MASTER THESIS

21st Century Trade Agreements:
A Data Study on Non-Tariff Barriers

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I. INTRODUCTION

The Trans-Pacific Partnership (TPP) currently under negotiation will be one of the biggest free trade deals ever established, covering almost forty percent of the global economy. The precedent of the TPP was set with the establishment of the Trans-Pacific Strategic Economic Partnership (TPSEP), an agreement between Brunei Darussalam, Chile, New Zealand and Singapore in 2005. Accession to this agreement, as granted by an accession clause, is being negotiated since 2009 by the United States, Australia, Vietnam and Peru, since 2010 by Malaysia and since 2012 by Canada and Mexico. The last country to join the negotiations was Japan, who's Prime Minister, Mr. Abe, sees accession to an agreement like the TPP as an essential part of his third arrow of structural reforms. Also currently under negotiation is the Transatlantic Trade and Investment Partnership (TTIP), an even larger agreement between the European Union and the United States, which covers nearly half of world GDP. Besides reducing tariffs on imports between the two entities, the TTIP strives to "… tackle barriers behind the customs border – such as differences in technical regulations, standards and approval procedures."[1] The Trans-Pacific Partnership does have similar aims, with key features being 'comprehensive market access', 'fully regional agreement', 'cross-cutting trade issues' including 'regulatory coherence' and 'business facilitation', and 'new trade challenges' covering investment.[2]

This apparent trend of agreements covering much more than tariff reduction alone calls for more approaches to, and a broader analysis of barriers to trade. Non-tariff barriers have become increasingly important in the recent past, as tariffs have drastically been reduced. Figure 1 shows that after the Uruguay round in 1995 tariffs dropped, and that tariffs are generally higher in low income countries. Figure 2 shows the 'overall trade restrictiveness index' for 2010, based on estimated ad valorem equivalents (UNCTAD, 2013). It illustrates how tariff and non-tariff barriers compare, and confirms the higher tariffs imposed by low income countries. On the other hand, non-tariff barriers have a bigger role when income is higher.

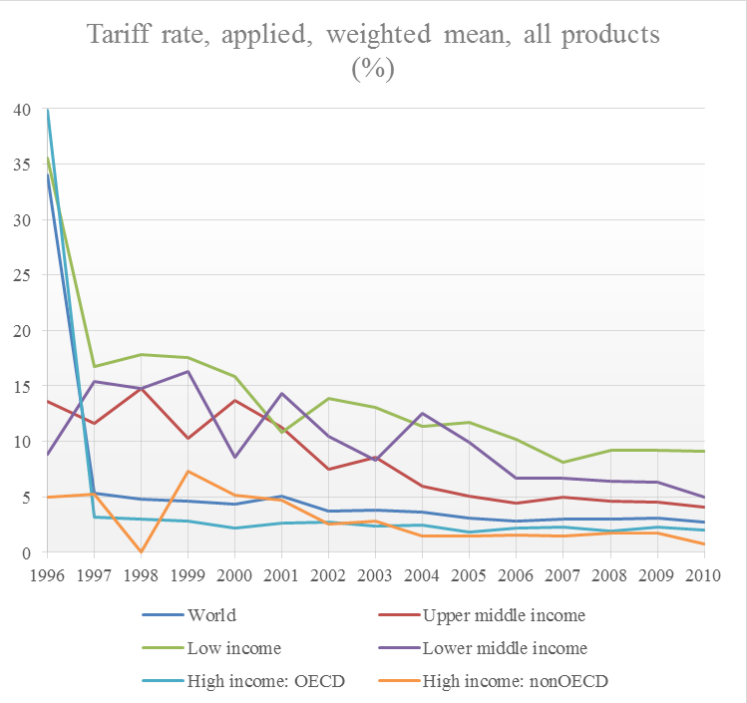

Figure 1 **Source: World Bank World Development Indicators**

[1] http://ec.europa.eu/trade/policy/in-focus/ttip/about-ttip/
[2] http://www.ustr.gov/about-us/press-office/fact-sheets/2011/november/outlines-trans-pacific-partnership-agreement

For some time now, empirical research on trade using a gravity approach focused on the effect of trade agreements, Rose (2004) being a prime example. This particular paper studies the effect of the World Trade Organization (WTO) and its predecessor, the General Agreement on Tariffs and Trade (GATT), on bilateral trade between members and non-members, and provides us with an extended gravity equation approach as well as with a few ways to check the model for robustness and sensitivity. More recently research has been increasingly focused on non-tariff barriers, such as domestic regulations, customs procedures, corruption, etcetera. The effects of this so-called 'trade facilitation' measures have for example been studied by Wilson et al. (2003) and Lee and Park (2007). This thesis aims to follow up on this research, and aims to add to the literature by combining an extensive, up-to-date dataset with the various insights on trade facilitation, tariffs and free trade agreements.

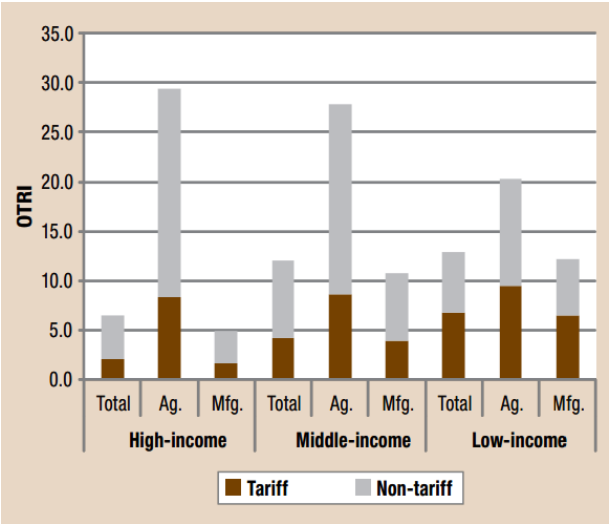

Figure 2 **Source: UNCTAD (2013)**

I will now proceed with a literature overview in part II. This will consist of a discussion on the use of gravity equations and its theoretical justification, as well as of a discussion on transport costs, tariffs and trade facilitation. After that the theoretical framework will be established in part III. Part IV describes the equations and variables used to analyze the data. After this I will describe the data used in this thesis in part V; how it is transformed, composed, selected and extracted. Part VI will contain the first empirical results, including a basic gravity approach and some robustness checks. An empirical approach to transport costs, tariffs and trade facilitation will extend the benchmark framework from part VI, in part VII. Finally part VIII will draw conclusions from the analyses in this thesis.

II. Literature overview

In this section a brief review of the literature on the gravity equation is presented. After that, literature related to the role of tariffs, non-tariff measures and other border-costs is presented, in order to relate to the empirical analysis of this thesis.

a. Foundations of the gravity equation

The use of gravity equations for analyzing trade flows has been hotly debated for decades. Despite its empirical success in explaining trade flows, in the early days gravity analysis has been criticized for a lack of theoretical foundation. Nowadays theoretical foundations for the gravity equation are abundant, although based on a variety of assumptions and coming from different backgrounds.

Tinbergen (1962) was the first person to model the gravity equation, although he did not name his analysis as such. With the goal of establishing a 'normal' pattern of international trade, Tinbergen came up with the following equation:

$$(T1) \qquad E_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3}$$

With E_{ij} representing the export from country i to j, Y_i (Y_j) being the GNP of country i (j), and D_{ij} being the distance between both countries. In this same study he also added a few dummy variables to this equation already, noting the important role of trade impediments such as tariffs which he tried to identify using this 'normal' pattern of trade and its deviations.

Anderson (1979) was the first one to establish some proof based on the assumption of identical Cobb-Douglas preferences, implying identical expenditure shares, and on the Armington assumption, i.e. products differentiated by country of origin. Anderson (1979) already describes the relation between the error terms and the income variables as a potential bias too. Krugman (1979) on the other hand, although not explicitly stated, derives a representation of the gravity equation from a one factor monopolistic competition model based on Dixit-Stiglitz demand. This approach was explicitly related to the gravity equation in Helpman and Krugman (1985), and Helpman (1987) based proof for the monopolistic competition model on the gravity equation. Bergstrand (1985) also criticizes the gravity equation, especially because it excludes prices and because it often excludes trade barriers. He theoretically proves that the gravity equation is "a reduced form from a partial equilibrium subsystem" and can be derived from a general equilibrium trade model with nationally differentiated products. In Bergstrand (1989), the author reconciles the Heckscher-Ohlin theory of (inter-industry) trade and the monopolistic competition approach of (intra-industry) trade with the gravity equation, and shows important implications regarding trade along SITC industry classifications. However, his empirical results on the included price variables, the importer and exporter wholesale price index, were mostly insignificant and showed mixed signs. Other literature with an explicit role for prices include Deardorff (1998) who justifies some simplifying assumptions, and Baier and Bergstrand (2001), who develop a constant-elasticity-of-transformation (CET) function including price terms but empirically test a relatively standard gravity model. The CET function allows their model to possibly differentiate output along markets because of "the potential presence of costs in distributing the product to each market". Another paper is Anderson and Van Wincoop (2003), who point out the bias caused by omitted multilateral resistance terms such as prices. Baier and Bergstrand (2007) finally provide us with econometric techniques to counter the problem of including price variables and multilateral resistance terms. Some of these techniques, such as the use of fixed effects, will be used in this thesis. In conclusion, initially the gravity equation was criticized for a lack of theoretical foundations. Nowadays economic theory can convincingly be reconciled with the gravity equation and its empirical results. Two papers that show the implications of using the gravity equation with different sets of assumptions in a clear way are Feenstra

et al. (2001) and Evenett and Keller (2002). Feenstra et al. (2001) evaluate four theoretical models, the monopolistic competition model, the Armington-type model and the open and closed reciprocal dumping model, and the empirical evidence produced by the gravity equation, provided for the assumptions underlying the respective models. They divide trade in three categories from differentiated goods to homogeneous goods, and prove that the empirical results are consistent with the theoretical predictions. Evenett and Keller (2002) perform a similar analysis with two theoretical models, the Heckscher-Ohlin theory and the monopolistic competition model, and a classification of trade based on the Grubel-Lloyd index, which measures the share of intra-industry trade in total trade (Grubel and Lloyd, 1975). With their approach the evidence for both theories is mixed; perfect specialization is not supported, imperfect specialization and a mix of increasing returns and differences in factor endowments is sometimes supported, and imperfect specialization with factor differences alone is supported by the evidence.

b. Impediments to trade

The most obvious barrier to trade is distance. The more distance between two agents, the less trade will take place, think of the way of doing ones groceries. Distance causes explicit transport costs, like fuel, which would be the only costs in an absolute free trade world which economic models often assume. However, reality does not show a world with free trade, and barriers to trade exist in a variety of ways next to geographical distance. These impediments to trade can be in the form of tariffs or non-tariff barriers like quotas and export subsidies, or are related to cultural, institutional and political differences.

