Asymmetric Trade Costs:
Agricultural Trade among Developing and Developed Countries

Jihyun Eum, Ian Sheldon[1], and Stanley Thompson

Department of Agricultural, Environmental, and Development Economics

Ohio State University

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[1] Corresponding author: email address – sheldon.1@osu.edu

Abstract

In this paper, the reasons why developing countries trade fewer agricultural goods than developed countries is analyzed. Based on earlier findings that low trade volume in the agricultural sector is due to high trade costs (Reimer and Li, 2010; Xu, 2015), the analysis investigates how bilateral trade costs in agricultural sector actually differ among trading partners. Using a Ricardian trade model, the results show that systematically, asymmetric bilateral trade costs and variations in the level of agricultural productivity across all countries in the sample, are the main trade barriers for developing countries' agricultural exports. In addition, low-income countries face higher trade costs to export than do high-income countries.

Keywords: agricultural trade, productivity, trade costs,

JEL codes: F11, F14, Q17

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1. Introduction

The value of trade value in agricultural goods (less than US$ 2 trillion in 2013) is significantly less than that of manufacturing goods (about US$ 13 trillion in 2013). Agricultural trade mostly originates from developed countries, with in excess of 60 percent of trade in food and vegetable products flowing largely from either developed to developed countries (North-North) or from developed to developing (North-South) (UNCTAD, 2014).

The main causes of low agricultural trade flows from developing countries are considered to be significant relative productivity differences and high trade costs (Tombe, 2015; Xu, 2015). Productivity variation across countries is more significant in the agricultural sector than in the non-agricultural sector (Caselli, 2005; Restuccia, Yang, and Zhu, 2008; Lagakos and Waugh, 2013). Gollin, Lagakos, and Waugh (2013) attribute relatively lower productivity in the agricultural sector, the so-called "agricultural productivity gap", to the misallocation of labor across sectors, where the gap is even greater in developing countries. Lagakos and Waugh (2013) find that self-selection of heterogeneous workers is a major contributor to cross-sector and cross-country productivity differences. They observe that, in developing countries, where a large percent of the workforce is engaged in the agricultural sector, the level of productivity in the agricultural sector is lower than that in manufacturing. Conversely, in industrialized countries, they find the opposite relationship holds. Furthermore, Gollin and Rogerson

(2014) and Adamopoulos (2015) suggest that high transport frictions also affect low labor productivity in agriculture and distort labor allocations across sectors. Alleviation of transportation costs is expected to improve agricultural productivity as well as welfare of an economy.

In this paper, the differences in trade of agricultural goods between developing and industrialized countries are examined using a neo-Ricardian trade model. The multi-country model consists of individual countries specializing in a continuum goods according to their comparative advantage. Countries exhibit a range of productivity levels, where productivity is randomly drawn from a country-specific distribution (Eaton and Kortum, 2002; Waugh, 2010; Reimer and Li, 2010). Bilateral trade flows in the model are explained by relative unit costs of production, bilateral trade costs, and productivity differences. In this paper, the value of the elasticity of trade for the agricultural sector is estimated. The low estimated value for this elasticity reflects the range of agricultural productivity across countries, implying that the degree of comparative advantage has a strong potential to counteract resistance due to trade barriers. Asymmetric trade costs are also found to be the main cause of bilateral agricultural trade share differences between the developed (North) and developing (South) countries. In particular, developing countries face relatively higher trade costs to export their agricultural products to the North than what developed countries incur to export their agricultural goods to the South.

Reimer and Li (2010) investigate the gains from agricultural trade liberalization by estimating the elasticity of trade. They conclude that the gains are not distributed equally because of differences in trade-openness and productivity. Xu (2015) finds the causes of low trade intensity in the agricultural sector, as compared to manufacturing trade, to be due to high trade costs and the large range in agricultural productivity. However, neither paper addresses systematically asymmetric trade costs between developing and developed countries. In this paper, a method for appropriate accounting of systematically asymmetric trade costs, as developed by Waugh (2010), is used to analyze why agricultural products are not traded from South to North to the same degree that they are traded from North to South.

The remainder of the paper is structured as follows. In Section 2, the theoretical model is derived. The data are described in Section 3. The empirical specification, the estimation methodology and the results are presented in Section 4. Finally, in Section 5, the essay is summarized and conclusions are drawn.

2. Model

Following Reimer and Li (2012), each country i is assumed to have a tradable agricultural product sector. There is a continuum of agricultural products indexed by $j \in [0,1]$ (Dornbusch, Fischer, and Samuelson, 1977). Countries differ in their production efficiency $z_i(j)$. In terms of producing agricultural goods in country i, land (L_i) with land rental rate (r_i) is used with productivity $z_i(j)$. With a constant return to scale, the cost of production is r_i / z_i.

Productivity is assigned by a random draw from a country-specific Fréchet probability distribution (Eaton and Kortum, 2002). This probabilistic structure allows each country to have some possibility of producing at a lower cost than others, thereby assigning comparative advantage:

$$F_i(z) = \exp\{-T_i z_i^{-\theta}\}. \tag{1}$$

The location of the distribution is controlled by the parameter T_i, implying average productivity in country i. A more productive country has a higher T_i. The parameter θ, which is common across countries, governs the distribution of yields. A lower θ implies great variation in productivity levels across products and countries, indicating that comparative advantage acts as more of a counter than trade costs do on trade patterns.

Assume that country i is the exporter and country n is the importer. The delivery of one unit of an agricultural good requires τ_{ni} units produced in country i. Home trade indicates $\tau_{ii} = 1$ when i=n. Assuming that the market is perfectly competitive, the price that country n pays for the imported product j from country i is:

$$p_{ni}(j) = \frac{\tau_{ni} r_i}{z_i(j)}. \tag{2}$$

The consumer price in n for good j is the lowest price across all trading partners:

$$p_n(j) = \min\{p_{n1}(j), p_{n2}(j), p_{n3}(j), ..., p_{nN}(j)\}.$$

A representative consumer has the following constant elasticity of substitution (CES) utility function:

$$U = [\int_0^1 q(j)^{(\sigma-1)/\sigma} dj]^{\sigma/(\sigma-1)},$$

where $q(j)$ indicates the quantity purchased by consumers and σ is the elasticity of substitution across products. Utility maximization is subject to an aggregate (across all buyers in country *n*) budget constraint X_n, accounting for total spending in country *n*.

The possibility that country *i* exports a good to country *n* is the probability that the price of country *i* will be the lowest. Using the productivity distribution in (1), Eaton and Kortum (2002) have shown that the probability that country *i* delivers its good at the lowest price to country *n* is given by:

$$\Pr[P_{ni}(j) \le P_{nl} \forall l \ne i] = \frac{T_i (r_i \tau_{ni})^{-\theta}}{\sum_{i=1}^{N} T_i (r_i \tau_{ni})^{-\theta}}, \qquad (3)$$

where country *i*'s probability of exporting to country *n* decreases with the land rental rate (r_i) and distance between trade partners(τ_{ni}), while it increases with higher average yields (T_i) .

Equilibrium 1. Price Index: At the country level, each country *n* has an aggregated price index. The moment-generating function for the extreme value distribution generates the following price index (Eaton and Kortum, 2002):

$$P_n = [\Gamma(\frac{\theta + 1 - \sigma}{\theta})]^{1/(1-\sigma)} [\sum_{i=1}^{N} T_i (r_i \tau_{ni})^{-\theta}]^{-1/\theta} \quad \text{where} \quad \theta > \sigma - 1, \qquad (4)$$

and $[\Gamma(\frac{\theta + 1 - \sigma}{\theta})]^{1/(1-\sigma)}$ is the Gamma function. The aggregate price index is expressed as a function of the technology level (T_i), the land rental rate (r_i), and trade costs (τ_{ni}).

Equilibrium 2. Trade shares: Denote X_{ni} as *n*'s total expenditure on imports from *i* and X_n as *n*'s total spending. The share of *n*'s expenditure on imported products from *i* relative to *n*'s total expenditure is equal to the probability that country *i* exports to *n* at the minimum price. Therefore, the probability that country *i* exports to country *n* at the minimum price can be written with the trade share at the aggregate level:

$$\frac{X_{ni}}{X_n} = \frac{T_i(r_i\tau_{ni})^{-\theta}}{\sum_{i=1}^{N} T_i(r_i\tau_{ni})^{-\theta}}. \tag{5}$$

Expression (5) shows that trade shares are a function of the productivity parameters (T_i), bilateral trade costs (τ_{ni}), and the land rental rate (r_i). Using (5), the trade share is then normalized by the share of domestic production in total expenditure of importers, which is also a function of the relative technology level (T_i), the land rental rate (r_i), and bilateral trade costs (τ_{ni}):

$$(\frac{X_{ni} / X_n}{X_{nn} / X_n}) = \frac{T_i}{T_n}(\frac{r_i}{r_n})^{-\theta}\tau_{ni}{}^{-\theta}. \tag{6}$$

Equilibrium 3. Allocation of land resource and land rental rate: (7.1) gives the trade balance requirement, i.e., total exports are equal to total imports, while (7.2) shows that total domestic product equals the sum of country *i*'s exports towards all trading partners, including itself. Optimal land allocation, which is derived from the first-order condition of the producer's problem, is given by: $r_i L_i = \sum_{n=1}^{I} X_{ni}$.

