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Prospects for Trade in Intermediates and Trade in Services: What Does the Gravity Model of Bilateral Trade Tell Us?*

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***Abstract*:** This study uses product-level international bilateral trade panel data for the period 1995 to 2009, covering 40 countries from the recently released World Input-Output Database (WIOD). Constructing this dataset into a standard gravity model, this paper aims to compare the magnitude of coefficients across two pairs of equations with different dependent variables: trade in intermediates in comparison with trade in final products, and total trade in goods as opposed to total trade in services. So as to investigate these differences further, this study also analyzes the models by sector. This paper applies the sample selection model in order to account for the zero trade flows. Estimation results confirm that trading partners in East Asia engage much more in both trade in intermediate inputs and assembled final products, especially the former, compared to EU and NAFTA blocs. Trade in services presents remarkable resilience to the current financial crisis. Intermediate services trade, in particular, is affected less by trade costs and market size. By liberalizing trade and increasing economic freedom, there will be a highly significant, positive effect on nearly all kinds of trade flows.

***Keywords*:** Trade in intermediates, services trade, gravity model

***JEL classification*:** F14

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1. Introduction

This paper's main goal is to see the differences between what determines the amount of trade in intermediate inputs and trade in final products, and between determinants of goods trade and services trade. For instance, what factors affect trade in intermediates more as opposed to trade in final products, and do trade costs have a significantly greater impact on trade in goods or trade in services? It is important to distinguish these trade flows because first, purchasers for intermediate inputs are different from those for end-use final products. It is usually the firms who buy and use intermediate inputs for further production, and final products are sold to end-users, often consumers.[1] Second, goods and services also have distinctive characteristics[2], for instance, services have an intangible nature, and production and consumption must occur simultaneously (Kimura and Lee, 2006). Therefore, although they are all international trade, their determinants should vary.

Figures 1-4 show how trade in intermediates and trade in services have increased their prominence in world trade during the past decade. First, Figure 1 shows the increasing trend in the world's ratio of foreign to domestic inputs. Firms are increasingly purchasing and using intermediate inputs from abroad. According to Miroudot, Lanz and Ragoussis (2009), trade in intermediates account for about 56% of world trade in case of goods and 73% in case of services. Figure 2 depicts the increasing share of world's intermediates trade in total trade, in contrast with the stagnant share of world's final products trade in total trade. In addition, you can see how intermediates trade share in total trade in East Asia is exceptionally high, leading the increasing trend in trade in intermediate products.

Second, trade in services shows higher growth compared to trade in goods, as you can see from Figure 3. Figure 4 reveals how trade in services has been representing a higher share of total trade than trade in goods. Moreover, what is striking is that both figures depict that services trade seems to have been affected much less by the financial crisis compared to goods trade.

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[1] While final products highly rely on advertisement and promotion aimed for final consumers, intermediate inputs trade could be determined more by other factors, such as preferences, customs and habits. (Miroudot *et al.*, 2009)

[2] For more on trade in services and the four modes of supply, see the document for General Agreement on Trade in Services (GATS), available on the World Trade Organization website (http://www.wto.org/english/tratop_e/serv_e/serv_e.htm).

Innovations such as the internet and container shipping have revolutionized trade and value chains. Thanks to these developments, we are seeing more and more of trade in intermediates and trade in total services, even seemingly overpowering the traditional trade in final products and trade in total goods. There has been, however, comparatively much less attention paid to trade in intermediates and trade in services, mostly due to the lack of statistics. Therefore, this present study will try to present new additional evidence on the different implications for different forms of trade, by using the recently released World Input-Output Database (WIOD). This is a set of product-level international input-output tables with bilateral trade flows covering the period of 15 consecutive years.

This study uses the framework of gravity model of bilateral trade to analyze the differences in what determines the amount of trade 1) between intermediates and final products, and 2) and between goods and services. In order to account for the zero trade flows between countries, estimation of this model follows a sample selection bias model by the maximum likelihood estimator (see Linders and de Groot, 2006; Cameron and Trivedi, 2009).

The results show that trade in intermediate inputs is more sensitive to trade costs compared to trade in final products. Consistent with trade statistics, trading partners in East Asia do tend to engage much more in both trade in intermediate inputs and trade in assembled final products, especially the former, compared to EU and NAFTA blocs. Trade in services is much more resilient to the current financial crisis compared to trade in goods. This may be because services production and trade are affected less by external trade costs and market size. One important characteristic of services trade to note is that sharing the official language is a big factor for two countries to engage in trade.

Further analysis by sector reveals that economic freedom has a highly significant, positive effect on nearly all kinds of trade flows. By liberalizing trade and increasing economic freedom, agricultural and services exports and manufacturing imports are likely to rise more than agricultural and services imports. Moreover, when compared to agricultural and manufacturing sectors, services trade, especially intermediate services trade, showed the same characteristics mentioned above.

In this paper I will assess the differences between intermediate and final products (includes both goods and services products) trade, as well as differences between trade in services and trade in goods. The rest of the paper is organized as follows. Section II provides background and reviews the literature. Section III describes the data, gravity model for international trade, and estimation techniques to account for observations with

zero trade flows. Section IV discusses the estimation results of sample selection bias model by the maximum likelihood estimator. Section V investigates the results from Section IV further by estimating the model disaggregated into three sectors. Section VI concludes.

2. Literature Review

2.1 Background

Trade in Intermediates

'Global value chains' have rapidly emerged as production processes have become more geographically fragmented since the 1990s. International trade and production are increasingly structured around these 'global value chains'. A 'value chain' can be simply defined as the full range of activities that firms and workers carry out in order to bring a product from its conception to its end use and beyond (see Gereffi and Fernandez-Stark, 2011). The term 'global' comes from the fact that these activities are increasingly spread over multiple countries. The fragmentation of value chains has been motivated by sourcing intermediate inputs from more cost-efficient producers, foreign or domestic, in order to enhance efficiency. As a result, domestic production has been increasingly relying on foreign intermediate inputs, as shown in Figure 1.

With this increasing presence of trade in intermediates, there continues to be a rising demand for comprehensive and trustable data on the various dimensions of the internationalization of production networks. The increasing fragmentation of production across countries, however, has led current global production networks to be multi-country and back-and-forth in nature (Koopman, Powers, Wang and Wei, 2011), making it difficult to capture in statistics.

All official trade statistics are measured in gross terms, which include both intermediate inputs and final products. They record the value of intermediate inputs traded along the value chain, crossing international borders several times, back and forth, for further processing. These trade flows are thus counted multiple times. Consequently, the country of the final producer appears as creating most of the value of goods and services traded, giving the misleadingly wrong picture, overlooking the role of countries providing inputs upstream in the global value chain. For example, an exported good may require considerable intermediate inputs from domestic manufacturers, who, in turn, require considerable intermediate imports, and so, much of the revenue, or value-added, from selling the exported good may accrue abroad to reflect purchases of intermediate imports

used in production.

Trade in Services

Globalization is no longer only about goods; it increasingly involves trade in services. Many service activities are becoming internationalized. Rapid advances in information and communications technology (ICT) and infrastructure growth have increased the tradability of many service activities, thereby facilitating the sourcing of services from abroad. In addition, services trade liberalization has reduced regulatory barriers in key sectors of the global logistics chain, such as transport, finance and telecommunications. Business services, for example, are now an integral part of the global value chain.

In spite of this increasing prominence of trade in services, however, much attention has been focused on the impact of relevant factors on trade in goods. This is partly due to the unfortunate fact that official statistical data do not provide much detailed information on services trade, compared to the goods sector, where they have detailed and timely data available for a broad range of countries. In contrast, the quality of bilateral services trade statistics by industry or product is unsurprisingly very low, with many missing observations.

