

Turkson, Festus Ebo

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## Logistics and bilateral exports in developing countries: A multiplicative form estimation of the logistics augmented gravity equation

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**Logistics and Bilateral Exports in Developing Countries: A  
Multiplicative Form Estimation of the Logistics Augmented Gravity  
Equation**

by

**Festus Ebo Turkson**

**Abstract**

This paper argues for the need to improve logistics and trade infrastructure in developing countries in order to increase trade flows. Based on a multiplicative form gravity regression framework, this paper assesses the impact of logistics on bilateral exports in developing countries. The logistics augmented gravity model estimations incorporating heterogeneity indicate that logistics impacts positively on bilateral trade in developing countries. With regards to the individual measures of logistics, the ease and affordability of shipping and timeliness had the greatest and least impact on bilateral exports respectively. Domestic logistics costs were however not significant in explaining bilateral trade flows. The evidence also shows asymmetries within country groups. Logistics at the destination was more important for primary commodity exports, at the origin more important for the export of oil/gas and manufactures and in developing countries more important for exports to high income countries. The evidence also indicates customs efficiency and timeliness as more important for trade in low income countries. Other explanatory variables such as economic size, distance, tariffs and country characteristics were found to be important determinants of trade involving developing countries.

**JEL Classification:** F10, F14, O57, C21

**Keywords:** Trade Flows and Costs, Bilateral Exports, Logistics, Gravity Model,  
Developing Countries



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**Outline**

1. Introduction
2. Literature Review
3. Methodology and Empirical Model
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5. Concluding Comments

**The Author**

Festus Ebo Turkson is currently a third year doctoral candidate in the School of Economics, University of Nottingham, and a lecturer (on study-leave) from the Department of Economics, University of Ghana.

Author: [lexfet@nottingham.ac.uk](mailto:lexfet@nottingham.ac.uk); [eturkson@ug.edu.gh](mailto:eturkson@ug.edu.gh)

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## 1 Introduction

One area in modern international trade research that has received enormous attention from trade economists is trade costs. There is a growing literature on trade costs and how it affects the volume and pattern of international trade and especially the trade performance of countries. Apart from being one of the most important factors determining the volume of trade between countries, trade costs have in the last five decades played a critical role in understanding foreign direct investment and firm outsourcing, economic geography, and the proliferation of regional trade agreements.

Trade costs, frictions that impede international trade flows, can be defined generally to include all costs (other than the marginal cost of producing the good) incurred in getting a good to the final user. Within the trade literature trade costs have been classified as arising mainly from two sources: natural and artificial sources. Natural trade costs refer to costs incurred mainly as a result of how countries are spread globally (i.e. geography). This includes costs related to distance (i.e. transportation), country-specific or fixed costs and time. Artificial trade costs are those that are incurred as a result of public policy. It includes cost imposed by tariff and nontariff barriers -- customs and "behind the border" costs such as local distribution costs, legal and regulatory costs, foreign exchange costs, contract enforcement costs and communication costs.

Trade costs have become increasingly important in international trade because apart from being large and variable, they also have large welfare implications, are linked to policy, matter for economic geography and, as argued by Obstfeld and Rogoff (2000), help to explain the six major puzzles of international macroeconomics (Anderson and van Wincoop, 2004).

Until about two decades ago, trade economists had focused attention extensively on trade barriers (i.e. tariffs) and freight rates (Anderson and Wincoop, 2004; Jacks, Meissner and Novy, 2008). Other components of trade costs such as infrastructure, logistics and facilitation (country specific or fixed costs of trade) and nontariff barriers had not been explored mainly because of the difficulty in measuring such costs. Indeed as at the end of the twentieth century trade economists knew little about the magnitude, evolution and the determinants of nontariff barriers, time and fixed costs as impediments to international trade.

Recent studies on trade costs have concentrated on the contribution of logistics, trade facilitation, infrastructure development and time to the build-up of trade costs and how that impacts on the volume and pattern of trade. Like any other transaction, trade has associated costs mainly from logistics, facilitation and infrastructure (i.e. transactions costs) which influence the pattern and volume of trade. For many economists who have

been concerned with explaining the sources of comparative advantage these transactions costs help to explain why some countries produce and trade in specific commodities rather than others.

The literature on the magnitude of trade costs indicates that although over time trade costs have generally declined they have been relatively high especially for developing countries. Across countries and regions as well as goods and sectors, Portugal-Perez and Wilson (2008) provide evidence to show that trade costs in the form of average costs of exports and import procedures (i.e. official fees levied on a 20-foot container excluding tariffs and trade taxes) are highest in sub-Saharan African countries. In addition, the average cost of export and import procedures in African countries is twice as high as in high income OECD countries.

In an attempt to contribute to the literature on why developing countries have higher trade costs and on average lag behind in global trade flows, this paper assesses the impact of logistics on bilateral exports in developing countries. This paper is motivated by three factors. First, the increasing importance of logistics, trade infrastructure and facilitation to trade costs and volumes in developing countries, second, the recent availability of data on measures of logistics by the World Bank and third, the need to make use of alternative regression techniques considered more appropriate within the context of the trade gravity literature to account for zero-valued bilateral trade flows and correct the bias that results from the logarithmic transformation of the gravity equation.

## **2. Literature Review**

The importance of logistics, trade facilitation and other non policy barriers has increased in significance mainly because trade policy barriers have increasingly accounted for a smaller proportion of overall trade costs (Anderson and Van Wincoop, 2004). More recently, logistics, trade facilitation and infrastructure have been found to be significant determinants of trade. According to Hoekman and Nicita (2008), the hypothesis that domestic trade costs and the macroeconomic environment are significant determinants of bilateral trade volumes is generally supported by the literature.

There are a number of papers that have examined the influence of infrastructure, institutions and trade facilitation and logistics on trade volume and costs. The main motivation has been to find answers to the obvious question of why countries like China and India (known as “globalizers”) have seen tremendous growth in trade, whereas developing countries (mainly in Africa) have had limited trade growth in this era of globalization.

Studies such as Dollar and Kraay (2002 & 2004), Rodrik et al (2004) and Chang et al (2005) have provided evidence to the effect that institutions as well as infrastructure and facilitation matters for trade and that if some countries were lagging behind in terms of trade and growth it had something to do with the poor state of institutions and infrastructure among other factors. This consensus has informed the development agenda of Development Agencies in the developing world who have in recent times focused on trade facilitation and institutional building to improve trade.

As noted by Behar and Manners (2008), actual trade costs are substantially reduced by aspects of physical infrastructure, logistics and more generally trade facilitation. Bougheas et al (1999), Limao and Venables (2001), Clarke et al (2004), Nordas and Piermartini (2004), Hummels (2001), Wilson et al (2004), Francois and Manchin (2006), Djankov et al (2006), Wilson et al (2008), Hoekman and Nicita (2008) and Behar and Manners (2008) provide empirical evidence to the effect that an improvement (deterioration) in physical infrastructure, trade facilitation and logistics reduces (increases) trade costs significantly and thereby increases (reduces) trade volumes.

The impact of infrastructure on trade flows is well documented in the trade literature. The various studies (such as Bougheas et al,1999; Limao and Venables, 2001; Francois and Manchin; 2006) that have looked at the impact of infrastructure on trade costs and flows have concluded that the level/state of infrastructure is one of the main determinants of trade costs especially in developing countries. While many countries in the developing world have not been able to take advantage of globalization to increase trade, others have little or no trade with the rest of the world mainly because of the lack of infrastructure to be able to produce and compete effectively in export markets.

Bougheas et al (1999), the first to introduce infrastructure variables into the gravity model, argued that differences in the quality and volume of infrastructure across countries could be responsible for the differences in trade competitiveness of countries. The authors showed that improvements in infrastructure through its impact on transportation cost impacts positively on trade. Using evidence from European countries, the authors were able to confirm their theoretical findings that by extending the Dornbusch-Fisher-Samuelson (DSF) Richardian trade model it was possible to show a positive relationship between the level of infrastructure and trade volumes for pairs of countries for which it is optimal to invest in infrastructure.

Limao and Venables (2001) provide evidence to show that improvement in infrastructure is quantitatively significant in determining trade cost and that inadequate and/poor infrastructure accounts for 40 and 60 percent of transport costs for coastal and landlocked countries respectively. Similarly, Clarke et al (2004) found general

infrastructure and port facilities contribution to ocean freight as a significant determinant of bilateral trade. Comparatively of a lower impact than Limao and Venables, Clarke et al provided evidence to show that a move from the 25th to 75th percentiles increased trade by 22 percent

Francois and Manchin (2006) examined the impact of institutional quality and infrastructure (among others) on the pattern of bilateral trade flows for a sample of about 104 countries from 1988 to 2002. By combining a probit analysis (the probability of a given bilateral trade occurring) with a least-squares analysis of the volume of trade within the context of a gravity model, the authors find variation in infrastructure relative to the expected values for a given income cohort to be strongly linked to exports. They also find that domestic infrastructure in terms of communications and transportation matters for exports while the evidence on institutions was to some extent mixed. For the least developed countries the authors find evidence of a broad three-part complementarity between increased government participation in the economy and both the domestic communication and domestic transport infrastructure on the one hand, and export performance on the other. Within Africa, Wilson et al (2008) use trade data from 2003 to 2004 to show that apart from the traditional determinants of bilateral trade, improvement in port efficiency and services infrastructure and to a lesser extent regional trade agreements have a significant positive effect on intra-African trade flows. Customs and the regulatory environment were however found by the authors to be the main impediments to intra-African trade.

In an attempt to explain the poor growth performance of sub-Saharan African countries, Mbabazi, Milner and Morrissey (2006) using data on a sample of developing countries between 1970 and 1995 identified high natural barriers to trade especially with regards to transactions and transport costs to distant dynamic markets as one of the main factors contributing to the poor growth performance. Limao and Venables (2000) on a sample of countries from Africa and the rest of the world indicated that in general a 10 percent increase in transport cost will lead to a reduction in trade volumes by approximately 20 percent. Booth et al (2000) shared this view, arguing that high transport costs is the main reason why trade liberalization in Africa has not had the same success experienced in Asia and Latin America.

With regards to trade facilitation and logistics studies such as Wilson et al (2008), Djankov et al (2006), Wilson et al (2008), Hoekman and Nicita (2008) and Behar and Manners (2008) confirm the view that trade facilitation and logistics are imperative for increasing trade flows especially in developing countries. Wilson et al (2004) quantified and examined the impact of trade facilitation on trade costs and volumes. The authors

find unilateral trade facilitation reforms in the areas of port efficiency, customs and regulatory environment reforms and e-business to be significant determinants of increasing trade flows. Djankov, Freund and Pham (2006) provide evidence in support of the positive impact of improvements in trade facilitation on trade costs and flows. By estimating a modified gravity equation using World Bank data on the days it takes to transport a standard cargo from the factory gate to the ship in 126 countries, Djankov et al (2006) show that for each day a product is delayed in transition, trade flows decline by 1 percent. The reduced trade flow is found to be greater for time-sensitive exports and exports from developing countries. Hoekman and Nicita (2008) investigated the impact of policies that underpin logistics and trade facilitation on trade costs and flows in developing countries. Their study indicates that apart from traditional trade policies, policies associated with logistics and trade facilitation (at and behind the border) have a greater impact on trade costs and flows than further reductions in tariffs and NTBs as well as additional trade preferences.

By making use of a new and comprehensive measure of logistics quality, Behar and Manners (2008) estimated by least squares a logarithmic transformation of a logistics augmented gravity model. They found logistics in the exporting and partner country to have an important impact on bilateral exports: a one standard deviation improvement in the exporting country's logistics would raise exports by about 60% and that logistics does reduce the trade effects of distance without eliminating them.

### 3. Methodology and Empirical Model

The traditional gravity equation for trade pioneered by Jan Tinbergen (1962) and later theoretically founded by Anderson (1979) and Anderson and Van Wincoop (2003) to include multilateral resistance terms has a long tradition of successfully explaining bilateral trade patterns among countries. The enormous popularity enjoyed by traditional gravity models of trade is derived from the strong theoretical foundation upon which it is grounded. Empirically the size of each country (proxied by the GDPs of the two countries) as well as the distance between them (proxy for bilateral trade cost) has successfully explained much of the variation in bilateral exports between countries. The theoretical basis for these findings is grounded on the premise that the most important determinants of bilateral trade are size and trade costs.

The stochastic version of the canonical gravity equation used in empirical studies has been of the form

$$x_{ij} = \varphi_0 Y_i^{\varphi_1} \cdot Y_j^{\varphi_2} \cdot Z_{ij}^{\varphi_3} \cdot \eta_{ij} \quad (1)$$



Where  $\varphi_0$ ,  $\varphi_1$ ,  $\varphi_2$  and  $\varphi_3$  are unknown parameters to be estimated,  $\eta_{ij}$  is an error factor assumed to be statistically independent of the regressors with  $E(\eta_{ij}/y_i, y_j, Z_{ij})=1$ . The traditional equation as stated in (1) indicates that trade flow from country  $i$  to country  $j$  (i.e.  $X_{ij}$ ) is proportional to the economic mass/size of both the exporting and importing countries (proxied by the product of the two countries GDP, denoted as  $Y_i$  and  $Y_j$ ) and inversely proportional to the distance between them,  $Z_{ij}$  (broadly defined to include all factors that pose as resistance to trade and thereby impose trade costs).

Within the international trade literature, economists have recently shown a renewed interest in the theoretical foundations underlying the traditional gravity model of trade. This has resulted in the traditional specification of the gravity equation being subjected to theoretical refinement and augmentation. One of the most outstanding contributions that resulted from the theoretical insight was the argument that because the traditional specification of the gravity equation does not account for average trade resistance between a country and its trading partners (i.e. the resistance posed by country  $i$ 's shipments to other possible destinations and  $j$ 's shipments from other origins) it suffers from omitted variable bias.

As argued by Anderson and Van Wincoop (2003), by not taking into account multilateral resistance terms (i.e. relative prices) the traditional gravity equation had not been correctly specified. The motivation behind this argument stemmed from the highly overstated impact of national borders found by McCallum (1995) resulting from estimating the traditional gravity equation for bilateral trade between United States and Canada. McCallum (1995) estimated a version of equation (1) for U.S. states and provinces of Canada with two  $z$  variables (bilateral distance and a dummy variable that is equal to one if the two regions are located in the same country and equal to zero otherwise). After controlling for distance and size McCallum found trade between provinces to be twenty-two times more than trade between states and provinces, suggesting that there were substantial trade costs incurred in trade across the United States-Canada border.

Anderson and van Wincoop's (2003) theory-based gravity equation was therefore a theoretical refinement of the traditional gravity model to include multilateral trade resistance variables. As suggested by Anderson and Van Wincoop (2003) and Feenstra (2004), one way of augmenting the traditional gravity equation with multilateral resistance terms is to include exporter and importer fixed effects leading to the stochastic theory based gravity equation of the form;

$$X_{ij} = \varphi_0 Y_i^{\varphi_1} \cdot Y_j^{\varphi_2} \cdot Z_{ij}^{\varphi_3} \cdot e^{\alpha_i d_i + \alpha_j d_j} \quad (2)$$

Where  $\varphi_0$ ,  $\varphi_1$ ,  $\varphi_2$ ,  $\varphi_3$ ,  $\alpha_1$  and  $\alpha_2$  are unknown parameters to be estimated, and  $d_i$  and  $d_j$  are exporter and importer dummies and  $\varphi_1 = \varphi_2 = 1$  (unit-income elastic). The Anderson and van Wincoop's (2003) theory-based gravity equation has been widely used by various authors to explain the pattern of bilateral trade amongst countries.

In addition to augmenting the traditional gravity equation with multilateral resistance terms in an attempt to fully explain bilateral trade amongst countries, the traditional specification as well as the theory-based gravity equations has been subjected to further augmentation to include other factors that are deemed significant determinants of trade costs and volumes. Most studies that have made use of the gravity equation have augmented it with various measures of distance and country characteristics, as well as measures of trade facilitation, infrastructure and logistics.

According to Behar and Manners (2008), the broader interpretation that has been given to "distance" in both the traditional and theory-based gravity specifications has been an attempt to include geographical factors such as a country's land area and whether it is landlocked or has access to navigable water bodies, as well as colonial relationship and common language in the gravity equation because these variables are deemed to impact on trade costs.

### ***Methodological Issues***

Within the trade literature the gravity model has gained popularity due to its success in explaining trade flows among countries and regions. After a period of extensive theoretical critique and reformulation, research focus on the gravity model seemed to have now shifted towards the appropriateness of the estimation technique used. Conventionally, the gravity equation for trade as pioneered by Jan Tinbergen (1962) and later augmented by Andersen and Van Wincoop (2003) to include multilateral resistance terms have been estimated by Least squares. The normal approach has been to estimate by least squares the gravity equation in the logarithms of the dependent variable.

Methodologically, Santos Silva and Tenreyro (2006), Flowerdew and Aitkin (1982) and other studies have pointed out in several ways the flaws with this procedure. The validity of estimating log-linearized representation of gravity equations (i) or (ii) depends critically on the assumption that the error term/factor  $\eta_{ij}$ , and its log (i.e.  $\ln \eta_{ij}$ ) are statistically independent of the regressors (i.e. homoskedastic). However, Santos Silva and Tenreyro (2006) found overwhelming evidence that the error terms/factors in the normal log-linear representation of the gravity equation are heteroskedastic. In the presence of heteroskedasticity, the estimates of elasticities obtained from the least squares method are inefficient and inconsistent.

Secondly, the log-normal model formulation used in estimating the gravity model by least squares generates estimates of  $\ln X_{ij}$  but not  $X_{ij}$ . Following from Jensen's inequality which implies that  $E(\ln X_{ij}) \neq \ln E(X_{ij})$  and the concavity of the log function, Santos Silva and Tenreyro (2006) argued that the standard practice of interpreting the parameters from the log-linearized model of the gravity equation by least squares as elasticities is misleading in the presence of heteroskedasticity.

The Newtonian gravity theory from which the gravity model of trade was derived allows for gravitational force to be very small but not zero. However within the trade gravity literature there are frequent occurrences of zero-valued bilateral trade flows. There are various reasons for the presence of zero-valued bilateral trade flows. In most cases as argued by Frankel (1997), the zero values arise simply as a result of lack of trade between some pairs of countries, especially small and distant countries within a given period. The zero values may also arise from rounding errors when bilateral trade between pairs of countries does not reach a minimum value and are therefore rounded-down as zeros. In addition, the existence of zero-valued trade flows could be as a result of measurements errors arising from mistakenly recording missing observations as zeros.

Irrespective of the reasons for the occurrence of zero-valued bilateral trade flows, the practice of estimating by least squares the log-normal gravity model in the presence of such zero-valued trade flows poses both theoretical and methodological problems especially where the presence of the zero values is excessive. Traditionally, the approach that has been adopted by a large majority of empirical studies is to drop the pairs of countries with zero-valued trade flows from the dataset and estimate the log-normal gravity model by least squares. As indicated by Burger et al (2009); Linders and Groot (2006); Eichengreen and Irwin (1998), by dropping all zero-valued trade flows, important information on why such low levels of trade occur between certain countries would be omitted from the analysis leading to biased results (especially when such zero-valued trade flows are not randomly distributed). This is so because leaving countries with zero-valued trade flows out of the analysis will place a greater weight both in terms of magnitude and statistical significance on the remaining observations and their corresponding coefficient estimates.