For a long time, the common representation of transport costs has been the concept of 'iceberg transport costs', introduced by Paul Samuelson (1954), further explained in the next part. It is a simple and useful method to introduce transport costs and barriers to trade, which cause the costs, in for example partial equilibrium analysis since no market for transport needs to be modelled. Modelling trade costs has always been one of the key challenges for analyzing and estimating trade flows. As noted before, the gravity equation also faces these difficulties, and has often been criticized for it. Anderson (1979) includes a transit cost factor similar to the iceberg transport costs just mentioned. He notes that the model he specifies introduces bias in the estimator when the transit cost factor deviates from one, but that the bias will be less severe when the transit costs of the countries under consideration are more alike. Deardorff (1998) concludes something similar: "if importing country *j*'s relative distance from exporting country *i* is the same as an average of all demanders' relative distances from *i*, then exports from *i* to *j* will be the same as in the Cobb-Douglas case", with the Cobb-Douglas case he refers to similar as the one presented in the next section.

In addition to these papers and the literature mentioned in IIa, more practical and specific applications within the topic of non-tariff barriers can be found in for example Deardorff and Stern (1997), who provide a useful overview of the complexities surrounding non-tariff barriers, its characteristics and

methods to quantify them. Maskus et al. (2000) provide us with an overview of methodological issues related to technical barriers to trade, and propose ways to gather the relevant information for future research. Their ideas are still relevant, as data is still limited. Papers combining the gravity equation with trade facilitation include Lee and Park (2005, 2007) and Wilson et al. (2003, 2005), who develop variables to estimate the effects of trade facilitation measures and indicators related to non-tariff barriers. Lee and Park (2007) and Wilson et al. (2003) will be described in more detail in the next section.

III. THEORETICAL FRAMEWORK

Based on Anderson (1979), consider a world with *N* different countries producing *N* different products. Each country produces an amount q_i with price p_i, so that the gross domestic product (GDP) of country *i* amounts to $Y_i = p_i q_i$. As noted consumer preferences are assumed similar and Cobb-Douglas, so that fraction β_i of their incomes will be spent on product *i*. Since we assume perfect competition and free trade, prices are equal and no trade imbalances will exist, so that country supply is equal to world demand:

$$(A1) \qquad Y_i = p_i q_i = \sum_{j=1}^{N} \beta_i Y_j = \beta_i Y_w$$

With $\beta_i Y_j$ being country *j*'s consumption of good *i*, world demand is Y_w. Imports from country *i* into country *j*, recognizing that β_i is Y_i / Y_w, can be represented as:

$$(A2) \qquad m_{ij} = \beta_i Y_j = \frac{Y_i Y_j}{Y_w}$$

This is the simplest definition of the gravity equation, dubbed 'frictionless trade' by Deardorff (1998). The bilateral trade flow between countries *i* and *j* is positively related to the product of their GDPs, just as gravitational force between two objects is positively related to their mass. Note that at this stage, imports m_{ij} are equal to exports from *i* to *j*, x_{ij}.

Missing from this definition is the analog of 'proximity' in physics; it is unrelated to distance. Although the role of distance can be integrated in a number of ways according to previous literature, I will forgo going into the mathematical details of those papers, since I intend this thesis to be empirical. The role of distance, in a narrow sense as well as in a broader sense described later, can simply be shown by including a transport factor τ_{ij}. This factor then represents all costs related to the transport of commodities between *i* and *j*, from pure transport costs like fuel, to tariffs, quotas and other border related costs. Transport factor τ_{ij} is bigger than 1, so that $(\tau_{ij} - 1)$ represents the cost of transport. This representation of transport costs has come to be known as 'iceberg transport costs', and was introduced by Paul Samuelson (1954). Equation (*A2*) can then be rewritten as:

$$x_{ij} = \frac{m_{ij}}{\tau_{ij}} = \frac{1}{\tau_{ij}} \frac{Y_i Y_j}{Y_w} \quad (A3)$$

Interpretation is straightforward: m_{ij} is mostly valued on a 'cost, insurance and freight' (*cif*) basis, exports x_{ij} are valued on a 'free on board' (*fob*) basis. The difference between the two valuations thus are transport costs ($\tau_{ij} - 1$). Equation (*A3*) immediately reveals the relationship between exports and transport costs; the higher the transport factor, the lower the export from *i* to *j*.

IV. METHODOLOGY

This section will establish the methods and techniques that will be used to find the answers to the central questions of this thesis. First I will describe what will be the basic framework as used by Rose (2004). Although I am certainly interested in the effects of WTO membership, I am more interested in the role of regional trade agreements, which only had a small part in Rose' analysis. Furthermore I am interested in barriers to trade not specified in Rose (2004), such as tariffs and non-tariff barriers. I will extend the basic framework to analyze the effects of these variables.

a. Basic framework

As mentioned, Rose (2004) analyses the effect of WTO membership on trade between members and non-members, as well as being part of the Generalized System of Preferences. To that end he employs the following equation:

$$\ln(EX_{ijt}) = \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma_1 Bothin_{ijt} + \gamma_2 Onein_{ijt} + \gamma_3 GSP_{ijt} + \epsilon_{ijt} \quad (1)$$

Where *i* and *j* denotes trading partners, *t* denotes time, and T_t is a comprehensive set of time fixed effects. Dependent variable ln(EX_{ijt}) denotes the logarithm of the real bilateral trade between country *i* and *j* at time *t*. Specifically stated are the variables of interest for Rose' analysis; $Bothin_{ijt}$, $Onein_{ijt}$ and GSP_{ijt}. $Bothin_{ijt}$ is a dummy variable indicating if both countries *i* and *j* are members of the WTO or not, and is expected to be positive. $Onein_{ijt}$ on the other hand indicates if one of the countries *i* and *j* is a member. If trade between members is harmful for outsiders, this variable is expected to be negative. GSP_{ijt} tells us if country *i* or *j* is a beneficiary of the other under the Generalized System of Preferences. Being part of the GSP is expected to have a positive effect on trade. Finally, *X'* is a set of fourteen explanatory variables which are:

- lnD_{ij}: logarithm of the distance between *i* and *j*
- ln(Y_iY_j): logarithm of the product of [real] GDP of both countries
- ln(Y_iY_j/Pop_iPop_j): logarithm of the product of [real] GDP per capita of both countries
- $Lang_{ij}$: binary variable which is 1 of *i* and *j* have a common language and 0 otherwise
- $Cont_{ij}$: binary variable which is 1 if *i* and *j* share a border and 0 otherwise

- $Landl_{ij}$: number of landlocked countries in the country-pair (0, 1 or 2)
- $Island_{ij}$: number of island nations in the country-pair (0, 1 or 2)
- ln($Area_iArea_j$): logarithm of the product of the area of both countries
- $ComCol_{ij}$: binary variable which is 1 if both had a common colonizer after '45 and 0 otherwise
- $CurCol_{ijt}$: binary variable which is 1 if *i* is a colony of *j* at time *t* or vice versa
- $Colony_{ijt}$: binary variable which is 1 if *i* ever colonized *j* or vice versa
- $ComNat_{ij}$: binary variable which is 1 if *i* and *j* remained part of the same nation
- CU_{ijt}: binary variable which is 1 if *i* and *j* are in a currency union at time *t*
- FTA_{ijt}: binary variable which is 1 if *i* and *j* are part of the same regional trade agreement

Starting with the traditional gravity variables, trade is expected to be positively influenced by the gross domestic product of both countries, and negatively by the distance between trading partners, as explained before. Population, although not included in isolation, is commonly expected to be correlated negatively to trade, since a larger market at home relative to production decreases the need to export. Its inclusion in the per capita GDP variable makes this one interesting, because it reflects heterogeneous tastes between countries with similar income levels, as well as the relative endowment of capital. Contingency is expected to show a positive sign; being next to each other obviously simplifies trade. Having different languages can be thought of as cultural distance, so we expect the dummy variable, which takes the value 1 if the same language is used, to have a positive sign. Landlockedness and being an island nation reduces infrastructural options, therefore inhibiting trade. The signs of these variables are thus expected to be negative. The log-product of *Area* is another simple measure of distance. The bigger the countries, the more transport costs, so this sign is expected to be negative too. $ComCol_{ij}$, $CurCol_{ijt}$ and $Colony_{ijt}$ all indicate a colonial relationship at a certain point in time. Since one of the main goals of colonialism was securing raw materials, rare commodities and trade routes, colonial ties are expected to have a positive effect on trade. The same goes for $ComNat_{ij}$. The use of a common currency removes exchange rate uncertainty for exporters, this is expected to be beneficial for trade. Both countries *i* and *j* being part of the same free trade agreement (FTA), represented by the dummy variable FTA_{ijt}, is also expected to show a positive sign.

In addition to equation 1 Rose repeats this estimation with country specific effects:

$$(2) \qquad \ln(EX_{ijt}) = \alpha_i + \alpha_j + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma_1 Bothin_{ijt} + \gamma_2 Onein_{ijt} + \gamma_3 GSP_{ijt} + \epsilon_{ijt}$$

Which are represented by α_i and α_j. According to Feenstra (2002) and Anderson and van Wincoop (2003) the inclusion of country fixed effects captures both countries' resistance to trade with the rest of the world. Part of these fixed effects are possibly explained by undefinable or unquantifiable variables like 'regulatory barriers', 'corruption', 'bureaucracy' etcetera. Another method to account for unobservables and multilateral resistance terms is to use country-pair fixed effects instead of country fixed effects, as

is done by Baier and Bergstrand (2007). In this way, the model is able to focus solely on the variation over time. This specification will look like this:

$$\ln(EX_{ijt}) = \alpha_{ij} + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma_1 Bothin_{ijt} + \gamma_2 Onein_{ijt} + \gamma_3 GSP_{ijt} + \epsilon_{ijt} \quad (3)$$

In this equation, α_{ij} are the country-pair fixed effects.

