5.8%	7.9%	11.4%
Std. deviations	3.4%	4.5%	4.5%
Minimum (country)	1.3% (Afghanistan)	1.9% (Botswana)	1.8% (Palau)
Maximum (country)	19.1% (Samoa)	16.7% (South Africa)	16.9% (Belgium)
2. Same language everywhere			
Overall	3.5%	5.1%	6.5%
Simple average across countries	2.2%	3.3%	5.5%
Std. deviations	1.9%	2.8%	2.6%
Minimum (country)	0.1% (Tonga)	0.1% (St. Vincent)	0.2% (Antigua)
Maximum (country)	7.4% (Thailand)	9.2% (Turkey)	9.1% (Netherlands)
3. Improvement in export inefficiency			
Overall	8.5%	6.9%	3.8%
Simple average across countries	8.7%	5.6%	3.9%
Std. deviations	5.0%	3.1%	2.6%
Minimum (country)	2.4% (Honduras)	0.0% (Estonia)	0.0% (Singapore)
Maximum (country)	25.2% (Chad)	12.6% (South Africa)	9.8% (Slovak)
4. Tariff eliminations			
Overall	1.3%	1.9%	3.2%
Simple average across countries	0.6%	1.2%	2.6%
Std. deviations	0.8%	1.1%	1.7%
Minimum (country)	0.0% (Solomon)	0.0% (St. Lucia)	0.0% (St. Kitts)
Maximum (country)	3.5% (India)	3.8% (South Africa)	5.1% (Netherlands)

Note: In this table, we report the shares of observations that are zeros for the predicted and ones in the counterfactual cases in estimated observations.