Thus, instead of dropping the zero-valued trade flows, some authors make use of the strategy of substituting the zeros by a small positive constant. Under this strategy the authors estimate the log-normal gravity model using  $X_{ij} + k$  as the dependent variable. The choice of this constant  $k$  (varies between 0.01 and 1) as indicated by Linders and De Groot (2006) is usually arbitrary (without theoretical or empirical justification).

Flowerdew and Aitkin (1982) provide evidence to show that small differences in the arbitrary constant that is chosen can distort the results significantly.

### ***Recent Methodological Approach***

Recently, international trade economists have begun to pay serious attention to the problems associated with the log-normal formulation, excessive zero-valued trade flows and estimation of the gravity model. Increasingly trade economists are making use of alternative regression techniques considered more appropriate within the context of the trade gravity literature. Various extensions of Tobit estimation, truncated regression, probit regressions, Poisson and modified Poisson models have been used to deal with the problems associated with the log-normal formulation and excessive zero-valued trade flows within the trade gravity framework.

The censored regression model (i.e. Tobit model) has been employed by some studies (e.g. Rose, 2004; Andersen and Marcouiller, 2002) to deal properly with the zero-valued flows that might have arisen either because actual trade flows are not observable (hence mapped to zero) or because of measurement errors resulting from rounding. According to Linders and De Groot (2006) the appropriateness of using the Tobit model to study zero-valued flows within the gravity framework depends on whether desired trade could be negative and whether rounding up of trade flows is an important concern. Linders and De Groot (2006) argued that because desired trade cannot be negative (since zeros do not reflect unobservable trade) and trade flows cannot be censored from below it is inappropriate to use the Tobit model.

Within the trade gravity literature, attention has also been given to the use of the Poisson and modified Poisson specifications of the gravity model. Because of its multiplicative form the fixed effects Poisson pseudo maximum likelihood (PPML) estimation provides a natural way to deal with zero-valued trade flows. Also by making use of the maximum likelihood estimation method, the Poisson estimation ensures that the estimates generated are adapted to the actual data implying that the sum of the predicted values are virtually identical to the sum of the input values. (Burger et al, 2009; Santos Silva and Tenreyro, 2006). In addition, the Poisson regression model avoids under prediction of large trade flows and volumes by generating estimates of  $X_{ij}$  but not  $\ln X_{ij}$ .

An important limitation of the PPML estimation model is the over-dispersion in the dependent variable (i.e. trade flows) because of the presence of unobserved heterogeneity<sup>1</sup> from omitted variables usually not accounted for in the conditional mean.

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<sup>1</sup> The Poisson model only takes account of observed heterogeneity.

The over-dispersion which usually manifests in spuriously small p-values and large z-values (due to downward biased standard errors) generates consistent but inefficient estimates of trade flows. To correct for the over-dispersion, some authors have made use of modified Poisson models in the form of either negative binomial pseudo maximum likelihood (NBPML) or zero-inflated pseudo maximum likelihood models. The choice of which model to adopt has depended on whether the sample has excessive zero-valued trade flows or not. As noted by Burger et al (2009), technically the NBPML model is not well suited to handle situations in which the number of observed zero-valued trade flows exceeds the number of zeros predicted by the model.

The zero-inflated estimation approach models the origin of the zero counts by distinguishing country pairs having strictly zero-valued trade flows from those that have non-zero probability of having non-zero-valued trade flows. The zero-inflated estimation process which bears resemblance to the Heckman selection model (as used in Helpman et al, 2007; Linders and De Groot, 2006) consists of two parts. The first part contains a logit or probit regression of the probability of no bilateral trade, while the second part contains a Poisson regression of the probability of each zero count for the country pairs that have non-zero probability or interaction intensity other than zero.

The Heckman selection model as used by Helpman et al (2007), is used to explain zero trade flows both symmetrically and asymmetrically. Under this model a gravity specification is generated from the model and zero trade flows are qualified into those that arise because a country will not necessarily have enough productive firms to export profitably and those for which trade flows are zeros for other reasons. A two-step estimation procedure is then followed which embodies the heterogeneous firms model where the probability of a country exports are estimated with predicted values and then entered into a second gravity relationship. Unlike the Heckman selection model the zero-inflated models are less restrictive and do not require an instrument for the second stage of the regression. In addition, the bias that results from the logarithmic transformation in the second part of the Heckman selection model is obviated because of the multiplicative form equations used under the family of Poisson and modified Poisson models.

### ***Empirical Model and Approach***

The approach to estimate the impact of logistics, trade facilitation and infrastructure on bilateral trade has been to include variables that seek to measure physical infrastructure, trade facilitation and logistics in the gravity equation. In an attempt to investigate the relationship between logistics and bilateral trade using the new index of logistics

developed by the World Bank, Behar and Manners (2008) estimated by least squares a logarithm-transformed logistics augmented gravity equation of the form;

$$X_{ij} = \beta_0 + \beta_1 \cdot y_i + \beta_2 \cdot y_j + \beta_3 \cdot d_{ij} + \beta_4 \cdot l_i + \beta_5 \cdot l_j + \gamma W + e_{ij} \quad (3)$$

As indicated in equation (3) the authors linked bilateral exports ( $X_{ij}$ ) to the GDPs of the exporting and importing countries ( $y_i$  and  $y_j$  respectively), the distance between them ( $d_{ij}$ ), logistics indicators for the exporter and importer ( $l_i$  and  $l_j$  respectively), and a vector  $W$  of controls that measure aspects of distance and other country characteristics. In addition, Behar and Manners included terms for neighbouring countries infrastructure and interactions between logistics and whether a country was landlocked.

Models similar to equation (3) have been used by many studies (Wilson et al, 2002; Djankov, 2006; Shepherd and Wilson, 2008; Hoekman and Nicita, 2008) to measure empirically the impact of in trade logistics, facilitation and infrastructure on bilateral trade relations using different estimation techniques. Using a similar framework, this paper estimates a gravity equation specification, augmented with measures of logistics and remoteness. Following closely the specification of Behar and Manner (2008) and Hoekman and Nicita (2008), the general specification used assuming a multiplicative form is given as;

$$X_{ij} = \varphi_0 Y_i^{\varphi_1} \cdot Y_j^{\varphi_2} \cdot Y_{PC_i}^{\varphi_3} \cdot Y_{PC_j}^{\varphi_4} \cdot \tau_{ij}^{\theta} \cdot d_{ij}^{\phi} \cdot Z_{ij}^{\gamma_k} \cdot L_i^{\alpha_1} \cdot L_j^{\alpha_2} \cdot R_i^{\delta_1} \cdot R_j^{\delta_2} \cdot \varepsilon_{ij} \quad (4)$$

As noted in equation (4) bilateral exports ( $X_{ij}$ ) is specified to be a function of GDP ( $Y$ ) and GDP per capita ( $Y_{PC}$ ), the tariff specific to trading partners  $i$  and  $j$  ( $\tau_{ij}$ ), the distance between them ( $d_{ij}$ ), a vector  $\mathbf{z}$  of controls thought to proxy for other aspects of distance and other country characteristics ( $\mathbf{z}_{ij}$ ), various logistics indicators for the exporter and importer ( $L_i$  and  $L_j$  respectively), the remoteness of the exporting and importing countries ( $R_i$  and  $R_j$  respectively) and a well-behaved error term  $\varepsilon_{ij}$ . Subscripts  $i$  and  $j$  refer to exporting and importing countries respectively,  $k$  is the number of control variables in the vector  $\mathbf{z}$ . and  $\varphi_0, \varphi_1, \varphi_2, \varphi_3, \varphi_4, \delta_1, \delta_2, \theta, \gamma_k, \alpha_1$  and  $\alpha_2$  are unknown parameters to be estimated.

The choice of the augmented gravity equation is based on the fact that the gravity model rests on a solid theoretical foundation and remains the standard empirical framework used in examining bilateral trade relations. In addition, the theoretical underpinning of the gravity model is consistent with different theories of international trade such as the Richardian, Heskler-Ohlin increasing returns to scale many countries type model (differences in factor endowments), Krugman type differentiated product model (differences in product characteristics), and more recently the Melitz (2003) firm level heterogeneity model (firms differing in productivity).

Although the methodological approach follows closely Hoekman and Nicita (2008), there are several ways in which this paper differs and makes a contribution to the literature. First, unlike Hoekman and Nicita (2008) this paper introduces heterogeneity through the composition of bilateral exports (i.e. primary commodities versus manufactures) as well as countries of different income levels (low, middle and high income). Secondly, both the aggregate logistics performance index and the different components that make up the index (i.e. customs, infrastructure, domestic logistics, timeliness, transport etc) entered. This will allow illustration of the importance of each of the seven different elements of the aggregate logistics performance index. Hoekman and Nicita (2008) only made use of two of the elements of the LPI (efficiency of customs and a measure of access and affordability of international shipment).

Most importantly, this paper adopts the negative binomial pseudo maximum likelihood (NBPML) estimation model instead of the Poisson pseudo maximum likelihood used by Hoekman and Nicita (2008). The choice of NBPML over PPML is to account for the unobserved heterogeneity between countries. The previous section explains the theoretical basis on which the NBPML model is preferred to the PPML and other estimation methods used in the literature to deal with zero-valued trade flows.

### ***Data and Descriptive Statistics***

The initial sample consisted of 121 countries made up of 101 developing and 20 developed countries. Given the limited coverage of the logistics performance indicators (covers 150 countries) the final sample will cover 103 countries made up of 84 developing and 19 developed countries. Out of a total dataset of 10,506 observations, 8,568 observations are bilateral exports from the 84 developing (i.e.  $84 \times 102$ ). The remaining 1,938 observations are bilateral exports from the 19 developed countries (i.e.  $19 \times 102$ ). Out of the total dataset 6,972 observations involved bilateral trade amongst the 84 developing countries, 3,192 observations involved bilateral trade between the 19 developed countries and 84 developing countries and 342 observations involved bilateral trade amongst the 19 developed countries.

### ***Bilateral Exports***

Bilateral export (Gross Exports valued at F.O.B and denominated in US dollars) data used in this paper is sourced from the WITS (COMTRADE) database. Out of a possible 10,506 observations, positive bilateral trade flows occurs for 8,235 (about 79%) of the observations while the remaining 2,271 (about 21%) observations were zero-valued

flows. The export values in the dataset represent the average bilateral gross exports over three years 2005-2007.

The main justification for using average exports is that because logistics and remoteness remain reasonably stable over a short period, average trade volumes over that period would be better explained than annual trade volumes (which may exhibit significant yearly variations). In addition, where there were missing values, averaging (based on the values available) will help “weed out” the missing values in the dataset. The choice of three years from 2005 to 2007 is to bring the bilateral export trade data closer to the year (i.e. 2007) for which the logistics performance index was constructed.

As the importance of logistics may vary according to the type of products being exported, data from the World Bank WTI database for 2007 was used to separate bilateral exports into primary commodities (29 countries), oil and gas (22 countries) and manufactures (52 countries). A country was considered an exporter of manufactures if at least 40% of its exports were manufactures, otherwise a primary commodity or oil and gas exporter. If a country is an exporter of primary commodities, its exports will be less sensitive to the physical measures and rather more sensitive to the services measures of infrastructure. For instance, for a country that exports perishable agricultural commodities timeliness would be of utmost importance as their value depreciates quickly.

Custom arrangements in countries will differ based on whether that country's exports are primary commodities, oil and gas or manufactures. There are different customs arrangements for different goods; therefore logistics with respect to customs will have a different impact in the logistics augmented gravity model estimated by this paper.

### ***Logistics Performance Index***

The measure of logistics used in this paper is the logistics performance index (LPI) published by the World Bank for 150 countries. The LPI provides a picture of the supply chain performance of countries by measuring logistical barriers to trade on six indicators considered to have direct influence on the volume of trade. These are customs efficiency; transport and information technology infrastructure; ease and affordability of international shipping; local logistics industry competence; tracing and tracking facilities and timeliness.

Based on a worldwide survey of more than 800 global freight forwarders and express carriers (i.e. more than 5000 country evaluations), the LPI measures the logistics ‘friendliness’ of the countries surveyed. Feedback from the survey (in the form of a perceptions-based measure) was supplemented with data on the performance of key



components of the logistics chain namely domestic logistics environment, institutions and the performance of the domestic supply chain assessed by logistics professionals in the home country. The six sub-indicators used in generating the overall index were given approximately equal weights of 0.18, 0.15, 0.20, 0.16, 0.16 and 0.15 for customs efficiency, transport and information technology infrastructure, ease and affordability of international shipping, local logistics industry competence, tracing and tracking facilities and timeliness respectively (Behar and Manner, 2008).

#### ***Measures of Economic size (GDP)***

Average GDP and GDP per capita from 2005 to 2007 measured in constant (year 2000) US dollars was used to measure economic size. The data was sourced from the World Development indicators. In addition each country's share of world GDP was calculated by dividing its average GDP by the measure of average World GDP (also sourced from WDI) from 2005 to 2007. This was to help in the construction of each country's remoteness index.

#### ***Measures of Distance and other Country characteristics***

The measure of bilateral distance used in this paper captures the weighted distance measure using city-level data to assess the geographic distribution of population inside each country. The idea is to calculate distance between two countries based on bilateral distances between the largest cities of those two countries, those inter-city distances being weighted by the share of the city in the overall country's population. A general formula developed by Head and Mayer (2002) is used by CEPII for calculating the weighted distance between countries  $i$  and  $j$ . Control variables such as country's area in square km and dummies indicating whether the two countries are contiguous (share a common border), share a common language, have had a common colonizer after 1945, have ever had a colonial link, have had a colonial relationship after 1945, are currently in a colonial relationship are also sourced from CEPII. There are two common languages dummies, one based on whether two countries share a common official language and the other if an ethnic language is spoken by at least 9% of the population in both countries. Colonization is used generally to describe a relationship between two countries, independently of their level of development, in which one has governed the other over a long period of time and has therefore contributed to the current state of institutions in the colonized country. Additional variables such the ease of doing business index, number of documents required to export or import, days it takes to export or import, the cost of exporting a container etc. are taken from the World Bank Doing Business database.

### ***Trade Tariff Measures***

This paper uses weighted average of Most Favoured Nation (MFN) tariff rates sourced from the WITS (TRAINS) database. The weighted average MFN tariff rates are calculated at the bilateral level. The MFN tariff rate is a low tariff rate that members of the World Trade Organization (WTO) award to each other in such a way that a nation with MFN status will not be treated worse than any other nation with MFN status except to allow for preferential treatment of developing countries, custom unions and regional free trade areas. For bilateral countries that had missing values of trade tariffs in the dataset, the country average Trade Tariff Restrictive Index (TTRI) MFN applied tariff for all goods was used.

### ***Remoteness***

To include multilateral resistance to trade of each of the bilateral countries in the gravity specification (Anderson and Van Wincoop, 2003), a proxy variable “remoteness” for country  $i$  and  $j$ , following Baier and Bergstrand (2007) is included in the logistics augmented gravity equation. The approach of including remoteness variables for both exporting and importing countries instead of using country fixed effects is to allow for the estimation of the effects of domestic factors not accounted for in the vector  $Z$ .

There are several ways of measuring remoteness; however a good measure is one that considers both the average distance of a country from all its trading partners and the level of economic activity taking place in each other country. As noted by Frankel (1997), although the country pairs of Australia and New Zealand on one hand, and Spain and Poland on the other have almost the same distance between them, one would expect trade between Australia and New Zealand to be significantly higher than trade between Spain and Poland. This is so because there are many more countries within close proximity to Spain and Poland than Australia and New Zealand. Following Brun et al. (2005) and other studies, remoteness is calculated by taking a weighted average of the distance to trading partners, where the weights are the proportions of world GDP held by trading partners.

### ***Summary Statistics***

As is evident from Table 1, there is a large deviation in the incidence of bilateral exports. The standard deviation of US\$6.56million indicates a massive disparity between regular and irregular exports among the countries in the sample. With regards to country groups,

the average value of bilateral exports (i.e. US\$0.272million) between developing countries (henceforth referred to as developing-developing bilateral trade) was less than the average bilateral trade of US\$1.149million with regards to trade between developing and developed countries (henceforth referred to as “developing-developed” and/or “developed-developing” bilateral trade).

**Table 1: Summary Statistics of Main Variables used in the Gravity Equation**

Variable	Full Sample		Among Developing Countries		Between Developing & Developed Countries		Among Developed Countries	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Exports	7.197x10 <sup>5</sup>	6.56x10 <sup>6</sup>	2.72 x10 <sup>5</sup>	3.25 x10 <sup>6</sup>	11.49x10 <sup>5</sup>	7.18x10 <sup>6</sup>	58.48x10 <sup>5</sup>	24.4 x 10 <sup>6</sup>
GDP i	3.43 x 10 <sup>11</sup>	12.5 x 10 <sup>11</sup>	1.03 x10 <sup>11</sup>	2.74 x10 <sup>11</sup>	7.54 x10 <sup>11</sup>	19.6 x10 <sup>11</sup>	14.1 x 10 <sup>11</sup>	26.0 x 10 <sup>11</sup>
GDP j	3.43 x 10 <sup>11</sup>	12.5 x 10 <sup>11</sup>	1.03 x10 <sup>11</sup>	2.74 x10 <sup>11</sup>	7.54 x10 <sup>11</sup>	19.6 x10 <sup>11</sup>	14.1 x 10 <sup>11</sup>	26.0 x 10 <sup>11</sup>
GDP Per Capita i	8385.776	12247.67	4346.647	8896.795	15294.81	13985.74	26242.98	8510.289
GDP Per Capita j	8385.776	12247.67	4346.647	8896.795	15294.81	13985.74	26242.98	8510.289
MFN Tariff Rate	7.736	8.027	8.877	8.619	5.908	6.260	1.523	1.658
Area in sq Km i	10.71 x 10 <sup>5</sup>	2.52 x 10 <sup>6</sup>	9.44 x10 <sup>5</sup>	2.30 x10 <sup>6</sup>	12.88x10 <sup>5</sup>	2.84x10 <sup>6</sup>	16.32x10 <sup>5</sup>	3.25x10 <sup>6</sup>
Area in sq Km j	10.71 x 10 <sup>5</sup>	2.52 x 10 <sup>6</sup>	9.44 x10 <sup>5</sup>	2.30 x10 <sup>6</sup>	12.88x10 <sup>5</sup>	2.84x10 <sup>6</sup>	16.32x10 <sup>5</sup>	3.25x10 <sup>6</sup>
Distance	7620.4	4307.202	7695.174	4372.257	7608.552	3923.117	6206.645	5880.398
Ease of Doing Business i	83.175	50.337	96.583	44.628	60.239	51.268	23.895	24.978
Ease of Doing Business j	83.175	50.337	96.583	44.628	60.239	51.268	23.895	24.978
Days it takes to Export	22.66	12.261	25.512	11.664	17.782	11.709	10.053	4.316
Days it takes to Import	26.35	16.336	29.857	15.978	20.350	15.156	10.842	4.822
Cost of Exporting a Container	1121.951	552.03	1173.905	586.632	1033.084	474.239	892.263	257.116
Cost of Importing a Container	1305.767	760.952	1375.81	815.701	1185.957	639.367	996.105	283.194
Aggregate LPI i	2.832	0.633	2.615	0.468	3.204	0.701	3.794	0.265
Aggregate LPI j	2.832	0.633	2.615	0.468	3.204	0.701	3.794	0.265
Customs Efficiency i	2.639	0.626	2.426	0.457	3.003	0.704	3.581	0.342
Customs Efficiency j	2.639	0.626	2.426	0.457	3.003	0.704	3.581	0.342
Infrastructure i	2.677	0.728	2.430	0.536	3.099	0.813	3.767	0.376
Infrastructure j	2.677	0.728	2.430	0.536	3.099	0.813	3.767	0.376
International Shipments i	2.813	0.591	2.625	0.471	3.136	0.633	3.648	0.236
International Shipments j	2.813	0.591	2.625	0.471	3.136	0.633	3.648	0.236
Logistics Competence i	2.800	0.678	2.574	0.517	3.186	0.743	3.798	0.296
Logistics Competence j	2.800	0.678	2.574	0.517	3.186	0.743	3.798	0.296
Tracking and Tracing i	2.828	0.686	2.596	0.522	3.226	0.749	3.855	0.235
Tracking and Tracing j	2.828	0.686	2.596	0.522	3.226	0.749	3.855	0.235
Domestic Logistics Costs i	2.857	0.366	2.942	0.329	2.712	0.381	2.483	0.278
Domestic Logistics Costs j	2.857	0.366	2.942	0.329	2.712	0.381	2.483	0.278
Timeliness i	3.255	0.641	3.051	0.520	3.602	0.679	4.153	0.213
Timeliness j	3.255	0.641	3.051	0.520	3.602	0.679	4.153	0.213
Remoteness i	13.701	0.213	13.721	0.195	12.983	0.775	13.612	0.262
Remoteness j	13.701	0.213	13.721	0.195	12.983	0.775	13.612	0.262
Number of Observations	<b>10506</b>		<b>6972</b>		<b>3192</b>		<b>342</b>	

Country i and j refers to Exporting and Importing countries respectively. GDP is measured in year 2000 US dollars.