After these regressions enable us to compare Rose' results with results using new data, a new benchmark will be set with the following specifications:

$$\ln(EX_{ijt}) = \Sigma_t \phi_t T_t + \beta X'_{ijt} + \epsilon_{ijt} \quad (4)$$

$$\ln(EX_{ijt}) = \alpha_i + \alpha_j + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \epsilon_{ijt} \quad (5)$$

$$\ln(EX_{ijt}) = \alpha_{ij} + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \epsilon_{ijt} \quad (6)$$

Easy to see, equations 4, 5 and 6 are equivalent to equations 1, 2 and 3, except for the variables on WTO membership and the GSP regime. Comparability with the other literature referenced to in this thesis is the main reason the exclude these variables from the analysis. A more technical reason for exclusion is the conclusion of Rose (2004), who found that the role of WTO membership was ambiguous at best. The initial analysis presented below casts doubt on the robustness of *Bothin*, *Onein* and *GSP* too, and common knowledge dictates that the role of WTO membership or non-membership hardly changed since the Uruguay round, with the failure of the Doha round as prime example. Instead countries turned to trade agreements, which are included in the equation.

b. Extended framework

In recent years, more attention has already been drawn to the identification of these effects as pointed out in part II. In line with recent empirical work, I will extend the basic framework with variables on trade facilitation and tariffs. One example of including trade facilitation variables is found in Wilson et al. (2003), in which the authors include four variables which correspond to the term 'trade facilitation'; 'Port Efficiency', 'Customs Environment', 'Regulatory Environment' and 'E-business Usage'. The data used by Wilson et al. (2003) for constructing these four variables consisted of a number of indicators from the World Economic Forum's Global Competitiveness Report (GCR), IMD Lausanne's World Competitiveness Yearbook (WCY), Transparency International's Global Corruption Report (TI) and a World Bank working paper by Micco, Dollar and Ximena (2001). Because their data is extracted from different sources these indicators are standardized as follows:

$$\overline{I_{jn}} = I_{jn} / (\frac{\sum_{j=1}^{N} I_{jn}}{N})$$

Where I_{jn} is the raw data for country j (and j = 1, 2, 3, … , N) from report n. To come up with the four variables mentioned, these indexed indicators are simply averaged:

$$F_{jk} = \frac{\sum_{n=1}^{N} \overline{I_{jn}}}{N}$$

Where subscript k denotes the variables 'Port Efficiency', 'Customs Environment', 'Regulatory Environment' and 'E-business Usage'. This standardization and indexation can be shown with the example in Table 1.

TABLE 1: EXAMPLE

Report (n)	Country (j)	Score (I_{jn})	Standardized value ($\overline{I_{jn}}$)
Port Efficiency report 1	A	2	2 / (2+4+5)/3 = 0.545
	B	4	4 / (2+4+5)/3 = 1.091
	C	5	5 / (2+4+5)/3 = 1.364
Port Efficiency report 2	A	3	3 / (3+4+6)/3 = 0.692
	B	4	4 / (3+4+6)/3 = 0.923
	C	6	6 / (3+4+6)/3 = 1.385
Constructed variable (k)	Country (j)		Variable value (F_{jk})
Port Efficiency	A	(0.545 + 0.692)/2 =	0.619
	B	(1.091 + 0.923)/2 =	1.007
	C	(1.364 + 1.385)/2 =	1.375

Another example is found in Lee and Park (2007), who include a single 'trade facilitation index'. Their index is constructed much like the variables from Wilson et al. (2003) mentioned above, out of four indicators from the GCR, but is inserted differently in the gravity equation. Whereas Wilson et al. (2003) include the indexes of the importing country in their equation, Lee and Park include the product of the indexes F of country j and country i.

One major drawback of Wilson et al. (2003) is the fact that their trade facilitation variables are time invariant. They are constructed out of single year data, thus constant for the whole period analyzed. This is recognized by the authors, and they subsequently re-estimate their model with newly constructed trade facilitation time series. Although they argue that their qualitative results do not change much, the re-estimation was done with a significant loss of data. Lee and Park (2007) faced the same data issues. Starting out with the dataset of Rose (2004), consisting of 175 countries in a period of fifty years, they had to cut back to 50 countries and a period of five years. In this thesis I will cover a longer time span, including more data on trade facilitation. By including variables on trade facilitation and tariffs, the extended equation will then be as follows:

(7) $$\ln(EX_{ijt}) = \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma F'_{ijt} + \lambda \ln(100 + Tariff) + \varepsilon_{ijt}$$

With *X'* being the same set of explanatory variables as in the basic framework and *F'* being a set of trade facilitation variables in logarithms. These extended equations are also tested with country fixed effects and country-pair fixed effects, as in equation 8 and 9:

$$\ln(EX_{ijt}) = \alpha_i + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma F'_{ijt} + \lambda \ln(100 + Tariff) + \varepsilon_{ijt} \quad (8)$$

$$\ln(EX_{ijt}) = \alpha_{ij} + \Sigma_t \phi_t T_t + \beta X'_{ijt} + \gamma F'_{ijt} + \lambda \ln(100 + Tariff) + \varepsilon_{ijt} \quad (9)$$

Equations 7-9 are analog to equations 4-6. For equation 8 however, the country effects approach is applied in a slightly different way. Because I try to estimate the border related, non-tariff barriers to trade, the country fixed effects of country *j*, α_j, are not included in this equation. Country fixed effects generally fit the purpose of absorbing those unknown deviations from the theoretical gravity model. When including those of country *j*, they possibly capture variance that will otherwise be explained by the constructed variables, what we hypothesize to be the case. It is possible this will also be true for regression 9 for the same reason. The country effect of country *i* is included because border related costs will also be present with the exporter, but may be born out of different aspects than barriers to trade on the side of the importer.

To sum up, the analysis of this thesis will start out with regression 1 specified above. This regression will give us benchmark results analog to those of Rose (2004) which will tell us how well that particular specification of the gravity model fits the most recent data. Regression 1 will also be applied to subsets, one without high income OECD countries and one with years prior to 2007, of the full dataset. At this stage, the compiled dataset is at its largest, but more on that in the next section. Next, regression 2 as stated above will include country specific effects. Regression 3 with cross-section fixed effects will also serve as some kind of robustness check. Having completed the analog to Rose (2004), regressions 1, 2 and 3 will be redone as regressions 4 to 6, without the WTO and GSP variables. The implications of different specifications will be discusses afterwards. Now having established the basic gravity model with this new dataset, the interesting part of this thesis will finally commence with equations 7, 8 and 9. These equations will constitute the core analysis of this thesis, with extensions for tariffs and non-tariff barriers on regressions 4-6. The inclusion of trade facilitation variables is expected to significantly improve the basic model, and can possibly provide us with more knowledge and tools to study the potential of free trade agreements like the Trans-Pacific Partnership and the Transatlantic Trade & Investment Partnership.

TABLE 2: SUMMARY STATISTICS

	All (*n=499205)*				Both in WTO (*n=312139)*				One in WTO (*n=166342)*			
	Mean	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*
log real exports	14.788	3.966	-14.151	26.535	15.130	3.980	-14.151	26.535	14.054	3.831	-2.227	24.845
log $gdp_i gdp_j$	47.922	3.067	35.947	59.518	48.348	3.102	39.190	59.518	47.297	2.857	36.318	58.058
log $gdp_i gdp_j / pop_i pop_j$	16.352	2.282	9.540	22.689	16.573	2.297	9.681	22.506	16.043	2.209	9.545	22.689
log $area_i area_j$	23.164	3.580	6.477	32.769	23.210	3.417	8.814	32.769	23.077	3.808	6.477	32.769
log distance	8.702	0.798	2.349	9.901	8.721	0.807	2.349	9.901	8.696	0.769	4.394	9.901
log gdp_i	24.041	2.236	18.453	30.305	24.208	2.260	19.336	30.305	23.821	2.190	18.453	30.305
log gdp_j	23.891	2.312	16.775	30.305	24.142	2.272	19.336	30.305	23.520	2.335	16.775	30.305
log gdp_i / pop_i	8.189	1.638	4.623	11.382	8.287	1.655	4.649	11.382	8.066	1.612	4.623	11.382
log gdp_j / pop_j	8.167	1.632	4.623	11.382	8.287	1.638	4.649	11.382	7.996	1.609	4.623	11.382
	All (*n=171971)*				Both in WTO (*n=129685)*				One in WTO (*n=39988)*			
	Mean	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*
log govern. $performance_j$	-0.013	0.172	-0.692	0.481	-0.003	0.170	-0.692	0.481	-0.041	0.174	-0.692	0.481
log port $efficiency_j$	-0.020	0.258	-0.875	0.517	-0.001	0.252	-0.828	0.517	-0.068	0.269	-0.875	0.517
log hidden $barriers_j$	-0.011	0.176	-0.620	0.410	0.002	0.175	-0.620	0.410	-0.044	0.174	-0.620	0.410
log $tariffs_j$	4.663	0.051	4.605	5.049	4.660	0.050	4.605	5.049	4.668	0.054	4.605	5.049

V. DATA

I designed a panel dataset to estimate the equations specified in the previous section. The sample consists of 178 exporting countries for which data is available, who potentially trade with 192 countries, amounting to a total of 29,365 cross-sections. An overview of the countries is listed in Appendix 1. The timespan is limited to seventeen years, the years 1997 to 2013, for the sake of a very complete dataset. The year 1997 may seem somewhat arbitrarily chosen, but is chosen because most post-communism and post-war effects in Eastern Europe, as apparent in the data, have faded at that moment.

a. Standard data

The export data is extracted from the International Monetary Fund's Direction of Trade Statistics (DOTS) and is deflated using the implied GDP deflator per country, following Baier and Bergstrand (2007). GDP data, including GDP in current US Dollars, GDP in constant 2005 US Dollars and GDP per capita, come from the World Bank's World Development Indicators[3]. Data on the traditional gravity variables, such as distance, contiguity, common language, common colonizer etcetera, is obtained from the Centre d'Etudes Prospectives et d'Informations Internationales' (CEPII) GeoDist database[4]. Of the different distance measures this database provides us with, the simple measure of distance, the distance between the most import cities/agglomerations, is chosen. Also from CEPII is the data on FTAs for the years 1997 to 2006. For the years 2007 to 2013 the WTOs 'Regional Trade Agreement Information System' was consulted. Income and region classifications used in this thesis are those used by the World Bank.

The raw data, excluding dummy variables, will be transformed to natural logarithms because the resulting estimations then correspond to elasticities of the explanatory variable to the dependent variable. By transforming the raw data to natural logarithms, observations with values of zero are lost. As noted in Head et al. (2010), this usually is not a bad thing since zero's mostly represent missing data or other anomalies. For the benchmark analysis this means the panel will be restricted further to 25,961 cross-sections totaling 323,071 observations.