2.2 Former Empirical Studies

As you can see, there has been a recent rise in attention to both trade in intermediate inputs and trade in services. Yet research has been hindered by the limited availability of reliable and adequate statistics. Coming up with a methodology to differentiate between intermediate and final products, as well as measuring trade in services, has been challenging.

Due to these limitations in the international trade data, there have only been a handful of empirical studies on trade in intermediate inputs or trade in services. The recent development (albeit slightly) in data quality and availability, however, have helped boost the number of studies. This is all thanks to the attempts to devise methods of measuring value-added trade in the empirical literature. Daudin, Rifflart and Schweisguth (2011) and Koopman *et al.* (2011) are among the first to explicitly refer to a measurement of trade in value-added using an empirical framework. These studies rely on an estimated Inter-Country Input-Output (ICIO) table based on the GTAP database to calculate trade flows in value-added. They proportionally allocate gross trade flows into intermediate and

final goods and distribute across users. Both show that countries and sectors differ widely in their ratio of value-added to gross trade.

Daudin *et al.* (2011) identify "who produces what and for whom" by reallocating the value-added contained in final goods to each country participating in their production. The authors calculate the share of exports used as inputs to further exports and the domestic content of imports (that is, domestic value-added that comes back to the country through intermediates originally exported and re-imported within more processed products). Koopman *et al.* (2011) allow two-way trade in intermediates (that is, each country can import intermediate inputs, add value, and then export semi-finished goods to another country to produce final goods). They successfully provide a full decomposition of value-added exports in a single conceptual framework that encompasses all the previous measures.

One of the recent prominent empirical works is Miroudot *et al.* (2009), where they analyze trade in intermediate goods and services, comparing intermediates trade and final products trade across goods and services industries, using data at four- to five-year intervals (mostly years 1995, 2000 and 2005). They use disaggregate trade data at the industry level. This present paper mainly follows their study because they also make a comparison between goods industry and services industry.

As for research focusing on trade in services, Kimura and Lee (2006) use a standard–type gravity equation to assess the differences between trade in services and trade in goods, utilizing bilateral trade data for 26 OECD member countries for years 1999 and 2000. Fukao and Ito (2003) estimate gravity equations to test whether Japan's market for services is more closed for establishment transactions, using data on U.S. services exports, for years 1992 and 1997.

All these existing empirical studies, however, have limitations that this study seeks to overcome. Former empirical studies either used aggregate trade data, and/or data at four to five-year intervals. The present study contributes to the intermediates trade and services trade literature because unlike previous research, this study uses a panel dataset: annual data from 1995 to 2009 and trade data disaggregated at the product-level. This study also contributes to the literature by conducting empirical analyses for both trade in intermediates and trade in services.

3. Methodology

3.1 Data

This study uses trade data from the World Input-Output Database (WIOD)[3], which was released for the general public in April 2012. The international supply and use table covers annual time-series data from 1995 to 2009 for 40 countries[4]. In order to maximize observations for trade in services, trade data broken down by different products were used, instead of those classified by industries[5]. For trade in services, I strictly followed and included all products covered by the General Agreement on Trade in Services[6]. As a result, this dataset provides this analysis with a good coverage balance between goods and services trade.[7] All intermediate, final and total goods and services trade data are classified into 59 products, based on Statistical Classification of Products by Activity (CPA). The classification of products into goods and services sectors is shown in Appendix Table A.1.

In addition to its disaggregate, product-level data characteristic, the advantage of this new input-output database is that it covers a period of 15 consecutive years, whereas most former studies had to rely on data at five-year intervals more or less (Baier and Bergstrand, 2007; Johnson and Noguera, 2012).

In order to approximate non-policy trade costs in a standard gravity model, this study uses proxies discussed in Johnson and Noguera (2012), which are distance, common language, adjacency (common borders) and colonial links. These data were obtained from CEPII's database[8]. Gross Domestic Product (GDP) of trading partners was used to account for their size of markets, or demand for goods and services. This study uses data on GDP,

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[3] This new World Input-Output Database is available at http://www.wiod.org/database/index.htm. The core of the database is a set of harmonized national supply and use tables, linked together with bilateral trade data in goods and services. These two sets of data are then integrated into a world input-output table. See Timmer (2012) for the detailed framework and calculations.

[4] Appendix Table A.2 depicts country coverage by continent.

[5] The WIOD classifies 59 products (based on CPA) whereas for industries they only have 35 categories (based on NACE rev.1 (ISIC rev.2) classifications).

[6] The GATS services sectoral classification list is available at http://www.wto.org/english/tratop_e/serv_e/serv_e.htm or http://www.wto.org/english/tratop_e/serv_e/mtn_gns_w_120_e.doc

[7] 52.5% of the data are on goods trade and 47.5% are on services trade.

[8] CEPII databases are available at http://www.cepii.fr/anglaisgraph/bdd/bdd.htm This study uses contiguity indicator, common colonial origin indicator and common official language indicator from the CEPII Gravity Dataset. Data on distance, measured as the simple distance between the capitals in the two countries, is from CEPII GeoDist.

GDP per capita and population mainly from the International Monetary Fund (IMF)'s World Economic Outlook (WEO) database[9]. Descriptive statistics for continuous variables are shown in Table 1.

Furthermore, Kimura and Lee (2006) add Economic Freedom of the World (EFW) index, published by the Fraser Institute of Canada since 1996, to their gravity equation. This index measures the degree of economic freedom in five major areas. Due to this index's limitation regarding year coverage, this study uses Index of Economic Freedom[10] from the Heritage Foundation instead.

For exclusion restrictions in the Heckman sample selection models, this study follows Helpman, Melitz and Rubinstein (2008), using country-level data on regulation costs of firm entry, collected and analyzed by Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002). These entry costs are measured by their effects on the number of days, number of legal procedures and the relative cost (as a percentage of GDP per capita) needed for an entrepreneur to legally start operating a business.

3.2 Model

This study estimates bilateral trade using a standard gravity model, initially proposed by Tinbergen (1962). Gravity equations have been favored in trade literature mainly because of their high explanatory power, empirically succeeding at predicting bilateral trade flows. However, the model has been criticized for lacking respectable theoretical foundations, causing it to suffer from incorrect specifications. Anderson and van Wincoop (2003) developed a solution by augmenting the traditional equation with multilateral resistance terms (for example, calculating remoteness indices, or adding exporter and importer fixed effects), adding strong theoretical foundations to the model. Feenstra (2004) thus explains that gravity equation has finally succeeded empirically in the field of international trade.

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[9] IMF's World Economic Outlook Database October 2012 is available at http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx
Due to missing values, I used data from the World Bank's *World Development Indicators* (http://databank.worldbank.org/ddp/home.do?Step=12&id=4&CNO=2)
for Lithuania during the period 1995-1998. The values for GDP, GDP per capita and population were all exactly the same for Lithuania in 1999 in both databases.

[10] Index of Economic Freedom is available at http://www.heritage.org/index/
Aiming to measure the degree of economic freedom in the world's nations, it is a series of 10 economic measurements created by the Heritage Foundation and the Wall Street Journal in 1995. See Beach and Kane (2008) and Miller and Kim (2012).

Inspired by Sir Isaac Newton's work on *Law of Universal Gravitation*[11], for which he published a paper in 1687, Tinbergen (1962) linked the functional form to international trade flows, predicting a gravity relationship for trade flows analogous to Newton's law. It holds that the bilateral trade flows between two countries are directly proportional to the trading countries' respective economic sizes, and inversely related to trade costs. Trade costs can be proxied by the geographical distance[12] between the two trading countries, while their size of the market can be proxied using their respective GDPs. Therefore, in other words, the underlying assumption of the gravity model of bilateral trade is that trade flows should increase as a trading partner's GDP rises, and should decrease if distance between a trading partner is farther.