Export = Import: $$\sum_{i \neq n} X_{in} = \sum_{i \neq n} X_{ni}, \tag{7.1}$$

$$Y_i = \sum_{n=1}^{I} X_{ni} = r_i L_i. \tag{7.2}$$

3. Data

Balanced product trade flow data for a sample of 8 countries were obtained for the year 2013. The total number of observations is 9,709. The countries and descriptive statistics are shown in Tables 1 and 2 respectively. Zero trade flows are revised to 1/10000000 in order not to lose a substantial number of observations.[1] Trade and production data were obtained from the Food and Agriculture Organization of the United Nations (FAO) database. The observed values for mainland China, Macao, Taiwan, and Hong Kong are aggregated as one country "China". The observed value at the country-level is aggregated trade and production values for agricultural products, the list of observed products being presented in Table 3. Trade cost data were obtained from the Centre d'Etudes Prospectives et d'Information Internationales (CEPII) gravity dataset. The geographic distances between two countries, common border, common language, and common regional trade agreements were used as proxies for impediments to trade. Distance variables consist of six dummies, representing the intervals of the circular distance between country capitals. The criteria for dividing the intervals ([0,375); [375,750); [750, 1500); [1500, 3000); [3000, 6000); and [6000, maximum]) is taken from Eaton and Kortum (2002). Arable land data are obtained from the World Bank's World Development Indicators.

4. Empirical Analysis

4.1. Estimation of the elasticity of trade

The value of the elasticity of trade is critical to estimating the effect of trade policies on trade (Simonovska and Waugh, 2014), and the welfare benefits of trade (Arkolakis, Costinot and Rodríguez-Clare, 2012), because it influences the measurement of trade frictions, the fluctuation of trade flows, and the welfare effects - see (6). In this paper, estimation of the elasticity of trade parameter follows the approach used by Eaton and Kortum (2002), who suggest using the second highest price difference among trade partners to measure bilateral trade costs with product-level price data:

$$\left(\frac{X_{ni} / X_n}{X_{ii} / X_i}\right) = \left(\frac{P_i \tau_{ni}}{P_n}\right)^{-\theta}, \tag{8.1}$$

where $$\ln\left(\frac{P_i \tau_{ni}}{P_n}\right) = \frac{\max 2\{\ln P_n(j) - \ln P_i(j)\}}{\frac{1}{J}\sum_{j=1}^{J}(\ln P_n(j) - \ln P_i(j))}. \tag{8.2}$$

(8.1) indicates that the trade share of country i in country n relative to i's share at home can be expressed through relative prices and trade costs. If the relative price in market i with respect to n falls or the distance between country i and n increases, then country i's normalized share in n declines. In the theoretical model, a lower θ indicates more variation in productivity, reflecting strength of comparative advantage – see (1). As θ becomes small, the left-hand side of the equation, representing normalized import share, is less elastic to relative prices and trade costs τ_{ni} (Eaton and Kortum, 2002). Therefore a low elasticity of trade (θ), implying greater variation in productivity levels across products and countries, enhances the effect of relative price differences and trade costs on trade shares.

By converting (8.1) into logarithmic form and substituting the right-hand side variable into (8.2), the value of the trade elasticity θ can be recovered by using simple ordinary least squares (OLS) estimation. The product-level price data come from the FAO price statistics database for each observed country in the year 2013. A simple OLS estimation yields a value of θ = 2.536. This value is similar to that in Reimer and Li (2010): 2.83 and 2.52 based on their use of the generalized method of moments (GMM) and maximum likelihood estimation (MLE) techniques, respectively, for trade in crop products among twenty-three countries in 2001. Originally, Eaton and Kortum (2002) used a simple method-of-moments technique for the manufacturing sector based on a sample of 19 OECD countries in 1990, reporting a value of θ = 8.28. Simonovska and Waugh (2014) estimate a value for θ of 2.79 to 4.46 based on results from the simulated method-of-moments estimations for all sectors in a sample of 123 countries in 2004. The estimates of the latter two studies suggest larger values for θ than the estimates reported in the current paper largely because the focus here is limited to agriculture.

4.2. Estimation of S_i

Equation (6) shows that the trade share normalized by domestic production is a function of trade of the relative technology level, land rental rate, and trade costs. Taking logs of (6) yields a structural "gravity" equation:

$$\ln\left(\frac{X_{ni}/X_n}{X_{nn}/X_n}\right) = S_i - S_n - \theta \ln \tau_{ni}, \qquad (9)$$

where $$\ln \tau_{ni} = b_{ni} + \mathrm{l}_{ni} + RTA_{ni} + \sum_r d_{r_{ni}} + ex_i + \upsilon_{ni}.$$

Following Eaton and Kortum (2002), Waugh (2010), and Heerman and Sheldon (2016), trade costs (τ_{ij}) consist of: a common border (b_{ni}) between countries, a common language (l_{ni}) between countries, membership of a common regional trade agreement (RTA_{ni}), distance between two countries ($d_{r_{ni}}$), and exporter fixed effects (ex_i), where the distance variable is constructed over the k^{th} distance intervals. S_i has the same value in the parameter vector S, which is the combination of the state of technology and the land rental rate - $S_i \equiv \ln(T_i r_i^{-\theta})$. The error term ($\upsilon_{ni}$) is assumed to be the sum of the two components: $\upsilon_{ni}{}^1 + \upsilon_{ni}{}^2$, of which the first component ($\upsilon_{ni}{}^1$) indicates an unobserved one-way direction (with variance $\sigma_1{}^2$), while the second component is country-pair specific affecting two-way direction, so that $\upsilon_{ni}{}^2 = \upsilon_{in}{}^2$ (with variance $\sigma_2{}^2$).[2] Accordingly, the error term has a variance-covariance matrix with the diagonal elements of $E(\upsilon_{ni} \cdot \upsilon_{in}) = \sigma_1{}^2 + \sigma_2{}^2$ and the off-diagonal elements of $E(\upsilon_{ni} \cdot \upsilon_{ni}) = \sigma_2{}^2$ (see Eaton and Kortum, 2002). The error term, overall, controls the potential reciprocity in the geographic barriers (Reimer and Li, 2010):[3]

$$\ln(\frac{X_{ni} / X_n}{X_{nn} / X_n}) = \hat{S}_i - \hat{S}_n - \theta\hat{\tau}_{ni} - \theta\upsilon_{ni} = \overline{S}_i - \hat{S}_n - \theta(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{r_{ni}} + \upsilon_{ni}), \quad \text{where} \quad \overline{S}_i = \hat{S}_i - \theta\hat{e}x_i. \tag{10}$$

The exporter fixed effects (ex_i) measure the additional trade costs for a specific exporter i, which enables identification of the difference between high export costs and S_i. Including the exporter fixed effects in the trade cost equation helps identify the importer and exporter effects separately (Simonovska and Waugh, 2014). As shown in (10), the two separate effects, destination country fixed effects ($\hat{S}_n$) and source-country fixed effects ($\bar{S}_i$), are estimated with dummy variables. Since $\hat{S}_i$ is a common component for countries that are both exporters and importers, the exporter-specific component of trade costs is recovered as the deviation in the importer and exporter fixed effects ($\hat{S}_i - \bar{S}_i = \hat{S}_i - (\hat{S}_i - \theta ex_i) = \theta ex_i$). Accordingly, (10) is estimated using generalized least squares (GLS) with the diagonal elements ($\sigma_1^2 + \sigma_2^2$) of the variance-covariance matrix (Eaton and Korum 2003; Reimer and Li 2010; Simonovska and Waugh 2014). In order to avoid the dummy variable trap, two constraints ($\sum S_n = 0$, $\sum ex_i = 0$) are imposed (Reimer and Li 2010; Simonovska and Waugh 2014).