Summary statistics are provided in Table 2. From this table, it is possible to gather some suggestive information already. According to the logarithmic means of trade, WTO members trade more with each other than they do with non-members. It even seems like membership of the WTO diverts trade from non-members, since the logarithmic mean of trade of country pairs of which one is a WTO member is lower than the corresponding mean of the sample as a whole. This pattern is also recognizable for the statistics on income and income per capita; they tend to be higher than average in a sample consisting

[3] Data on Taiwan is from the IMF's World Economic Outlook 2014, data on Jamaica, Myanmar, New Caledonia and the Democratic People's Republic of Korea is from the UN Statistics Division.
[4] All data comes from three different files; geo_cepii.xls, dist_cepii.xls and col_regfile09.zip. The last one is the dataset used by Head et al (2010).

of WTO members only, and lower than average in a sample consisting of country pairs with one WTO member, and one non-member.

b. Data on tariffs and non-tariff barriers

The data on tariffs and the trade facilitation variables to-be-constructed come from the Global Competitiveness Index of the World Economic Forum[5]. This data spans the years 2006 to 2014, and will thus limit the full dataset used for the benchmark analysis. The tariff rate is a trade-weighted average tariff rate, which is not ideal for our purposes but readily available in contrary to more specific tariff data. Ideally, we would use the average tariff rate imposed by the importing country *j* and faced by the exporting country *i*, thus per country-pair, whereas the tariff rate now used is a trade-weighted average rate against the rest of the world. The GCI data in general consists of survey data, with scores ranging mostly from 1 to 7 on a broad range of subjects. Just as in Wilson et al. (2003) variables will be constructed from this dataset, following the method described in part IV. Although this time all the inputs used in constructing the variables come from the same source and are in the same format, the data is standardized to better reflect differences between countries and the rest of the world. See Appendix 2 for a detailed description of the indicators. The constructed variables are:

- "Government performance" for each country *j* the average of two indexes *n*:
    - Burden of government regulation
    - Transparency of government policymaking
- "Port efficiency" for each country *j* the average of the two indexes *n*:
    - Quality of port infrastructure
    - Quality of air transport infrastructure
- "Hidden import barriers" for each country *j* the average of the two indexes *n*:
    - Prevalence of trade barriers
    - Burden of customs procedures

Summary statistics on this data can also be found in Table 2. By construction, the average of the logarithm of the three trade facilitation variables mentioned above is close to zero. From these statistics too some implications can already be inferred; the variables 'port efficiency', 'government performance' and 'hidden import barriers' seem to be higher than average in case both countries are WTO member, meaning the countries score better on these indicators, and lower than average when only one of the

[5] Downloaded from http://www3.weforum.org/docs/GCR2014-15/GCI_Dataset_2006-07-2014-15.xlsx

countries is, meaning the opposite. For tariffs the opposite seems to be true: country-pairs with two WTO members have lower tariffs on average, whereas country-pairs with one WTO member have higher tariffs than average.

VI. BENCHMARK RESULTS

As mentioned, this part constitutes the results obtained by replicating the analysis of Rose (2004), translated to equations 1 and 2 in part IV, while using new data. After comparing the new results with those of Rose, a new benchmark will be set to proceed with in the rest of this study. The results are presented in Tables 3-5.

a. Comparing new and old results

The default specification stated in Table 3 represents regression 1 mentioned in part IV. The dummy variable on being a colony at time *t* is removed, since colonies are practically non-existent in the sample period. Furthermore Rose' dummy variable of a currency union is replaced by one on the use of a common currency. All the other variables correspond directly to those used by Rose (2004). The default specification is estimated with year fixed effects and robust standard errors.

TABLE 3: REGRESSIONS 1-2

	Default - Regression 1 -	No high income OECD countries	Pre 2007	Country fixed effects - Regression 2 -
Both in WTO	-0.003[d]	-0.127[a]	-0.140[a]	-0.128[a]
One in WTO	-0.231[a]	-0.285[a]	-0.258[a]	-0.360[a]
GSP	-0.868[a]	-0.917[a]	-0.696[a]	0.274[a]
log distance	-1.137[a]	-1.241[a]	-1.094[a]	-1.589[a]
log product real GDP	1.125[a]	1.086[a]	1.102[a]	0.883[a]
log product real GDP p/c	-0.096[a]	-0.183[a]	-0.092[a]	-0.101[b]
FTA	0.754[a]	1.410[a]	0.796[a]	0.504[a]
Common currency	0.166[a]	0.132[a]	0.256[a]	0.012[d]
Common language	0.633[a]	0.446[a]	0.587[a]	0.552[a]
Land border	0.964[a]	1.001[a]	0.972[a]	0.578[a]
Number landlocked	-0.436[a]	-0.629[a]	-0.346[a]	-33.723[b]
log product land area	-0.073[a]	-0.082[a]	-0.080[a]	3.188[b]
Common colonizer	0.786[a]	0.808[a]	0.742[a]	0.930[a]
Ever a colony	1.210[a]	0.577[a]	1.322[a]	1.215[a]
Observations	323,071	171,039	183,153	323,071
R^2	0.627	0.494	0.627	0.719

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at 1% [b]sign. at 5% [c]sign. at 10%, [d]**not** significant

The model mostly works as expected. Countries with a larger income trade more, and the farther they are apart the less they trade. Being part of a free trade agreement significantly increases trade, as does using the same currency, de facto sharing a language and sharing a border. As in Rose (2004), being landlocked inhibits trade and countries with more square kilometers trade less too. Colonial history between two countries still matters significantly for trade between them according to these estimations.

Surprisingly, income per capita shows a significant negative effect on trade, even for country pairs consisting of OECD countries only (not reported). The variables Rose was interested in, *Bothin*, *Onein* and *GSP*, are all negative, with *Bothin* insignificant, and *Onein* and *GSP* statistically significant at the 1% level. Could the estimations in Rose (2004) be called ambiguous about the effect of WTO membership, the estimations in Table 2 clearly suggest WTO membership does not have a positive effect on trade. They even maybe suggest trade diversion as the *Onein* variable is significantly negative, indicating reduced trade between members and non-members.

The other columns of Table 3 contain some different specifications to check for robustness. First, country-pairs with high income OECD countries only were dropped from the sample. Most of the estimated coefficients become more pronounced, and the *Bothin* variable is now statistically significant too. The FTA coefficient nearly doubles by this manipulation, suggesting free trade agreements play a bigger than average role in the low-, lower middle- and upper middle-income countries. Secondly, the sample is restricted to the years before the Great Recession. This manipulation does not show much qualitative differences but for the common currency variable, which is significantly higher in the pre-2007 sample. The fact that the Euro-area has been at the center stage of the Great Recession and the resulting Euro-crisis after that might be an explanation for this.

Last column corresponds to the last column in Table 1 of Rose (2004) and to regression 2 specified in part IV. First thing to notice is the difference between these estimates of *Bothin* and *Onein* compared to those of Rose (2004). Whereas by controlling for country specific effects the coefficients for those variables became positive in the analysis of Rose, in the current analysis they show an even more pronounced negative value, contrary to what we would expect. In contrast, the *GSP* variable has a positive sign after controlling for country effects. Like WTO membership, distance shows a more pronounced negative value when controlling for country effects. Actually, for all regular gravity variables the coefficients moved downwards compared to the benchmark regression. Notable exceptions to this observation are *number landlocked* and *log product land area*. The estimates of these two variables display curious values, which are very large in comparison to Table 1, column four in Rose (2004)[6]. The coefficient of *number landlocked* implies 100% less trade for every landlocked country in a bilateral country-pair[7], ceteris paribus. Land area shows, contrary to our expectations, a positive value now. Both estimates should be interpreted carefully however, since variables of this kind are usually specified differently in the literature, mostly separate for both countries. In such a specification these variables are omitted when including country fixed effects, for the obvious reason that land area and the state of being landlocked are generally fixed over time.

[6] In which values are -1.54 and 0.38 respectively, both significant at the 1% level.
[7] $e^{-33.723} - 1 \approx -1$, or -100%

TABLE 4: FIXED EFFECTS

	Country-pair fixed effects - Regression 3 -	No high income OECD countries	Pre 2007
Both in WTO	0.194[a]	0.186[a]	0.212[a]
One in WTO	0.020[d]	0.019[d]	0.058[d]
GSP	-0.287[a]	-0.209[a]	-0.147[b]
log product real GDP	0.943[a]	0.859[a]	1.226[a]
log product real GDP p/c	-0.014[d]	-0.093[d]	-0.293[a]
FTA	0.116[a]	0.222[a]	0.142[a]
Common currency	0.125[a]	0.705[d]	0.046[c]
Observations	323,071	171,039	183,153
R^2 - within	0.049	0.054	0.027
R^2 - between	0.578	0.383	0.546

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

Table 4 displays another fixed effects estimation, presented as regression 3 in part IV. This specification introduces cross-section fixed effects, for this particular dataset to be named more properly country-pair fixed effects. All variables that are constructed pairwise or that indicate a pairwise relationship and that are constant over time are thus emitted, for example the variables just mentioned; *number landlocked* and *log product land area*. Estimation results of this specification confirm the sign of the traditional variables shown in the specifications of Table 3. The income variable is close to unity and highly significant. Income per capita in this case is far from significant for the dataset as a whole and for the subset excluding country-pairs with two high income OECD countries. Being in a free trade agreement together improves trade significantly, but the effect appears to be less than indicated by the results of Table 3.

On the contrary, the WTO membership variables show opposite signs compared to the benchmark specification. According to this fixed effects estimation, country-pairs in which both are WTO member trade about twenty percent more than country-pairs in which neither is a WTO member, while the previous specifications indicated WTO membership for both hurt trade for about twelve percent. Same goes for *Onein*, which showed to be negative and highly significant without any fixed effects and with country effects but is now estimated to relate positively to trade, although insignificant. The coefficient of the GSP variable is down on magnitude, but is still negative.

The changes in magnitude and sign of the FTA variable and the WTO variables are in opposite directions comparing the results shown in Table 3 and Table 4. Furthermore, other robustness checks with different specifications also show ambiguous results[8]. This leads me to be suspicious about the WTO and GSP variables. As noted in part IV.a, it is clear that the WTO itself hardly had a role in shaping the world

[8] Regressions 1, 2 and 3 specified with GDP and GDP per capita for both countries included separately, not reported.

economy during the period under consideration. Together with the other remarks from part IV.a in mind the variables *Bothin*, *Onein* and *GSP* will be omitted, and a new benchmark will be set to proceed with in the following section.

b. New benchmark

The results of equations 4, 5 and 6 are shown in Table 5. Omitting the variables just mentioned does not change any conclusions made with regards to the other, traditional gravity model variables under consideration, as shown in the output of regression 4. All signs are as they were, and values are comparable too.