Following Miroudot *et al.* (2009)'s gravity regression model, the standard gravity equation to be estimated here is:

$$\begin{aligned} lnTrade_{ijpt} = {} & \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 ln(GDP_{it}/Population_{it}) \\ & + \beta_4 ln(GDP_{jt}/Population_{jt}) + \beta_5 lnDistance_{ij} + \beta_6 Adjacency_{ij} \\ & + \beta_7 Language_{ij} + \beta_8 ColonialTies_{ij} + \beta_9 lnEconomicFreedom_{it} \\ & + \beta_{10} lnEconomicFreedom_{jt} + \beta_{11} EU_{ij} + \beta_{12} EA_{ij} + \beta_{13} NA_{ij} + \gamma_t + \delta_p \\ & + \varepsilon_{ijpt} \end{aligned}$$

where

$lnTrade_{ijpt}$ is the (natural log of) bilateral imports of total, intermediate or final goods and/or services product *p*, between country *i* and country *j* in year *t*;

$lnGDP_{it}$ is the natural log of importer country's GDP; $lnGDP_{jt}$ is the natural log of exporter country's GDP;

$ln(\frac{GDP_{it}}{Population_{it}})$ is the natural log of importer country's GDP per capita; $ln\,(\frac{GDP_{jt}}{Population_{jt}})$ is the natural log of exporter country's GDP per capita;

$lnDistance_{ij}$ is natural log of the geographic distance between the capitals of country *i* and country *j*;

$Adjacency_{ij}$ refers to a dummy variable indicating whether the country pairs share a common land border;

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[11] A calculator based on this law can be found here: http://www.pythia.com.ar/?id=gravlaw

[12] Miroudot and Ragoussis (2009) add that in addition to transport costs, distance, used as a proxy for trade costs, also captures regulatory differences as well as cultural differences between countries.

$Language_{ij}$ refers to a dummy variable indicating whether the country pairs share a common official language;

$ColonialTies_{ij}$ refers to a dummy variable indicating whether the country pairs ever had colonial ties;

$lnEconomicFreedom_{it}$ is natural log of the overall score of the Index of Economic Freedom for country *i* in year *t*; $lnEconomicFreedom_{jt}$ is natural log of the overall score of the Index of Economic Freedom for country *j* in year *t*;

EU_{ij} takes the value 1 if both countries are members of the European Union (EU);

EA_{ij} takes the value 1 if both countries are members of the Association of Southeast Asian Nations (ASEAN) plus China, Japan, Korea and Taiwan;

NA_{ij} takes the value 1 if both countries are members of North American Free Trade Agreement (NAFTA);

γ_t = year fixed effects; δ_p = product fixed effects; i = importer (reporter/destination) country subscript; j = exporter (partner /origin) country subscript; p = product subscript; and t = year subscript.

Based on this standard gravity equation, this study will pool across products[13]. The dependent variable is bilateral trade in (1) intermediate goods and services, (2) final goods and services, (3) total goods, and (4) total services, respectively, with the same regressors. This study follows Miroudot *et al.* (2009) and Kimura and Lee (2006) with regard to using the same gravity equation framework as goods trade for services trade.

This paper estimates import equations because the dataset consists of the same set of home and partner countries: exports are defined as mirror flows from imports (i.e., values of exported products from country *j* to country *i* are assumed to be equal to the values of imported products of country *i* from country *j*) in the WIOD trade data this study uses (Timmer, 2012).

In addition, this study adds Index of Economic Freedom, following Kimura and Lee (2006), to measure restrictiveness and examine the effect of economic freedom on international trade. This index scores countries on 10 factors: business freedom, trade freedom, monetary freedom, government size/spending, fiscal freedom, property rights, investment freedom, financial freedom, freedom from corruption, and labor freedom.

[13] For each importer-exporter country pair in a given year, 59 products for both trade in intermediates and final products; 31 products for trade in goods, and 28 products for trade in services.

Following Frankel (1997), I have also included regional binary variables for each year to test the effects of membership in a common trading bloc. With the increase in free trade agreements (FTAs) throughout the whole international economy, this study chooses EU, East Asia (ASEAN plus China, Japan, Korea and Taiwan) and NAFTA as trading bloc dummy variables. The three regional variables represent a country's formal membership status of a trading bloc with the other country in the corresponding year.

Finally, I acknowledge the fact that importer country effects and exporter country effects should be included in the estimation in order to control for the multilateral price terms. However, inclusion of these variables causes multicollinearity diagnostics. First, examination of the variance inflation factor, which shows how much the variance of the coefficient estimate is being inflated by near-collinearity, revealed to be 20.86 (tolerance is 0.048) for GDP.[14] In addition, when checking the correlations of the estimated coefficients, approximately 95% of the coefficients for the importer fixed effect dummies and exporter fixed effect dummies showed high correlations of over 0.90 (the highest being 0.996), between importing country's GDP_i, and exporting country's GDP_j, respectively. Therefore, due to these indications of possible collinearity problems, both importer and exporter fixed effects are not accounted for in the current analysis.[15]

3.3 Estimation Techniques

Standard procedure to estimate multiplicative gravity models for trade is to take the logarithms so as to be able to estimate it in linear form. This study, however, uses a dataset for which around 40% of the bilateral trade data between country *i* and country *j* is in fact zero.[16] Zero trade flows are actually quite common in the bilateral international trade matrix (see, for example, Haveman and Hummels, 2004; Silva and Tenreyro, 2006; Helpman *et al.*, 2008). The proportion of zeros increases in line with country diversity (40*39 bilateral country pairs for this study) as well as sectoral disaggregation (59 classified products in this analysis). On the one hand, presence of zeros tends to bias estimates (especially OLS gravity model estimates), but on the other hand, disregarding the zeros means throwing away some potentially interesting information. Although the

[14] A commonly given rule of thumb is that VIFs of 10 or higher (or equivalently, tolerances of 0.10 or less) may be reason for concern. (Chatterjee and Hadi, 2006)

[15] Kimura and Lee (2006) also excluded exporter and importer country fixed effects from their gravity model because it "would incur a multicollinearity problem" (p. 113).

[16] 38.9%, 44% and 37% of the observations are zero, for trade in intermediates, final products, and total goods and services, respectively.

literature is still undecided as to the best way to deal with the zero trade flows, the following are among the few of the approaches commonly taken in empirical studies.

One of the approaches is to simply drop the pairs with zero bilateral trade from the dataset by estimating the log-linear form (for example, see Johnson and Noguera, 2012).[17] This means, however, that an important observation is left out of the model: the zero trade flow. This is undesirable because the omitted observations contain information as to why low levels of trade flow are observed, or why some countries trade in some products while others do not.

In order to avoid throwing away observations with zero-values, Eichengreen and Irwin (1994; 1998) estimate their model using the logarithm of $(1 + Trade)$ as the dependent variable. However, Linders and de Groot (2006), among others, showed that this approach is prone to yield upward biased estimates. Santos Silva and Tenreyro (2006) indicate that log linear models cannot be expected to provide unbiased estimates under heteroskedasticity. They propose an econometric solution for the zero-value problem in count data: a Poisson pseudo-maximum-likelihood model (PPML). This model, commonly used for count data, is known for its ability to deal with occurrence of zeros and discrete nonnegative nature of the dependent variable (see Greene, 2008).

The standard Poisson pseudo-maximum-likelihood model, however, is vulnerable to problems of over-dispersion[18] and excess zero flows[19]. Therefore, in order to overcome these problems, it is highly necessary to re-estimate using zero-inflated negative binomial regression or zero-inflated Poisson regression models, following Burger, van Oort and Linders (2009). Yet, these estimations failed to converge by using the algorithm implemented in STATA.

Consequently, the alternative procedure this study pursues is the sample selection model, correcting for the possible selection bias. Martin and Pham (2008) indicate that Heckman maximum likelihood estimators can outperform PPML estimators as long as the true identifying restrictions are available. Heckman's sample selection model comprises a

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[17] Taking logarithms effectively drops such observations from the sample because log(0) is undefined.