With regards to trade between developed countries (henceforth referred to as “developed-developed” bilateral trade), the average bilateral exports value was US\$5.85million. This indicates that on average developing countries traded less amongst each other than they did with developed countries. The deviation in the incidence of bilateral exports was higher with respect to developed-developed trade than developing-developed and developing-developing trade. The summary statistics highlights a similar trend with regards to GDP and GPD per capita for both exporting and importing countries.

The average MFN tariff rate imposed on imports in developing-developing bilateral trade is significantly higher than the average imposed on bilateral imports in developing-developed and developed-developed bilateral trade (i.e. 8.9% as compared with 5.9% and 1.5% respectively). The disparity in the tariff rate imposed on imports is larger amongst developing countries (i.e. standard deviation of 8.6 compared to 6.3 and 1.6). There are also large differences between country groups with respect to the time that is required to export a good. While the average time to export among developing countries is 25.5 days, in developing-developed country trade it takes almost a week less (i.e. 18 days) and much lesser (i.e. 10 days) in the case of developed-developed trade indicating that countries in the developing world are much less efficient in trading amongst each other. A similar pattern is observed for days to import.

To export a standard 20-foot container to other developing countries costs on average US\$1173.9, slightly higher than how much it cost to transport the same container with respect to developing-developed trade and much higher than for developed-developed trade in the sample. The difference in the costs between groups can be explained by the average bilateral distance among developing countries as compared to developed countries.

The summary statistics also highlight the differences between country groups with respect to the mean scores on the aggregate measure of logistics (LPI) and the disaggregated measures for both exporting and importing countries. Generally developed countries in the sample performed better than developing countries on the aggregate and the disaggregated measures of logistics. This is evident in the higher average index (for both the aggregate and disaggregated measures) reported for developed-developed and developing-developed bilateral trade as compared with developing-developing bilateral trade. Between groups, while customs efficiency has the lowest value of the seven indices among developing countries, domestic logistics costs has the lowest value with respect to bilateral exports with and among developed countries. With the exception of timeliness which has the highest value of above 3.0 for both importers and exporters and

between groups, the aggregate LPI fairly reflects the value of all the other seven indicators. Although the measures for infrastructure suffers the greatest variation, a good deal of the variation in the disaggregated elements with the exception of domestic logistics cost is fairly captured in the variation of the aggregate LPI.

To check the degree of interdependence between the disaggregated measures, pairwise correlation coefficients are computed for the disaggregated measures of logistics. This is done to ensure their inclusion in a gravity equation model does not distort the coefficient estimates of the model if the measures are correlated.

**Table 2 Correlation Matrix of Components of LPI**

	Customs	Infrastructure	Shipments	Logistics	Tracking	Dom. Log. Cost	Timeliness
Customs	1						
Infrastructure	0.9616	1					
Shipments	0.9264	0.9426	1				
Logistics	0.9295	0.9422	0.9426	1			
Tracking	0.9132	0.9246	0.932	0.9423	1		
Dom. Log. Cost	-0.3881	-0.4542	-0.405	-0.3781	-0.3887	1	
Timeliness	0.8697	0.8634	0.8646	0.8886	0.8885	-0.3343	1

The pairwise correlation coefficients shown in Table 2 indicate that, with the exception of domestic logistics costs a high degree of interdependence exists between the various measures of logistics for both exporting and importing countries. This implies that if all the measures of logistics performance were included in a single regression, the coefficient estimates will be biased. In line with this finding, each component will be entered in the gravity model separately to account for its impact on bilateral exports.

### ***Endogeneity Issues***

Although the gravity equation specification rules out reverse causality (relies on an i.i.d. assumption), in reality there could be a possibility of reverse causality between logistics and trade. In the gravity specification higher logistics cause higher trade, but it is also possible that higher trade may lead to greater investment in infrastructure or maintenance thus increasing logistics performance. If this holds true, then coefficient estimates may be higher.

To check for the potential endogeneity between exports and logistics a two stage least squares (2SLS) procedure was adopted. The results of the endogeneity test (see Appendix table 2) rules out reverse causality between logistics and trade. The endogeneity test statistic (distributed as chi-squared with degrees of freedom equal to the number of regressors tested) of 0.705 was found to be insignificant thereby indicating an

acceptance of the null hypothesis that the specified endogenous regressor (i.e. exporting country's aggregate LPI) can actually be treated as exogenous in the gravity equation.

The validity of the two stage least squares (2SLS) procedure is confirmed by the under, weak and over identification test results. The Chi-sq (1) p-value for the Kleibergen-Paap rk LM statistic indicates that the equation is identified implying that the instrument used (i.e. the number of exporting documents) is correlated with the endogenous regressor (exporter's aggregate LPI). The weak identification test also confirms the use of strong instrument, while the Hansen j statistic for over identification indicates that the equation is exactly identified.

A plausible reason for the absence of reverse casualty between exports and logistics is that investments in logistics and infrastructure are endogenous to the level of government expenditures, and as such they may be considered as policy measures rather than being determined by trade volumes.

#### **4. Results and Discussion**

##### **Aggregate Logistics Performance Index**

Appendix Table B1 reports the estimated coefficients for a series of estimation techniques using the aggregate LPI. The first column reports OLS estimates using the logarithm of exports as the dependent variable. This regression leaves out close to 20% pairs of countries with zero bilateral trade (i.e. 2, 271 out of 10,506 country pairs in the sample).

The exclusion of zero-valued export flows biases the results because it places greater weight on the magnitude and significance of the estimated coefficients of the remaining positive-valued flows. The second column reports the OLS estimates using logarithm of  $(1 + \text{Exports})$  as dependent variable, as a way of dealing with zeros. As noted before, the estimates under this regression are biased and results significantly distorted by the arbitrary constant.

The third column presents PPML estimates while the fourth column reports NBPMML estimates using the full sample (including zero-trade pairs). The first point to notice is that PPML-estimated coefficients are remarkably different from the NBPMML. Most coefficients from the NBPMML differ oftentimes significantly from those obtained under the PPML. The log of the dispersion parameter  $(\ln\alpha)$  in the NBPMML regression is significantly (at 1%) greater than zero confirming over dispersion in the data due to unobserved heterogeneity and justifying the choice of the NBPMML over the PPML model.

The results in table 3 on the full and sub-samples (i.e. developing-developed, developing-developing and developed-developing country trade; and primary commodity exports, oil and gas and manufactures) are typical of results from other similar empirical studies and widely in line with theory. Economic size in terms of the GDP and per capita GDP of exporters and importers as well as bilateral distance, area, common border and language, and colonial link were found to be important determinants of bilateral trade in the full sample as well as within groups.

With the exception of exporters of oil and gas, both the GDP of the importer and exporter have a significant positive impact on bilateral trade. The NBPML estimates obtained under developing-developing country trade and manufactured exports predict almost equal coefficients for the GDP of exporters and importers implying that there is no significant difference in the magnitude of the impact of GDP on bilateral trade. The elasticity of bilateral exports to the GDP of the importer and exporter for developing-developing country trade is 0.053 and 0.057 respectively and exporters of manufactures 0.052 and 0.056 respectively.

With respect to primary commodity exports, the elasticity of exports to GDP for the exporter was significantly higher (i.e. 0.638) than the importer (i.e. 0.054). Noticeably, the coefficients for the GDP of developed countries as importers and as exporters are markedly higher than that of their counterpart developing country under the developed-developing and developing-developed bilateral trade pairs. While the elasticity of exports to GDP of developed countries are close to unity (i.e. 1.062 as an importer and 0.997 as an exporter) that of counterpart developing countries in the bilateral trade relation was at most 0.050.

With regards to GDP per capita, the estimates show interesting asymmetries across country groupings. Unlike GDP, the NBPML estimates of GDP per capita for exporters and importers predict differing impact on bilateral exports. There are marked differences between the elasticity of exports to GDP per capita across groups (with the exception of the GDP per capita of the developed country as an importer). The asymmetries are revealed under the developing-developed and developed-developing bilateral trade results. In both cases the GDP per capita estimates for the developed country as an exporter and as an importer are found to have a significantly negative impact on exports.

Under developing-developed bilateral trade, the GDP per capita of the developed country (as an importer) is -0.540, whilst under developed –developing trade where the developing country is an exporter it is -1.021. This gives an indication that on average consumers in developed countries consume less of imports from developing countries when their per capita incomes increase. In addition, consumers in developed countries

substitute domestic products for imports from developing countries when their per capita income increases thereby exporting less.

Based on these findings, it can be concluded that developed countries export and import less to and from developing countries when per capita incomes of its residents increase. The negative binomial pseudo maximum likelihood estimates also reveal that, with the exception of developed countries, the coefficient on importer's and exporter's GDP and GDP per capita are not, as generally believed, close to 1. This is similar to the results found by Santos Silva and Tenreyro (2006) using PPML.

The estimates in table 3 also indicate the role of geographical distance as a deterrent to bilateral trade. Across specifications bilateral distance is found to have a significantly negative impact on bilateral trade and this is more pronounced for oil and gas exports (elasticity of 2.312) and developing-developing bilateral trade (elasticity of 2.006). The size of the geographical area of both importers and exporters is also found to be statistically significant (positive) in explaining bilateral trade flow across specifications (with the exception of developed countries). Interestingly, the geographic size of developed countries as exporters and importers has a negative impact on bilateral exports. This evidence indicates that larger (in terms of population weighted geographical area) developed countries export and import less from developing countries.



**Table 3: Gravity Equation Results (NBPMLE Estimator): Aggregate LPI (Country Groups)**

Dependent Variable: Exports	Full Sample	Development Status of Bilateral Countries			Composition of Exports from Developing Countries		
		Developing-Developed	Developing-Developing	Developed-Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	0.048*** (0.011)	1.062*** (0.076)	0.053*** (0.013)	0.050*** (0.009)	0.054*** (0.018)	0.032 (0.028)	0.052*** (0.014)
Log of GDP i	0.042*** (0.010)	0.034** (0.015)	0.057*** (0.012)	0.997*** (0.046)	0.638*** (0.103)	-0.020 (0.026)	0.056*** (0.008)
Log of GDP per capita j	0.235*** (0.041)	-0.540** (0.270)	0.208*** (0.053)	0.409*** (0.043)	0.057 (0.108)	0.581*** (0.105)	0.275*** (0.051)
Log of GDP per capita i	0.467*** (0.046)	0.521*** (0.073)	0.513*** (0.055)	-1.021*** (0.186)	0.334** (0.130)	0.437*** (0.165)	0.648*** (0.070)
MFN Tariff	-0.007* (0.004)	-0.022*** (0.007)	-0.007 (0.004)	-0.006 (0.005)	-0.002 (0.007)	-0.001 (0.006)	-0.001 (0.005)
Log of Area i	0.530*** (0.021)	0.586*** (0.029)	0.591*** (0.027)	-0.167*** (0.035)	0.322*** (0.078)	0.690*** (0.057)	0.603*** (0.029)
Log of Area j	0.381*** (0.019)	-0.235*** (0.059)	0.425*** (0.028)	0.378*** (0.019)	0.447*** (0.045)	0.545*** (0.050)	0.355*** (0.027)
Log of Distance	-1.667*** (0.064)	-1.269*** (0.134)	-2.006*** (0.089)	-1.211*** (0.089)	-2.011*** (0.156)	-2.312*** (0.175)	-1.606*** (0.072)
Contiguity Dummy	0.973*** (0.249)	0.601 (0.384)	0.758** (0.311)	1.170*** (0.363)	0.801** (0.333)	0.977* (0.582)	0.371 (0.232)
Common Official Language	0.098 (0.166)	1.171*** (0.299)	0.216 (0.214)	0.519*** (0.165)	0.354 (0.377)	1.219** (0.516)	0.532*** (0.193)
Common Ethnic Language	0.632*** (0.168)	-0.288 (0.259)	0.763*** (0.215)	0.222 (0.142)	0.717* (0.390)	1.310** (0.520)	0.337* (0.173)
Colonial Link	0.912*** (0.210)	0.339 (0.309)	1.870*** (0.354)	0.248 (0.163)	0.387 (0.493)	1.478*** (0.370)	1.286*** (0.441)
Once Same Country	0.417* (0.251)	0.156 (0.298)			0.951** (0.435)	0.040 (0.595)	0.783** (0.324)
Landlocked i	-0.948*** (0.125)	-0.238 (0.265)	-1.010*** (0.195)	0.012 (0.183)	0.111 (0.299)	-0.728** (0.366)	-0.771*** (0.259)
Landlocked j	-0.829*** (0.148)	0.651 (0.396)	-1.197*** (0.165)	-0.708*** (0.137)	-0.766** (0.356)	-0.648** (0.326)	-0.948*** (0.151)
Ease of Doing Business i	0.003*** (0.001)	-0.008*** (0.002)	0.004*** (0.001)	-0.006* (0.003)	0.000 (0.002)	0.001 (0.004)	0.002 (0.002)
Ease of Doing Business j	0.002* (0.001)	0.015*** (0.004)	0.001 (0.002)	-0.001 (0.001)	-0.003 (0.003)	0.007** (0.003)	0.001 (0.001)
Number of Days to Export	0.026*** (0.006)	-0.018* (0.010)	0.022*** (0.008)	-0.007 (0.014)	0.021 (0.017)	-0.042*** (0.016)	0.054*** (0.010)
Number of Days to Import	-0.010** (0.004)	-0.173*** (0.029)	-0.003 (0.005)	-0.001 (0.005)	-0.008 (0.010)	-0.011 (0.010)	-0.009* (0.005)
Log of Cost Export Container	-0.722*** (0.110)	0.035 (0.194)	-0.625*** (0.152)	0.210 (0.178)	-0.649** (0.291)	1.479*** (0.310)	-1.038*** (0.167)
Log of Cost Import Container	-0.034 (0.101)	1.812*** (0.317)	-0.030 (0.138)	-0.267*** (0.095)	-0.183 (0.229)	-0.107 (0.300)	-0.039 (0.118)
<b>Aggregate LPI i</b>	<b>2.369***</b> <b>(0.106)</b>	<b>1.615***</b> <b>(0.170)</b>	<b>3.101***</b> <b>(0.161)</b>	<b>1.407***</b> <b>(0.211)</b>	<b>1.715***</b> <b>(0.356)</b>	<b>3.035***</b> <b>(0.439)</b>	<b>2.479***</b> <b>(0.163)</b>
<b>Aggregate LPI j</b>	<b>2.207***</b> <b>(0.097)</b>	<b>-0.499</b> <b>(0.429)</b>	<b>2.556***</b> <b>(0.149)</b>	<b>1.734***</b> <b>(0.111)</b>	<b>2.795***</b> <b>(0.231)</b>	<b>2.432***</b> <b>(0.237)</b>	<b>1.689***</b> <b>(0.120)</b>
Remoteness i	1.916*** (0.178)	2.757*** (0.474)	1.843*** (0.283)	0.979*** (0.238)	1.049 (0.904)	-0.899 (0.716)	3.002*** (0.249)
Remoteness j	1.105*** (0.196)	1.155*** (0.387)	1.499*** (0.271)	1.308*** (0.306)	0.636 (0.457)	2.261*** (0.432)	0.419* (0.227)
Constant	-44.02*** (4.156)	-75.312*** (10.311)	-50.909*** (5.656)	-41.280*** (5.767)	-32.073** (14.008)	-36.43*** (12.208)	-49.782*** (5.417)
Number of Observations	10506	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-98796.6	-18911.7	-54120.3	-19981.7	-18651.5	-17316.3	-37016.7
<b>Over dispersion (ln<math>\alpha</math>)</b>	<b>1.725***</b> (0.015)	<b>1.048***</b> (0.037)	<b>1.900***</b> (0.018)	<b>0.370***</b> (0.046)	<b>1.988***</b> (0.029)	<b>1.987***</b> (0.033)	<b>1.363***</b> (0.025)
Pseudo-R2	0.0443383	.0492365	.0497521	.062044	.0460272	.0366429	.0555491

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

Although Trade policy in terms of MFN tariff is statistically important as a deterrent to bilateral trade for the full sample, it only serves as a statistically significant deterrent to developing-developed country trade. Sharing a common border, same language (both

official and ethnic) and having been in a colonial relationship have positive significant effects on bilateral trade.

Among country groups, while sharing a common official language and border are statistically significant in determining the volume of developing-developed and developed-developing trade, bilateral trade volumes among developing countries is significantly determined by colonial relationships, common border and ethnic language. The statistical significance of colonial relationships in determining developing-developing trade implies that developing countries of similar colonial heritage trade more with each other than with others with different colonial heritage.

Landlocked countries were generally found to trade less in the full as well as the sub-samples. Within country groups, while importers from landlocked countries trade less than exporters (i.e. -1.197 and -1.010 respectively) in developing-developing bilateral trade, only landlocked importers in the case of developed-developing trade were found to trade less. A country's landlockedness does not impact on its trade with regards to developing-developed trade. With regards to the composition of exports, landlocked importers of both primary and manufactured commodities traded less than landlocked exporters. In the case of oil and gas exports, landlocked exporters trade less than landlocked importers.

With the exception of primary commodities, the results support the hypothesis that longer distance to all other countries increases the bilateral trade between two countries. Markedly, the remoteness of a developing exporting country and exporters of manufactures increased bilateral exports more than the remoteness of the importing country. This implies that all things being equal, remoteness increases exports more than imports when one considers developing-developed and developing-developing bilateral trade. In the case of developed-developing bilateral trade pairs, remoteness increases imports more than exports from and to the developing country trade partner. In the case of oil and gas, the remoteness of the exporter is found to lower trade while the importer's remoteness increases trade. The exporter coefficient is however statistically insignificant. This finding confirms the necessity of oil and gas because it shows that an importer's remoteness increases its imports whereas for exporters, their remoteness does not influence the amount of oil and gas they export.

The results of regression specifications in table 3 suggest that aggregate logistics (aggregate LPI) of both exporter and importer have a statistically significant positive impact on bilateral trade flows. For the full sample, the results indicate that a percentage point improvement in the LPI score would increase bilateral trade volumes by over 2

percent both of exporters and importers. There are asymmetries in degree of the impact of aggregate logistics on bilateral trade within country groups.