Added to this table is a column with results obtained while using data with high income OECD countries only. This makes for an interesting comparison with the benchmark results and with the 'no high income OECD country-pairs' data. For the benchmark specification, some notable differences catch the eye. Distance and contiguity for example show smaller magnitudes compared to both the first and second columns, implying that distance between trading partners matters less for high income OECD country-pairs, which seems reasonable. Per capita GDP and the use of a common currency are non-significant for this subset. Regarding the latter this may be a bit surprising, since most Euro-countries are classified as high income OECD.

Regression 5 includes country fixed effects, just as regression 2 in the previous section did. Comparing regression 5 results with those of regression 2, we can conclude again that omitting the WTO variables generally does not lead to different results. Only differences are that the coefficient of real GDP per capita is now insignificant, and the coefficient for a common currency, which was and still proves to be insignificant, changed sign.

When we proceed with the next columns, the same trends are recognizable as for the different subsets subject to regression 4 for most variables. Distance has a more negative impact on trade in the data-subset without the richest countries compared to the data-subset containing rich countries only. The benefits of both being in an FTA on the other hand prove to be greater for the first. Sharing a border again benefits rich countries less than it benefits country-pairs without high income OECD countries. Notable exceptions to the trend are the use of a common currency and both income variables. In regression 4, without any fixed effects, the use of a common currency proved to be positive and significant for the data excluding the rich OECD countries. With country fixed effects added however, it is for the rich OECD members that a common currency proves to be significant. The most striking result of regression 5 applied to different subsets of the data is about the income variables, real GDP and real GDP per capita. In the benchmark specification of regression 4, both variables were similar across subsets. When applying country fixed effects however, for the rich countries real GDP turns negative and real per capita GDP turns positive, both highly significant.

TABLE 5: REGRESSIONS 4-6

- Regression 4 – Benchmark; no fixed effects	All	No high income OECD countries	High income OECD countries	Pre 2007
log distance	-1.133[a]	-1.226[a]	-0.879[a]	-1.097[a]
log product real GDP	1.123[a]	1.086[a]	0.931[a]	1.095[a]
log product real GDP p/c	-0.118[a]	-0.202[a]	-0.012[d]	-0.107[a]
FTA	0.864[a]	1.438[a]	0.294[a]	0.892[a]
Common currency	0.257[a]	0.160[a]	0.029[d]	0.268[a]
Common language	0.673[a]	0.499[a]	0.588[a]	0.607[a]
Land border	1.029[a]	1.043[a]	0.464[a]	1.023[a]
Number landlocked	-0.479[a]	-0.650[a]	-0.362[a]	-0.385[a]
log product land area	-0.079[a]	-0.088[a]	-0.027[a]	-0.083[a]
Common colonizer	0.843[a]	0.819[a]	-	0.788[a]
Ever a colony	1.061[a]	0.551[a]	0.265[a]	1.208[a]
Observations	323,071	171,039	15,612	183,153
R^2	0.620	0.490	0.857	0.623
- Regression 5 - Country fixed effects	All	No high income OECD countries	High income OECD countries	Pre 2007
log distance	-1.573[a]	-1.591[a]	-1.091[a]	-1.526[a]
log product real GDP	0.821[a]	0.960[a]	-0.944[a]	1.029[a]
log product real GDP p/c	-0.027[d]	-0.234[a]	2.532[a]	-0.265[a]
FTA	0.483[a]	1.043[a]	0.278[a]	0.460[a]
Common currency	-0.040[d]	0.039[d]	0.074[a]	0.026[d]
Common language	0.563[a]	0.588[a]	0.419[a]	0.563[a]
Land border	0.603[a]	0.720[a]	0.163[a]	0.613[a]
Number landlocked	-29.158[b]	-80.926[a]	-8.031[a]	-41.357[b]
log product land area	2.791[b]	7.714[a]	-4.077[c]	3.810[b]
Common colonizer	0.932[a]	0.837[a]	-	0.854[a]
Ever a colony	1.230[a]	0.645[a]	0.413[a]	1.298[a]
Observations	323,071	171,039	15,612	183,153
R^2	0.718	0.620	0.904	0.720
- Regression 6 - Country-pair fixed effects	All	No high income OECD countries	High income OECD countries	Pre 2007
log distance				
log product real GDP	0.936[a]	0.856[a]	-0.902[a]	1.198[a]
log product real GDP p/c	0.009[d]	-0.071[d]	2.727[a]	-0.232[b]
FTA	0.114[a]	0.216[a]	-0.007[d]	0.149[a]
Common currency	0.119[a]	0.701[d]	0.038[d]	0.034[d]
Common language				
Land border				
Number landlocked				
log product land area				
Common colonizer				
Ever a colony				
Observations	323,071	171,039	15,612	183,153
R^2 - within	0.048	0.053	0.342	0.027
R^2 - between	0.572	0.381	0.127	0.551

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

This observation suggests that trade between rich countries is mainly driven by per capita income, which is associated with intra-industry trade of differentiated products as found in the literature on monopolistic competition (Krugman 1980, Helpman 1987, Bergstrand 1989). More specifically, it possibly is the similarity in factor endowments, for which income per capita is a proxy, of the rich countries that causes the large positive estimate for this variable.

The output of regression 6 in Table 5 corresponds to the output of regression 3 in Table 4. Again we can conclude there are no qualitative differences with respect to the traditional variables between the two specifications. Regarding the estimations of the income and income per capita variables we can conclude they do not differ very much compared to all other regressions for column one, two and three. For high income OECD countries, those estimations look like the ones from regression 5, with the log product of real GDP negative, significant and close to unity, and the log product of real GDP per capita significant and economically very large. Looking at the estimations of the FTA and common currency variables in regression 6 and comparing them to the output of regression 3, we can again conclude that the removal of the WTO variables did not affect the country-pair fixed effects model. Comparing the country-pair fixed effects model to the models of regression 4 and 5 shows striking differences with regards to the magnitude and significance of the FTA and common currency variables. The effect of being in an FTA together is much less according to the country-pair fixed effects model, ranging from no effect for high income OECD countries to 24 percent for data excluding country-pairs from this set of countries, compared to about 34 percent and 320 percent respectively in regression 4. Using a common currency is not significantly different from zero for the different subsets of regression 6, but is significantly different from zero and positive using the total dataset.

c. Robustness checks

To further check the reliability of the estimations represented in Table 5, the regression specification and the dataset is altered a few more times. In Table 6 we see the results of a regression in which the income and income per capita variables are not included in multiplicative form, but for both countries *i* and *j* individually. A specification like this can for example be found in Feenstra et al. (2001) and Wilson et al. (2003). The results for regressions 4a, 5a and 6a shown in Table 6 should be compared to the first and third columns of regressions 4-6 in Table 5. The estimation results of models 4 to 6 seem to be robust to the alteration of the income variables. For the altered benchmark model as well as for both altered fixed effects models, signs and magnitudes are hardly different compared to the initial specifications. Feenstra et al. (2001) provide us with some insights to interpret the findings of *Log real* GDP_x and *log real GDP* p/c_x, which seem to have different effects depending on the country classification. As the authors themselves say: "Nevertheless, alternative theories … predict subtle differences in key parameter values that should emerge in an estimated gravity equation, which can therefore be used to distinguish the theories." Related to the estimates of *log real* GDP_x, they find

evidence of the home-market effect of monopolistic competition for differentiated goods, which tells that the elasticity of trade is larger with respect to the income of the exporter, *i*, than to the income of the importer, *j*. They also find evidence of the opposite case: for homogeneous goods and segmented markets export elasticity is larger with respect to the income of the importer. Regression 4a shows that the trade flow is more dependent on the domestic production of the exporting country. Thus, according to Feenstra et al. (2001), global trade fits the predictions of the monopolistic competition models. The former observation is different when regression 4a is run on high income OECD country-pairs only; the estimate of *log real GDP* of country *j* is larger than that of *log real GDP* of country *i*. Both observations are at odds with the common observation of relatively more intra-industry trade between rich countries compared to the rest of the world, and we would expect the opposite to be true. On the other hand, both fixed effects models indicate that global trade is dependent to a greater extent on the income of the importing country. This corresponds to the evidence in Feenstra et al. (2001), under the assumption that the majority of global trade is in homogeneous necessities instead of differentiated luxury goods. For high income OECD country-pairs trade is mainly driven by income per capita, which is a proxy for capital endowment and is associated with intra-industry trade and heterogeneous tastes of varieties. Although Feenstra et al. (2001) did not include income per capita in their analysis, the estimates in column four of Table 6 might correspond to their conclusions, as the elasticity of exports is larger with respect to *log real GDP p/c*$_i$ than to *log real GDP p/c*$_j$.

TABLE 6: REGRESSIONS 4a-6a

	- Regr. 4a -	- Regr. 4a - High OECD	- Regr. 5a -	- Regr. 5a - High OECD	- Regr. 6a -
log distance	-1.149[a]	-0.880[a]	-1.573[a]	-1.091[a]	
log real GDP$_i$	1.129[a]	0.923[a]	0.299[a]	-1.410[a]	0.461[a]
log real GDP$_j$	0.987[a]	0.938[a]	1.342[a]	-0.394[c]	1.411[a]
log real GDP p/c$_i$	-0.092[a]	0.084[a]	0.265[a]	2.696[a]	0.264[a]
log real GDP p/c$_j$	-0.163[a]	-0.108[a]	-0.323[a]	2.279[a]	-0.251[a]
FTA	0.868[a]	0.294[a]	0.483[a]	0.278[a]	0.115[a]
Common currency	0.253[a]	0.029[d]	-0.041[d]	0.074[b]	0.122[a]
Common language	0.676[a]	0.588[a]	0.563[a]	0.420[a]	
Land border	1.021[a]	0.463[a]	0.603[a]	0.163[a]	
Number landlocked	-0.490[a]	-0.363[a]	-32.975[b]	6.617[b]	
log product land area	-0.081[a]	-0.027[a]	2.809[b]	-4.079[a]	
Common colonizer	0.887[a]	-	0.932[a]	-	
Ever a colony	1.026[a]	0.265[a]	1.229[a]	0.412[a]	
Observations	323,071	15,612	323,071	15,612	323,071
R^2	0.642	0.858	0.719	0.904	

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

Table 7 shows regression results for subsets of the data according to income classification. Because only country-pairs in which both countries belong to the same classification are considered, the number of observations is substantially lower than before. Because of this data restriction, this check for robustness is relatively strong since underlying econometric properties such as normality are less favorable than is

the case for the full dataset. However, the conclusions drawn before remain valid. The fixed effects models were also applied to the different income categories and confirmed the robustness of both specifications[9].