[18] The Poisson specification has been criticized because it has the property that its mean is equal to its variance, known as the equidispersion property. Empirical work most often rejects this specification in favor of overdispersion (describes the feature Var(y|x)>E(y|x) in a regression model). To model this overdispersion, the negative binomial specification is usually employed.

[19] Another problem with the Poisson specification is that it cannot explain the occurrence of excess zeros. The zero-inflated Poisson in its simplest form gives a constant zero-inflation probability q to nonusers and *(1-q)* to users. This is estimated using maximum likelihood methods.

probit selection equation (or participation equation) to determine whether a particular bilateral trade flow will be zero or positive (i.e., whether two countries decide to engage in trade), with the dependent variable:

$$s_{ij} = \begin{cases} 1 \; if \; Trade_{ijpt} > 0 \\ 0 \; if \; Trade_{ijpt} = 0 \end{cases}$$

and an error term, u_{ijpt} ~$N(0,1)$.

The resultant outcome equation to estimate the relationship between trade values and explanatory variables using only the truncated sample of observations with positive trade flows is:

$$lnTrade_{ijpt} = \beta X_{ijt} + \gamma_t + \delta_p + \varepsilon_{ijpt}$$

where ε_{ijpt} ~$N(0,\sigma)$.

There are two ways of estimating the model: Heckman's two stage method and maximum likelihood estimation. The maximum likelihood estimation should provide the most efficient estimates because the model is derived by assuming that the error terms in both equations have normal distributions (see Cameron and Trivedi, 2009).[20]

Estimation by maximum likelihood uses assumptions that correlated errors are jointly normally distributed with mean 0 and homoskedastic, with: (ε, u) ~$N(0,0,\sigma_\varepsilon^2,\sigma_u^2,\rho_{\varepsilon u})$ where $\rho_{\varepsilon u}$ indicates the correlation coefficient $corr(\varepsilon, u)$; and that normalization is used in the probit regression model: Var(u)= σ_u^2=1.

Furthermore, in applied work, it is common to impose exclusion restrictions in order to deal with identification issues concerning the specification of the selection equation. Therefore, the selection equation should have exogenous variables that are excluded from the second stage trade-flow equation. These excluded variables need to be able to generate substantial (nontrivial) variation in the selection variable (i.e., the probability of selection), while not directly affecting the outcome variable (Cameron and Trivedi, 2009).

Helpman *et al.* (2008) explain that this excluded variable requires to be trade barriers that have impact on fixed trade costs but do not affect variable trade costs. They construct a bilateral variable from data on entry costs of forming new firms as a measure of the fixed costs of trade. These variables reflect regulation costs that do not affect a firm's

[20] As stated before, this is consistent with the findings of Martin and Pham (2008), who showed that the maximum likelihood estimator outperformed the two-step estimator in their Monte Carlo simulations.

volume of exports to a particular country, hence satisfying the requisite exclusion restrictions. This study constructs and uses the same regulation costs of firm entry as Helpman *et al.* (2008).[21]

In sum, for this study, I have decided to use maximum likelihood estimation of 2000 Nobel Laureate James Heckman's sample selection model (see Heckman, 1979). For the excluded variables, I follow Helpman *et al.* (2008) and use the number of days and legal procedures along with relative entry costs (as a percentage of GDP per capita).

4. Main Results

In Tables 2 and 3, I present the results of the estimation of sample selection bias model by the maximum likelihood estimator. The first two columns from the left are results from regressions with *Entry Dummy* as the dependent variable. *Entry Dummy* is an indicator for whether or not the importing and exporting country pairs actually trade (i.e., have more than zero trade flows). The third and fourth columns from the left show the results from the second stage outcome equation, with *Trade Volume* as the dependent variable. *Trade Volume* is the natural logarithm of bilateral trade flows, if positive.

For the analysis of the results, I will mainly focus on the outcome equation results (columns highlighted with gray shade in the tables). For all four estimations, based on the Wald test of independent equations, the estimated correlation between the error terms is highly significantly different from zero and positive, rejecting the null hypothesis that the two parts are independent at the 1% level, showing strong evidence of a sample selection problem. Moreover, the excluded variables, *procedures&days* and *relative cost* are statistically significant in all four first-stage probit estimations at the 1% level.

I also conducted truncated OLS regressions discussed in the previous section, using the natural logarithm of imports as the dependent variable, thus leaving out pairs of countries with zero bilateral trade flows. Comparing the results with maximum likelihood estimates in Tables 2 and 3, in general, the OLS regression coefficients are smaller in absolute value.[22] Omitting zero trade flow observations and taking into account only the

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[21] Strictly following Helpman *et al.* (2008), I constructed an indicator for high fixed-cost trading country pairs, consisting of pairs in which both importing and exporting countries have entry regulation measures above the cross-country median. One variable is based on the sum of number of days and procedures, while the other uses relative entry costs.

[22] What is worth noting, however, is that the truncated OLS coefficients for the trading bloc binary variables are larger compared to the sample selection model outcome regression results.

sample with non-zero bilateral trade seem to cause an overall underestimation of estimates. Lastly, the χ^2 tests of equality of coefficients across the two pairs of outcome equations in Tables 2 and 3 reveal that coefficients for most regressors can be compared with a statistically significant difference (results are available upon request).[23]

Trade in Intermediates and Trade in Final Products

Table 2 presents the results for trade in intermediates and trade in final products from the estimation of sample selection bias model by the maximum likelihood estimator. The results show that they are consistent with the findings of Miroudot *et al.* (2009).

The impact of trade costs on intermediate inputs trade is relatively higher, compared to that on final products trade. Two adjacent countries tend to engage in trade in intermediate inputs approximately 93% more than two otherwise similar countries. In contrast, two adjacent countries trade final products about 80% more.[24] In addition, trade in intermediates is negatively affected by distance slightly more than trade in final products. These differences in trade costs may be because intermediate inputs tend to be less subject to consumers' preferences; hence the price-elasticity of their demand tends to be higher and firms switch easily from one supplier to another.

On the other hand, trade in intermediate inputs is affected less by the recent financial crisis (98% decrease) than trade in final products (117% decrease). This may also be because of the differences in purchasers – consumers' demand for final use products decreased much more compared to parts and components demand for production.

Moreover, two East Asian countries engage in trade in intermediates 111% more than two otherwise similar countries (which is in line with the high intermediates trade flows within East Asia, as seen in Figure 2), and in trade in final products by 62% more. In contrast, common EU membership will on average increase two member countries' trade by about 20% and 25%, for intermediate inputs and final products, respectively. The results regarding the East Asian region depict the thriving trade within the region of not only intermediate inputs, but also of assembled final products.

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[23] The purpose of this test is to assess whether or not the coefficients in the multiple equations are significantly equal.

[24] The formula to compute this effect is $\left(e^{b_{ij}} - 1\right) * 100\%$, where b_{ij} is the estimated coefficient. So here, for example, the computation will be [exp(0.656)-1.0]*100=92.7%] and [exp(0.59)-1.0]*100=80.4%], for intermediates trade and final products trade, respectively.

Trade in Goods and Trade in Services

Table 3 shows the regression results with goods imports and services imports as dependent variables, respectively, from the estimation of sample selection bias model by the maximum likelihood estimator.

The estimated coefficients for distance between importing country and exporting country tell us that when the distance between two trading partners increase by 1%, trade in goods decreases by 1.29% whereas trade in services drops by 0.78%. Trade in services is affected less by distance and adjacency compared to trade in goods. A similar point can be made about market size: size of the market has a much smaller impact on services trade than in the case of goods trade.

In addition, services trade is much more sensitive to common language than trade in goods. When two countries share the same official language, they tend to engage in services trade approximately 148% more, compared to a 26% increase for goods trade.[25] This is also consistent with Miroudot *et al.* (2009)'s results.