**Table 4: Gravity Equation Results: Importing Country's Income Group**

Dependent Variable: Exports	Destination of Exports from Developing Countries			
	High Income OECD Countries	High Income Non OECD Countries	Middle Income Countries	Low Income
Log of GDP j	1.062*** (0.067)	-0.007 (0.047)	0.644*** (0.059)	0.657*** (0.101)
Log of GDP i	0.016 (0.015)	0.065** (0.028)	0.066*** (0.013)	0.080*** (0.013)
Log of GDP per capita j	-0.666** (0.274)	0.197 (0.595)	0.070 (0.092)	0.339 (0.251)
Log of GDP per capita i	0.512*** (0.071)	0.932*** (0.112)	0.481*** (0.069)	0.207** (0.084)
MFN Tariff	-0.019*** (0.003)	-0.173*** (0.027)	-0.007 (0.006)	-0.006 (0.008)
Log of Area i	0.607*** (0.028)	0.577*** (0.046)	0.544*** (0.035)	0.537*** (0.040)
Log of Area j	-0.221*** (0.052)	0.505*** (0.083)	0.157*** (0.049)	0.108 (0.077)
Log of Distance	-1.116*** (0.119)	-2.311*** (0.204)	-1.775*** (0.087)	-2.572*** (0.172)
Contiguity Dummy	1.032*** (0.355)	-2.300*** (0.572)	0.997*** (0.351)	1.360** (0.605)
Common Official Language	0.463 (0.406)	1.135** (0.551)	0.161 (0.251)	0.150 (0.233)
Common Ethnic Language	0.597 (0.394)	-0.767 (0.519)	0.207 (0.228)	1.105*** (0.238)
Colonial Link	0.255 (0.308)	1.452*** (0.344)	2.881*** (0.406)	
Once Same Country	-0.512 (0.385)	-0.170 (1.163)	0.432 (0.367)	-0.118 (0.462)
Landlocked i	-0.314 (0.256)	0.107 (0.478)	-1.143*** (0.201)	-1.988*** (0.389)
Landlocked j	0.863** (0.397)	-0.785*** (0.196)	-0.456 (0.321)	
Ease of Doing Business i	-0.008*** (0.002)	0.007** (0.003)	0.004** (0.002)	0.002 (0.002)
Ease of Doing Business j	0.017*** (0.004)	0.004 (0.010)	-0.003 (0.002)	0.003 (0.003)
Number of Days to Export	-0.019** (0.009)	-0.009 (0.018)	0.029*** (0.008)	0.054*** (0.014)
Number of Days to Import	-0.156*** (0.027)	-0.289*** (0.076)	0.004 (0.007)	-0.005 (0.008)
Log of Cost to Export Container	-0.090 (0.205)	0.047 (0.281)	-0.517*** (0.150)	-1.226*** (0.226)
Log of Cost to Import Container	1.550*** (0.319)	1.577 (1.162)	-0.282 (0.186)	-0.841*** (0.221)
<b>Aggregate LPI i</b>	<b>1.619***</b> <b>(0.174)</b>	<b>2.355***</b> <b>(0.279)</b>	<b>3.051***</b> <b>(0.163)</b>	<b>3.540***</b> <b>(0.195)</b>
<b>Aggregate LPI j</b>	<b>-0.083</b> <b>(0.432)</b>	<b>0.160</b> <b>(2.032)</b>	<b>1.158***</b> <b>(0.233)</b>	<b>0.600</b> <b>(0.420)</b>
Remoteness i	2.336*** (0.474)	3.136*** (0.651)	2.252*** (0.270)	2.211*** (0.464)
Remoteness j	0.887*** (0.340)	2.195 (2.671)	0.918*** (0.277)	0.727 (0.786)
Constant	-65.097*** (10.066)	-78.659** (36.931)	-55.226*** (5.771)	-35.935*** (10.989)
Number of Observations	1595	748	4613	1992
Over dispersion (ln $\alpha$ )	0.996*** (0.035)	1.601*** (0.058)	1.779*** (0.023)	1.896*** (0.035)
Pseudo-R2	.0504083	.0509654	.0505893	.0497062

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

Generally logistics in the developing countries tend to have a greater impact on trade flows than logistics in the developed countries. The logistics coefficient of developing countries as exporters to developed and other developing countries was 1.615 and 3.101 respectively, and these were higher than the counterpart logistics coefficient of importers. In the case of developed-developing country trade (where developing countries are importers) the importer's logistics coefficient of 1.734 is found to be higher than the exporter logistics coefficient of 1.407.

Whilst aggregate logistics of the importer has a greater significant impact on bilateral trade than that of the exporter for primary commodity exports, with respect to export of oil and gas and manufactures the aggregate logistics of the exporter matters more than that of the importer. This is expected because the nature of primary commodities, especially unprocessed agricultural commodities requires adequate logistics in the importing country to preserve quality due to its perishable nature and intrinsic value to importers.

The results shown in table 4 confirm the findings from table 3 and also show interesting asymmetries with regards to the destination of exports from developing countries. Table 4 shows that except for high income non-OECD countries, the GDP of OECD, middle and low income countries impacted on exports more than the GDP of the exporting countries. The magnitude of the coefficient of the GDP of OECD countries (1.062) confirms the earlier finding in table 3 (with regards to developing-developed country trade). Tariffs are also found to have a dampening effect on exports from developing countries to high income countries, with the coefficient of high income non-OECD countries higher than that of OECD countries. The results on remoteness and distance support earlier findings.

With regards to logistics, the aggregate logistics of the exporting countries (i.e. developing countries) are found to have a greater impact on exports than the logistics in the importing countries. Relatively the impact is more pronounced for exports to low income (i.e. 3.540) and middle income (3.051) countries than high income countries (2.355 and 1.619 for high income non OECD and OECD countries).

#### **4.2 Disaggregated Logistics Performance Measures**

The results in table 5 show estimates of the gravity model specifications with the disaggregated measures of logistics performance included in each specification individually. This is in line with the high correlation found to exist between the measures (see table 2).

**Table 5: Gravity Equation Results (NBPML Estimator): Disaggregated Measures of LPI**

Dependent Variable: Exports	Customs Efficiency	Infrastructure	Shipments	Logistics Competence	Tracking and Tracing	Domestic Logistics Costs	Timeliness
Log of GDP j	0.050*** (0.01)	0.059*** (0.009)	0.078*** (0.01)	0.055*** (0.011)	0.045** (0.019)	0.050*** (0.012)	0.070*** (0.014)
Log of GDP i	0.042*** (0.009)	0.045*** (0.01)	0.072*** (0.009)	0.061*** (0.008)	0.060*** (0.009)	0.053*** (0.009)	0.075*** (0.009)
Log of GDP per capita j	0.441*** (0.044)	0.279*** (0.043)	0.380*** (0.041)	0.277*** (0.046)	0.284*** (0.045)	0.571*** (0.049)	0.244*** (0.053)
Log of GDP per capita i	0.732*** (0.044)	0.528*** (0.047)	0.653*** (0.046)	0.557*** (0.048)	0.498*** (0.053)	0.822*** (0.053)	0.476*** (0.055)
MFN Tariff	-0.002 (0.005)	-0.003 (0.005)	-0.008* (0.005)	-0.007 (0.004)	-0.008** (0.004)	-0.002 (0.006)	-0.007 (0.004)
Log of Area i	0.635*** (0.022)	0.568*** (0.02)	0.548*** (0.021)	0.516*** (0.021)	0.543*** (0.021)	0.610*** (0.023)	0.507*** (0.023)
Log of Area j	0.449*** (0.019)	0.384*** (0.02)	0.370*** (0.02)	0.367*** (0.02)	0.383*** (0.022)	0.408*** (0.022)	0.340*** (0.022)
Log of Distance	-1.640*** (0.061)	-1.632*** (0.056)	-1.576*** (0.068)	-1.646*** (0.064)	-1.719*** (0.066)	-1.538*** (0.07)	-1.558*** (0.062)
Contiguity Dummy	0.983*** (0.256)	1.120*** (0.318)	1.020*** (0.271)	0.934*** (0.237)	0.780*** (0.219)	0.905*** (0.27)	0.964*** (0.192)
Common Official Language	0.019 (0.168)	0.171 (0.159)	0.408** (0.17)	0.500*** (0.169)	0.099 (0.167)	0.044 (0.188)	0.117 (0.192)
Common Ethnic Language	0.710*** (0.167)	0.501*** (0.162)	0.476*** (0.168)	0.300* (0.168)	0.500*** (0.162)	0.359** (0.182)	0.535*** (0.186)
Colonial Link	0.920*** (0.191)	0.890*** (0.177)	0.911*** (0.183)	0.875*** (0.191)	1.027*** (0.191)	0.961*** (0.138)	0.998*** (0.182)
Once Same Country	0.415* (0.247)	0.566** (0.269)	0.739** (0.307)	0.16 (0.254)	0.246 (0.271)	0.684** (0.271)	0.726 (0.455)
Landlocked i	-0.460*** (0.139)	-0.834*** (0.132)	-0.371*** (0.128)	-0.739*** (0.127)	-0.490*** (0.141)	0.601*** (0.203)	-0.420** (0.172)
Landlocked j	-0.577*** (0.156)	-0.694*** (0.146)	-0.451*** (0.17)	-0.694*** (0.153)	-0.720*** (0.147)	-0.096 (0.182)	-0.634*** (0.196)
Ease of Doing Business i	0.001 (0.001)	0.001 (0.001)	0.004*** (0.001)	0.002 (0.001)	0.005*** (0.001)	-0.006*** (0.002)	-0.002 (0.002)
Ease of Doing Business j	0.001 (0.001)	0.002* (0.001)	0.003*** (0.001)	-0.004*** (0.001)	0.004*** (0.001)	-0.004*** (0.001)	0.002 (0.001)
Number of Days to Export	0.020*** (0.007)	0.040*** (0.006)	0 (0.006)	0.018*** (0.006)	0.001 (0.006)	-0.027*** (0.008)	0.007 (0.007)
Number of Days to Import	-0.012*** (0.004)	-0.008* (0.004)	-0.018*** (0.004)	-0.010** (0.004)	-0.020*** (0.004)	-0.022*** (0.005)	-0.011** (0.005)
Log of Cost to Export Container	-0.937*** (0.116)	-0.841*** (0.109)	-0.551*** (0.112)	-0.707*** (0.109)	-0.502*** (0.126)	-1.421*** (0.133)	-0.888*** (0.134)
Log of Cost to Import Container	-0.190* (0.107)	0.045 (0.107)	0.144 (0.117)	-0.057 (0.107)	0.194* (0.115)	-0.686*** (0.126)	-0.344*** (0.115)
Remoteness i	0.851*** (0.069)	0.908*** (0.062)	0.950*** (0.063)	0.905*** (0.065)	0.984*** (0.063)	0.612*** (0.072)	0.670*** (0.07)
Remoteness j	0.432*** (0.081)	0.576*** (0.078)	0.461*** (0.083)	0.394*** (0.083)	0.525*** (0.079)	0.185** (0.085)	0.198** (0.082)
LPI Measure j	<b>1.876***</b> (0.096)	<b>2.187***</b> (0.093)	<b>2.362***</b> (0.095)	<b>1.873***</b> (0.083)	<b>2.186***</b> (0.103)	<b>-0.634***</b> (0.139)	<b>1.787***</b> (0.102)
LPI Measure i	<b>2.131***</b> (0.104)	<b>2.473***</b> (0.097)	<b>2.514***</b> (0.105)	<b>2.130***</b> (0.092)	<b>2.452***</b> (0.109)	<b>-0.247</b> (0.161)	<b>1.996***</b> (0.098)
Constant	-20.57*** (2.336)	-24.09*** (2.179)	-29.30*** (2.315)	-18.72*** (2.315)	-26.38*** (2.32)	6.36** (2.485)	-10.71*** (2.57)
Number of Observations	10164	10164	10164	10164	10164	10164	10164
Log Pseudolikelihood	-94853.19	-94465.38	-94588.5	-94555.66	-94627.52	-95467.52	-94853.13
Overdispersion (ln $\alpha$ )	1.732*** (0.014)	1.672*** (0.015)	1.691*** (0.015)	1.686*** (0.015)	1.697*** (0.016)	1.826*** (0.014)	1.732*** (0.016)
Pseudo-R2	0.0423603	0.0462757	0.0450327	0.0453642	0.0446387	0.0361581	0.042361

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

While the indices for the importer enter the model significantly, only six out of the seven indices for the exporter are individually significant in explaining bilateral trade

involving developing countries. Systematically all the logistics performance indices for the exporter have a greater impact on bilateral trade than that of the importer.

Comparing the magnitude of the individual impact of the logistic performance indices, the results in table 5 indicate that the ease and affordability of international shipping for both exporters and importers have the greatest impact while timeliness has the least positive impact on bilateral trade. With respect to domestic logistics costs, while the index for the importer serves as a deterrent to bilateral trade, that for the exporter has no influence on trade. Transportation infrastructure, tracking and tracing and customs efficiency (in that order) ranked behind ease and affordability of international shipments as having the greatest impact on bilateral exports. This is expected because these measures of logistics performance contain most of the main direct costs of bilateral trade especially involving developing countries.

Comparing the results by country groups reveals interesting asymmetries. With regards to developing-developed country trade and developing-developing country trade, table 6 shows that generally, logistics matters more for developing-developing country trade and for exporters more than developing-developed country trade and importers respectively. For both exporters and importers the magnitude of the coefficients for customs efficiency, infrastructure, shipping, logistics competence tracking and tracing and timeliness is greater for developing-developing country trade than developing-developed and developed-developing country trade. The relatively higher importance of logistics in developing countries to trade flows is reinforced by the coefficient estimates for export flows from developed countries to developing countries.

The magnitude of the coefficients for customs efficiency, infrastructure and timeliness indicates that the state of these indicators in developing countries (as importers) have a greater impact on trade flows than the state of the logistics indicators in the developed countries (i.e. the origin). Expectedly domestic logistics costs in the destination country had a greater impact on exports to developing countries than exports to developed countries.

Comparatively, the individual measures of logistics in exporting countries have a greater impact on bilateral trade than the importer for both developing-developing and developing-developed country trade (i.e. exports from developing countries). In terms of ranking, whilst ease and affordability of shipping, infrastructure, customs efficiency and tracking and tracing have the greatest impact on developing-developed country trade, infrastructure, customs efficiency and ease affordability of shipping and influence developing-developing country trade more than the other measures of logistics performance.

**Table 6: Impact of Measures of Logistics Performance on Exports from Developing Countries across Country Groups**

Measure of Logistics	Bilateral Export Flows			Composition of Bilateral Exports			Destination of Bilateral Exports			
	Developing to Developing	Developing to Developed	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures	High Income (OECD)	High Income (Non OECD)	Middle Income	Low Income
Customs Efficiency i	1.435*** (0.171)	2.564*** (0.164)	0.631*** (0.165)	1.322*** (0.330)	1.585*** (0.384)	2.235*** (0.182)	1.426*** (0.170)	2.041*** (0.272)	2.364*** (0.170)	3.073*** (0.208)
Customs Efficiency j	-0.244 (0.328)	1.930*** (0.138)	1.450*** (0.117)	2.281*** (0.211)	1.841*** (0.235)	1.173*** (0.119)	0.058 (0.435)	0.092 (0.579)	0.610*** (0.203)	1.500*** (0.448)
Infrastructure i	1.494*** (0.174)	2.774*** (0.139)	1.253*** (0.171)	1.943*** (0.365)	2.104*** (0.374)	2.718*** (0.162)	1.482*** (0.178)	2.365*** (0.231)	2.593*** (0.173)	3.229*** (0.191)
Infrastructure j	-0.199 (0.388)	2.193*** (0.141)	1.523*** (0.104)	2.672*** (0.200)	2.338*** (0.236)	1.533*** (0.113)	0.289 (0.409)	-0.355 (0.660)	1.103*** (0.231)	0.525 (0.370)
International Shipping i	1.464*** (0.162)	2.673*** (0.148)	2.131*** (0.225)	0.813*** (0.281)	2.625*** (0.308)	2.499*** (0.178)	1.455*** (0.169)	1.992*** (0.255)	2.740*** (0.162)	3.170*** (0.193)
International Shipping j	-0.251 (0.420)	2.364*** (0.138)	1.600*** (0.108)	2.852*** (0.225)	2.551*** (0.210)	1.611*** (0.122)	0.161 (0.406)	0.269 (1.308)	0.920*** (0.220)	0.252 (0.273)
Logistics Competence i	1.105*** (0.140)	2.248*** (0.131)	1.587*** (0.199)	0.760*** (0.230)	2.764*** (0.353)	1.809*** (0.133)	1.118*** (0.141)	1.614*** (0.228)	2.263*** (0.140)	2.554*** (0.155)
Logistics Competence j	-0.574 (0.381)	1.862*** (0.118)	1.235*** (0.090)	2.238*** (0.187)	1.963*** (0.173)	1.237*** (0.109)	-0.233 (0.359)	-0.479 (14.819)	0.971*** (0.203)	0.039 (0.271)
Tracking and Tracing i	1.209*** (0.170)	2.504*** (0.155)	1.547*** (0.232)	1.336*** (0.274)	1.052** (0.415)	2.301*** (0.145)	1.171*** (0.174)	1.851*** (0.278)	2.699*** (0.140)	2.987*** (0.192)
Tracking and Tracing j	-0.815** (0.383)	1.939*** (0.141)	1.466*** (0.108)	2.221*** (0.220)	1.852*** (0.247)	1.521*** (0.114)	-0.552 (0.390)	0.057 (2.299)	0.833*** (0.179)	0.167 (0.285)
Domestic Logistics Costs i	-0.263 (0.168)	-0.113 (0.187)	0.093 (0.409)	0.121 (0.190)	-0.269 (0.317)	0.751*** (0.290)	-0.253 (0.170)	-0.091 (0.337)	-0.216 (0.218)	0.138 (0.279)
Domestic Logistics Costs j	-1.433** (0.715)	-0.454*** (0.136)	-0.335*** (0.112)	-0.588* (0.316)	-0.928*** (0.240)	-0.441*** (0.155)	-1.056 (0.660)	0.512 (1.690)	0.003 (0.218)	-0.008 (0.172)
Timeliness i	1.036*** (0.130)	1.955*** (0.129)	0.569*** (0.214)	0.091 (0.291)	1.133*** (0.266)	1.920*** (0.124)	1.037*** (0.128)	1.478*** (0.234)	2.325*** (0.137)	2.359*** (0.167)
Timeliness j	-0.496 (0.412)	1.678*** (0.139)	1.188*** (0.091)	2.279*** (0.232)	1.723*** (0.235)	1.285*** (0.110)	-0.245 (0.444)	-1.969 (2.772)	0.877*** (0.190)	0.522** (0.246)
<b>Number of Observations</b>	<b>1596</b>	<b>6972</b>	<b>1596</b>	<b>2856</b>	<b>2040</b>	<b>3672</b>	<b>1595</b>	<b>748</b>	<b>4613</b>	<b>1992</b>

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

With respect to developed-developing bilateral trade, the ease and affordability of shipping, logistics competence and tracking and tracing in the developed country have the greater impact on exports to developing country than the other indicators.