TABLE 7: ACCORDING TO INCOME CLASS

- Regression 4 -	Lower income	Lower middle income	Upper middle income	High income non-OECD
log distance	-0.944[a]	-1.189[a]	-1.255[a]	-1.022[a]
log product real GDP	1.158[a]	0.886[a]	1.120[a]	1.322[a]
log product real GDP p/c	-0.240[a]	0.028[d]	-0.154[a]	-0.307[b]
FTA	0.997[a]	1.906[a]	1.331[a]	1.863[a]
Common currency	0.381[a]	1.121[a]	1.001[a]	-0.270[d]
Common language	0.582[a]	0.220[a]	0.429[a]	1.520[a]
Land border	1.987[a]	0.583[a]	1.066[a]	0.836[a]
Number landlocked	-0.366[a]	-1.135[a]	-0.530[a]	-
log product land area	-0.246[a]	0.050[a]	-0.110[a]	-0.135[a]
Common colonizer	0.328[a]	0.815[a]	2.312[a]	0.876[a]
Ever a colony	-	-0.185[d]	-0.170[d]	2.079[a]
Observations	5,735	12,689	22,193	5,088
R^2	0.414	0.494	0.545	0.578

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

VII. TARIFF AND NON-TARIFF BARRIERS

As described in part IV, regressions 7 to 9 are different model specifications containing variables on barriers to trade. One variable is the natural log of the trade weighted applied tariff rate of the importing country. The three other variables are a normalized score on government performance, port efficiency and hidden import barriers, all three for the importing country as well. For the tariff rate we expect it to have a negative effect on trade, for the other three variables we expect a positive relationship. The set-up of this part is somewhat different than the previous part, because the results vary to a greater extent dependent on the model specification. Each model will be described in isolation, discussion of the results will conclude this part.

a. Model 7

Output for models 7-9 is presented in Table 8. Most of the conventional variables that were also included in models 1-6 show similar values and signs for regression 7, again confirming the robustness of their role in shaping trade. Only the common currency dummy is remarkably lower and now insignificant. The colony variable too shows very different results, with 0.752 and -0.070 in the first two columns of regression 7 against 1.061 and 0.551 in the first two columns of regression 4.

The estimates for the newly added variables are rather unexpected. Tariffs are positive for trade according to this model, and having good ports and the absence of hidden barriers hurts trade, except

[9] Not reported to save space.

for rich countries. The effect of good government behavior on the other hand proves to be positive for trade as expected, but not for rich countries. For these countries the positive relation between the absence of hidden import barriers and good ports is present as expected. In general, the estimates of regression 7 often contradict the hypothesized effect of tariff and non-tariff barriers.

b. Model 8

This again is a model specification including country specific fixed effects. It is directly comparable to model 5, but the country fixed effects are treated differently, since the specification only includes country fixed effects for the exporter for reasons stipulated earlier. Comparing regression 8 to regression 5, there are more pronounced differences recognizable than in the previous paragraph on model 7. *Log distance*, *FTA*, *common language*, *land border* and both colonial variables roughly show similar signs and values compared to model 5 in Table 5. The most striking difference is for the income variables *log product real GDP* and *log product real GDP p/c* for the high income OECD country-pairs only data. Before, without the trade facilitation variables, the model specification with country fixed effects showed *log product real GDP* to be significantly negative, while *log product real GDP p/c* was shown to be significantly positive, and its value a multitude of the former. Now it is in line with the results for the total dataset and the data without high income OECD country-pairs, with the coefficient of income close to unity and income per capita slightly negative. This reverses the notion about intra-industry trade and high income OECD country-pairs from part VI.

The other differences are found for *Number landlocked* and *log product land area*. Earlier it was already mentioned that these variables should be interpreted with caution, as they are usually included as variables defined per country[10], and thus usually will be omitted from a country fixed effects specification. For regression 8, the estimations of these variables show values and signs that make more sense both statistically and economically, and much more in line with existing literature. Both the differences for the income variables and the land variables thus seem to be particularly influenced by the inclusion or exclusion of country fixed effects for the importer.

Tariff, *Government performance*, *Port efficiency* and *Hidden import barriers* show different estimates compared to those of model 7. Overall, the estimates of regression 8 tell us that tariffs significantly impede trade, while good government, indicated by less burdensome and more transparent regulations, and efficient ports enhance trade. Thus, most of the estimates show the expected signs, but there are a few notable exceptions. First, the estimate of *Hidden import barriers* in columns one, two and four indicate that the absence of *Hidden import barriers* has a significant negative effect on trade, contrary to our expectations. Second, the estimates of *Tariff* and *Government performance* for the data consisting

[10] For example as two dummy variables with a value of 1 (0) on country *i* and *j* being landlocked (not landlocked) and as two variables *log land area*$_x$ respectively.

TABLE 8: REGRESSIONS 7-9

- Regression 7 –	All	No high income OECD countries	High income OECD countries	Post 2010
log distance	-1.141[a]	-1.244[a]	-0.950[a]	-1.152[a]
log product real GDP	1.279[a]	1.247[a]	0.950[a]	1.275[a]
log product real GDP p/c	-0.128[a]	-0.231[a]	-0.174[a]	-0.118[a]
FTA	1.014[a]	1.517[a]	0.311[a]	1.036[a]
Common currency	0.031[d]	0.094[d]	-0.024[d]	0.142[b]
Common language	0.730[a]	0.658[a]	0.494[a]	0.718[a]
Land border	1.021[a]	1.051[a]	0.383[a]	1.002[a]
Number landlocked	-0.496[a]	-0.683[a]	-0.206[a]	-0.614[a]
log product land area	-0.087[a]	-0.081[a]	-0.018[b]	-0.089[a]
Common colonizer	0.870[a]	0.793[a]	-	0.792[a]
Ever a colony	0.752[a]	-0.070[d]	0.243[a]	0.720[a]
Tariff	1.147[a]	-0.386[d]	6.698[a]	2.638[a]
Government performance	2.055[a]	3.085[a]	-0.468[a]	1.996[a]
Port efficiency	-0.565[a]	-0.541[a]	0.681[a]	-0.726[a]
Hidden import barriers	-1.798[a]	-1.390[a]	1.264[a]	-1.458[a]
Observations	125,056	64,341	7,322	48,321
R^2	0.650	0.537	0.856	0.650
- Regression 8 - Country fixed effects	All	No high income OECD countries	High income OECD countries	Post 2010
log distance	-1.427[a]	-1.507[a]	-0.990[a]	-1.413[a]
log product real GDP	1.128[a]	1.106[a]	0.903[a]	1.119[a]
log product real GDP p/c	-0.414[a]	-0.429[a]	-0.351[a]	-0.404[a]
FTA	0.477[a]	1.064[a]	0.310[a]	0.503[a]
Common currency	-0.310[a]	0.011[d]	0.083[a]	-0.277[a]
Common language	0.742[a]	0.645[a]	0.516[a]	0.738[a]
Land border	0.809[a]	0.893[a]	0.214[a]	0.859[a]
Number landlocked	-0.646[a]	-0.704[a]	-0.252[a]	-0.713[a]
log product land area	-0.057[a]	-0.063[a]	0.057[a]	-0.039[a]
Common colonizer	0.932[a]	0.797[a]	-	0.934[a]
Ever a colony	0.960[a]	0.222[c]	0.327[a]	0.874[a]
Tariff	-2.252[a]	-1.456[a]	5.667[a]	-2.070[a]
Government performance	0.428[a]	0.176[a]	-0.331[a]	0.406[a]
Port efficiency	1.395[a]	0.814[a]	1.029[a]	1.373[a]
Hidden import barriers	-0.343[a]	-0.392[a]	0.954[a]	-0.271[b]
Observations	125,056	64,341	7,322	48,321
R^2	0.722	0.630	0.891	0.723
- Regression 9 - Country-pair fixed effects	All	No high income OECD countries	High income OECD countries	Post 2010
log product real GDP	0.730[a]	0.562[a]	-0.648[b]	-0.037[d]
log product real GDP p/c	-0.021[d]	0.065[d]	1.922[a]	0.845[b]
FTA	-0.039[d]	0.014[d]	0.071[d]	0.038[d]
Common currency	0.087[c]	0.489[d]	0.071[c]	-
Tariff	0.039[d]	0.021[d]	0.227[d]	0.486[d]
Government performance	0.279[a]	0.321[b]	0.208[c]	0.311[c]
Port efficiency	0.177[a]	-0.054[d]	-0.301[c]	-0.093[d]
Hidden import barriers	-0.004[d]	-0.085[d]	0.206[c]	-0.064[d]
Observations	125,056	64,341	7,322	48,321
R^2 - within	0.013	0.015	0.113	0.003
R^2 - between	0.566	0.396	0.181	0.127

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

of rich OECD countries only show unexpected signs and a rather large value for the former. These estimates are different from the estimates in Wilson et al. (2003). In their paper the variable 'Customs Environment' proves to be positive for trade, as expected. *Hidden import barriers* is very similar to this variable, but proves to be negative for three out of four datasets.

c. Model 9

Analog to models 3 and 6, this model is the full, country-pair fixed effects model. In this way the model is able to produce estimates solely based on variation that occurs over time. The estimates for the traditional gravity variables are comparable to the estimates that are produced by regression 6 applied to the same period[11]. According to these estimates, being in an FTA together cannot be proved to significantly influence trade for the period 2007-2013. This can also be said for using the same currency, in any case not for the conventional one and five percent levels. The coefficients of the income variables mirror those shown in Table 5, with income per capita being a significant driver of trade between the rich OECD countries, but different from the estimates of model 8. When the period is limited to the years 2011-2013, which were chosen because the recession was over by 2010 for the majority of countries, trade is also estimated to be significantly influenced by income per capita. This possibly reflects the downward trends of economic growth, trade and prices of homogeneous commodities in the less developed and developing parts of the world, while these countries fared relatively well during the Great Recession, and the more positive developments in the developed world. However, this cannot be concluded from the analysis.