Table 4 shows the estimation results for (10) based on using 9,709 observations for 128 countries. Most of the coefficients are statistically significant with an adjusted R^2 of 0.523. Panel A indicates the estimated coefficients of the geographic barriers and Panel B presents the estimated S_i terms and recovered exporter effects. The coefficients for the geographic barriers imply that the trade share increases in common border, common language, and common regional trade agreements. The coefficients are positive and statistically significant at the 1 percent level. At the same time, the normalized trade share decreases in distance between the countries. In detail, the coefficient on the first distance dummy is -13.75 and this is the smallest in magnitude relative to the further distance dummies. The magnitudes of all distance variables in absolute values are larger than that of any other variables, suggesting that transport costs are the main impediment to agricultural trade.

The estimated destination country effects (S_i) the exporter effects (θex_i) are reported in Panel B of Table 4. S_i, which is equivalent to $\ln(T_i r_i^{-\theta})$, is interpreted as the adjusted average productivity level by unit production cost of country *i*. In other words, S_i is a decreasing function of the unit cost for a producer with the average technology level. The estimated S_i implies that unit production costs, based on the average productivity level, do not significantly vary with GDP per capita, implying that countries in the South and North are similar in term of unit production costs, as shown in Figure 1 (Waugh, 2010).[4] By using exporter fixed effects, the model precisely reflects the same level of aggregate price of tradeable goods across countries in the data. In the next section, the impact on trade costs and heterogeneous technology for agricultural trade between the North and South is examined

4 3. Effects on trade costs and state of technology

Given the estimated value of θ, in Table 5 results are reported showing the implied effects of the various factors on trade costs and the state of the technology. The implied effects on trade costs is estimated by $(e^{(-1/\theta)*b} - 1)$ with θ= 2.5. In Panel A, the effects of the geographic barriers on trade share are estimated. While common border, common language, and common regional trade agreement reduce trade costs, the distance variables increase trade costs. The size of the geographic distance influence is much larger for the distance than that of the shared border, shared language, and shared regional trade agreement. A distance of less than 375 miles requires at least an additional 243.69 units of agricultural goods to be traded. Other geographic barriers (common border, common language, and common regional agreement) reduce trade costs by at least an additional 0.28~0.73 units of traded agricultural goods.

Agricultural goods exported from the US are cheaper by an additional 1 unit than products exported from the average country. Similarly, it costs less to export from Argentina, China, Chile, and Brazil than from the average country (about 0.97 units). On the other hand, a product exported from Nigeria costs about 44.66 units more than the average. Goods exported from Mali, Mongolia, Guinea and Surinam cost more than an additional 50 units than the average country. Therefore, it costs less for the relatively open and developed countries to export, as Figure 2 shows.

As noted in the previous section, the unit costs of a producer with the average productivity level are equivalent among countries (Waugh, 2010). The differences in S_i are assumed to be caused by differences in agricultural productivity. The average status of technology is recovered using the definition of S_i:

$$\ln T_i \equiv \hat{S}_i + \theta \ln r_i,$$

where r_i is estimated using the exporter's agricultural output per hectare of arable land (Heerman and Sheldon, 2016). From this, the country's average technology level (T_i) can be separated from its competitiveness (S_i). As Figure 3 shows, more productive countries reveal higher income. The relationship between the log of estimated technology level (T_i) and the log of GDP per capita is positive. The North and South differ in terms of technology level. Table 6 shows the normalized technology level by calculating the value relative to the US value $(\frac{T_i}{T_{us}})^{1/\theta}$. The US, China, Argentina, Brazil, and Chile are recorded as the top five high-technology countries in the agricultural sector whereas Gambia, Botswana, Benin, Guyana, and Zimbabwe are recorded as the bottom five countries. Also, the normalized technology level is interpreted as the technology level of a country adjusted by its land rental rate. For instance, Australia (8.243) is more competitive than France (8.01) and Germany (7.61), but it is ranked below France and Germany. It is assumed that the competitive edge is due to lower land rental rates rather than the state of technology. Similarly, low estimate for the competitiveness of Belgium (ranked 24th) is the consequence of a high land rental rate (ranked 19th).

4.4. Recovering Asymmetric Trade Costs, τ_{ij}

Using the estimates from the previous section, bilateral trade costs from the structural model are estimated. Equation (9) is used to derive asymmetric trade costs:

$$\tau_{ni} = \exp(-\hat{b}_{ni} / \theta) * \exp(-\hat{l}_{ni} / \theta) * \exp(-r\hat{t}a_{ni} / \theta) * \exp(-\sum_r \hat{d}_{r_{ni}} / \theta) * \exp(\hat{e}x_i / \theta).$$

Trade costs for selected countries are presented in Table 7. The rows indicate exporters and the columns indicate destination markets. Trade costs to export (τ_{ni}) follow the standard iceberg assumption, in that they refer to transportation costs or costs necessary to overcome geographic barriers. They also include unobserved related barriers, which are the asymmetric components. .

For rich countries, e.g., China, France, Japan, the UK, the US, and so on, trade costs to the South, which are represented in the upper diagonal, are less than the trade costs for the South towards the North, as represented in the lower diagonal. For example, trade costs for the US to Zimbabwe (6) is smaller than that of Zimbabwe to the US (31,672). In addition, the trade cost of Ethiopia to France is more than twice the cost of France exporting agricultural products to Ethiopia. Accordingly, asymmetric trade costs imply that countries in the South trading with the North, face relatively more difficulty in exporting their goods than importing goods from the North.

Figure 4 shows the relationship between τ_{in} and τ_{ni} (where *n* is trading partner and *i* is the US). Trade cost from the US towards country *n* is relatively smaller than that of country *n*'s trade costs towards the US market. Developing countries are located in the upper part of the figure, indicating that they have a relatively higher trade cost than that of the US. Figure 5 shows the relationship between asymmetric trade costs and GDP per capita. Most countries have a positive deviation of trade costs, meaning their trade costs towards the US market are higher than the US trade costs towards their markets. The relationship between GDP per capita and the deviation is negative. Thus, countries with a higher deviation of trade cost towards the US also have a lower GDP per capita. An important conclusion is that low-income countries in the South pay relatively higher trade costs as compared to the US.

5. Summary and Conclusion

Trade flows in the agricultural sector are significantly less than those for in manufacturing. In this paper, the extent to which low agricultural trade flows are due to either relative productivity differences and/or trade costs are examined. Based on a

Ricardian model, trade shares are expressed as a function of relative productivity, relative land rental rates, and bilateral trade costs. Using trade data for 128 countries for 2013, the value of the elasticity of trade is estimated, reported value being relatively lower than the value reported in other studies for the manufacturing sector. The low value for the elasticity of trade reveals that there is large heterogeneity in productivity in the agricultural sector, implying that the role of comparative advantage in countering trade costs should be strong.

Furthermore, large trade frictions restrict agricultural trade flows. In particular, asymmetric trade costs account for the low agricultural trade of developing countries in that the South faces relatively higher trade costs than does the North. Based on the estimation results, the trade costs incurred by the South are much higher than those incurred by the North, while domestic unit costs and the price of tradeable goods are equivalent between the North and the South. In conclusion, relatively higher trade costs, as well as differences in productivity are suggested as the main causes for why the South trades fewer agricultural goods.

Notes

1. If zero trade flows were dropped, the number of observations decreases to 4,928 with 116 countries.

2. Simonovska and Waugh (2014) use both specifications with the error term in (9), interpreting the error term as a measurement error and structural shock to trade barriers, respectively. According to their results, the estimates are nearly identical.

3. It is possible that the error term related to trade from *n* to *i* is correlated with the disturbance concerning trade from *i* to*n*.

4. The interpretation of S_i is different from Eaton and Kortum (2002) who use importer fixed effects. A model with importer fixed effects allows for a larger import share as a result of the lower unit cost of production. If two countries import a similar share of goods, then the model considers an increase in trade costs as the cause of a similar trade share.