On the composition of exports, there are asymmetries with respect to the impact of the various measures of logistics on bilateral trade. For primary commodity export from developing countries, the various measures of the importing partner's logistics are more important for bilateral trade than the logistics in the country of origin. The results obtained for oil and gas exports were similar with the exception of ease and affordability of international shipping and logistics competence. Indeed for the exports of oil and gas, the ease and affordability of international shipping and logistics competence of the exporting country has the greatest impact on the exports.

On the contrary, for exports of manufactures, the various measures of logistics of the exporter are more important than the importing partner's logistics. This should be expected because to the importer the intrinsic value of primary commodities is time dependent and as such the onus is on the importers to provide higher quality logistics in their own country as the qualities of the primary commodities is to be preserved. This explains why importers of primary commodities import from countries regardless of how poor the quality of logistics is in the exporting country. With regards to the exporters of manufactures, because the quality of logistics is very important when producing higher up the value chain, the exporters' own country's logistics will be more important than the quality of logistics in the importing partner's country.

In terms of ranking, while primary commodity exporters the ease and affordability of international shipping and infrastructure are the most important logistics, for exporters of manufactures ease and affordability of international shipping and tracking and tracing facilities are the most important. Intuitively, because the quality and intrinsic value of primary commodities are time-dependent providing adequate infrastructure in addition to shipping would be the most important logistics to the bilateral countries. Because the quality of manufactures is less time-dependent logistics concerning tracking and tracing in addition to shipping will be more important.

Comparing the impact of logistics in terms of the income status of destination countries also revealed interesting patterns in table 6. Developing countries exports to high income countries is found to depend on the state of infrastructure in the developing countries and not the destination countries (i.e. the high income countries). Comparatively, logistics in the developing country impacted more on exports to high income non OECD countries than OECD countries. With respect to exports to middle income countries, the state of logistics (with the exception of domestic logistics costs) in



both the country of origin (i.e. developing) and destination (middle income) impacted positively on flows, with that of the country of origin having a greater impact.

With regards to exports from developing to low income countries, customs efficiency and timeliness are the only indicators of logistics in both exporting and importing countries that impact positively on trade. The state of infrastructure, ease and affordability of international shipping, logistics competence and tracing and tracking in the exporting countries also impact on exports to low income countries. Interestingly, domestic logistics costs in both exporting and importing country across income groups are not significant in explaining export flows from developing countries.

## **5. Concluding Comments**

The focus of trade and development policy debates in the developing world has increasingly shifted towards the need for developing countries especially the low income countries to improve logistics, trade infrastructure and facilitation in order to increase trade flows. The argument that has been advanced in support of this prescription has to do with negative impact that improvement in logistics; trade infrastructure and facilitation are known to have on trade costs. The focus of this paper was to assess how the various measures of trade logistics had influenced the flow of bilateral exports in developing countries.

The logistics augmented gravity model estimations as well as the detailed analysis thereafter confirmed the positive impact of logistics on bilateral trade involving developing countries. The results indicated that logistics in the country of origin had a greater impact on bilateral exports from the developing countries than logistics in the destination country. This finding is in line with the argument that developing countries were lagging behind in global trade flows because of the inability of most of these countries to improve logistics and trade infrastructure in order to reduce trade costs.

With regards to the individual measures of logistics, all the six LPI measures were found to be important determinants of bilateral exports, with the ease and affordability of shipping having the greatest impact while timeliness had the least impact on bilateral exports. The evidence also shows asymmetries within country groups. Logistics at the destination was more important for primary commodity exports, while logistics at the origin was more important for the export of oil and gas and manufactures. Logistics in developing countries was also more important for exports to high income countries. With respect to low income countries the evidence indicates that customs efficiency and timeliness was more important for trade.

The signs and significance of the estimated parameters of economic size, distance, common border, language, colonial links, landlockedness, and tariffs were found to be widely in line with the theoretical priors and with estimates of previous empirical studies. These explanatory variables were found to be important determinants of trade among developing and with developed countries.

The results suggest the need for developing countries especially in Sub-Saharan Africa to improve trade logistics and infrastructure in order to “catch up” with the rest of the world in terms of global trade flows. Developing countries will realize the gains from trade if trade facilitation is also improved. By making administrative and physical procedures more efficient trade facilitation will lower substantially trade costs in developing countries and this will result in increased trade flows. Similar to Hoekman and Nicita (2008) this paper suggests the need for increased focus on the policies that impact positively on logistics, infrastructure and facilitation since they tend to have a greater impact on trade flows than other trade policy measures. The growth in trade of Asian developing countries especially China and India has been as a result of sustained improvements in trade logistics, infrastructure and facilitation and this is a cue that other developing countries cannot fail to emulate.

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## Appendices

Table A1a: Sample of Developing Countries

Composition of Exports			Income Status			
Primary	Oil and Gas	Manufactures	Low	Middle		High (OECD)
Armenia	Algeria	Albania	Benin	Algeria	Malaysia	Korea
Benin	Argentina	Bosnia & Herz.	Burundi	Argentina	Mauritius	
Burundi	Azerbaijan	Brazil	Côte d'Ivoire	Armenia	Mexico	
Chile	Bahrain	Bulgaria	Ethiopia	Azerbaijan	Moldova	
Ethiopia	Bolivia	China	Gambia	Bolivia	Morocco	<b>High (non OECD)</b>
Gambia	Cameroon	Costa Rica	Ghana	Cameroon	Philippines	Bahrain
Ghana	Colombia	Croatia	Kenya	Chile	Romania	Qatar
Guyana	Côte d'Ivoire	Dominica	Malawi	Colombia	South Africa	Saudi Arabia
Honduras	Ecuador	El Salvador	Mali	Ecuador	Sri Lanka	UAE
Jamaica	Gabon	Guatemala	Mauritania	Gabon	Taiwan	Hong Kong
Kenya	Iran	Hong Kong	Mongolia	Guyana	Thailand	Singapore
Malawi	Kyrgyzstan	India	Mozambique	Honduras	Tunisia	
Mali	Nigeria	Jordan	Niger	Iran	Turkey	
Mauritania	Oman	Korea	Nigeria	Jamaica	Ukraine	
Mongolia	Panama	Lebanon	Rwanda	Kyrgyzstan	Yugoslavia	
Mozambique	Qatar	Macedonia	Sudan	Namibia		
Namibia	Russian Fed.	Madagascar	Senegal	Nicaragua		
Nicaragua	Saudi Arabia	Malaysia	Tanzania	Oman		
Niger	Sudan	Mauritius	Uganda	Panama		
Paraguay	UAE	Mexico	Zambia	Paraguay		
Peru		Moldova	Zimbabwe	Peru		
Rwanda		Morocco	India	Russian Fed.		
Senegal		Pakistan	Lebanon	Uruguay		
Tanzania		Philippines	Madagascar	Albania		
Uganda		Romania	Pakistan	Bosnia & Herz.		
Uruguay		Singapore	Togo	Brazil		
Zambia		South Africa	Viet Nam	Bulgaria		
Zimbabwe		Sri Lanka		China		
		Taiwan		Costa Rica		
		Thailand		Croatia		
		Togo		Dominica		
		Tunisia		El Salvador		
		Turkey		Guatemala		
		Ukraine		Jordan		
		Viet Nam		Lebanon		
		Yugoslavia		Macedonia		

**Table A1b: Sample of Developed Countries**

<b>Composition of Exports</b>				<b>Income Status</b>		
<b>Primary</b>	<b>Oil and Gas</b>	<b>Manufactures</b>		<b>High (OECD)</b>		
New Zealand	Australia	Canada	Japan	Australia	Israel	Portugal
	Norway	Denmark	Netherlands	Canada	Italy	Spain
		France	Portugal	Denmark	Japan	Sweden
		Germany	Spain	France	Netherlands	Switzerland
		Greece	Sweden	Germany	New Zealand	United Kingdom
		Ireland	Switzerland	Greece	Norway	United States
		Israel	United Kingdom	Ireland		
		Italy	United States			



**Table A2: Test of Endogeneity (Exports and Logistics Indicator of Exporter)**

<b>Dependent Variable: Log of Exports</b>	<b>Robust Coefficients</b>	<b>Standard Errors</b>
<b>Aggregate LPI i</b>	<b>3.0561***</b>	<b>0.6774</b>
Log of GDP j	0.0674***	0.0121
Log of GDP i	0.0858***	0.0208
Log of GDP per capita j	0.0636	0.0416
Log of GDP per capita i	0.2886**	0.1347
MFN Tariff	0.0371***	0.0047
Log of Area i	0.5586***	0.0295
Log of Area j	0.3800***	0.0180
Log of Distance	-1.2998***	0.0734
Contiguity	0.6105	0.3951
Common Official Language	0.6897***	0.1529
Common Ethnic Language	0.4798***	0.1619
Colonial Link	1.7677***	0.2594
Once Same Country	2.3587***	0.3260
Landlocked i	-0.5580***	0.1721
Landlocked j	-0.6442***	0.1083
Ease of Doing Business i	-0.0009	0.0025
Ease of Doing Business j	-0.0010	0.0011
Number of days to Export	-0.0055	0.0057
Number of days to Import	-0.0223***	0.0038
Log of Cost to Export Container	-0.4627**	0.1985
Log of Cost to Import Container	-0.1407	0.1008
Aggregate LPI j	2.1987***	0.1016
Remoteness i	2.2971***	0.1593
Remoteness j	1.1137***	0.1613
Constant	-56.3838***	4.0976
Number of Observations	10506	
Centered R <sup>2</sup>	0.5561	
Uncentered R <sup>2</sup>	0.8544	
<b><u>Under identification test:</u></b>		
Kleibergen-Paap rk LM statistic	237.831	
Chi-sq(1) P-value	0.0000	
<b><u>Weak identification test:</u></b>		
Kleibergen-Paap rk Wald F statistic	259.545	
Stock-Yogo weak ID test critical values	10% (25%) maximal IV size = 16.38 (5.53)	
<b><u>Over identification test:</u></b>		
Hansen J statistic (equation exactly identified)	0.000	
<b>Endogeneity test of endogenous regressors</b>		
Chi-sq(1) P-value	0.705	
	0.4011	

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Standard errors are robust to heteroskedasticity; Country i and j refers to Exporter and Importer respectively

## Appendix B: Supplementary Econometric Results

Table B1: Gravity Equation Results across Specifications

	OLS Log Of Exports	OLS1 Log (Exports+1)	PPML Exports	NBPML Exports
Log of GDP j	0.081*** (0.011)	0.068*** (0.012)	0.149 (0.115)	0.048*** (0.011)
Log of GDP i	0.087*** (0.010)	0.100*** (0.013)	0.111 (0.096)	0.042*** (0.010)
Log of GDP per capita j	0.093*** (0.035)	0.065 (0.042)	0.092 (0.063)	0.235*** (0.041)
Log of GDP per capita i	0.280*** (0.037)	0.399*** (0.043)	0.286*** (0.085)	0.467*** (0.046)
MFN Tariff	-0.009*** (0.003)	0.037*** (0.005)	0.007 (0.006)	-0.007* (0.004)
Log of Area i	0.438*** (0.016)	0.577*** (0.018)	0.300*** (0.053)	0.530*** (0.021)
Log of Area j	0.292*** (0.015)	0.380*** (0.018)	0.292*** (0.060)	0.381*** (0.019)
Log of Distance	-1.535*** (0.042)	-1.303*** (0.073)	-0.435*** (0.088)	-1.667*** (0.064)
Contiguity Dummy	1.274*** (0.166)	0.585 (0.392)	0.891*** (0.250)	0.973*** (0.249)
Common Official Language	0.107 (0.114)	0.707*** (0.150)	-0.607* (0.368)	0.098 (0.166)
Common Ethnic Language	0.462*** (0.112)	0.453*** (0.158)	0.981*** (0.288)	0.632*** (0.168)
Colonial Link	1.428*** (0.134)	1.817*** (0.248)	0.429* (0.239)	0.912*** (0.210)
Countries were Once Same Country	0.666*** (0.223)	2.372*** (0.325)	1.450*** (0.321)	0.417* (0.251)
Landlocked i	-0.926*** (0.112)	-0.447*** (0.115)	-0.555** (0.233)	-0.948*** (0.125)
Landlocked j	-0.848*** (0.102)	-0.643*** (0.109)	-0.171 (0.221)	-0.829*** (0.148)
Ease of Doing Business i	0.003*** (0.001)	-0.003** (0.001)	0.005* (0.003)	0.003*** (0.001)
Ease of Doing Business j	0.003*** (0.001)	-0.001 (0.001)	0.006** (0.003)	0.002* (0.001)
Number of Days to Export	0.006 (0.005)	-0.007 (0.005)	0.027*** (0.010)	0.026*** (0.006)
Number of Days to Import	-0.014*** (0.003)	-0.022*** (0.004)	-0.033*** (0.012)	-0.010** (0.004)
Log of Cost to Export Container	-0.501*** (0.081)	-0.606*** (0.101)	-0.775*** (0.193)	-0.722*** (0.110)
Log of Cost to Import Container	-0.129 (0.083)	-0.143 (0.101)	-0.344** (0.160)	-0.034 (0.101)
Aggregate LPI i	2.908*** (0.092)	2.494*** (0.107)	1.493*** (0.325)	2.369*** (0.106)
Aggregate LPI j	2.129*** (0.081)	2.192*** (0.101)	1.330*** (0.346)	2.207*** (0.097)
Remoteness i	1.570*** (0.129)	2.275*** (0.156)	1.055*** (0.297)	1.916*** (0.178)
Remoteness j	0.652*** (0.140)	1.121*** (0.161)	0.670** (0.264)	1.105*** (0.196)
Constant	-34.697*** (3.089)	-54.811*** (3.567)	-26.349*** (5.875)	-44.018*** (4.156)
Number of Observations	8235	10506	10506	10506
Log Pseudolikelihood			-7.022x10 <sup>9</sup>	-98796.596
Overdispersion (ln $\alpha$ )				1.725*** (0.015)
R-squared	0.624	0.556		
Pseudo-R2			0.7058428	0.0443383

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B2: Gravity Equation Results (NBPML Estimator): Customs Efficiency**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.035*** (0.076)	0.039*** (0.012)	0.036*** (0.009)	0.029 (0.018)	0.024 (0.024)	0.050*** (0.013)
Log of GDP i	0.017 (0.015)	0.030** (0.013)	1.056*** (0.045)	0.787*** (0.095)	-0.038 (0.033)	0.043*** (0.009)
Log of GDP per capita j	-0.641** (0.268)	0.357*** (0.054)	0.493*** (0.045)	0.272*** (0.100)	0.777*** (0.106)	0.417*** (0.051)
Log of GDP per capita i	0.622*** (0.069)	0.721*** (0.054)	-0.888*** (0.202)	0.305** (0.131)	0.646*** (0.165)	0.788*** (0.071)
MFN Tariff	-0.022*** (0.007)	-0.000 (0.005)	-0.006 (0.006)	0.001 (0.008)	0.006 (0.010)	-0.005 (0.005)
Log of Area i	0.660*** (0.029)	0.715*** (0.028)	-0.188*** (0.036)	0.304*** (0.076)	0.777*** (0.078)	0.695*** (0.029)
Log of Area j	-0.223*** (0.054)	0.510*** (0.026)	0.448*** (0.020)	0.573*** (0.044)	0.610*** (0.046)	0.404*** (0.027)
Log of Distance	-1.270*** (0.123)	-1.989*** (0.093)	-1.209*** (0.095)	-1.988*** (0.158)	-2.332*** (0.178)	-1.576*** (0.073)
Contiguity Dummy	0.767* (0.396)	0.768** (0.343)	1.199*** (0.369)	0.857** (0.336)	0.888 (0.639)	0.321 (0.217)
Common Official Language	1.103*** (0.305)	-0.171 (0.201)	0.418** (0.172)	0.059 (0.353)	-1.559*** (0.518)	0.481** (0.205)
Common Ethnic Language	-0.132 (0.269)	1.009*** (0.201)	0.233 (0.151)	0.910** (0.371)	1.452*** (0.522)	0.362** (0.181)
Colonial Link	0.278 (0.310)	1.711*** (0.315)	0.269* (0.161)	0.383 (0.428)	1.606*** (0.390)	1.346*** (0.444)
Landlocked i	-0.005 (0.258)	-0.551*** (0.205)	0.066 (0.189)	-0.087 (0.301)	-0.720** (0.370)	-0.242 (0.266)
Landlocked j	0.707* (0.406)	-0.973*** (0.169)	-0.603*** (0.131)	-0.566 (0.360)	-0.486 (0.334)	-0.798*** (0.150)
Ease of Doing Business i	-0.009*** (0.002)	0.003** (0.002)	-0.007** (0.003)	0.000 (0.002)	-0.004 (0.004)	0.001 (0.002)
Ease of Doing Business j	0.015*** (0.004)	0.000 (0.002)	-0.002* (0.001)	-0.005* (0.003)	0.006** (0.003)	0.001 (0.002)
Number of Days to Export	-0.019** (0.010)	0.016* (0.008)	-0.022 (0.014)	0.047*** (0.017)	-0.038** (0.017)	0.055*** (0.011)
Number of Days to Import	-0.168*** (0.027)	-0.005 (0.005)	-0.000 (0.005)	-0.004 (0.011)	-0.012 (0.010)	-0.011* (0.006)
Log of Cost to Export Container	-0.143 (0.195)	-0.935*** (0.156)	0.299* (0.176)	-0.937*** (0.274)	0.795** (0.336)	-1.136*** (0.189)
Log of Cost to Import Container	1.737*** (0.319)	-0.313** (0.134)	-0.438*** (0.098)	-0.470** (0.234)	-0.295 (0.284)	-0.253** (0.121)
Remoteness i	2.718*** (0.454)	1.626*** (0.308)	1.028*** (0.241)	0.618 (0.936)	-0.039 (0.627)	2.850*** (0.287)
Remoteness j	1.004*** (0.353)	1.676*** (0.298)	1.346*** (0.327)	0.429 (0.461)	2.102*** (0.469)	0.412* (0.229)
<b>Customs Efficiency j</b>	<b>-0.244</b> <b>(0.328)</b>	<b>1.930***</b> <b>(0.138)</b>	<b>1.450***</b> <b>(0.117)</b>	<b>2.281***</b> <b>(0.211)</b>	<b>1.841***</b> <b>(0.235)</b>	<b>1.173***</b> <b>(0.119)</b>
<b>Customs Efficiency i</b>	<b>1.435***</b> <b>(0.171)</b>	<b>2.564***</b> <b>(0.164)</b>	<b>0.631***</b> <b>(0.165)</b>	<b>1.322***</b> <b>(0.330)</b>	<b>1.585***</b> <b>(0.384)</b>	<b>2.235***</b> <b>(0.182)</b>
Once Same Country		0.250 (0.282)		1.108** (0.439)	0.646 (0.589)	0.615* (0.317)
Constant	-70.883*** (9.608)	-46.253*** (6.327)	-41.302*** (6.134)	-22.662 (14.557)	-37.514*** (11.856)	-46.004*** (5.522)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18925.47	-54342.78	-20048.41	-18691.73	-17360.82	-37151.22
Overdispersion (ln $\alpha$ )	1.060*** (0.035)	1.956*** (0.018)	0.432*** (0.044)	2.014*** (0.027)	2.023*** (0.033)	1.419*** (0.025)
Pseudo-R2	.0485449	.0458462	.0589105	.0439688	.0341666	.052117