Trade in services shows much more resistance to the current financial crisis compared to trade in goods. This is consistent with the evident resilience of services trade to the financial crisis in Figures 3 and 4. The respective estimated coefficients of the 2009 year variable indicate that goods trade has been affected negatively by 139%, whereas services trade merely fell by 54%. This is consistent with Borchert and Mattoo (2009). They explain that services trade is weathering the current crisis much better than goods trade for two reasons: demand for a range of traded services is less cyclical, and services trade and production are less dependent on external finance.

As for trading blocs, two members of the EU trade goods about 21% more and services about 17% more than otherwise similar countries. The coefficient for NAFTA bloc for services trade is a significant -1.0, indicating that any of the three pairs of countries trade much less than expected, given their market size, distance and such.

Furthermore, the positive impact of economic freedom on services trade is slightly greater compared to its effect on goods trade. A 1% increase in economic freedom of the importing (exporting) country will increase trade between the two countries by 1.9% (2.5%) for goods and 2.3% (2.9%) for services. This implies that as countries move toward

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[25] The formula to compute this effect is $\left(e^{b_{ij}} - 1\right) * 100\%$, where b_{ij} is the estimated coefficient. So here, for example, the computation will be [exp(0.228)-1.0]*100=25.6%] and [exp(0.908)-1.0]*100=147.9%], for goods trade and services trade, respectively.

economic liberalization, services trade will grow faster than goods trade (Kimura and Lee, 2006).

5. Further Investigation by Sector

In order to find out how and why these differences emerge, this study explores estimations of trade in intermediates and trade in final products by disaggregating the dataset into three broad sectors: primary, secondary, and tertiary.[26]

Here, I also use the sample selection model, with the same regressors as the previous section. The only differences are the dependent variables and that the model is estimated using Heckman's two step method[27]. The results are presented in Table 4. Columns (1)-(3) show the results for intermediates trade by agricultural, manufacturing and services sectors, respectively; Columns (4)-(6) show those for final products trade. The inverse Mills ratio, or *lambda*, is highly significant in all six equations. It should be noted that the inverse Mills ratio in the manufactures estimation, for both intermediates and final products trade, is negative and significant. This result indicates that the error terms in the first step and second step equations have a negative correlation. Thus, the unobserved factors that make engagement in bilateral trade more likely tend to be associated with lower amounts of manufacturing trade in general.

In the previous section, results strongly revealed intermediate inputs trade's higher sensitivity to trade costs compared to final products trade. The source of this may be explained by characteristics unique to the agricultural sector. That is, *adjacency* and *common language* have the strongest positive impact (200% and 150%, respectively) on agricultural intermediates trade.

The high trade flows in East Asia is contributed the most by agricultural and manufacturing intermediate inputs: two East Asian countries tend to trade agricultural intermediate inputs 82% more, manufacturing inputs 101% more, than otherwise similar countries. In addition, two East Asian countries engage in final manufacturing products trade 58% more. This is consistent with our findings in the previous section that there are relatively high flows of trade in both intermediate inputs and final assembled products.

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[26] The primary sector (or agriculture, mining and quarrying sector) consists of CPA codes 1,2,5,10-14. The secondary sector (or manufacturing sector) comprises CPA codes 15-37. The tertiary sector (or services sector) is as shown in Appendix Table A.1.

[27] The two step method is usually used more often instead of maximum likelihood because it is consistent and more straightforward to estimate, especially with large datasets (see Greene, 2008).

There is also a significantly strong and positive relationship between EU trade bloc and final agricultural products trade.

Even when compared to agricultural and manufacturing sectors, services sector is still affected the least by market size and trade costs, especially more so for intermediates trade. Moreover, both intermediate and final services trade revealed to be the most resilient to the financial crisis. That is, intermediate services trade decreased merely by 131%, and final services trade dropped by 125%.

Furthermore, economic freedom has a highly significant, positive effect on nearly all kinds of trade flows. Among them, trade flows of agricultural products have the strongest relationship with economic freedom, followed by services products trade. For these two sectors, the coefficients of economic freedom are greater for exporting countries than for importing countries. This implies that economic freedom has greater impact on agricultural and services exports than on agricultural and services imports. In contrast, manufacturing products trade is impacted most by the importing country's economic freedom. Hence, manufacturing imports are affected by economic freedom more than agricultural and services imports. Economic freedom also has a balanced effect between manufacturing imports and exports.

6. Concluding Remarks

This study assesses how the same factors, such as economic size and trade costs, can significantly affect intermediate, final and total goods and services trade flows differently. With the technological development in ICT and transportation, trade in intermediates and trade in services have been increasing their prominence in international trade. However, constrained by data limitations, there have not been that many empirical studies. Therefore, this paper contributes to the literature by conducting empirical analyses for both trade in intermediate inputs and trade in services. This study uses the recently released World Input-Output Database (WIOD), a product-level international bilateral trade panel data for the period 1995 to 2009, covering 40 countries.

Using the gravity model of bilateral trade, I estimated and compared determinants for different types of trade. In order to take zero trade flows into account, this study adopts the sample selection bias model. The main findings of this paper can be summarized as follows:

1. *Trade in intermediate inputs*

Trade in intermediate inputs is more sensitive, albeit slightly, to trade costs compared to trade in final products. This may be because intermediate inputs tend to be less subject to consumers' preferences, and thus the price-elasticity of their demand tends to be higher and firms switch easily from one supplier to another.

2. *Trade in East Asian regional bloc*

There is much higher trade flow when two East Asian countries engage in trade, especially intermediate inputs trade, compared to EU and NAFTA countries. The prosperous trade within the East Asian region consists of both trade in intermediate inputs and trade in assembled final products. Further analysis by sector shows that the main products traded are manufacturing intermediate inputs and final products, along with agricultural intermediates.

3. *Trade in services*

Compared to trade in goods, trade in services is much more resilient to the financial crisis. This may be explained by the findings that trade costs and market size have a much smaller impact on services trade. In other words, services production and trade are affected less by external trade costs and market size. The results are the same even when compared to agricultural and manufacturing sectors, especially more so for intermediate services trade. One important characteristic of services trade to note is that sharing the official language is a big factor for two countries to engage in trade.

4. *Economic freedom: Implications*

The positive impact of economic freedom on services trade is slightly greater compared to its effect on goods trade, implying the importance of economic liberalization for further growth in services trade. Analysis by sector reveals that economic freedom has a highly significant, positive effect on nearly all kinds of trade flows. By liberalizing trade and increasing economic freedom, agricultural and services exports and manufacturing imports are likely to rise more than agricultural and services imports.

Through empirical analysis, this present study showed that trade in intermediate inputs and trade in services will continue to play an important role in international trade. It is necessary to distinguish trade in different products and whether they are for intermediate use or final consumption, when enforcing policies.

Finally, there is scope for further and deeper analysis. First of all, it is necessary to

figure out a method to incorporate importer and exporter country fixed effects without having to drop other regressors. There is also room for improvement for analyzing the effects on trade values by disaggregating the products further, and focusing on detailed product characteristics and their variety. Conducting a structural analysis to see the changes across time may give us some more insights as well.