Table 1: Observed Countries

Albania	Burkina Faso	Ethiopia	Japan	Netherlands	Saudi Arabia	USA
Algeria	Burundi	Fiji	Jordan	New Zealand	Senegal	Uruguay
Antigua & Barbuda	C?te d'Ivoire	Finland	Kazakhstan	Nicaragua	Seychelles	Vanuatu
Argentina	Cabo Verde	France	Kenya	Niger	Singapore	Venezuela
Armenia	Cambodia	Gambia	Kyrgyzstan	Nigeria	Slovakia	Viet Nam
Australia	Cameroon	Georgia	Latvia	Norway	Slovenia	Yemen
Austria	Canada	Germany	Lebanon	Oman*	South Africa	Zambia
Azerbaijan	Chile	Ghana	Lithuania	Pakistan	Spain	Zimbabwe
Bangladesh	China, mainland	Greece	Luxembourg	Panama	Sri Lanka	
Barbados	Colombia	Guinea	Madagascar	Paraguay	Suriname	
Belarus	Congo	Guyana	Malawi	Peru	Sweden	
Belgium		Honduras	Malaysia	Philippines	Switzerland	
Belize	Costa Rica	Hungary	Maldives	Poland	Thailand	
Benin	Croatia	Iceland	Mali	Portugal	FYR Macedonia	
	Cyprus	India	Malta		Togo	
Bolivia	Czech Republic	Indonesia	Mauritius	South Korea	Trinidad Tobago	
Bosnia &Herzegovina	Denmark	Iran	Mexico	Moldova	Tunisia	
Botswana	Ecuador	Ireland	Mongolia	Russia	Turkey	
Brazil	Egypt	Israel	Morocco	Rwanda	Ukraine	
Brunei Darussalam	El Salvador	Italy	Namibia	Saint Lucia	United Kingdom	
Bulgaria	Estonia	Jamaica	Nepal	St Vincent & Grenadines	Tanzania	

Table 2: Summary Statistics

Variable	Obs	Mean	Std.	Min	Max	Unit
Import value *ij*	9,709	26.071	346.478	0	21556.97	Million US$
Export value *ij*	9,709	45.616	624.006	0	38860.57	Million US$
RTA *ij*	9,709	0.207	0.405	0	1	
Common border *ij*	9,709	0.035	0.183	0	1	
Common lang *ij*	9,709	0.145	0.352	0	1	
Distance *ij*	9,709	4195.430	2815.637	37.044	12285.96	mile
dist1 *ij*	9,709	0.028	0.166	0	1	
dist2 *ij*	9,709	0.062	0.240	0	1	
dist3 *ij*	9,709	0.130	0.337	0	1	
dist4 *ij*	9,709	0.183	0.387	0	1	
dist5 *ij*	9,709	0.336	0.472	0	1	
dist6 *ij*	9,709	0.261	0.439	0	1	
Total imports *i*	9,709	2974.089	7818.797	0	64624.96	Million US$
Total exports *i*	9,709	2900.187	6730.051	0	45891.53	Million US$
Total prod *i*	9,709	35732.9	124458.6	8.75	1060080	Million US$
Xn *ij*	9,709	35806.8	129682.7	8.75	1117193	
Pini *ij*	9,709	0.861	0.137	0.203	1	
Dep *ij*	9,709	0.003	0.037	0	2.363	
ln dep *ij*	9,709	-17.795	8,169	-29.987	0.860	

Table 3: Observed Products

Wheat	Rapeseed	Tangerines, mandarins	Mata
Barley	Sesame seed	Lemons and limes	Hops
Maize	Mustard seed	Grapefruit	Pepper (piper spp.)
Rye	Poppy seed	Apples	Chillis and peppers
Oats	Cottonseed	Pears	Vanilla
Millet	Linseed	Quinces	Cinnamon (canella)
Sorghum	Oilseeds nes	Apricots	Nutmeg, mace and cardamoms
Buckwheat	Cabbages and other brassicas	Cherries, sour	Anise, badian, fennel, coriander
Triticale	Artichokes	Cherries	Ginger
Canary seed	Asparagus	Peaches and nectarines	Rubber, natural
Grain, mixed	Lettuce and chicory	Plums and sloes	Meat, cattle
Potatoes	Spinach	Strawberries	Milk, whole fresh cow
Sweet potatoes	Tomatoes	Gooseberries	Meat, sheep
Roots and tubers, nes	Cauliflowers and broccoli	Currants	Meat, goat
Sugar beet	Pumpkins, squash and gourds	Blueberries	Meat, pig
Beans, dry	Cucumbers and gherkins	Cranberries	Meat, chicken
Broad beans, horse beans, dry	Eggplants	Grapes	Eggs, hen, in shell
Peas, dry	Chillis and peppers, green	Watermelons	Meat, duck
Chick peas	Onions, shallots, green	Melons, other (inc.cantaloupes)	Meat, goose and guinea fowl
Lentils	Onions, dry	Figs	Meat, turkey
Cashew nuts, with shell	Garlic	Mangoes, mangosteens, guavas	Meat, horse
Chestnut	Leeks, other alliaceous vegetables	Avocados	Meat, rabbit
Walnuts, with shell	Beans, green	Pineapples	Meat, game
Pistachios	Peas, green	Dates	Honey, natural
Kola nuts	Carrots and turnips	Persimmons	
Nuts, nes	Maize, green	Kiwi fruit	
Soybeans	Mushrooms and truffles	Papayas	
Coconuts	Vegetables, fresh nes	Fruit, fresh nes	
Oil, palm	Ba as	Coffee, green	
Olives	Plantains	Cocoa, beans	
Sunflower seed	Oranges	Tea	

Table 4: Estimation of S_i

Panel A			
Dist1 ($-\theta$d1)	-13.75	***	(0.437)
Dist2 ($-\theta$d2)	-15.38	***	(0.299)
Dist3 ($-\theta$d3)	-18.21	***	(0.208)
Dist4 ($-\theta$d4)	-20.18	***	(0.161)
Dist5 ($-\theta$d5)	-21.83	***	(0.106)
Dist6 ($-\theta$d6)	-22.41	***	(0.153)
Border ($-\theta$b)	1.74	***	(0.456)
Lang ($-\theta$l)	0.823	***	(0.215)
RTA ($-\theta$rta)	3.286	***	(0.225)

Panel B	Destination country (S_n)		Source country (θex_i)			Destination country (S_n)		Source country (θex_i)	
	Coeff	SE	Coeff	SE		Coeff	SE	Coeff	SE
Armenia	1.700	(0.75)	-2.608	(0.52)	Lebanon	2.956	(0.75)	1.100	(0.65)
Albania	1.449	(0.38)	-0.174	(0.63)	Lithuania	1.613	(0.44)	1.603	(0.84)
Algeria	-0.039	(0.49)	-5.177	(0.58)	Madagascar	-0.165	(0.59)	1.220	(0.84)
Antigua and Barbuda	2.124	(1.08)	-2.599	(0.38)	Malawi	-1.549	(0.97)	-2.930	(0.79)
Argentina	-0.927	(0.30)	9.951	(0.52)	Malaysia	2.403	(0.69)	3.470	(0.58)
Australia	0.800	(0.35)	9.043	(0.67)	Mali	-9.052	(0.66)	-12.933	(0.52)
Austria	0.850	(0.29)	3.479	(0.52)	Malta	1.479	(0.53)	-4.659	(0.67)
Barbados	1.060	(0.80)	-3.663	(0.55)	Mauritius	3.200	(0.62)	-0.711	(0.56)
Bangladesh	-7.689	(0.61)	-8.239	(0.64)	Mexico	0.077	(0.67)	4.689	(0.68)
Bolivia	-3.169	(0.64)	-2.768	(0.79)	Mongolia	-6.797	(1.18)	-10.218	(0.48)
Botswana	0.897	(2.24)	-4.569	(0.89)	Morocco	0.477	(0.48)	-0.077	(0.62)
Brazil	-1.777	(0.53)	7.913	(0.65)	Moldova	2.159	(0.51)	3.280	(0.80)
Belize	-0.199	(0.76)	-3.806	(0.44)	Namibia	2.172	(0.71)	0.159	(0.66)
Brunei Darussalam	3.701	(1.04)	-1.999	(0.64)	Nepal	-2.462	(1.02)	-6.115	(0.40)
Bulgaria	1.603	(0.31)	3.681	(0.55)	Netherlands	3.057	(0.44)	9.964	(0.45)