At first sight, the estimates for *Tariff* and the three trade facilitation variables do not meet the expectations. All coefficients for *Tariff* for example are positive, while some of the estimated coefficients for *Port efficiency* and *Hidden import barriers* show a negative sign. Looking at the significance of those estimates however, most of the unexpected coefficients prove to be insignificant. *Tariff* is extremely insignificant for every dataset under consideration. The same is true for *Hidden import barriers*, for which only the estimate in the column with rich OECD countries-only data, is significant at the 10% level. Coincidentally or not, this is also the only estimate for this variable with an expected positive sign. The estimated coefficients for *Port efficiency* show a very ambiguous picture. While for the total dataset the coefficient is significant and positive as expected, both are negative and insignificant in column 2 and 3, columns that represent data that are exact opposites of each other; this observation contradicts logic. *Government performance* is the only variable that is significant and shows the expected positive sign across the four different sets of data. It should be noted that the inclusion of country-pair fixed effects might interfere with the added variables, as is explained in part IV.b.

[11] Not reported.

d. Robustness checks

Again, the models under consideration need to be checked for the robustness of their results. The estimated effects of the added variables could for example be the result of spurious correlations between them and the original variables, instead of genuine effects on trade between countries. Like in the previous part, the first alteration to be considered is replacing the log product of GDP and GDP per capita with their country specific counterparts, *log* GDP_x and *log* $GDP\ p/c_x$. As noted, this specification corresponds to for example Feenstra et al. (2001) and Wilson et al. (2003). The latter is particularly interesting this time, as the extended models presented in this part are based on their work.

TABLE 9: REGRESSIONS 7a-9a

	- Regr. 7a -	- Regr. 7a - High OECD	- Regr. 8a -	- Regr. 8a - High OECD	- Regr. 9a -
log distance	-1.150[a]	-0.950[a]	-1.429[a]	-0.989[a]	
log real GDP_i	1.359[a]	0.944[a]	0.259[d]	-1.851[a]	0.278[d]
log real GDP_j	1.101[a]	0.965[a]	1.129[a]	0.904[a]	1.285[a]
log real GDP p/c_i	-0.049[a]	-0.041[c]	-0.101[d]	2.020[a]	-0.017[d]
log real GDP p/c_j	-0.410[a]	-0.411[a]	-0.412[a]	-0.347[a]	0.125[d]
FTA	0.878[a]	0.305[a]	0.472[a]	0.315[a]	-0.031[d]
Common currency	-0.106[a]	-0.008[d]	-0.314[a]	0.075[a]	0.088[c]
Common language	0.716[a]	0.497[a]	0.742[a]	0.516[a]	
Land border	1.107[a]	0.379[a]	0.809[a]	0.216[a]	
Number landlocked	-0.479[a]	-0.190[a]	-0.646[a]	-0.254[a]	
log product land area	-0.061[a]	-0.021[a]	-0.057[a]	0.056[a]	
Common colonizer	0.848[a]	-	0.933[a]	-	
Ever a colony	0.772[a]	0.232[a]	0.959[a]	0.327[a]	
Tariff	-2.032[a]	5.275[a]	-2.235[a]	5.644[a]	-0.034[d]
Government perf.	0.427[a]	-0.199[c]	0.430[a]	-0.337[a]	0.147[c]
Port efficiency	1.367[a]	1.062[a]	1.386[a]	1.025[a]	0.086[d]
Hidden import bar.	-0.462[a]	0.964[a]	-0.352[a]	0.963[a]	-0.096[d]
Observations	125,056	7,322	125,056	7,322	125,056
R^2	0.667	0.859	0.722	0.891	

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant

Table 9 shows the results of regressions 7a to 9a. Overall, the estimates of specifications 7a and 8a confirm the signs and significance of the original models. Only regression 7a produces a few conspicuously different estimates compared to regression 7. Whereas *Tariff* and the three facilitation variables showed unexpected estimates for regression 7, the estimates for regression 7a are more in line with the evidence from specifications 8 and 8a, with *Tariff* negative, and *Port efficiency* positive, as expected. The negative effect of *Hidden import barriers* on trade persists across the different models for the total dataset. Only when applied to high income OECD countries the absence of hidden import barriers is estimated to benefit trade between those countries. Although the reasons for this observation can only be guessed at following this analysis, it might be possible that the importance of hidden import barriers is relatively limited compared to other problems inhibiting trade in most of the world. On the other hand, between rich countries with good infrastructure and reliable government the hidden import barriers might be the only barriers to trade left. The output of regression 9a is similar to the output of

regression 9, except that the effect of *Government performance* and *Port efficiency* now is far less significant and smaller.

TABLE 10: ACCORDING TO INCOME CLASS

- Regression 8 - destination country income class	Tariff	Government performance	Port efficiency	Hidden import barriers
Low income	-0.556[d]	1.178[a]	0.087[d]	0.095[d]
Lower middle income	-2.738[a]	0.235[d]	0.026[d]	0.696[a]
Upper middle income	-3.291[a]	1.066[a]	1.938[a]	-1.103[a]
High income non-OECD	-2.369[a]	2.172[a]	0.875[a]	0.004[d]

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant.

Table 10 shows the results of model 8 being applied to trade flows destined for countries in the different income classes. Note that this is different from the robustness checks in the previous part, where only trade between country-pairs from one class was considered. First thing to notice is the fact that all coefficients show the expected sign, except one. For the low income countries *Government performance* seems to be the most important variable influencing trade. *Tariff, Port efficiency* and *Hidden import barriers* are not significantly different from zero for this set of destination countries. For countries classified as lower middle income, tariffs significantly reduce trade in their direction whereas the absence of hidden barriers significantly improve trade. *Government performance* and *Port efficiency* are not significant. The negative effect of tariffs is even more pronounced when upper middle income countries apply them to their imports. An increase of the average applied tariff rate of 1 percent is estimated to reduce trade by over 96 percent for these countries. Improving the quality of government and ports will greatly increase trade, while the estimate of *Hidden import barriers* is negative, the only unexpected estimate in Table 10. The estimates for trade flowing to non-OECD high income countries are as expected, although the effect of perceived hidden barriers is not significantly different from zero.

TABLE 11: ACCORDING TO REGION

- Regression 8 - destination country region	Tariff	Government performance	Port efficiency	Hidden import barriers
East Asia and the Pacific	1.024[d]	-0.417[b]	3.106[a]	1.890[a]
Europe and central Asia	2.646[a]	-0.152[c]	2.118[a]	-1.170[a]
Latin America and the Caribbean	-2.254[a]	0.677[a]	0.690[a]	-0.534[a]
Middle East and North Africa	-1.754[a]	-1.546[a]	3.726[a]	0.413[d]
North America	-12.216[d]	2.566[d]	0.335[d]	0.734[d]
South Asia	-1.121[b]	-1.971[b]	-0.352[d]	2.179[a]
Sub-Saharan Africa	-1.075[b]	0.691[a]	1.009[a]	0.594[a]

Notes: Regressand: log real exports. OLS with year effects, robust standard errors. [a]significant at the 1% level [b]significant at 5% [c]significant at 10%, [d]**not** significant.

Table 11 shows the results of model 8 being applied to trade flows destined for countries in different regions of the world, as classified by the World Bank. The evidence presented in Table 11 is much less convincing compared to Table 10. Only 19 out of 28 coefficients show the expected sign, of which

fourteen significant at the commonly used 5% level. The estimates for *Government performance* prove to be the most ambiguous. Only for trade destined for Latin American countries and countries in sub-Saharan Africa the coefficient is positive and significant as expected, while it is negative and significant for imports of South Asian, East Asian, Pacific, Middle Eastern and North African countries. *Tariff* proves to be negative and significant for trade, except for European and Central Asian countries, where is it positive and significant. Looking back at Table 8, the column with high income OECD countries only also shows a significant and positive coefficient. Recognizing that Europe consists of a lot of high income OECD countries, this might be the explanation of the estimate in Table 10, although the underlying explanation remains unknown. *Port efficiency* proves to be either significantly positive or not significantly different from zero across regions. Finally, *Hidden import barriers* is significantly negative in two regions, significantly positive in 3 regions, and not significantly different from zero in two regions. Its effect remains ambiguous, following the already ambiguous results in Table 8, 9 and 10.

VIII. CONCLUSION

The starting point of this thesis was a paper by Rose (2004), in which an unprecedented amount of data was analyzed to estimate the effect of WTO/GATT membership in a period of fifty years. I set out to replicate this dataset and the analysis with the most recent data, to complement the literature with an exhaustive update. In addition to this 'baseline' analysis, I aimed to contribute to the literature further by combining this extensive dataset with the more recent literature on the role of tariff and non-tariff barriers in global trade. I followed the insights of Wilson et al. (2003) to develop an extended framework with variables on these tariff and non-tariff barriers. A major drawback in Wilson et al. (2003) was that the trade facilitation variables were time-invariant. This thesis successfully improved upon their work by construction similar additional variables which are time-variant, while keeping the dataset as large as possible.

Part VI replicated the analysis of Rose (2004), and again confirmed the robustness of the standard gravity equation. The role of WTO membership and the Generalized System of Preferences could not unambiguously be estimated. Therefore these variables were omitted for the remaining analyses. New benchmark results without those variables were estimated, and proved to be robust against different specifications and datasets. Alongside the main analysis global trade was evaluated against the conclusions of Feenstra et al. (2001) which relate to the different theoretical approaches to the gravity equation. Global trade flows prove to be more sensitive to the income of the importing country, which according to Feenstra et al. (2001) corresponds to trade in homogeneous goods on segmented markets. This seems like a reasonable conclusion for global trade.

Part VII finally introduces the additional variables on tariff and non-tariff barriers. From the model without fixed effects to the model with country-pair fixed effects, the estimates of these additional

variables do not provide us with conclusive evidence of their significance. Half of the time tariffs are estimated to be beneficial for trade, while the absence of other trade barriers consistently proves to hurt trade according to these models. For the other variables the estimates are inconsistent across different specifications too, although the estimates of model 8 and model 8a are comparable to the results of Wilson et al. (2003) to some extent. However, in contrast to Wilson et al. (2003) I deem the results too inconclusive to be used for scenario analysis and forecasting.

It is apparent that much depends on the use of fixed effects and other underlying econometric properties, which were addressed in this thesis only to a certain extent. Follow up research on this work as well as on papers like Wilson et al. (2003) and Lee and Park (2007) should better address the use of different specifications, their econometric properties and the conclusions that follow from these concerns, in order to provide the overall analyses with more specific conclusions.