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B3: Gravity Equation Results (NBPMLE Estimator): Infrastructure**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.072*** (0.083)	0.046*** (0.012)	0.041*** (0.009)	0.058*** (0.017)	0.036 (0.025)	0.045*** (0.012)
Log of GDP i	0.021 (0.017)	0.030** (0.014)	0.903*** (0.049)	0.637*** (0.102)	-0.054* (0.031)	0.064*** (0.008)
Log of GDP per capita j	-0.626** (0.274)	0.215*** (0.053)	0.405*** (0.044)	-0.043 (0.110)	0.490*** (0.105)	0.269*** (0.050)
Log of GDP per capita i	0.508*** (0.078)	0.495*** (0.057)	-0.942*** (0.184)	0.457*** (0.134)	0.504*** (0.182)	0.463*** (0.074)
MFN Tariff	-0.022*** (0.008)	-0.000 (0.005)	-0.011*** (0.004)	0.004 (0.009)	0.002 (0.007)	0.000 (0.005)
Log of Area i	0.616*** (0.030)	0.650*** (0.026)	-0.168*** (0.033)	0.327*** (0.077)	0.742*** (0.064)	0.620*** (0.028)
Log of Area j	-0.214*** (0.059)	0.448*** (0.028)	0.412*** (0.019)	0.453*** (0.047)	0.540*** (0.053)	0.358*** (0.027)
Log of Distance	-1.353*** (0.138)	-1.944*** (0.086)	-1.269*** (0.088)	-1.857*** (0.152)	-2.362*** (0.167)	-1.668*** (0.062)
Contiguity Dummy	0.491 (0.407)	0.986** (0.408)	0.968*** (0.334)	1.059*** (0.337)	1.229* (0.657)	0.300 (0.241)
Common Official Language	1.082*** (0.294)	-0.002 (0.197)	0.439*** (0.164)	0.144 (0.347)	-1.231** (0.494)	0.274 (0.171)
Common Ethnic Language	-0.212 (0.252)	0.745*** (0.199)	0.305** (0.144)	0.930*** (0.348)	1.360*** (0.523)	0.326** (0.157)
Colonial Link	0.317 (0.299)	1.727*** (0.396)	0.281* (0.166)	0.510 (0.526)	1.389*** (0.378)	1.224*** (0.390)
Landlocked i	-0.216 (0.263)	-1.105*** (0.203)	-0.215 (0.191)	-0.298 (0.296)	-0.688** (0.364)	-0.793*** (0.270)
Landlocked j	0.638 (0.392)	-1.046*** (0.172)	-0.531*** (0.140)	-0.916*** (0.330)	-0.728** (0.298)	-0.918*** (0.142)
Ease of Doing Business i	-0.008*** (0.002)	0.002 (0.001)	-0.005* (0.003)	-0.001 (0.002)	-0.001 (0.004)	0.001 (0.002)
Ease of Doing Business j	0.016*** (0.004)	0.000 (0.002)	-0.001 (0.001)	-0.003 (0.003)	0.007** (0.003)	0.002 (0.001)
Number of Days to Export	-0.008 (0.010)	0.040*** (0.008)	0.002 (0.014)	0.058*** (0.016)	-0.028* (0.015)	0.070*** (0.010)
Number of Days to Import	-0.172*** (0.034)	-0.002 (0.005)	-0.001 (0.004)	-0.004 (0.010)	-0.005 (0.010)	-0.007 (0.005)
Log of Cost to Export Container	-0.025 (0.193)	-0.749*** (0.147)	0.314* (0.181)	-0.794*** (0.278)	1.066*** (0.278)	-0.562*** (0.172)
Log of Cost to Import Container	1.696*** (0.350)	0.028 (0.134)	-0.256*** (0.098)	-0.030 (0.233)	-0.067 (0.301)	0.005 (0.115)
Remoteness i	3.179*** (0.470)	1.926*** (0.261)	1.169*** (0.231)	-0.196 (0.844)	0.185 (0.645)	3.280*** (0.234)
Remoteness j	1.201*** (0.386)	1.760*** (0.277)	1.690*** (0.295)	0.916* (0.486)	2.520*** (0.424)	0.705*** (0.208)
<b>Infrastructure j</b>	<b>-0.199</b> <b>(0.388)</b>	<b>2.193***</b> <b>(0.141)</b>	<b>1.523***</b> <b>(0.104)</b>	<b>2.672***</b> <b>(0.200)</b>	<b>2.338***</b> <b>(0.236)</b>	<b>1.533***</b> <b>(0.113)</b>
<b>Infrastructure i</b>	<b>1.494***</b> <b>(0.174)</b>	<b>2.774***</b> <b>(0.139)</b>	<b>1.253***</b> <b>(0.171)</b>	<b>1.943***</b> <b>(0.365)</b>	<b>2.104***</b> <b>(0.374)</b>	<b>2.718***</b> <b>(0.162)</b>
Once Same Country		0.439 (0.305)		1.132*** (0.422)	0.379 (0.613)	0.780*** (0.295)
Constant	-80.209*** (10.619)	-53.368*** (5.514)	-46.453*** (5.507)	-20.831 (13.452)	-48.496*** (11.671)	-59.068*** (5.189)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18911.86	-54155.29	-19982.76	-18639	-17317.43	-36999.05
Overdispersion (ln $\alpha$ )	1.048*** (0.037)	1.909*** (0.018)	0.371*** (0.046)	1.980*** (0.029)	1.988*** (0.033)	1.355*** (0.025)
Pseudo-R2	0.049229	0.0491382	0.0619923	0.0466661	0.0365806	0.0559994

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B4: Gravity Equation Results (NBPMLE Estimator): Shipping**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.061*** (0.075)	0.070*** (0.013)	0.057*** (0.009)	0.073*** (0.018)	0.062*** (0.022)	0.066*** (0.013)
Log of GDP i	0.040*** (0.015)	0.071*** (0.012)	0.998*** (0.045)	0.761*** (0.104)	-0.010 (0.026)	0.082*** (0.009)
Log of GDP per capita j	-0.616** (0.247)	0.298*** (0.051)	0.487*** (0.039)	0.178* (0.101)	0.596*** (0.094)	0.353*** (0.048)
Log of GDP per capita i	0.600*** (0.071)	0.678*** (0.054)	-0.805*** (0.171)	0.472*** (0.133)	0.567*** (0.147)	0.818*** (0.068)
MFN Tariff	-0.023*** (0.007)	-0.006 (0.004)	-0.011** (0.004)	0.000 (0.008)	-0.002 (0.006)	-0.005 (0.005)
Log of Area i	0.583*** (0.029)	0.596*** (0.029)	-0.117*** (0.036)	0.322*** (0.075)	0.683*** (0.052)	0.601*** (0.030)
Log of Area j	-0.223*** (0.059)	0.409*** (0.029)	0.375*** (0.019)	0.439*** (0.045)	0.513*** (0.045)	0.357*** (0.028)
Log of Distance	-1.235*** (0.132)	-1.964*** (0.102)	-1.118*** (0.088)	-2.133*** (0.157)	-2.347*** (0.191)	-1.570*** (0.071)
Contiguity Dummy	0.453 (0.381)	0.821** (0.349)	1.183*** (0.332)	0.709* (0.382)	0.753 (0.671)	0.413* (0.225)
Common Official Language	1.248*** (0.288)	0.294 (0.218)	0.544*** (0.164)	0.317 (0.390)	-0.903* (0.503)	0.729*** (0.199)
Common Ethnic Language	-0.318 (0.252)	0.726*** (0.217)	0.279** (0.141)	0.777** (0.396)	1.030** (0.505)	0.140 (0.179)
Colonial Link	0.328 (0.299)	1.723*** (0.392)	0.313* (0.176)	0.182 (0.374)	1.312*** (0.388)	1.247*** (0.412)
Landlocked i	-0.188 (0.269)	-0.732*** (0.211)	0.545*** (0.191)	0.112 (0.302)	-1.030*** (0.358)	-1.058*** (0.258)
Landlocked j	0.724* (0.427)	-1.061*** (0.190)	-0.577*** (0.142)	-0.319 (0.360)	-0.221 (0.383)	-0.723*** (0.160)
Ease of Doing Business i	-0.006*** (0.002)	0.007*** (0.002)	0.002 (0.003)	0.001 (0.002)	0.005 (0.004)	0.003 (0.002)
Ease of Doing Business j	0.016*** (0.004)	0.003* (0.002)	0.000 (0.001)	-0.000 (0.003)	0.008*** (0.003)	0.002 (0.002)
Number of Days to Export	-0.024** (0.010)	0.007 (0.008)	-0.010 (0.013)	0.033* (0.018)	-0.044*** (0.016)	0.076*** (0.012)
Number of Days to Import	-0.165*** (0.028)	-0.007 (0.005)	-0.005 (0.004)	-0.024** (0.010)	-0.025** (0.010)	-0.013** (0.006)
Log of Cost to Export Container	0.086 (0.197)	-0.674*** (0.153)	-0.137 (0.179)	-0.996*** (0.272)	1.191*** (0.268)	-0.846*** (0.177)
Log of Cost to Import Container	1.669*** (0.317)	0.023 (0.143)	-0.234** (0.096)	-0.002 (0.235)	0.253 (0.281)	-0.003 (0.125)
Remoteness i	3.029*** (0.464)	2.159*** (0.307)	0.853*** (0.230)	0.735 (0.920)	-1.452** (0.664)	3.730*** (0.248)
Remoteness j	1.038*** (0.381)	2.054*** (0.285)	1.401*** (0.306)	0.903* (0.467)	2.479*** (0.448)	0.466** (0.228)
<b>Shipping j</b>	<b>-0.251</b> <b>(0.420)</b>	<b>2.364***</b> <b>(0.138)</b>	<b>1.600***</b> <b>(0.108)</b>	<b>2.852***</b> <b>(0.225)</b>	<b>2.551***</b> <b>(0.210)</b>	<b>1.611***</b> <b>(0.122)</b>
<b>Shipping i</b>	<b>1.464***</b> <b>(0.162)</b>	<b>2.673***</b> <b>(0.148)</b>	<b>2.131***</b> <b>(0.225)</b>	<b>0.813***</b> <b>(0.281)</b>	<b>2.625***</b> <b>(0.308)</b>	<b>2.499***</b> <b>(0.178)</b>
Once Same Country		0.552 (0.347)		1.379** (0.545)	0.625 (0.622)	0.763** (0.336)
Constant	-77.858*** (10.141)	-64.154*** (6.227)	-45.412*** (5.501)	-32.532** (14.683)	-32.973*** (11.825)	-65.393*** (5.473)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18919.88	-54220	-19967.37	-18663.98	-17317.43	-37070.78
Overdispersion (ln $\alpha$ )	1.055*** (0.036)	1.925*** (0.018)	0.357*** (0.047)	1.996*** (0.028)	1.984*** (0.033)	1.385*** (0.025)
Pseudo-R2	.0488258	.0480021	.0627147	.0453885	.0368265	.0541692

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B5: Gravity Equation Results (NBPMLE Estimator): Logistics Competence**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.080*** (0.079)	0.046*** (0.013)	0.046*** (0.010)	0.040** (0.019)	0.025 (0.024)	0.056*** (0.014)
Log of GDP i	0.034** (0.014)	0.058*** (0.010)	0.930*** (0.049)	0.747*** (0.094)	0.020 (0.025)	0.044*** (0.009)
Log of GDP per capita j	-0.470* (0.266)	0.228*** (0.058)	0.443*** (0.045)	0.074 (0.110)	0.569*** (0.096)	0.293*** (0.058)
Log of GDP per capita i	0.557*** (0.074)	0.579*** (0.058)	-1.045*** (0.183)	0.316** (0.130)	0.464*** (0.163)	0.774*** (0.074)
MFN Tariff	-0.023*** (0.007)	-0.006 (0.004)	-0.004 (0.005)	-0.003 (0.007)	-0.005 (0.006)	-0.003 (0.005)
Log of Area i	0.582*** (0.029)	0.569*** (0.029)	-0.102*** (0.037)	0.348*** (0.077)	0.580*** (0.052)	0.597*** (0.031)
Log of Area j	-0.257*** (0.064)	0.422*** (0.028)	0.383*** (0.019)	0.448*** (0.045)	0.543*** (0.048)	0.346*** (0.027)
Log of Distance	-1.321*** (0.143)	-2.035*** (0.097)	-1.208*** (0.086)	-2.057*** (0.157)	-2.288*** (0.185)	-1.630*** (0.079)
Contiguity Dummy	0.408 (0.380)	0.693** (0.316)	1.122*** (0.358)	0.561 (0.365)	0.989* (0.584)	0.344 (0.250)
Common Official Language	1.309*** (0.294)	0.370* (0.213)	0.690*** (0.161)	0.433 (0.401)	-0.768 (0.521)	0.683*** (0.189)
Common Ethnic Language	-0.416* (0.252)	0.524** (0.214)	0.107 (0.136)	0.552 (0.409)	1.043** (0.521)	0.097 (0.168)
Colonial Link	0.324 (0.289)	1.473*** (0.324)	0.240 (0.159)	0.338 (0.376)	1.295*** (0.359)	1.270*** (0.434)
Landlocked i	-0.111 (0.282)	-1.012*** (0.204)	0.157 (0.189)	0.031 (0.308)	-0.141 (0.367)	-0.800*** (0.254)
Landlocked j	0.530 (0.390)	-1.071*** (0.183)	-0.625*** (0.137)	-0.495 (0.351)	-0.570* (0.328)	-0.871*** (0.161)
Ease of Doing Business i	-0.010*** (0.002)	0.000 (0.002)	-0.006* (0.003)	-0.002 (0.002)	-0.003 (0.004)	0.000 (0.002)
Ease of Doing Business j	0.017*** (0.004)	-0.005*** (0.002)	-0.005*** (0.001)	-0.008*** (0.003)	0.002 (0.003)	-0.003* (0.001)
Number of Days to Export	-0.020** (0.010)	0.025*** (0.008)	0.003 (0.014)	0.028* (0.017)	-0.055*** (0.016)	0.066*** (0.011)
Number of Days to Import	-0.185*** (0.029)	-0.002 (0.005)	0.001 (0.005)	-0.010 (0.011)	-0.013 (0.010)	-0.011* (0.006)
Log of Cost to Export Container	-0.119 (0.190)	-0.872*** (0.142)	0.080 (0.181)	-0.729*** (0.276)	1.527*** (0.266)	-1.483*** (0.170)
Log of Cost to Import Container	1.874*** (0.306)	-0.225* (0.135)	-0.414*** (0.092)	-0.358 (0.228)	-0.265 (0.282)	-0.079 (0.118)
Remoteness i	2.982*** (0.486)	2.017*** (0.291)	0.726*** (0.242)	1.324 (0.903)	-1.408* (0.723)	3.154*** (0.261)
Remoteness j	1.341*** (0.413)	1.557*** (0.281)	1.515*** (0.289)	0.698 (0.456)	2.009*** (0.418)	0.416* (0.237)
<b>Logistics Competence j</b>	<b>-0.574</b> <b>(0.381)</b>	<b>1.862***</b> <b>(0.118)</b>	<b>1.235***</b> <b>(0.090)</b>	<b>2.238***</b> <b>(0.187)</b>	<b>1.963***</b> <b>(0.173)</b>	<b>1.237***</b> <b>(0.109)</b>
<b>Logistics Competence i</b>	<b>1.105***</b> <b>(0.140)</b>	<b>2.248***</b> <b>(0.131)</b>	<b>1.587***</b> <b>(0.199)</b>	<b>0.760***</b> <b>(0.230)</b>	<b>2.764***</b> <b>(0.353)</b>	<b>1.809***</b> <b>(0.133)</b>
Once Same Country		-0.034 (0.303)		1.014** (0.504)	-0.255 (0.620)	0.645** (0.321)
Constant	-78.915*** (10.997)	-45.816*** (5.819)	-36.954*** (5.768)	-32.565** (14.036)	-21.614* (12.045)	-45.427*** (5.539)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18924.64	-54206.31	-19993.46	-18668.42	-17305.25	-37065.57
Overdispersion (ln $\alpha$ )	1.059*** (0.036)	1.922*** (0.018)	0.381*** (0.046)	1.999*** (0.028)	1.978*** (0.033)	1.383*** (0.026)
Pseudo-R2	.0485866	.0482423	.0614901	.0451612	.0372581	.0543021

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B6: Gravity Equation Results (NBPML Estimator): Tracking and Tracing**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.099*** (0.081)	0.033 (0.021)	0.053*** (0.010)	0.047** (0.020)	0.027 (0.026)	0.054*** (0.014)
Log of GDP i	0.037*** (0.014)	0.056*** (0.012)	0.947*** (0.047)	0.662*** (0.098)	0.049** (0.025)	0.045*** (0.008)
Log of GDP per capita j	-0.418 (0.282)	0.262*** (0.056)	0.446*** (0.043)	0.154 (0.113)	0.696*** (0.112)	0.288*** (0.052)
Log of GDP per capita i	0.545*** (0.074)	0.510*** (0.059)	-0.923*** (0.176)	0.047 (0.131)	0.729*** (0.163)	0.711*** (0.067)
MFN Tariff	-0.027*** (0.007)	-0.007* (0.004)	0.004 (0.007)	-0.006 (0.005)	0.004 (0.010)	-0.002 (0.004)
Log of Area i	0.595*** (0.028)	0.593*** (0.027)	-0.171*** (0.034)	0.339*** (0.082)	0.572*** (0.059)	0.631*** (0.027)
Log of Area j	-0.266*** (0.057)	0.442*** (0.030)	0.378*** (0.019)	0.500*** (0.047)	0.550*** (0.048)	0.351*** (0.026)
Log of Distance	-1.302*** (0.133)	-2.146*** (0.106)	-1.259*** (0.083)	-2.174*** (0.170)	-2.449*** (0.188)	-1.641*** (0.068)
Contiguity Dummy	0.497 (0.369)	0.443* (0.261)	1.142*** (0.408)	0.521 (0.382)	0.093 (0.445)	0.236 (0.219)
Common Official Language	1.118*** (0.294)	-0.112 (0.201)	0.542*** (0.165)	-0.068 (0.355)	-1.397** (0.546)	0.423** (0.181)
Common Ethnic Language	-0.195 (0.259)	0.788*** (0.197)	0.095 (0.147)	0.823** (0.363)	1.180** (0.546)	0.392** (0.165)
Colonial Link	0.247 (0.289)	1.869*** (0.311)	0.281 (0.177)	0.575 (0.443)	1.691*** (0.380)	1.294*** (0.442)
Landlocked i	0.015 (0.289)	-0.591*** (0.219)	-0.051 (0.193)	0.426 (0.329)	-1.154*** (0.377)	-1.002*** (0.261)
Landlocked j	0.414 (0.358)	-1.044*** (0.194)	-0.616*** (0.148)	-0.359 (0.338)	-0.328 (0.346)	-0.992*** (0.151)
Ease of Doing Business i	-0.007*** (0.002)	0.007*** (0.002)	-0.008** (0.003)	0.001 (0.002)	0.001 (0.004)	0.007*** (0.002)
Ease of Doing Business j	0.017*** (0.004)	0.003** (0.002)	-0.001 (0.001)	0.000 (0.004)	0.009*** (0.003)	0.003** (0.001)
Number of Days to Export	-0.026*** (0.010)	0.002 (0.008)	-0.010 (0.015)	-0.016 (0.019)	-0.022 (0.016)	0.028*** (0.010)
Number of Days to Import	-0.181*** (0.026)	-0.016*** (0.005)	-0.003 (0.005)	-0.029*** (0.010)	-0.019* (0.010)	-0.014** (0.005)
Log of Cost to Export Container	-0.114 (0.198)	-0.634*** (0.161)	0.290 (0.180)	-0.102 (0.312)	0.354 (0.313)	-1.322*** (0.172)
Log of Cost to Import Container	1.960*** (0.294)	-0.023 (0.141)	-0.295*** (0.098)	-0.143 (0.222)	-0.109 (0.303)	0.019 (0.115)
Remoteness i	3.054*** (0.482)	2.339*** (0.326)	0.906*** (0.235)	3.402*** (0.932)	-0.482 (0.747)	2.605*** (0.269)
Remoteness j	1.370*** (0.396)	2.001*** (0.299)	1.514*** (0.290)	0.989** (0.471)	2.463*** (0.453)	0.444** (0.220)
<b>Tracking and Tracing j</b>	<b>-0.815** (0.383)</b>	<b>1.939*** (0.141)</b>	<b>1.466*** (0.108)</b>	<b>2.221*** (0.220)</b>	<b>1.852*** (0.247)</b>	<b>1.521*** (0.114)</b>
<b>Tracking and Tracing i</b>	<b>1.209*** (0.170)</b>	<b>2.504*** (0.155)</b>	<b>1.547*** (0.232)</b>	<b>1.336*** (0.274)</b>	<b>1.052** (0.415)</b>	<b>2.301*** (0.145)</b>
Once Same Country		0.107 (0.311)		1.391*** (0.502)	0.521 (0.644)	0.937*** (0.323)
Constant	-81.735*** (10.652)	-59.771*** (6.446)	-42.880*** (5.656)	-68.191*** (14.619)	-32.460** (12.653)	-42.392*** (5.639)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18931.85	-54275.92	-20015.2	-18685.06	-17356.71	-37002.64
Overdispersion (ln $\alpha$ )	1.066*** (0.035)	1.939*** (0.019)	0.401*** (0.044)	2.010*** (0.028)	2.020*** (0.034)	1.357*** (0.025)
Pseudo-R2	.0482242	.0470202	.0604697	.0443102	.0343953	.0559078