Table 4 continued

Panel B	Destination country (S_n)		Source country (θex_i)			Destination country (S_n)		Source country (θex_i)	
	Coeff	SE	Coeff	SE		Coeff	SE	Coeff	SE
Burundi	0.380	(1.34)	-2.864	(0.74)	Macedoni	0.996	(0.51)	1.677	(0.72)
Cameroon	-6.175	(0.82)	-8.297	(0.69)	Vanuatu	-5.207	(1.16)	-9.224	(1.61)
Canada	3.377	(0.56)	12.692	(0.56)	New Zealand	1.035	(0.55)	7.954	(0.66)
Cabo Verde	3.687	(0.87)	-0.778	(0.49)	Nicaragua	-0.228	(0.95)	-2.121	(0.67)
Sri Lanka	1.520	(0.44)	4.927	(0.81)	Niger	0.993	(1.18)	-3.274	(0.57)
Chile	-0.489	(0.35)	7.926	(0.54)	Nigeria	-8.447	(0.96)	-9.553	(0.60)
China	3.511	(0.79)	14.453	(0.52)	Norway	1.830	(0.46)	-3.058	(0.53)
Colombia	-0.757	(0.55)	-0.786	(0.50)	Pakistan	-0.375	(0.47)	-0.476	(0.53)
Congo	4.400	(0.92)	-0.134	(0.29)	Panama	0.499	(0.92)	-2.034	(0.51)
Costa Rica	-0.745	(0.69)	-0.009	(0.68)	Czech Republic	0.502	(0.35)	1.090	(0.67)
Cyprus	2.051	(0.45)	0.839	(0.56)	Paraguay	-2.630	(0.68)	1.248	(0.93)
Azerbaijan	-0.078	(0.72)	-4.380	(0.48)	Peru	-0.847	(0.62)	4.604	(0.69)
Benin	-3.264	(1.24)	-8.904	(0.59)	Philippines	0.373	(0.44)	1.674	(0.63)
Denmark	0.298	(0.30)	4.161	(0.57)	Poland	-0.732	(0.33)	2.373	(0.57)
Belarus	1.548	(0.62)	-3.184	(0.74)	Portugal	1.146	(0.43)	2.388	(0.56)
Ecuador	-1.887	(0.67)	-1.798	(0.63)	Zimbabwe	0.137	(0.92)	-4.316	(0.47)
Egypt	0.404	(0.50)	4.520	(0.56)	Rwanda	-3.004	(0.95)	-5.611	(0.72)
El Salvador	0.492	(1.74)	-2.232	(0.56)	Russian Federation	3.694	(0.73)	8.865	(0.77)
Estonia	0.106	(0.56)	-1.795	(0.75)	Saint Lucia	-3.101	(0.71)	-8.397	(0.57)
Fiji	1.725	(1.04)	-1.111	(0.83)	Saint Vincent	-3.752	(1.16)	-8.682	(0.42)
Finland	-0.642	(0.47)	-1.701	(0.61)	Saudi Arabia	1.344	(0.60)	0.150	(0.56)
France	1.038	(0.42)	9.048	(0.48)	Senegal	0.573	(0.78)	-0.970	(0.73)
Georgia	3.154	(0.55)	-0.946	(0.57)	Seychelles	-0.421	(1.22)	-5.505	(0.83)
Gambia	1.042	(1.68)	-4.332	(0.54)	Slovenia	1.882	(0.37)	1.114	(0.68)
Germany	1.009	(0.39)	8.623	(0.40)	Slovakia	0.502	(0.49)	-0.599	(0.74)
Bosnia and Herzegovina	2.481	(0.45)	-0.313	(0.79)	Singapore	5.613	(0.51)	1.901	(0.52)
Ghana	0.145	(0.67)	-2.094	(0.58)	South Africa	1.267	(0.38)	8.051	(0.61)
Greece	0.988	(0.62	2.389	(0.50	Spain	2.572	(0.58)	9.804	(0.45)
Guinea	-6.510	(0.65)	- 10.780	(0.35)	Suriname	-5.849	(1.06)	-10.082	(0.45)
Guyana	-1.156	(1.00)	-6.405	(0.40)	Sweden	1.039	(0.35)	0.203	(0.55)

Table 4 continued

Panel B	Destination country (S_n)		Source country (θex_i)			Destination country (S_n)		Source country (θex_i)	
	Coeff	SE	Coeff	SE		Coeff	SE	Coeff	SE
Honduras	-5.296	(0.75)	-5.304	(0.59)	Switzerland	1.496	(0.41)	-0.600	(0.59)
Hungary	0.304	(0.33)	4.651	(0.48)	Tanzania	-2.438	(0.58)	-4.849	(0.78)
Croatia	1.926	(0.36)	0.255	(0.69)	Thailand	1.390	(0.44)	6.312	(0.57)
Iceland	0.927	(0.70)	-3.164	(0.68)	Togo	-0.419	(0.95)	-4.760	(0.51)
India	0.329	(0.67)	6.694	(0.61)	Trinidad and Tobago	-4.033	(0.59)	-7.944	(0.56)
Indonesia	0.555	(0.67)	2.308	(0.62)	Tunisia	0.239	(0.63)	-2.375	(0.67)
Iran	-8.234	(0.75)	-7.290	(0.54)	Turkey	1.252	(0.74)	6.335	(0.53)
Ireland	-1.005	(0.46)	-0.898	(0.64)	United Kingdom	1.930	(0.47)	7.083	(0.46)
Israel	0.257	(0.44)	3.166	(0.67)	Ukraine	1.026	(0.42)	6.308	(0.64)
Italy	0.772	(0.39)	7.395	(0.45)	USA	5.212	(0.76)	17.146	(0.51)
Cote d'Ivoire	-0.238	(0.63)	-2.414	(0.56)	Burkina Faso	-2.083	(1.05)	-5.617	(0.80)
Kazakhstan	2.864	(0.61)	4.098	(0.90)	Uruguay	0.227	(0.40)	5.045	(0.71)
Jamaica	0.367	(0.90)	-2.590	(0.40)	Venezuela	-2.320	(0.70)	-5.357	(0.46)
Japan	2.493	(0.83)	3.729	(0.49)	Viet Nam	3.013	(0.69)	5.963	(0.64)
Jordan	2.266	(0.51)	0.201	(0.57)	Ethiopia	-0.713	(0.53)	3.272	(0.70)
Kyrgyzstan	-5.616	(1.06)	-3.865	(0.99)	Yemen	1.819	(0.69)	-1.636	(0.38)
Kenya	0.692	(0.49)	2.141	(0.66)	Zambia	-2.325	(1.03)	-3.364	(1.22)
Cambodia	-0.565	(0.98)	-2.307	(1.38)	Belgium	2.264	(0.36)	6.898	(0.46)
South Korea	0.912	(0.54)	1.935	(0.51)	Luxembourg	-3.543	(0.96)	-8.157	(0.80)
Latvia	1.290	(0.55)	-0.680	(0.76)					
Observations	9,709								
Groups	129 countries								
F stat	846.36								
R^2	0.536								
Adj R^2	0.523								

Notes: Estimated by generalized least squares. The specification is given in equation (9). Standard errors are in parentheses. * p <10 percent, ** p <5 percent, *** p<1 percent.

Figure 1: Destination country effects (S_i) and GDP per capita

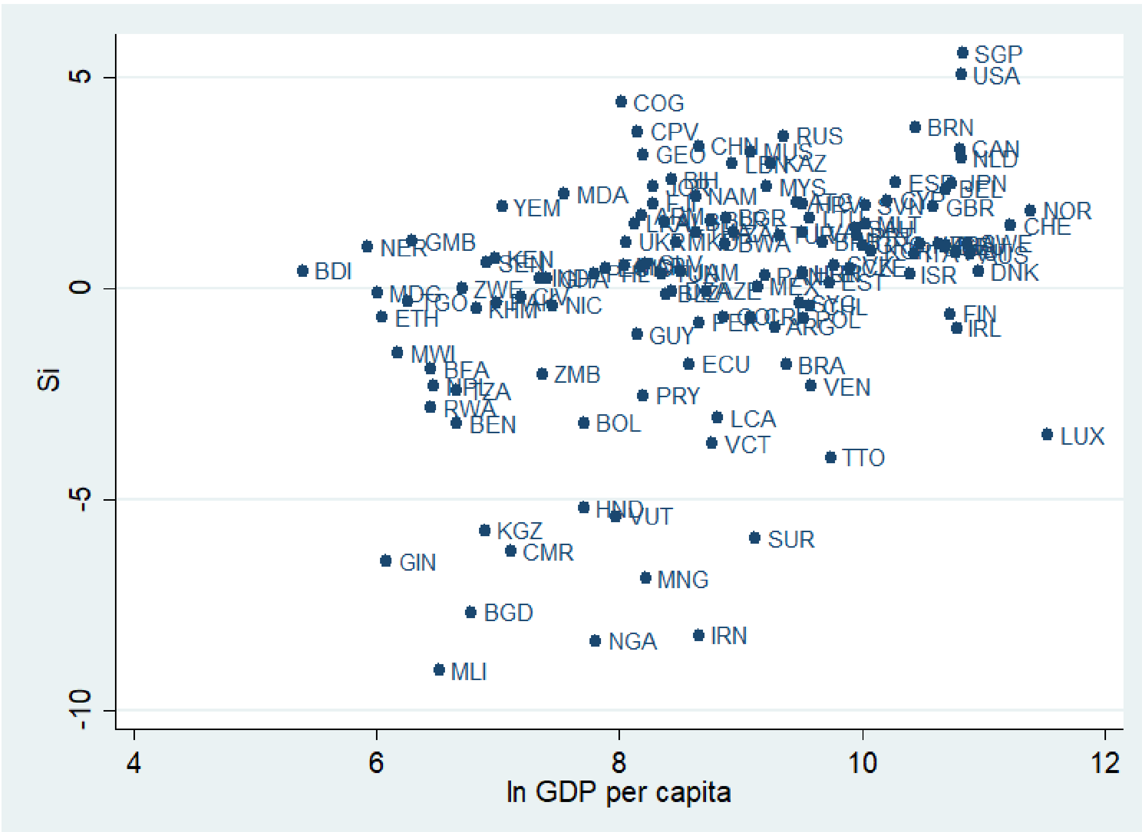


Table 5: Estimation of the Effects on Trade Costs

Panel A			effect on cost θ =2.5
Dist1 (-θd1)	-13.75	***	243.59
Dist2 (-θd2)	-15.38	***	468.07
Dist3 (-θd3)	-18.21	***	1455.20
Dist4 (-θd4)	-20.18	***	3205.25
Dist5 (-θd5)	-21.83	***	6197.16
Dist6 (-θd6)	-22.41	***	7831.21
Border (-θb)	1.74	***	-0.50
Lang (-θl)	0.823	***	-0.28
RTA (-θrta)	3.286	***	-0.73