REFERENCES

Baier, S. L., Bergstrand, J. H., 2007. 'Do free trade agreements actually increase members' international trade?', *Journal of International Economics*, **71**, pp. 72-95.

Deardorff, A. (1998), 'Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?' in J. A. Frankel (Ed.), *The Regionalism of the World Economy* (Chicago: University of Chicago Press), 7-28.

Deardorff, A. V. (2013), 'Trade Implications of the Trans-Pacific Partnership for ASEAN and Other Asian Countries', Gerald R. Ford School of Public Policy, University of Michigan, Discussion Paper No. 638.

Deardorff, A. V. and R. M. Stern (1997), 'Measurement of Non-Tariff Barriers', OECD Economics Department Working Papers, No. 179, OECD Publishing.

Evenett, S. J., Keller, W. (2002), 'On Theories Explaining the Succes of the Gravity Equation', *Journal of Political Economy*, **110**, 2, 281-316.

Feenstra, R. C., Markusen, J. R. and Rose, A. K. (2001) 'Using the Gravity Equation to Differentiate Among Alternative Theories of Trade', *Canadian Journal of Economics*, **34**, 2, 430-447.

Feenstra, R. C. (2003), *Advanced International Trade: Theory and Evidence* (Princeton, NJ: Princeton University Press).

Groot, De, H. L. F., Linders, G., Rietveld, P. and Subramanian, U. (2004), 'The Institutional Determinants of Bilateral Trade Patterns', *Kyklos*, **57**, 1, 103-123.

Grubel, H. G., and Lloyd, P. J. (1975), *Intra-industry Trade: The Theory and Measurement of International Trade in Differentiated Products*. (London: Macmillan).

Head, K., Mayer, T. and Ries, J. (2010), 'The erosion of colonial trade linkages after independence', *Journal of International Economics*, **81**, 1-14.

Krugman, P. (1979), 'Increasing Returns, Monopolistic Competition, and International Trade', *Journal of International Economics*, **9**, 469-479.

Krugman, P. (1980), 'Scale Economies, Product Differentiation, and the Pattern of Trade', *The American Economic Review*, **70**, 5, 950-959.

Lee, H., Park, I. (2005), 'Free Trade Areas in East Asia: Discriminatory or Non-Discriminatory?', *The World Economy*, **28**, 1, 21-48.

Lee, H., Park, I. (2007), 'In Search of Optimised Regional Trade Agreements and Applications to East Asia', *The World Economy*, **30**, 5, 783 – 806.

Micco, A., Clark, X., and Dollar, D. (2002). 'Maritime Transport Costs and Port Efficiency.' World Bank Working Paper Series 2781. (The World Bank).

Rose, A. K. (2004), 'Do We Really Know that the WTO Increases Trade?' *American Economic Review*, **94**, 1, 98–114.

Tinbergen, J. (1962). *Shaping the world economy: Suggestions for an international economic policy* (New York: the Twentieth Century Fund).

UNCTAD (2013). Non-Tariff Measures to Trade: Economic and Policy Issues for Developing Countries (UNCTAD/DITC/TAB/2012/1). New York and Geneva.

Wilson, J. S., Mann, C. L. and Otsuki, T. (2003), 'Trade Facilitation and Economic Development: Measuring the Impact', World Bank Policy Research Paper 2988 (The World Bank).

Wilson, J. S., Mann, C. L. and Otsuki, T. (2005), 'Assessing the Benefits of Trade Facilitation: A Global Perspective', *The World Economy*, **28**, 6, 841–69.

APPENDIX

1. Country lists

Exporting countries (178)			
Afghanistan	Djibouti	Lebanon	Sao Tome and Principe
Albania	Dominica	Liberia	Saudi Arabia
Algeria	Dominican Republic	Libya	Senegal
Angola	Ecuador	Lithuania	Serbia
Argentina	Egypt	Luxembourg	Seychelles
Armenia	El Salvador	Macao	Sierra Leone
Aruba	Equatorial Guinea	Macedonia	Singapore
Australia	Estonia	Madagascar	Slovak Republic
Austria	Ethiopia	Malawi	Slovenia
Azerbaijan	Fiji	Malaysia	Solomon Islands
Bahamas, The	Finland	Maldives	South Africa
Bahrain	France	Mali	South Korea
Bangladesh	Gabon	Malta	Spain
Barbados	Gambia	Mauritania	Sri Lanka
Belarus	Georgia	Mauritius	St. Kitts and Nevis
Belgium	Germany	Mexico	St. Lucia
Belize	Ghana	Moldova	St. Vincent and the
Benin	Greece	Mongolia	Grenadines
Bermuda	Greenland	Morocco	Sudan
Bolivia	Grenada	Mozambique	Suriname
Bosnia and	Guatemala	Myanmar	Sweden
Herzegovina	Guinea	Nepal	Switzerland
Brazil	Guinea-Bissau	Netherlands	Syria
Brunei Darussalam	Guyana	New Caledonia	Tajikistan
Bulgaria	Haiti	New Zealand	Tanzania
Burkina Faso	Honduras	Nicaragua	Thailand
Burundi	Hong Kong	Niger	Togo
Cabo Verde	Hungary	Nigeria	Tonga
Cambodia	Iceland	North Korea	Trinidad and Tobago
Cameroon	India	Norway	Tunisia
Canada	Indonesia	Oman	Turkey
Central African	Iran	Pakistan	Turkmenistan
Republic	Iraq	Panama	Uganda
Chad	Ireland	Papua New Guinea	Ukraine
Chile	Israel	Paraguay	United Arab Emirates
China	Italy	Peru	United Kingdom
Colombia	Jamaica	Philippines	United States
Comoros	Japan	Poland	Uruguay
Congo	Jordan	Portugal	Uzbekistan
Congo DR	Kazakhstan	Qatar	Vanuatu
Costa Rica	Kenya	Romania	Venezuela
Cote d'Ivoire	Kuwait	Russia	Vietnam
Croatia	Kyrgyz Republic	Rwanda	Yemen
Cuba	Lao	Samoa	Zambia
Cyprus	Latvia		Zimbabwe
Czech Republic			
Denmark			

Importing countries (192)			
Afghanistan	Djibouti	Lebanon	Saudi Arabia
Albania	Dominica	Lesotho	Senegal
Algeria	Dominican Republic	Liberia	Serbia
Angola	Ecuador	Libya	Seychelles
Antigua and Barbuda	Egypt	Lithuania	Sierra Leone
Argentina	El Salvador	Luxembourg	Singapore
Armenia	Equatorial Guinea	Macao	Slovak Republic
Aruba	Eritrea	Macedonia	Slovenia
Australia	Estonia	Madagascar	Solomon Islands
Austria	Ethiopia	Malawi	South Africa
Azerbaijan	Fiji	Malaysia	South Korea
Bahamas, The	Finland	Maldives	Spain
Bahrain	France	Mali	Sri Lanka
Bangladesh	French Polynesia	Malta	St. Kitts and Nevis
Barbados	Gabon	Mauritania	St. Lucia
Belarus	Gambia	Mauritius	St. Vincent and the
Belgium	Georgia	Mexico	Grenadines
Belize	Germany	Moldova	Sudan
Benin	Ghana	Mongolia	Suriname
Bermuda	Greece	Morocco	Swaziland
Bhutan	Greenland	Mozambique	Sweden
Bolivia	Grenada	Myanmar	Switzerland
Bosnia and	Guatemala	Namibia	Syria
Herzegovina	Guinea	Nepal	Taiwan
Botswana	Guinea-Bissau	Netherlands	Tajikistan
Brazil	Guyana	New Caledonia	Tanzania
Brunei Darussalam	Haiti	New Zealand	Thailand
Bulgaria	Honduras	Nicaragua	Timor-Leste
Burkina Faso	Hong Kong	Niger	Togo
Burundi	Hungary	Nigeria	Tonga
Cabo Verde	Iceland	North Korea	Trinidad and Tobago
Cambodia	India	Norway	Tunisia
Cameroon	Indonesia	Oman	Turkey
Canada	Iran	Pakistan	Turkmenistan
Central African	Iraq	Palau	Tuvalu
Republic	Ireland	Panama	Uganda
Chad	Israel	Papua New Guinea	Ukraine
Chile	Italy	Paraguay	United Arab Emirates
China	Jamaica	Peru	United Kingdom
Colombia	Japan	Philippines	United States
Comoros	Jordan	Poland	Uruguay
Congo	Kazakhstan	Portugal	Uzbekistan
Congo DR	Kenya	Qatar	Vanuatu
Costa Rica	Kiribati	Romania	Venezuela
Cote d'Ivoire	Kuwait	Russia	Vietnam
Croatia	Kyrgyz Republic	Rwanda	West Bank and Gaza
Cuba	Lao	Samoa	Yemen
Cyprus	Latvia	Sao Tome and Principe	Zambia
Czech Republic			Zimbabwe
Denmark			

2. Survey input trade facilitation variables

"Government performance" for each country *j* the average of two indexes *n*:

a. Burden of government regulation:

"In your country, how burdensome is it for businesses to comply with governmental administrative requirements (e.g., permits, regulations, reporting)? [1 = extremely burdensome; 7 = not burdensome at all]"

b. Transparency of government policymaking

"In your country, how easy is it for businesses to obtain information about changes in government policies and regulations affecting their activities? [1 = extremely difficult; 7 = extremely easy]"

The correlation between the two inputs is 0.908.

"Port efficiency" for each country *j* the average of the two indexes *n*:

a. Quality of port infrastructure

"In your country, how would you assess the quality of seaports? (For landlocked countries: How accessible are seaport facilities?) [1 = extremely underdeveloped—among the worst in the world; 7 = extensive and efficient—among the best in the world]"

b. Quality of air transport infrastructure

"In your country, how would you assess the quality of air transport infrastructure? [1 = extremely underdeveloped—among the worst in the world; 7 = extensive and efficient—among the best in the world]"

The correlation between the two inputs is 0.930.

"Hidden import barriers" for each country *j* the average of the two indexes *n*:

a. Prevalence of trade barriers

"In your country, to what extent do non-tariff barriers (e.g., health and product standards, technical and labeling requirements, etc.) limit the ability of imported goods to compete in the domestic market? [1 = strongly limit; 7 = do not limit at all]"

b. Burden of customs procedures

"In your country, how efficient are the customs procedures (related to the entry and exit of merchandise)? [1 = not efficient at all; 7 = extremely efficient]"

The correlation between the two inputs is 0.916.