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B7: Gravity Equation Results (NBPML Estimator): Domestic Logistics Costs**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	0.766*** (0.153)	0.045*** (0.014)	0.050*** (0.010)	0.043** (0.020)	0.033 (0.024)	0.076*** (0.013)
Log of GDP i	0.032** (0.013)	0.058*** (0.012)	1.033*** (0.074)	1.008*** (0.092)	0.047* (0.026)	0.060*** (0.010)
Log of GDP per capita j	-0.865*** (0.276)	0.434*** (0.062)	0.579*** (0.043)	0.550*** (0.107)	0.981*** (0.102)	0.538*** (0.052)
Log of GDP per capita i	0.687*** (0.068)	0.821*** (0.060)	-0.574** (0.239)	0.156 (0.139)	0.842*** (0.149)	1.087*** (0.082)
MFN Tariff	-0.026*** (0.007)	-0.000 (0.006)	-0.005 (0.005)	-0.007 (0.007)	0.010 (0.012)	-0.015*** (0.005)
Log of Area i	0.626*** (0.027)	0.642*** (0.031)	-0.189*** (0.040)	0.365*** (0.078)	0.593*** (0.053)	0.752*** (0.033)
Log of Area j	-0.144** (0.062)	0.452*** (0.029)	0.406*** (0.021)	0.611*** (0.046)	0.588*** (0.046)	0.376*** (0.029)
Log of Distance	-1.353*** (0.133)	-2.214*** (0.109)	-1.248*** (0.087)	-2.292*** (0.174)	-2.478*** (0.207)	-1.663*** (0.075)
Contiguity Dummy	0.413 (0.409)	0.524* (0.295)	0.783** (0.333)	0.801* (0.415)	-0.419 (0.424)	0.245 (0.244)
Common Official Language	1.208*** (0.307)	-0.339 (0.228)	0.514*** (0.192)	-0.880*** (0.279)	-1.213** (0.572)	0.551** (0.223)
Common Ethnic Language	-0.198 (0.254)	0.707*** (0.223)	-0.055 (0.165)	1.319*** (0.286)	0.706 (0.569)	0.005 (0.196)
Colonial Link	0.060 (0.268)	1.234*** (0.318)	0.464*** (0.171)	0.785** (0.307)	1.772*** (0.373)	1.182*** (0.320)
Landlocked i	0.356 (0.282)	0.205 (0.276)	0.000 (0.247)	-0.277 (0.334)	-1.070*** (0.332)	-1.025*** (0.279)
Landlocked j	0.030 (0.498)	-0.851*** (0.204)	-0.487*** (0.154)	0.514 (0.358)	0.092 (0.380)	-0.522*** (0.172)
Ease of Doing Business i	-0.012*** (0.002)	-0.002 (0.002)	-0.009** (0.004)	0.000 (0.003)	-0.002 (0.004)	-0.006*** (0.002)
Ease of Doing Business j	0.026*** (0.006)	-0.004* (0.002)	-0.006*** (0.001)	-0.012*** (0.004)	0.002 (0.003)	-0.002 (0.002)
Number of Days to Export	-0.027*** (0.010)	-0.009 (0.009)	-0.046** (0.021)	0.032* (0.019)	-0.018 (0.017)	0.016 (0.011)
Number of Days to Import	-0.225*** (0.040)	-0.009 (0.006)	-0.001 (0.005)	-0.037*** (0.012)	-0.031*** (0.010)	-0.017** (0.007)
Log of Cost to Export Container	-0.675*** (0.180)	-1.635*** (0.165)	0.533** (0.251)	-0.798*** (0.286)	-0.238 (0.309)	-2.104*** (0.209)
Log of Cost to Import Container	2.603*** (0.566)	-0.827*** (0.145)	-0.817*** (0.101)	-0.895*** (0.245)	-0.636** (0.289)	-0.459*** (0.137)
Remoteness i	4.108*** (0.458)	3.702*** (0.339)	1.029*** (0.260)	1.407 (1.023)	-0.272 (0.665)	3.836*** (0.324)
Remoteness j	1.328*** (0.378)	3.554*** (0.328)	2.607*** (0.300)	1.594*** (0.508)	3.086*** (0.512)	0.891*** (0.250)
<b>Domestic Logistics Costs j</b>	<b>-1.433**</b> <b>(0.715)</b>	<b>-0.454***</b> <b>(0.136)</b>	<b>-0.335***</b> <b>(0.112)</b>	<b>-0.588*</b> <b>(0.316)</b>	<b>-0.928***</b> <b>(0.240)</b>	<b>-0.441***</b> <b>(0.155)</b>
<b>Domestic Logistics Costs i</b>	<b>-0.263</b> <b>(0.168)</b>	<b>-0.113</b> <b>(0.187)</b>	<b>0.093</b> <b>(0.409)</b>	<b>0.121</b> <b>(0.190)</b>	<b>-0.269</b> <b>(0.317)</b>	<b>0.751***</b> <b>(0.290)</b>
Once Same Country		0.458 (0.319)		1.709*** (0.541)	1.315* (0.708)	0.319 (0.338)
Constant	-79.924*** (9.792)	-76.097*** (7.273)	-52.853*** (6.622)	-39.971** (16.029)	-27.180** (12.375)	-52.058*** (5.983)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18966.33	-54668.09	-20141.79	-18802.85	-17401.34	-37330.68
Overdispersion (ln $\alpha$ )	1.095*** (0.034)	2.036*** (0.018)	0.518*** (0.041)	2.086*** (0.027)	2.056*** (0.032)	1.493*** (0.025)
Pseudo-R2	.0464908	.0401344	.0545275	.0382855	.0319121	.0475382

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively



**Table B8: Gravity Equation Results (NBPML Estimator): Timeliness**

Dependent Variable: Exports	Bilateral Export Flows			Composition of Developing Country's Exports		
	Developing to Developed	Developing to Developing	Developed to Developing	Primary Commodities	Oil and Gas	Manufactures
Log of GDP j	1.050*** (0.082)	0.060*** (0.016)	0.064*** (0.010)	0.074*** (0.020)	0.048* (0.027)	0.071*** (0.014)
Log of GDP i	0.048*** (0.013)	0.072*** (0.011)	1.037*** (0.046)	0.957*** (0.096)	0.062*** (0.023)	0.057*** (0.008)
Log of GDP per capita j	-0.511** (0.250)	0.182*** (0.068)	0.419*** (0.045)	0.066 (0.117)	0.628*** (0.113)	0.326*** (0.055)
Log of GDP per capita i	0.561*** (0.071)	0.486*** (0.060)	-0.849*** (0.199)	0.281* (0.147)	0.724*** (0.140)	0.505*** (0.072)
MFN Tariff	-0.023*** (0.007)	-0.006 (0.004)	0.001 (0.006)	-0.003 (0.007)	-0.001 (0.007)	-0.001 (0.005)
Log of Area i	0.563*** (0.029)	0.548*** (0.029)	-0.201*** (0.036)	0.369*** (0.078)	0.584*** (0.054)	0.580*** (0.027)
Log of Area j	-0.222*** (0.055)	0.385*** (0.029)	0.330*** (0.020)	0.400*** (0.048)	0.531*** (0.048)	0.339*** (0.028)
Log of Distance	-1.240*** (0.129)	-2.170*** (0.097)	-1.238*** (0.087)	-2.264*** (0.187)	-2.250*** (0.174)	-1.561*** (0.068)
Contiguity Dummy	0.657* (0.365)	0.674*** (0.254)	1.128*** (0.384)	0.502 (0.366)	0.213 (0.406)	0.484* (0.267)
Common Official Language	1.121*** (0.317)	-0.174 (0.227)	0.415** (0.181)	-0.118 (0.391)	-1.232** (0.551)	0.499** (0.220)
Common Ethnic Language	-0.253 (0.262)	0.759*** (0.230)	0.071 (0.157)	0.777** (0.392)	1.285** (0.550)	0.461** (0.197)
Colonial Link	0.220 (0.282)	1.640*** (0.306)	0.380** (0.160)	0.726** (0.318)	1.573*** (0.380)	1.272*** (0.414)
Landlocked i	-0.097 (0.273)	-0.559** (0.240)	-0.183 (0.196)	0.115 (0.338)	-0.758** (0.358)	-0.987*** (0.248)
Landlocked j	0.982** (0.436)	-1.261*** (0.177)	-0.904*** (0.148)	-0.522 (0.385)	-0.519 (0.352)	-0.930*** (0.156)
Ease of Doing Business i	-0.010*** (0.002)	0.001 (0.002)	-0.010*** (0.003)	0.002 (0.002)	-0.003 (0.004)	0.001 (0.002)
Ease of Doing Business j	0.015*** (0.004)	-0.001 (0.002)	-0.003*** (0.001)	-0.006* (0.003)	0.003 (0.003)	0.000 (0.001)
Number of Days to Export	-0.016* (0.010)	0.010 (0.008)	-0.036** (0.015)	0.021 (0.018)	-0.016 (0.017)	0.010 (0.010)
Number of Days to Import	-0.155*** (0.023)	-0.000 (0.005)	0.007 (0.005)	-0.011 (0.011)	-0.015 (0.010)	-0.008 (0.006)
Log of Cost to Export Container	-0.344* (0.187)	-1.119*** (0.158)	0.580*** (0.177)	-0.729** (0.283)	0.237 (0.324)	-1.326*** (0.163)
Log of Cost to Import Container	1.687*** (0.298)	-0.661*** (0.141)	-0.589*** (0.098)	-0.530** (0.234)	-0.471 (0.298)	-0.302*** (0.117)
Remoteness i	3.062*** (0.465)	2.760*** (0.304)	1.019*** (0.248)	1.619 (0.986)	-0.887 (0.649)	3.076*** (0.252)
Remoteness j	1.136*** (0.370)	2.250*** (0.313)	1.671*** (0.299)	0.900* (0.463)	1.986*** (0.475)	0.170 (0.215)
<b>Timeliness j</b>	<b>-0.496</b> <b>(0.412)</b>	<b>1.678***</b> <b>(0.139)</b>	<b>1.188***</b> <b>(0.091)</b>	<b>2.279***</b> <b>(0.232)</b>	<b>1.723***</b> <b>(0.235)</b>	<b>1.285***</b> <b>(0.110)</b>
<b>Timeliness i</b>	<b>1.036***</b> <b>(0.130)</b>	<b>1.955***</b> <b>(0.129)</b>	<b>0.569***</b> <b>(0.214)</b>	<b>0.091</b> <b>(0.291)</b>	<b>1.133***</b> <b>(0.266)</b>	<b>1.920***</b> <b>(0.124)</b>
Once Same Country		0.326 (0.442)		0.905* (0.470)	0.588 (0.634)	0.495 (0.336)
Constant	-75.331*** (9.733)	-58.982*** (6.277)	-44.652*** (5.906)	-41.029*** (14.619)	-19.458 (12.243)	-40.735*** (5.344)
Number of Observations	1596	6972	1596	2856	2040	3672
Log Pseudolikelihood	-18932.88	-54341.85	-20056.3	-18705.14	-17356.38	-37075.39
Overdispersion (ln $\alpha$ )	1.066*** (0.036)	1.956*** (0.019)	0.439*** (0.044)	2.023*** (0.028)	2.020*** (0.033)	1.387*** (0.025)
Pseudo-R2	.048172	.0458626	.0585403	.0432833	.0344139	.0540515

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B9: Gravity Equation Results (NBPML Estimator): Customs Efficiency**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.056*** (0.067)	-0.010 (0.041)	0.734*** (0.056)	0.717*** (0.113)
Log of GDP i	0.001 (0.015)	0.052** (0.026)	0.052*** (0.014)	0.050*** (0.013)
Log of GDP per capita j	-0.767*** (0.290)	0.145 (0.493)	0.059 (0.090)	0.168 (0.243)
Log of GDP per capita i	0.621*** (0.066)	1.079*** (0.108)	0.713*** (0.069)	0.420*** (0.084)
MFN Tariff	-0.018*** (0.003)	-0.169*** (0.029)	-0.003 (0.007)	-0.001 (0.007)
Log of Area i	0.679*** (0.028)	0.659*** (0.043)	0.635*** (0.041)	0.682*** (0.039)
Log of Area j	-0.218*** (0.051)	0.513*** (0.069)	0.147*** (0.051)	0.105 (0.081)
Log of Distance	-1.144*** (0.115)	-2.305*** (0.195)	-1.725*** (0.085)	-2.570*** (0.165)
Contiguity Dummy	1.155*** (0.364)	-2.371*** (0.581)	1.139*** (0.371)	1.477** (0.609)
Common Official Language	0.412 (0.405)	0.976* (0.559)	-0.214 (0.232)	-0.187 (0.234)
Common Ethnic Language	0.734* (0.392)	-0.726 (0.527)	0.391* (0.215)	1.374*** (0.229)
Colonial Link	0.206 (0.311)		1.339*** (0.317)	3.074*** (0.398)
Once Same Country	-0.563 (0.377)	0.259 (1.162)	0.580 (0.404)	-0.328 (0.406)
Landlocked i	-0.051 (0.252)	0.385 (0.470)	-0.808*** (0.207)	-1.771*** (0.381)
Landlocked j	0.912** (0.409)		-0.713*** (0.202)	-0.363 (0.293)
Ease of Doing Business i	-0.009*** (0.002)	0.006** (0.003)	0.003 (0.002)	0.002 (0.002)
Ease of Doing Business j	0.017*** (0.004)	0.002 (0.008)	-0.005*** (0.002)	0.003 (0.003)
Number of Days to Export	-0.020** (0.009)	-0.012 (0.017)	0.027*** (0.009)	0.051*** (0.014)
Number of Days to Import	-0.155*** (0.027)	-0.269*** (0.038)	0.003 (0.007)	0.004 (0.009)
Log of Cost to Export Container	-0.275 (0.205)	-0.112 (0.287)	-0.907*** (0.155)	-1.524*** (0.221)
Log of Cost to Import Container	1.519*** (0.316)	0.896 (1.128)	-0.294* (0.175)	-1.094*** (0.243)
Remoteness i	2.331*** (0.457)	2.875*** (0.655)	2.292*** (0.273)	2.092*** (0.479)
Remoteness j	0.795** (0.322)	2.142* (1.302)	1.073*** (0.289)	-1.519* (0.905)
<b>Customs Efficiency j</b>	<b>0.058</b> <b>(0.435)</b>	<b>0.092</b> <b>(0.579)</b>	<b>0.610**</b> <b>(0.203)</b>	<b>1.500***</b> <b>(0.448)</b>
<b>Customs Efficiency i</b>	<b>1.426***</b> <b>(0.170)</b>	<b>2.041***</b> <b>(0.272)</b>	<b>2.364***</b> <b>(0.170)</b>	<b>3.073***</b> <b>(0.208)</b>
Constant	-61.895*** (9.558)	-68.741** (27.631)	-55.679*** (5.963)	-3.068 (12.341)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19109.17	-7123.801	-38540.33	-13485.41
Overdispersion (ln $\alpha$ )	1.008*** (0.034)	1.620*** (0.057)	1.828*** (0.024)	1.931*** (0.034)
Pseudo-R2	.0496909	.049754	.0472401	.047049

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B10: Gravity Equation Results (NBPML Estimator): Infrastructure**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.052*** (0.075)	-0.001 (0.040)	0.658*** (0.059)	0.564*** (0.098)
Log of GDP i	0.000 (0.017)	0.050 (0.032)	0.056*** (0.013)	0.055*** (0.014)
Log of GDP per capita j	-0.810*** (0.278)	0.255 (0.506)	-0.040 (0.094)	0.386 (0.245)
Log of GDP per capita i	0.498*** (0.074)	0.942*** (0.115)	0.470*** (0.072)	0.163* (0.090)
MFN Tariff	-0.019*** (0.003)	-0.158*** (0.025)	-0.002 (0.007)	0.002 (0.007)
Log of Area i	0.639*** (0.029)	0.615*** (0.045)	0.561*** (0.036)	0.617*** (0.038)
Log of Area j	-0.193*** (0.053)	0.527*** (0.069)	0.108** (0.049)	0.188** (0.079)
Log of Distance	-1.190*** (0.125)	-2.395*** (0.191)	-1.832*** (0.089)	-2.345*** (0.175)
Contiguity Dummy	0.954** (0.381)	-2.374*** (0.595)	0.853*** (0.299)	1.584*** (0.613)
Common Official Language	0.381 (0.397)	1.194** (0.530)	-0.156 (0.245)	0.022 (0.264)
Common Ethnic Language	0.662* (0.385)	-0.877* (0.506)	0.232 (0.224)	1.037*** (0.263)
Colonial Link	0.224 (0.302)		1.416*** (0.336)	2.438*** (0.403)
Once Same Country	-0.766* (0.431)	-0.430 (1.185)	0.440 (0.341)	0.165 (0.420)
Landlocked i	-0.288 (0.254)	-0.130 (0.455)	-1.197*** (0.204)	-2.036*** (0.415)
Landlocked j	0.854** (0.397)		-0.930*** (0.194)	-0.586* (0.326)
Ease of Doing Business i	-0.009*** (0.002)	0.006** (0.003)	0.002 (0.002)	0.000 (0.002)
Ease of Doing Business j	0.018*** (0.004)	0.001 (0.008)	-0.003 (0.002)	0.001 (0.003)
Number of Days to Export	-0.010 (0.009)	0.007 (0.017)	0.045*** (0.009)	0.073*** (0.015)
Number of Days to Import	-0.144*** (0.032)	-0.310*** (0.044)	0.004 (0.007)	-0.004 (0.008)
Log of Cost to Export Container	-0.154 (0.201)	0.118 (0.274)	-0.678*** (0.156)	-1.285*** (0.223)
Log of Cost to Import Container	1.383*** (0.356)	1.514 (1.141)	-0.041 (0.188)	-0.648*** (0.217)
Remoteness i	2.777*** (0.469)	3.317*** (0.584)	2.594*** (0.265)	1.956*** (0.499)
Remoteness j	0.948*** (0.347)	3.085** (1.430)	1.386*** (0.278)	0.990 (0.775)
<b>Infrastructure j</b>	0.289 (0.409)	-0.355 (0.660)	1.103*** (0.231)	0.525 (0.370)
<b>Infrastructure i</b>	1.482*** (0.178)	2.365*** (0.231)	2.593*** (0.173)	3.229*** (0.191)
Constant	-69.365*** (10.330)	-91.677*** (29.088)	-63.290*** (5.511)	-36.670*** (10.350)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19095.09	-7108.969	-38436.15	-13460.77
Overdispersion (ln $\alpha$ )	0.996*** (0.036)	1.589*** (0.058)	1.790*** (0.024)	1.908*** (0.035)
Pseudo-R2	.0503914	.0517326	.0498155	.04879