Panel B	θex_i Coeff	effect on cost θ=2.5		θex_i Coeff	effect on cost θ =2.5
Armenia	-2.61	1.84	Lebanon	1.10	-0.36
Albania	-0.17	0.07	Lithuania	1.60	-0.47
Algeria	-5.18	6.93	Madagascar	1.22	-0.39
Antigua and Barbuda	-2.60	1.83	Malawi	-2.93	2.23
Argentina	9.95	-0.98	Malaysia	3.47	-0.75
Australia	9.04	-0.97	Mali	-12.93	175.47
Austria	3.48	-0.75	Malta	-4.66	5.45
Barbados	-3.66	3.33	Mauritius	-0.71	0.33
Bangladesh	-8.24	25.99	Mexico	4.69	-0.85
Bolivia	-2.77	2.03	Mongolia	-10.22	58.56
Botswana	-4.57	5.22	Morocco	-0.08	0.03
Brazil	7.91	-0.96	Moldova	3.28	-0.73
Belize	-3.81	3.58	Namibia	0.16	-0.06
Brunei Darussalam	-2.00	1.22	Nepal	-6.11	10.54
Bulgaria	3.68	-0.77	Netherlands	9.96	-0.98
Burundi	-2.86	2.14	Macedonia	1.68	-0.49
Cameroon	-8.30	26.63	Vanuatu	-9.22	39.03
Canada	12.69	-0.99	New Zealand	7.95	-0.96
Cabo Verde	-0.78	0.37	Nicaragua	-2.12	1.34
Sri Lanka	4.93	-0.86	Niger	-3.27	2.71
Chile	7.93	-0.96	Nigeria	-9.55	44.66
China	14.45	-1.00	Norway	-3.06	2.40
Colombia	-0.79	0.37	Pakistan	-0.48	0.21
Congo	-0.13	0.06	Panama	-2.03	1.26
Costa Rica	-0.01	0.00	Czech Republic	1.09	-0.35
Cyprus	0.84	-0.29	Paraguay	1.25	-0.39
Azerbaijan	-4.38	4.77	Peru	4.60	-0.84

Table 5 continued

Panel B	θex_i Coeff	effect on cost θ=2.5		θex_i Coeff	effect on cost θ =2.5
Benin	-8.90	34.23	Philippines	1.67	-0.49
Denmark	4.16	-0.81	Poland	2.37	-0.61
Belarus	-3.18	2.57	Portugal	2.39	-0.62
Ecuador	-1.80	1.05	Zimbabwe	-4.32	4.62
Egypt	4.52	-0.84	Rwanda	-5.61	8.43
El Salvador	-2.23	1.44	Russian Federation	8.87	-0.97
Estonia	-1.79	1.05	Saint Lucia	-8.40	27.76
Fiji	-1.11	0.56	Saint Vincent	-8.68	31.23
Finland	-1.70	0.97	Saudi Arabia	0.15	-0.06
France	9.05	-0.97	Senegal	-0.97	0.47
Georgia	-0.95	0.46	Seychelles	-5.50	8.04
Gambia	-4.33	4.66	Slovenia	1.11	-0.36
Germany	8.62	-0.97	Slovakia	-0.60	0.27
Bosnia and Herzegovina	-0.31	0.13	Singapore	1.90	-0.53
Ghana	-2.09	1.31	South Africa	8.05	-0.96
Greece	2.39	-0.62	Spain	9.80	-0.98
Guinea	-10.78	73.57	Suriname	-10.08	55.41
Guyana	-6.41	11.96	Sweden	0.20	-0.08
Honduras	-5.30	7.35	Switzerland	-0.60	0.27
Hungary	4.65	-0.84	Tanzania	-4.85	5.96
Croatia	0.26	-0.10	Thailand	6.31	-0.92
Iceland	-3.16	2.54	Togo	-4.76	5.71
India	6.69	-0.93	Trinidad and Tobago	-7.94	22.99
Indonesia	2.31	-0.60	Tunisia	-2.37	1.59
Iran	-7.29	17.47	Turkey	6.33	-0.92
Ireland	-0.90	0.43	United Kingdom	7.08	-0.94
Israel	3.17	-0.72	Ukraine	6.31	-0.92
Italy	7.39	-0.95	USA	17.15	-1.00
Cote d'Ivoire	-2.41	1.63	Burkina Faso	-5.62	8.46
Kazakhstan	4.10	-0.81	Uruguay	5.05	-0.87
Jamaica	-2.59	1.82	Venezuela	-5.36	7.52
Japan	3.73	-0.78	Viet Nam	5.96	-0.91
Jordan	0.20	-0.08	Ethiopia	3.27	-0.73
Kyrgyzstan	-3.86	3.69	Yemen	-1.64	0.92
Kenya	2.14	-0.58	Zambia	-3.36	2.84
Cambodia	-2.31	1.52	Belgium	6.90	-0.94
South Korea	1.93	-0.54	Luxembourg	-8.16	25.12
Latvia	-0.68	0.31			