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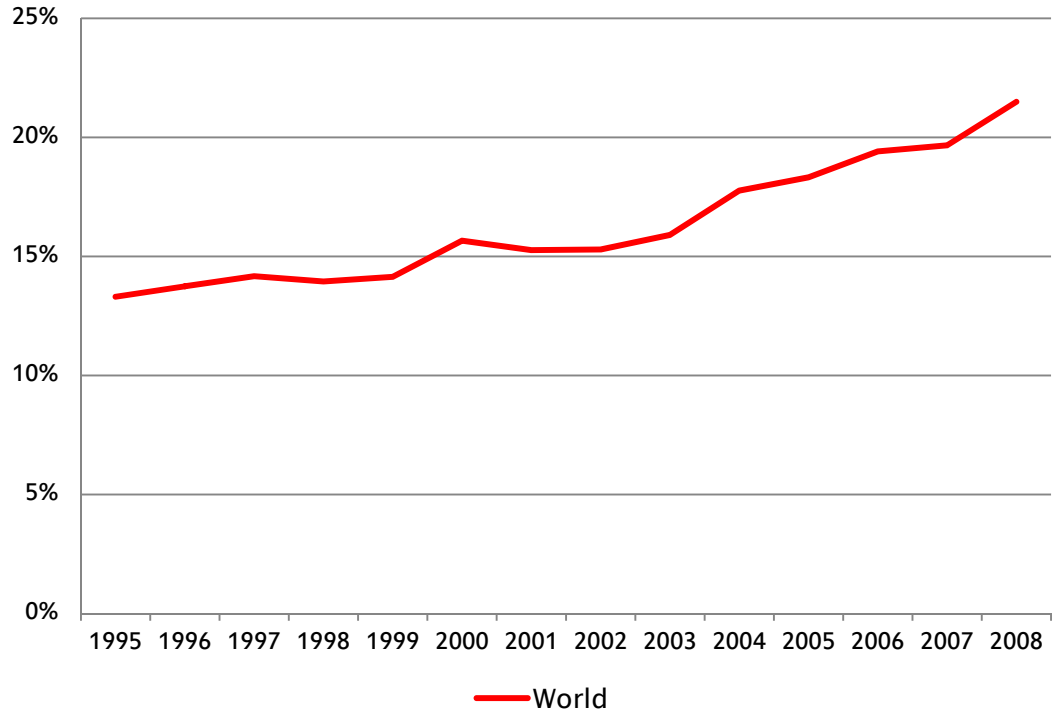
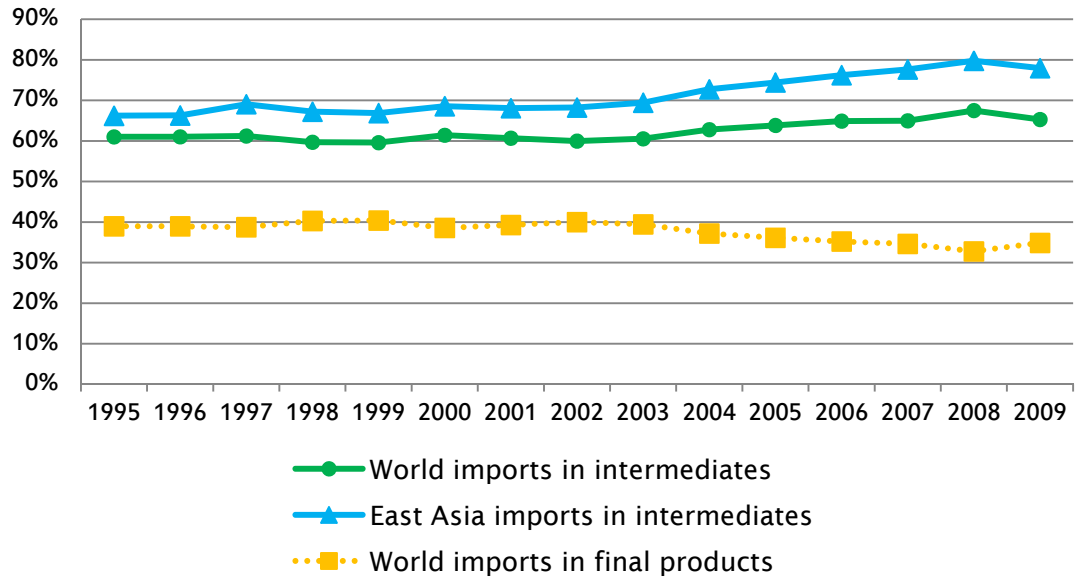
Figure 1: Trade in Intermediates – Ratio of Foreign to Domestic Intermediates



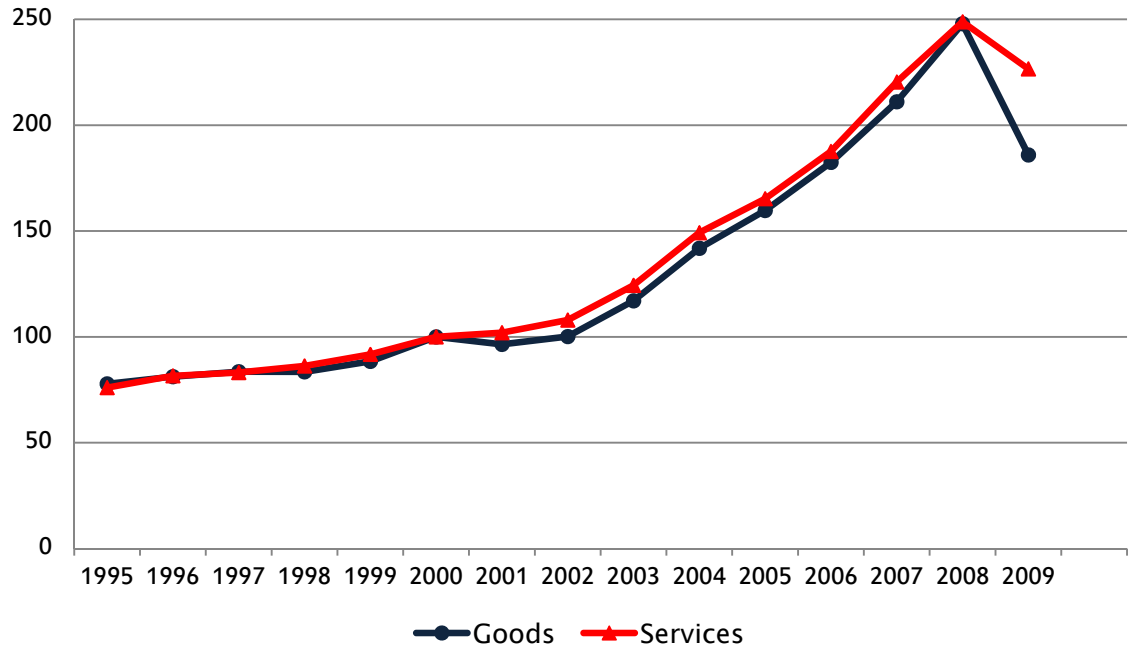
Source: Author's calculation based on WIOD.

Figure 2: Trade in Intermediates and Final Products as a Share of Total Imports



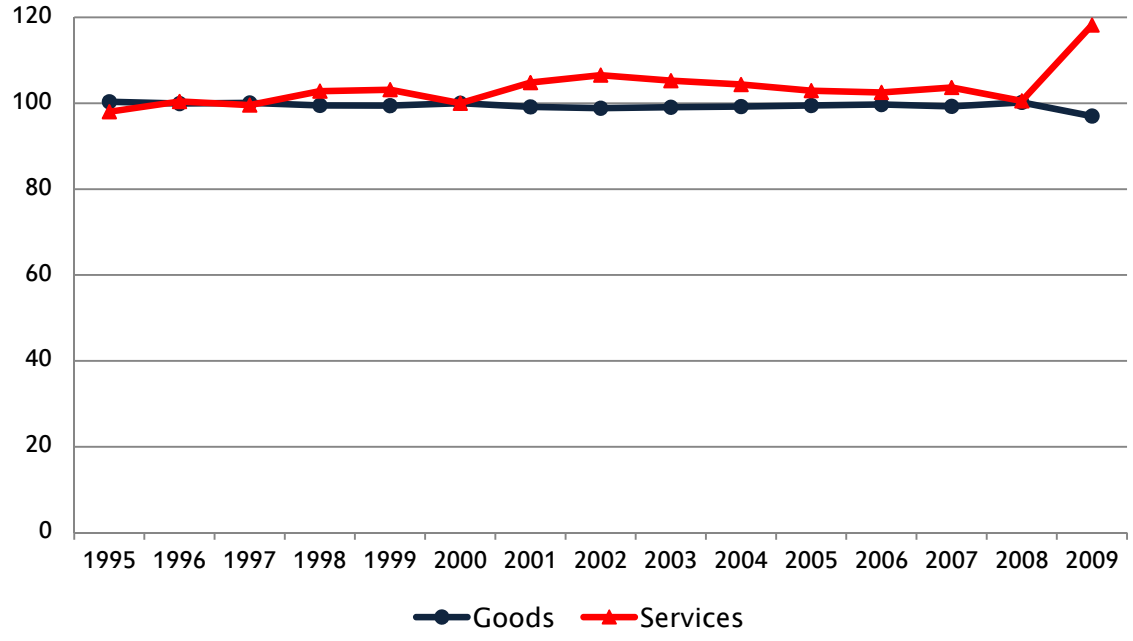
Source: Author's calculation based on WIOD.