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B11: Gravity Equation Results (NBPML Estimator): Shipping**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.064*** (0.065)	0.000 (0.033)	0.647*** (0.063)	0.645*** (0.100)
Log of GDP i	0.023 (0.015)	0.079*** (0.026)	0.083*** (0.014)	0.096*** (0.013)
Log of GDP per capita j	-0.702*** (0.241)	0.224 (0.515)	0.098 (0.094)	0.481** (0.243)
Log of GDP per capita i	0.598*** (0.068)	1.050*** (0.111)	0.638*** (0.069)	0.360*** (0.085)
MFN Tariff	-0.018*** (0.003)	-0.171*** (0.026)	-0.000 (0.007)	-0.009 (0.007)
Log of Area i	0.602*** (0.028)	0.593*** (0.044)	0.529*** (0.040)	0.550*** (0.040)
Log of Area j	-0.204*** (0.052)	0.500*** (0.074)	0.173*** (0.049)	0.103 (0.076)
Log of Distance	-1.061*** (0.116)	-2.258*** (0.201)	-1.772*** (0.094)	-2.612*** (0.177)
Contiguity Dummy	0.963*** (0.343)	-2.132*** (0.572)	0.862*** (0.326)	1.287** (0.589)
Common Official Language	0.495 (0.409)	1.029* (0.541)	0.214 (0.251)	-0.041 (0.227)
Common Ethnic Language	0.597 (0.396)	-0.689 (0.510)	0.151 (0.223)	1.045*** (0.237)
Colonial Link	0.255 (0.302)		1.481*** (0.336)	2.840*** (0.400)
Once Same Country	-0.240 (0.378)	-0.263 (1.158)	0.020 (0.339)	0.533 (0.452)
Landlocked i	-0.283 (0.263)	0.246 (0.472)	-0.734*** (0.214)	-1.471*** (0.452)
Landlocked j	1.028** (0.429)		-0.835*** (0.204)	-0.352 (0.335)
Ease of Doing Business i	-0.007*** (0.002)	0.007** (0.003)	0.008*** (0.002)	0.006*** (0.002)
Ease of Doing Business j	0.018*** (0.004)	0.002 (0.007)	-0.004** (0.002)	0.005 (0.003)
Number of Days to Export	-0.024*** (0.009)	-0.012 (0.018)	0.008 (0.009)	0.027* (0.016)
Number of Days to Import	-0.151*** (0.028)	-0.271*** (0.088)	0.006 (0.007)	-0.010 (0.008)
Log of Cost to Export Container	-0.053 (0.200)	-0.011 (0.274)	-0.532*** (0.165)	-1.170*** (0.237)
Log of Cost to Import Container	1.433*** (0.351)	1.451 (1.204)	-0.354** (0.175)	-0.899*** (0.220)
Remoteness i	2.575*** (0.463)	3.528*** (0.682)	2.615*** (0.294)	2.610*** (0.518)
Remoteness j	0.767** (0.331)	2.436** (1.006)	1.202*** (0.295)	1.208 (0.786)
<b>Shipping j</b>	0.161 (0.406)	0.269 (1.308)	0.920*** (0.220)	0.252 (0.273)
<b>Shipping i</b>	1.455*** (0.169)	1.992*** (0.255)	2.740*** (0.162)	3.170*** (0.193)
Constant	-67.874*** (9.698)	-87.967*** (25.491)	-63.837*** (6.492)	-47.680*** (11.260)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19104.09	-7120.297	-38450.42	-13468.71
Overdispersion (ln $\alpha$ )	1.004*** (0.035)	1.613*** (0.058)	1.795*** (0.023)	1.915*** (0.035)
Pseudo-R <sup>2</sup>	.0499438	.0502215	.0494628	.0482285

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B12: Gravity Equation Results (NBPMLE Estimator): Logistics Competence**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.065*** (0.069)	0.002 (0.103)	0.625*** (0.066)	0.664*** (0.100)
Log of GDP i	0.019 (0.014)	0.065*** (0.024)	0.059*** (0.012)	0.070*** (0.014)
Log of GDP per capita j	-0.579** (0.262)	0.272 (2.679)	0.151 (0.094)	0.476* (0.264)
Log of GDP per capita i	0.540*** (0.072)	0.936*** (0.113)	0.549*** (0.069)	0.292*** (0.092)
MFN Tariff	-0.019*** (0.003)	-0.176*** (0.028)	-0.009 (0.006)	-0.008 (0.007)
Log of Area i	0.600*** (0.028)	0.573*** (0.045)	0.522*** (0.039)	0.538*** (0.038)
Log of Area j	-0.235*** (0.055)	0.505 (0.625)	0.155*** (0.055)	0.063 (0.078)
Log of Distance	-1.154*** (0.122)	-2.350*** (0.219)	-1.759*** (0.092)	-2.575*** (0.173)
Contiguity Dummy	0.841** (0.345)	-2.282*** (0.568)	0.995*** (0.344)	1.317** (0.618)
Common Official Language	0.551 (0.411)	1.311** (0.561)	0.337 (0.275)	0.202 (0.213)
Common Ethnic Language	0.512 (0.405)	-0.990* (0.530)	0.090 (0.240)	0.850*** (0.226)
Colonial Link	0.247 (0.288)		1.198*** (0.297)	2.597*** (0.434)
Once Same Country	-0.593 (0.381)	-0.162 (1.157)	0.131 (0.350)	-0.167 (0.467)
Landlocked i	-0.180 (0.269)	0.041 (0.479)	-1.011*** (0.203)	-1.847*** (0.431)
Landlocked j	0.747* (0.386)		-0.665*** (0.220)	-0.334 (0.333)
Ease of Doing Business i	-0.011*** (0.002)	0.003 (0.003)	0.000 (0.002)	-0.001 (0.002)
Ease of Doing Business j	0.018*** (0.004)	0.005 (0.032)	-0.004** (0.002)	0.002 (0.003)
Number of Days to Export	-0.021** (0.009)	-0.013 (0.018)	0.029*** (0.008)	0.053*** (0.014)
Number of Days to Import	-0.168*** (0.027)	-0.311 (0.591)	0.005 (0.008)	-0.006 (0.008)
Log of Cost to Export Container	-0.250 (0.200)	-0.127 (0.273)	-0.801*** (0.149)	-1.534*** (0.218)
Log of Cost to Import Container	1.652*** (0.319)	1.398 (6.903)	-0.396** (0.191)	-0.896*** (0.226)
Remoteness i	2.509*** (0.480)	3.251*** (0.666)	2.080*** (0.263)	2.466*** (0.476)
Remoteness j	1.038*** (0.354)	2.751 (16.013)	0.740*** (0.283)	1.158 (0.807)
<b>Logistics Competence j</b>	-0.233 (0.359)	-0.479 (14.819)	0.971*** (0.203)	0.039 (0.271)
<b>Logistics Competence i</b>	1.118*** (0.141)	1.614*** (0.228)	2.263*** (0.140)	2.554*** (0.155)
Constant	-67.408** (10.585)	-81.139 (157.943)	-44.723*** (5.859)	-38.990*** (10.886)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19107.17	-7120.463	-38461.42	-13470.69
Overdispersion (ln $\alpha$ )	1.007*** (0.035)	1.613*** (0.059)	1.799*** (0.024)	1.917*** (0.035)
Pseudo-R2	.0497904	.0501994	.0491908	.0480892

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B13: Gravity Equation Results (NBPML Estimator): Tracking and Tracing**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.075*** (0.071)	-0.011 (0.032)	0.652*** (0.059)	0.704*** (0.108)
Log of GDP i	0.022* (0.014)	0.076*** (0.025)	0.063*** (0.013)	0.076*** (0.013)
Log of GDP per capita j	-0.431 (0.279)	0.144 (0.516)	0.098 (0.092)	0.424 (0.265)
Log of GDP per capita i	0.542*** (0.073)	1.037*** (0.117)	0.474*** (0.070)	0.198** (0.085)
MFN Tariff	-0.020*** (0.003)	-0.166*** (0.033)	-0.010** (0.005)	-0.001 (0.007)
Log of Area i	0.610*** (0.028)	0.593*** (0.044)	0.548*** (0.036)	0.568*** (0.040)
Log of Area j	-0.260*** (0.051)	0.508*** (0.072)	0.166*** (0.051)	0.087 (0.074)
Log of Distance	-1.171*** (0.118)	-2.482*** (0.218)	-1.721*** (0.086)	-2.778*** (0.167)
Contiguity Dummy	0.884*** (0.318)	-2.518*** (0.590)	1.346*** (0.416)	0.440 (0.518)
Common Official Language	0.512 (0.389)	1.219** (0.513)	0.122 (0.209)	-0.027 (0.230)
Common Ethnic Language	0.565 (0.379)	-0.699 (0.474)	0.205 (0.196)	0.893*** (0.230)
Colonial Link	0.161 (0.287)		1.491*** (0.360)	3.791*** (0.417)
Once Same Country	-0.773** (0.371)	-0.336 (1.178)	0.294 (0.349)	0.317 (0.485)
Landlocked i	-0.058 (0.288)	0.433 (0.510)	-0.933*** (0.213)	-1.774*** (0.388)
Landlocked j	0.532 (0.361)		-0.802*** (0.206)	-0.256 (0.322)
Ease of Doing Business i	-0.007*** (0.002)	0.011*** (0.003)	0.006*** (0.002)	0.005** (0.002)
Ease of Doing Business j	0.018*** (0.005)	0.008 (0.006)	-0.001 (0.002)	0.004 (0.003)
Number of Days to Export	-0.025*** (0.010)	-0.021 (0.017)	0.014* (0.008)	0.025* (0.014)
Number of Days to Import	-0.172*** (0.027)	-0.302*** (0.087)	-0.002 (0.007)	-0.014 (0.008)
Log of Cost to Export Container	-0.273 (0.209)	-0.071 (0.297)	-0.480*** (0.144)	-1.146*** (0.218)
Log of Cost to Import Container	1.814*** (0.317)	1.492 (1.532)	-0.338* (0.177)	-0.945*** (0.260)
Remoteness i	2.649*** (0.481)	3.598*** (0.696)	2.398*** (0.275)	2.487*** (0.482)
Remoteness j	1.124*** (0.354)	2.356 (1.630)	0.768*** (0.282)	0.727 (0.729)
<b>Tracking and Tracing j</b>	-0.552 (0.390)	0.057 (2.299)	0.833*** (0.179)	0.167 (0.285)
<b>Tracking and Tracing i</b>	1.171*** (0.174)	1.851*** (0.278)	2.699*** (0.140)	2.987*** (0.192)
Constant	-72.056*** (10.404)	-83.391*** (25.664)	-53.991*** (5.937)	-35.917*** (11.217)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19118.42	-7123.675	-38441.61	-13470.64
Overdispersion (ln $\alpha$ )	1.016*** (0.034)	1.620*** (0.058)	1.792*** (0.023)	1.917*** (0.034)
Pseudo-R2	.049231	.0497709	.0496805	.0480923

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B14: Gravity Equation Results (NBPMLE Estimator): Domestic Logistics Costs**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	0.878*** (0.123)	-0.015 (0.037)	0.726*** (0.063)	0.738*** (0.106)
Log of GDP i	0.018 (0.013)	0.085*** (0.021)	0.074*** (0.015)	0.078*** (0.016)
Log of GDP per capita j	-0.882*** (0.288)	-0.103 (0.699)	0.154 (0.096)	0.534** (0.251)
Log of GDP per capita i	0.677*** (0.068)	1.239*** (0.112)	0.973*** (0.075)	0.583*** (0.102)
MFN Tariff	-0.020*** (0.003)	-0.172*** (0.034)	0.003 (0.007)	-0.007 (0.007)
Log of Area i	0.642*** (0.027)	0.623*** (0.045)	0.586*** (0.050)	0.658*** (0.044)
Log of Area j	-0.192*** (0.052)	0.470*** (0.115)	0.137** (0.061)	0.039 (0.075)
Log of Distance	-1.210*** (0.117)	-2.614*** (0.227)	-1.712*** (0.090)	-2.767*** (0.181)
Contiguity Dummy	0.816** (0.363)	-2.568*** (0.618)	1.268*** (0.392)	0.250 (0.419)
Common Official Language	0.346 (0.427)	0.984* (0.570)	-0.217 (0.210)	-0.447** (0.221)
Common Ethnic Language	0.852** (0.412)	-0.783 (0.537)	0.139 (0.201)	0.801*** (0.220)
Colonial Link	0.011 (0.269)		1.372*** (0.246)	3.610*** (0.404)
Once Same Country	-0.463 (0.380)	0.148 (1.196)	-0.362 (0.367)	0.596 (0.395)
Landlocked i	0.259 (0.282)	0.835* (0.499)	0.153 (0.265)	-0.191 (0.487)
Landlocked j	0.399 (0.461)		-0.845*** (0.236)	-0.004 (0.313)
Ease of Doing Business i	-0.012*** (0.002)	0.002 (0.003)	-0.002 (0.002)	-0.002 (0.002)
Ease of Doing Business j	0.025*** (0.006)	0.002 (0.012)	-0.007*** (0.002)	0.002 (0.003)
Number of Days to Export	-0.025*** (0.010)	-0.021 (0.017)	-0.004 (0.009)	-0.012 (0.015)
Number of Days to Import	-0.205*** (0.036)	-0.307*** (0.102)	0.008 (0.008)	-0.008 (0.009)
Log of Cost to Export Container	-0.808*** (0.188)	-0.766*** (0.289)	-1.604*** (0.180)	-2.356*** (0.223)
Log of Cost to Import Container	2.173*** (0.489)	0.936 (1.179)	-0.439** (0.173)	-1.171*** (0.266)
Remoteness i	3.632*** (0.441)	4.730*** (0.673)	3.242*** (0.316)	4.322*** (0.533)
Remoteness j	1.224*** (0.371)	1.235 (3.522)	1.407*** (0.296)	-0.124 (0.824)
<b>Domestic Logistics Costs j</b>	-1.056 (0.660)	0.512 (1.690)	0.003 (0.218)	-0.008 (0.172)
<b>Domestic Logistics Costs i</b>	-0.253 (0.170)	-0.091 (0.337)	-0.216 (0.218)	0.138 (0.279)
Constant	-72.571*** (9.765)	-68.034 (51.509)	-60.514*** (6.629)	-34.683*** (12.740)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19151.11	-7142.73	-38687.9	-13576.63
Overdispersion (ln $\alpha$ )	1.044*** (0.032)	1.661*** (0.056)	1.882*** (0.024)	2.016*** (0.033)
Pseudo-R2	.0476055	.0472291	.043592	.0406024

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively

**Table B15: Gravity Equation Results (NBPML Estimator): Timeliness**

Dependent Variable: Exports	Destination of Bilateral Exports from Developing Countries			
	High Income- OECD Countries	High Income – Non OECD Countries	Middle Income Countries	Low Income Countries
Log of GDP j	1.053*** (0.070)	0.029 (0.064)	0.662*** (0.059)	0.766*** (0.118)
Log of GDP i	0.033** (0.013)	0.086*** (0.024)	0.091*** (0.013)	0.098*** (0.013)
Log of GDP per capita j	-0.551** (0.255)	0.528 (0.778)	0.073 (0.095)	0.337 (0.255)
Log of GDP per capita i	0.547*** (0.069)	0.990*** (0.114)	0.505*** (0.070)	0.194** (0.083)
MFN Tariff	-0.022*** (0.003)	-0.201*** (0.031)	-0.006 (0.006)	-0.012 (0.007)
Log of Area i	0.578*** (0.029)	0.562*** (0.046)	0.495*** (0.036)	0.480*** (0.040)
Log of Area j	-0.223*** (0.050)	0.617*** (0.162)	0.153*** (0.052)	-0.001 (0.070)
Log of Distance	-1.095*** (0.115)	-2.436*** (0.204)	-1.734*** (0.088)	-2.800*** (0.169)
Contiguity Dummy	1.052*** (0.335)	-2.363*** (0.586)	1.182*** (0.364)	0.717 (0.492)
Common Official Language	0.344 (0.433)	0.862 (0.544)	0.134 (0.219)	-0.064 (0.230)
Common Ethnic Language	0.683* (0.412)	-0.616 (0.516)	0.188 (0.198)	0.840*** (0.216)
Colonial Link	0.184 (0.284)		1.372*** (0.273)	3.583*** (0.415)
Once Same Country	-0.389 (0.368)	0.058 (1.164)	0.040 (0.353)	-0.079 (0.490)
Landlocked i	-0.186 (0.265)	0.845 (0.529)	-0.786*** (0.231)	-1.145*** (0.426)
Landlocked j	1.066** (0.438)		-0.873*** (0.206)	-0.216 (0.339)
Ease of Doing Business i	-0.010*** (0.002)	0.006** (0.003)	0.001 (0.002)	0.002 (0.002)
Ease of Doing Business j	0.016*** (0.005)	0.017 (0.018)	-0.005** (0.002)	0.003 (0.003)
Number of Days to Export	-0.016* (0.009)	-0.017 (0.017)	0.019** (0.008)	0.026* (0.013)
Number of Days to Import	-0.149*** (0.023)	-0.238*** (0.082)	0.007 (0.007)	-0.002 (0.009)
Log of Cost to Export Container	-0.478** (0.196)	-0.500* (0.292)	-0.870*** (0.142)	-1.880*** (0.196)
Log of Cost to Import Container	1.566*** (0.304)	-0.525 (2.587)	-0.505*** (0.195)	-1.300*** (0.276)
Remoteness i	2.637*** (0.457)	3.875*** (0.627)	2.368*** (0.271)	3.064*** (0.458)
Remoteness j	0.939*** (0.334)	6.326 (5.932)	0.848*** (0.277)	-0.329 (0.775)
<b>Timeliness j</b>	-0.245 (0.444)	-1.969 (2.772)	0.877*** (0.190)	0.522** (0.246)
<b>Timeliness i</b>	1.037*** (0.128)	1.478*** (0.234)	2.325*** (0.137)	2.359*** (0.167)
Constant	-66.879*** (9.596)	-123.946* (70.260)	-50.816*** (5.954)	-21.206* (11.172)
Number of Observations	1595	748	4613	1992
Log Pseudolikelihood	-19115.33	-7126.736	-38459.11	-13492.9
Overdispersion (ln $\alpha$ )	1.014*** (0.034)	1.627*** (0.057)	1.799*** (0.024)	1.938*** (0.034)
Pseudo-R2	.0493845	.0493626	.049248	.0465194

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; Robust standard errors are shown in parenthesis; Country i and j refers to Exporter and Importer respectively