Figure 2: Effect on Trade Costs and GDP per capita

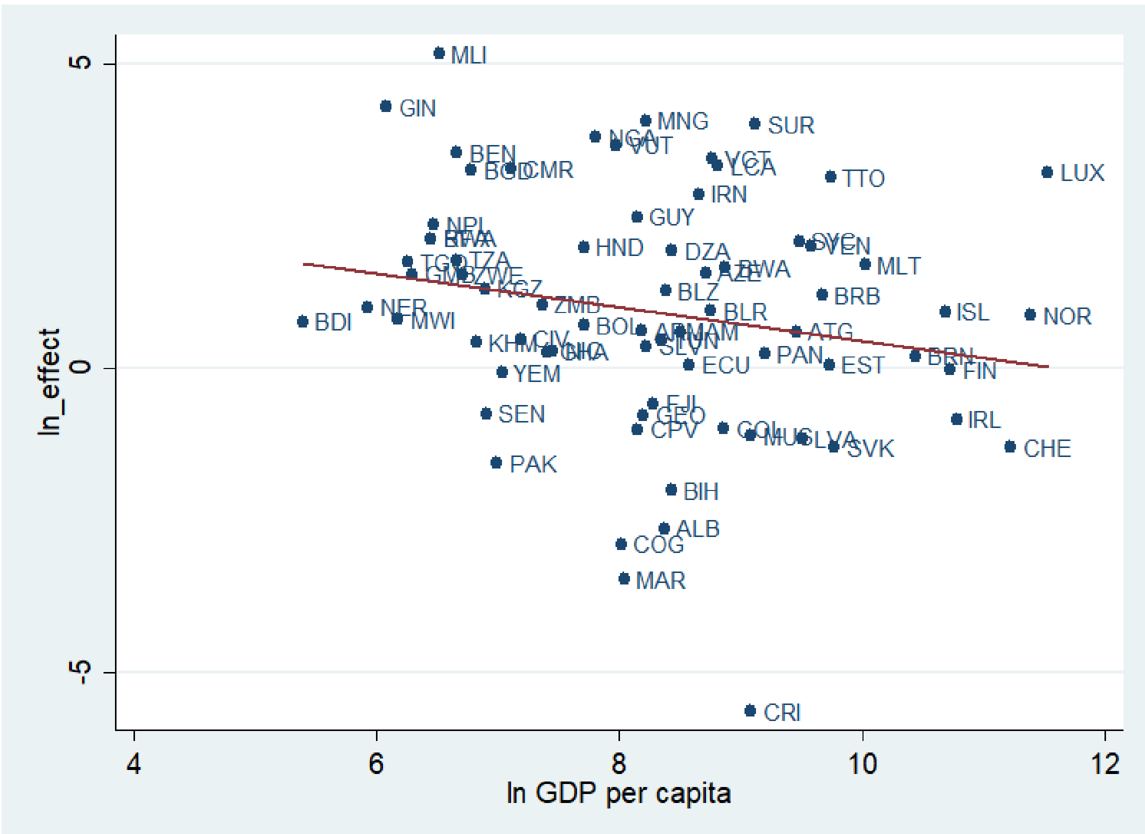


Figure 3: Productivity (T_i) and GDP per capita

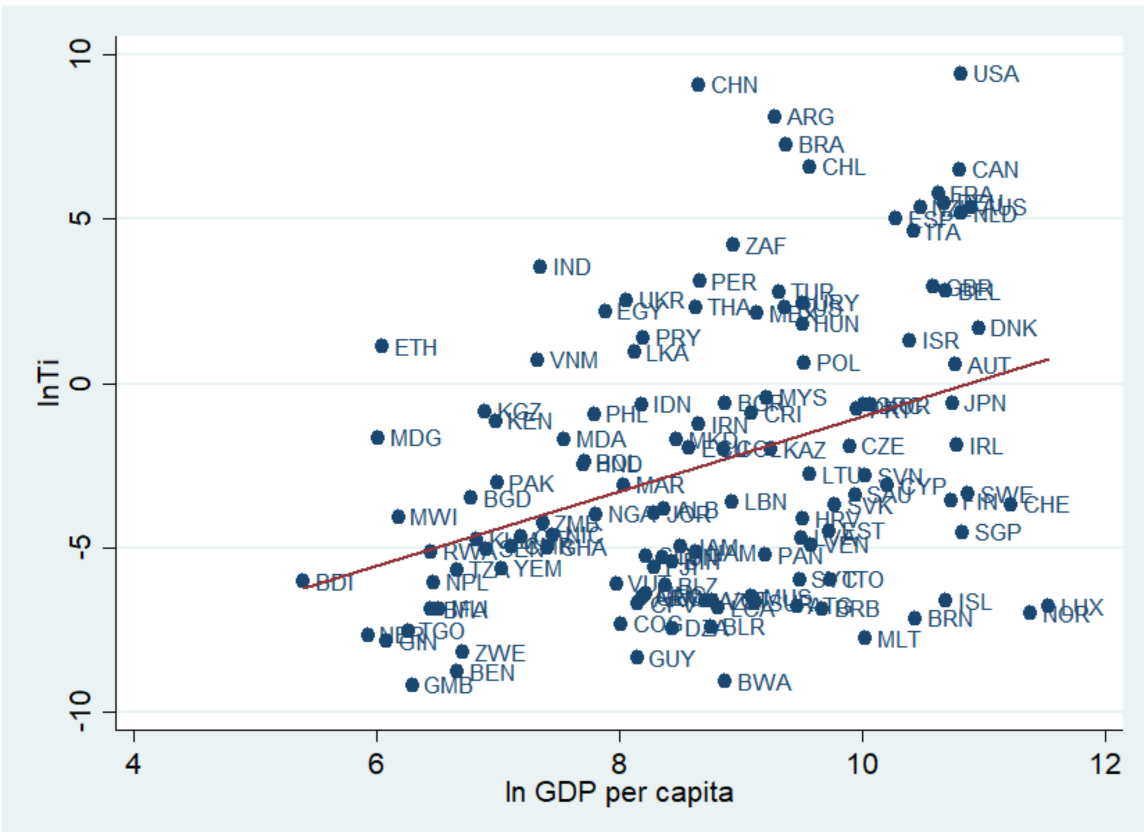


Table 6: Estimation of Productivity

Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$	Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$
United States of America	1.0000	Switzerland	0.0053
China, mainland	0.8783	Slovakia	0.0053
Argentina	0.5938	Albania	0.0050
Brazil	0.4242	Jordan	0.0047
Chile	0.3226	Nigeria	0.0047
Canada	0.3111	Malawi	0.0045
France	0.2326	Croatia	0.0044
Germany	0.2075	Zambia	0.0042
Australia	0.1982	Estonia	0.0038
New Zealand	0.1952	Singapore	0.0038
Netherlands	0.1829	Nicaragua	0.0036
Spain	0.1707	Cote d'Ivoire	0.0035
Italy	0.1463	Latvia	0.0035
South Africa	0.1237	Cambodia	0.0034
India	0.0952	Venezuela	0.0032
Peru	0.0800	Cameroon	0.0032
United Kingdom	0.0749	Jamaica	0.0032
Belgium	0.0707	Ghana	0.0031
Turkey	0.0704	Senegal	0.0031
Ukraine	0.0633	Rwanda	0.0030
Uruguay	0.0616	Namibia	0.0029
Thailand	0.0584	Panama	0.0029
Russian Federation	0.0581	El Salvador	0.0028
Egypt	0.0557	Tunisia	0.0028
Mexico	0.0542	Bosnia and Herzegovina	0.0026
Hungary	0.0476	Fiji	0.0025
Denmark	0.0455	Yemen	0.0024
Paraguay	0.0404	United Republic of Tanzania	0.0024

Table 6 continued

Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$	Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$
Israel	0.0388	Seychelles	0.0021
Ethiopia	0.0361	Trinidad and Tobago	0.0021
Sri Lanka	0.0338	Burundi	0.0021
Viet Nam	0.0306	Nepal	0.0020
Poland	0.0297	Vanuatu	0.0020
Austria	0.0289	Belize	0.0020
Malaysia	0.0195	Mongolia	0.0018
Japan	0.0181	Georgia	0.0017
Bulgaria	0.0181	Mauritius	0.0017
Indonesia	0.0178	Armenia	0.0017
Republic of Korea	0.0177	Saint Vincent and the Grenadines	0.0016
Greece	0.0177	Azerbaijan	0.0016
Portugal	0.0169	Iceland	0.0016
Kyrgyzstan	0.0165	Suriname	0.0016
Costa Rica	0.0160	Cabo Verde	0.0016
Philippines	0.0158	Antigua and Barbuda	0.0015
Kenya	0.0146	Luxembourg	0.0015
Iran	0.0140	Saint Lucia	0.0015
Madagascar	0.0119	Barbados	0.0015
Republic of Moldova	0.0117	Mali	0.0015
Macedonia	0.0116	Burkina Faso	0.0015
Ireland	0.0108	Norway	0.0014
Czech Republic	0.0108	Brunei Darussalam	0.0013
Ecuador	0.0105	Congo	0.0012
Colombia	0.0104	Belarus	0.0012
Kazakhstan	0.0103	Algeria	0.0012
Bolivia	0.0088	Togo	0.0011
Honduras	0.0086	Niger	0.0011
Lithuania	0.0076	Malta	0.0010
Slovenia	0.0075	Guinea	0.0010
Pakistan	0.0069	Zimbabwe	0.0009
Morocco	0.0067	Guyana	0.0008
Cyprus	0.0067	Benin	0.0007

Table 6 continued

Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$	Country	$(\frac{T_i}{T_{us}})^{-1/\theta}$
Sweden	0.0060	Botswana	0.0006
Saudi Arabia	0.0060	Gambia	0.0006
Bangladesh	0.0057		
Finland	0.0055		
Lebanon	0.0054		

Table 7: Asymmetric Trade Costs for Selected countries

Ex\Im	Argentina	China	France	Guyana	Italy	Japan	Morocco	Nicaragua	Peru	Zimbabwe	South Africa	Spain	UK	US	Vietnam	Ethiopia
Argentina	1	146	146	60	146	146	116	83	43	116	116	105	146	116	146	146
China	24	1	19	24	19	4	24	24	24	24	24	19	19	24	2	19
France	210	166	1	166	2	210	8	166	210	166	45	2	2	166	166	166
Guyana	41564	101534	80350	1	80350	101534					57812	80350	57812	29906		
Italy	407	322	3	322	1	407	20	407	407	322	86	20	20	322	322	167
Japan	1762	328	1762		1762	1	1762		1762	1762	1762	1762	1394	1762	721	
Morocco	6391	8076	290		403	8076	1		6391	6391	6391	130	403	1717	8076	6391
Nicaragua	10417	18294	14478		18294	18294		1	5388			10417		2012	18294	18294
Peru	366	1242	1242		1242	1242	983	366	1		1242	707	1242	983	1242	1242
Zimbabwe	34835	44019	34835		34835	44019		44019	44019	1	789	34835	25064	31672	34835	12965
South Africa	248	313	66	178	66	313	248	313	313	6	1	66	60	225	313	178
Spain	112	123	1	123	8	155	2	88	88	123	33	1	8	123	155	123
UK	461	365	4	262	23	365	23	365	461	262	89	23	1	262	365	262
US	7	8	7	2	7	8	2	1	7	6	6	7	5	1	8	6
Viet Nam	721	67	571		571	295	721	721	721	571	721	721	571	721	1	571
Ethiopia	2116	1674	1674		866	2116	1674	2116	2116	623	1205	1674	1205	1522	1674	1