Figure 3: Imports of Goods and Services (year 2000=100)



Source: Author's calculation based on WIOD.

Figure 4: Trade in Goods and Services as a Share of Total Imports (year 2000=100)



Source: Author's calculation based on WIOD.

Table 1: Descriptive Statistics for Continuous Variables

Variable	Unit of measure	Obs.	Mean	Std. Dev.	Min	Max
Intermediates imports	in million US dollars	1,380,600	39.7	365	0	59,700
Final imports	in million US dollars	1,380,600	25.8	327	0	55,100
Total imports	in million US dollars	1,380,600	65.6	591	0	72,300
GDP	in million US dollars	1,380,600	883,000	1,890,000	3,660	14,300,000
GDP per capita	in million US dollars	1,380,600	0.0195	0.0166	0.0004	0.1189
Distance	km	1,380,600	5,133	4,433	59.62	18,523.81
Total goods imports	in million US dollars	725,400	104	778	0	72,300
Total services imports	in million US dollars	655,200	23.2	249	0	44,700

Table 2: Trade in Intermediates and Trade in Final Products: Estimation of Sample Selection Bias Model

	Entry Dummy		Trade Volume	
Dependent Variable:	Intermediates Imports	Final Products Imports	Intermediates Imports	Final Products Imports
$\ln GDP_i$	0.100***	0.094***	0.947***	0.917***
	(0.004)	(0.004)	(0.007)	(0.007)
$\ln GDP_j$	0.189***	0.196***	1.014***	1.032***
	(0.004)	(0.004)	(0.007)	(0.007)
$\ln(GDP/pop)_i$	0.139***	0.169***	-0.214***	-0.075***
	(0.007)	(0.007)	(0.014)	(0.014)
$\ln(GDP/pop)_j$	0.040***	0.048***	-0.218***	-0.239***
	(0.007)	(0.007)	(0.013)	(0.014)
lnDistance	-0.359***	-0.357***	-1.107***	-1.094***
	(0.007)	(0.007)	(0.013)	(0.013)
Adjacency	-0.014	-0.014	0.656***	0.590***
	(0.026)	(0.026)	(0.042)	(0.043)
Common language	-0.096***	-0.095***	0.466***	0.442***
	(0.028)	(0.029)	(0.047)	(0.048)
Colonial ties	0.026	0.029	-0.031	0.010
	(0.031)	(0.031)	(0.052)	(0.052)
Index of Economic Freedom$_i$	0.074	0.124**	2.221***	2.079***
	(0.050)	(0.051)	(0.097)	(0.100)
Index of Economic Freedom$_j$	0.487***	0.382***	2.643***	2.807***
	(0.050)	(0.052)	(0.099)	(0.102)
EU bloc	-0.095***	-0.090***	0.180***	0.227***
	(0.012)	(0.012)	(0.022)	(0.023)
East Asia bloc	-0.473***	-0.507***	0.748***	0.481***
	(0.051)	(0.051)	(0.090)	(0.084)
NAFTA bloc	-0.958***	-0.934***	-0.022	-0.002
	(0.093)	(0.097)	(0.139)	(0.137)
Year 2009	-0.135***	-0.147***	-0.683***	-0.774***
	(0.010)	(0.010)	(0.018)	(0.019)
procedures&days	0.122***	0.144***		
	(0.013)	(0.013)		
relative cost	-0.082***	-0.067***		
	(0.012)	(0.012)		
Constant	-6.838***	-7.977***	-44.806***	-49.727***
	(0.298)	(0.305)	(0.555)	(0.571)
ρ			0.097***	0.109***
			(0.003)	(0.004)
Number-of-obs.	1,212,686	1,212,686	760,610	695,741

Notes: *Entry Dummy* is an indicator for whether or not the importing and exporting country pairs actually trade (i.e., have more than zero trade flows). *Trade Volume* is the natural logarithm of bilateral trade flows if positive. The standard errors for *rho* are based on Wald test of independent equations.
Estimates are made with time and product fixed effects. Clustered standard errors are shown in parentheses.
* p<0.1, ** p<0.05, *** p<0.01

Table 3: Trade in Goods and Trade in Services: Estimation of Sample Selection Bias Model

	Entry Dummy		Trade Volume	
Dependent Variable:	Goods Imports	Services Imports	Goods Imports	Services Imports
$\ln GDP_i$	0.292***	0.018***	1.013***	0.820***
	(0.006)	(0.005)	(0.008)	(0.012)
$\ln GDP_j$	0.494***	0.042***	1.115***	0.857***
	(0.006)	(0.005)	(0.007)	(0.013)
$\ln(GDP/pop)_i$	-0.002	0.224***	-0.222***	-0.023
	(0.010)	(0.009)	(0.015)	(0.026)
$\ln(GDP/pop)_j$	-0.095***	0.116***	-0.278***	-0.128***
	(0.010)	(0.009)	(0.014)	(0.026)
lnDistance	-0.586***	-0.267***	-1.287***	-0.783***
	(0.011)	(0.009)	(0.014)	(0.023)
Adjacency	0.294***	-0.080**	0.680***	0.624***
	(0.056)	(0.032)	(0.047)	(0.075)
Common language	0.219***	-0.171***	0.228***	0.908***
	(0.055)	(0.037)	(0.051)	(0.090)
Colonial ties	-0.030	0.050	0.016	-0.042
	(0.063)	(0.039)	(0.056)	(0.097)
Index of Economic $Freedom_i$	0.379***	-0.076	1.949***	2.311***
	(0.072)	(0.068)	(0.105)	(0.181)
Index of Economic $Freedom_j$	0.987***	0.379***	2.473***	2.897***
	(0.071)	(0.068)	(0.114)	(0.176)
EU bloc	-0.099***	-0.107***	0.193***	0.160***
	(0.020)	(0.016)	(0.025)	(0.040)
East Asia bloc	-0.222*	-0.564***	0.725***	0.720***
	(0.118)	(0.071)	(0.091)	(0.196)
NAFTA bloc	-0.862***	-0.964***	0.252*	-1.035***
	(0.268)	(0.126)	(0.136)	(0.262)
Year 2009	-0.122***	-0.162***	-0.870***	-0.432***
	(0.019)	(0.012)	(0.020)	(0.035)
procedures&days	0.071***	0.183***		
	(0.018)	(0.018)		
relative cost	-0.138***	-0.071***		
	(0.017)	(0.016)		
Constant	-18.610***	-3.490***	-45.018***	-45.055***
	(0.456)	(0.396)	(0.619)	(1.018)
ρ			0.066***	0.131***
			(0.005)	(0.006)
Number-of-obs.	637,174	575,512	503,181	279,165

Notes: *Entry Dummy* is an indicator for whether or not the importing and exporting country pairs actually trade (i.e., have more than zero trade flows). *Trade Volume* is the natural logarithm of bilateral trade flows if positive. The standard errors for *rho* are based on Wald test of independent equations.
Estimates are made with time and product fixed effects. Clustered standard errors are shown in parentheses.
* p<0.1, ** p<0.05, *** p<0.01

Table 4: Trade in Intermediates and Trade in Final Products: Estimation Results by Sector

	Intermediates Imports			Final Products Imports		
	Sector			Sector		
Dependent Variable:	Agriculture	Manufacture	Services	Agriculture	Manufacture	Services
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln GDP_i$	1.135***	1.028***	0.858***	1.008***	0.979***	0.908***
	(0.010)	(0.003)	(0.004)	(0.012)	(0.003)	(0.004)
$\ln GDP_j$	1.288***	1.117***	0.962***	1.398***	1.144***	0.987***
	(0.014)	(0.003)	(0.004)	(0.017)	(0.003)	(0.004)
$\ln(GDP/pop)_i$	-0.152***	-0.367***	0.642***	0.163***	-0.120***	0.547***
	(0.017)	(0.006)	(0.012)	(0.022)	(0.006)	(0.012)
$\ln(GDP/pop)_j$	-0.954***	-0.160***	0.180***	-0.967***	-0.254***	0.162***
	(0.017)	(0.005)	(0.010)	(0.021)	(0.006)	(0.010)
lnDistance	-1.293***	-1.333***	-1.501***	-1.571***	-1.314***	-1.501***
	(0.019)	(0.005)	(0.011)	(0.023)	(0.006)	(0.011)
Adjacency	1.098***	0.625***	0.457***	0.644***	0.582***	0.446***
	(0.046)	(0.014)	(0.024)	(0.050)	(0.015)	(0.024)
Common language	0.918***	0.085***	0.347***	0.884***	0.121***	0.370***
	(0.050)	(0.015)	(0.028)	(0.057)	(0.016)	(0.028)
Colonial ties	0.060	-0.018	0.026	0.137**	-0.005	0.129***
	(0.055)	(0.017)	(0.029)	(0.062)	(0.017)	(0.030)
Index of Economic $Freedom_i$	1.230***	2.439***	1.881***	-0.104	2.207***	1.747***
	(0.131)	(0.041)	(0.064)	(0.159)	(0.043)	(0.065)
Index of Economic $Freedom_j$	4.065***	2.403***	3.815***	4.021***	2.714***	3.509***
	(0.139)	(0.045)	(0.064)	(0.169)	(0.048)	(0.064)
EU bloc	0.280***	0.149***	-0.220***	0.867***	0.218***	-0.251***
	(0.033)	(0.011)	(0.017)	(0.041)	(0.011)	(0.017)
East Asia bloc	0.601***	0.698***	-0.886***	-0.222**	0.455***	-1.026***
	(0.083)	(0.027)	(0.061)	(0.095)	(0.026)	(0.061)
NAFTA bloc	0.093	0.084**	-3.883***	-0.037	0.197***	-3.748***
	(0.130)	(0.040)	(0.094)	(0.153)	(0.042)	(0.089)
Year 2009	-0.982***	-0.867***	-0.836***	-1.318***	-0.936***	-0.810***
	(0.069)	(0.021)	(0.035)	(0.084)	(0.023)	(0.035)
Excluded variables:						
dprocdays	-0.058***	0.095***	0.166***	-0.051***	0.110***	0.187***
	(0.010)	(0.009)	(0.005)	(0.013)	(0.008)	(0.005)
dcost	-0.102***	-0.200***	-0.074***	0.045***	-0.149***	-0.083***
	(0.010)	(0.008)	(0.005)	(0.012)	(0.008)	(0.005)
lambda	2.236***	-0.301***	6.213***	2.057***	-0.082**	6.050***
	(0.072)	(0.043)	(0.082)	(0.082)	(0.037)	(0.079)
R-squared	0.330	0.589	0.446	0.496	0.585	0.421
Adj-R-squared	0.329	0.589	0.446	0.496	0.585	0.421
Number-of-obs.	79,134	403,822	277,654	43,453	388,595	263,693

Notes: Uses Heckman's two-step estimation procedure to estimate the sample selection model.
Estimates are made with time and product fixed effects. Robust standard errors are shown in parentheses.
* p<0.1, ** p<0.05, *** p<0.01

Appendix Tables

Appendix Table A.1: Products Description with CPA Classification

Goods Sector		Services Sector	
CPA	Product	CPA	Product
1	Products of agriculture, hunting and related services	40	Electrical energy, gas, steam and hot water
2	Products of forestry, logging and related services	41	Collected and purified water, distribution services of water
5	Fish and other fishing products; services incidental of fishing	45	Construction work
10	Coal and lignite; peat	50	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of a
11	Crude petroleum and natural gas; services incidental to oil and gas extraction	51	Wholesale trade and commission trade services, except of motor vehicles and motorcycle
12	Uranium and thorium ores	52	Retail trade services, except of motor vehicles and motorcycles; repair services of person
13	Metal ores	55	Hotel and restaurant services
14	Other mining and quarrying products	60	Land transport; transport via pipeline services
15	Food products and beverages	61	Water transport services
16	Tobacco products	62	Air transport services
17	Textiles	63	Supporting and auxiliary transport services; travel agency services
18	Wearing apparel; furs	64	Post and telecommunication services
19	Leather and leather products	65	Financial intermediation services, except insurance and pension funding services
20	Wood and products of wood and cork (except furniture); articles of straw and plaiting mate	66	Insurance and pension funding services, except compulsory social security services

Appendix Table A.1 (continued)

Goods Sector		Services Sector	
CPA	Product	CPA	Product
21	Pulp, paper and paper products	67	Services auxiliary to financial intermediation
22	Printed matter and recorded media	70	Real estate services
23	Coke, refined petroleum products and nuclear fuels	71	Renting services of machinery and equipment without operator and of personal and house
24	Chemicals, chemical products and man-made fibers	72	Computer and related services
25	Rubber and plastic products	73	Research and development services
26	Other non-metallic mineral products	74	Other business services
27	Basic metals	75	Public administration and defense services; compulsory social security services
28	Fabricated metal products, except machinery and equipment	80	Education services
29	Machinery and equipment n.e.c.	85	Health and social work services
30	Office machinery and computers	90	Sewage and refuse disposal services, sanitation and similar services
31	Electrical machinery and apparatus n.e.c.	91	Membership organization services n.e.c.
32	Radio, television and communication equipment and apparatus	92	Recreational, cultural and sporting services
33	Medical, precision and optical instruments, watches and clocks	93	Other services
34	Motor vehicles, trailers and semi-trailers	95	Private households with employed persons
35	Other transport equipment		
36	Furniture; other manufactured goods n.e.c.		
37	Secondary raw materials		
	52.5%		47.5%

Appendix Table A.2: Country Coverage by Continent

Continent			
Europe		Americas	
Country	ISO	Country	ISO
Austria	AUT	Brazil	BRA
Belgium	BEL	Canada	CAN
Bulgaria	BGR	Mexico	MEX
Cyprus	CYP	United States	USA
Czech Republic	CZE	Obs.	138,060
Germany	DEU	Percentage	10%
Denmark	DNK	Asia Pacific	
Spain	ESP	Australia	AUS
Estonia	EST	China	CHN
Finland	FIN	Indonesia	IDN
France	FRA	India	IND
United Kingdom	GBR	Japan	JPN
Greece	GRC	South Korea	KOR
Hungary	HUN	Russia	RUS
Ireland	IRL	Taiwan	TWN
Italy	ITA	Obs.	276,120
Lithuania	LTU	Percentage	20%
Luxembourg	LUX		
Latvia	LVA		
Malta	MLT		
Netherlands	NLD		
Poland	POL		
Portugal	PRT		
Romania	ROU		
Slovak Republic	SVK		
Slovenia	SVN		
Sweden	SWE		
Turkey	TUR		
Obs.	966,420		
Percentage	70%		