Figure 4: Asymmetric Trade Costs

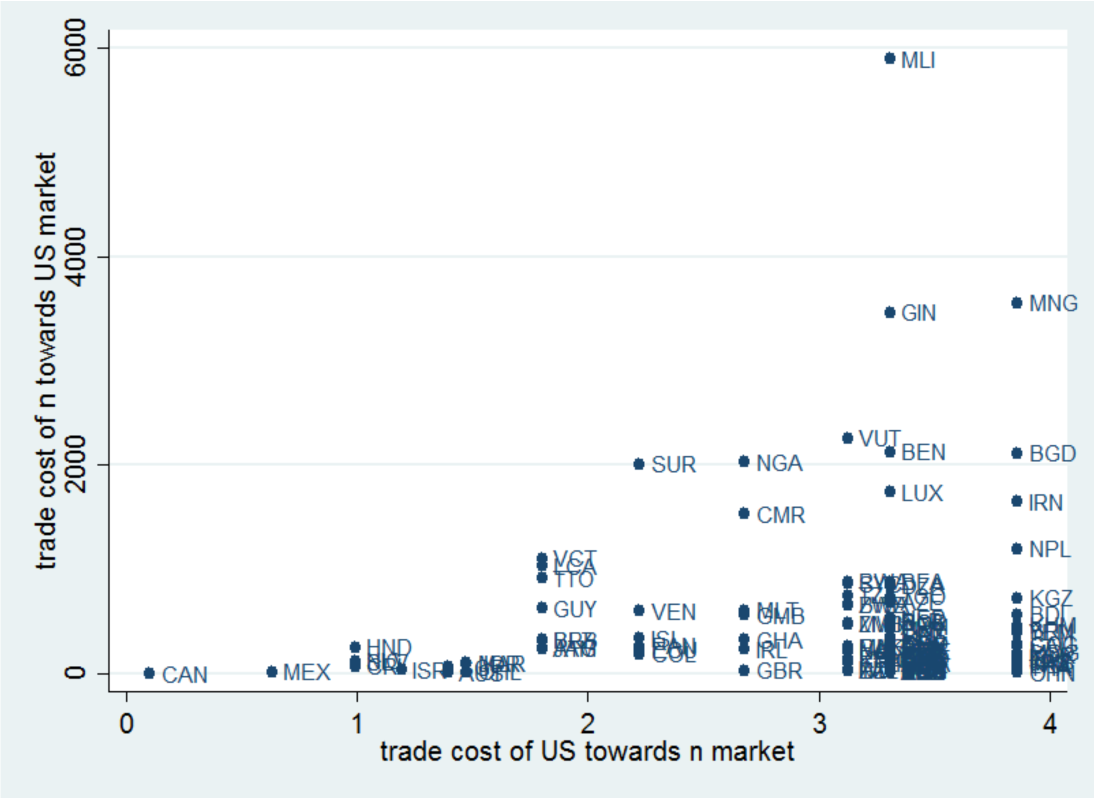
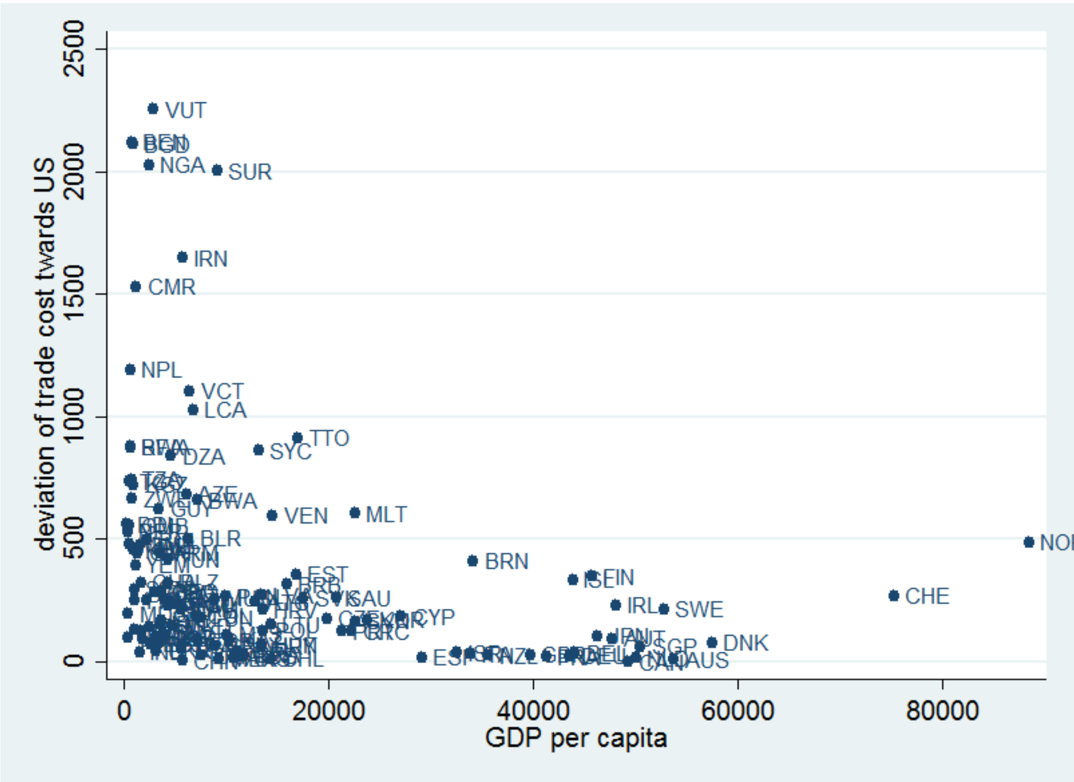


Figure 5: Asymmetric Trade Costs and GDP per capita



References

Adamopoulos, T. (2011). Transportation costs, agricultural productivity, and cross-country income differences. *International Economic Review*, *52*(2), 489-521.

Arkolakis, C., Costinot, A., and Rodríguez-Clare. (2012). New trade models, same old gains? *American Economic Review*, 102(1), 94-130.

Caselli, F. (2005). Accounting for cross-country income differences. In P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth.* Amsterdam: North Holland.

Centre d'Etudes Prospectives et d'Information Internationales. (2011). GeoDist database. Paris: CEPII

Centre d'Etudes Prospectives et d'Information Internationales. (2015). Gravity database. Paris: CEPII

Dornbusch, R., Fischer, S., and Samuelson, P. A. (1977). Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods. *American Economic Review*, 67(5), 823–839.

Eaton, J., and Kortum, S. (2002). Technology, geography, and trade. *Econometrica*, 70(5), 1741–1779.

Food and Agricultural Organization of the United Nations. (2014) FAOSTAT statistics database. Rome: FAO.

Gollin, D., Lagakos, D., Waugh, M. E. (2014). The agricultural productivity gap. *Quarterly Journal of Economics*, 129(2), 939–993.

Gollin, D., and Rogerson, R. (2014). Productivity, transport costs and subsistence agriculture. *Journal of Development Economics*, 107, 38-48.

Heerman, K., and Sheldon, I. (2016). Eco-Labeling and the gains from agricultural and food trade: A Ricardian approach. Unpublished working paper, Columbus: Ohio State University.

Lagakos, D., and Waugh, M. (2013). Specialization, agriculture, and cross-country productivity differences. *American Economic Review*, 103(2), 948–980.

Reimer, J. J., and Li, M. (2010). Trade costs and the gains from trade in crop agriculture. *American Journal of Agricultural Economics*, 92(4), 1024–1039.

Restuccia, D., Yang, D. T., and Zhu, X. (2008). Agriculture and aggregate productivity: A quantitative cross-country analysis. *Journal of Monetary Economics*, *55*(2), 234-250.

Simonovska, I., and Waugh, M. E. (2014). The elasticity of trade: Estimates and evidence. *Journal of International Economics*, 92(1), 34–50.

Tombe, T. (2015). The missing food problem: Trade, agriculture, and international productivity differences. *American Economic Journal: Macroeconomics*, 7(3), 226–258.

UNCTAD. (2013). *Key Statistics and Trends in Trade Policy 2014*, *UNCTAD/DITC/TAB/2014/2*. Geneva: UNCTAD.

Waugh, M. E. (2010). International trade and income distribution. *American Economic Review*, 100(5), 2093–2124.

World Bank. (2016). *World Development Indicators 2016*. Washington, DC: World Bank.

Xu, K. (2015). Why are agricultural goods not traded more intensively: High trade costs or low productivity variation? *World Economy*, 38(11), 1722–1743.