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– A Gravity Model Approach

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Abstract

Cuba has since the fall of the Soviet Union been running large trade deficits and its government has urged the Cuban firms to become more export oriented. This thesis aims to examine the Cuban export potential towards its largest export markets in the EU. A gravity model is estimated using panel data for the years 2010 to 2014 containing exports from developing countries towards the 35 OECD members. The results suggest that, overall, there is room for growth in Cuban exports towards the EU. However, the results should be taken into account with caution due to the limitations of the thesis. It could prove difficult for Cuba to reach its full potential in the EU market due to current political situations and trade barriers.

Sammanfattning

Kuba har sedan Sovjetunionens upplösning haft stora handelsunderskott och Kubas regering har uppmanat landets företag att bli mer exportorienterade. Denna kandidatuppsats kommer beräkna Kubas exportpotential till deras största exportmarknader i EU. En gravitationsmodell estimeras med hjälp av paneldata från 2010 till 2014 bestående av exporter från utvecklingsländer till de 35 OECD medlemmarna. Resultaten fastställer att det finns utrymme för Kuba att öka sina exporter till EU. Men på grund av begränsningarna av uppsatsen bör resultaten tolkas med försiktighet. I det nuvarande läget kan det dock vara svårt för Kuba att nå sin fulla potential i EU:s marknad med anledning av politiska relationer och handelshinder.

Abbreviations

CGE	Computable generalised equilibrium
COMECON	Council for Mutual Economic Assistance
EU	European Union
GDP	Gross domestic product
GNI	Gross national income
GSP	Generalised Scheme of Preferences
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
PDCA	Political Dialogue and Cooperation Agreement
UN	United Nations
USD	United States dollar

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1 Introduction

1.1 Background

In the 1980s Cuba's trade was nearly solely with the Soviet Union and the other members of the Council for Mutual Economic Assistance (COMECON), an organization enabling trade arrangements containing socialist countries lead by the Soviet Union (Gonzalez and McCarthy, 2004). Cuba could export its sugar to the Soviet Union in exchange for oil at a favourable rate along with aid in other forms allowing the Cuban socialist government to supply the population with free high quality healthcare and education while reducing its rural poverty. But after the fall of the Soviet Union in 1991 the aid to Cuba diminished and its economy entered a severe state as its GDP dropped by one third. Consequently, Cuba needed to establish new trading partners and develop new exporting goods to get its economy back on track.

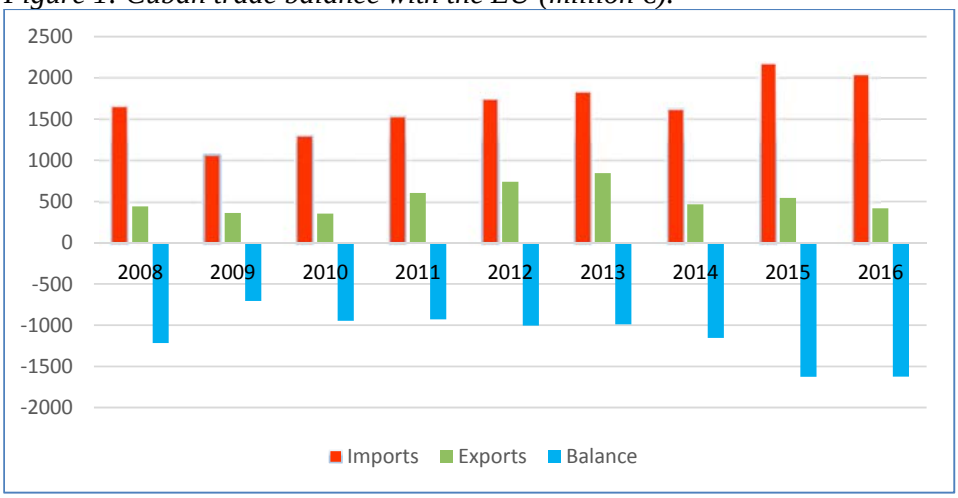
While struggling to do this, Cuba has experienced trade deficits ever since. By 2005 Cuba's value of exports was at 2.3 billion USD while the value of its imports calculated for around 8 billion USD (WITS, 2017). Cuba's imports have been continuing to increase meanwhile its exports even have experienced periods of decrease. This trend raised concerns for the Cuban government and in an official statement their Foreign Trade Minister, Rodrigo Malmierca, urged the Cuban companies to become more export oriented in order for Cuba to improve its balance of trade (Frank, 2009). Cuba has for long been dependent on oil received from Venezuela as payments for the thousands of doctors and other professions that Cuba is sending to work there. The oil Cuba receives is used domestically and is re-exported as a pivotal part of Cuba's export flow, but in recent years the supply of oil from Venezuela has been decreasing (Frank and Parraga, 2017), which partly has been given the blame for Cuba's economic decline in 2016 (LeoGrande, 2016). It is therefore important for Cuba to find ways to increase and diversify its exports without relying on old partners in order to pay for its imports and stimulate growth in the Cuban economy. And being able to maintain a high level of trade is also important for developing countries as it facilitates development through increased investments and improves the competitiveness of the domestic industries which can lead to improvements in quality and labour. Trade can also help with export diversification as it allows the developing country access to new markets and new material, and it improves livelihoods by boosting economic sectors that can offer stable jobs and higher incomes (European Commission, 2012).

By 2015 the EU had established itself as Cuba's main export market and the latest statistics from the UN comtrade database suggest that it accounts for about 32 % of Cuba's exports. Amongst Cuba's top 10 export destinations, in terms of countries, six of them belong to the EU (see appendix I). Cuba's main exporting goods to the EU are mineral fuels, sugar, beverages and tobacco, with its trade balance with the EU seen in figure 1. There was a period between 2009 and 2013 during which Cuba's exports were increasing, followed by a drop in 2014 which was likely due to the reform of the EU's Generalised Scheme of Preferences (GSP), causing Cuba to lose its trade preference in its exports to the EU in January 2014 due to being classified as an upper-middle-income country. Cuba's tobacco exports were specially impacted by this as the custom fees for Cuban tobacco exports to the EU were considerably increased (European External Action Service, 2016).

In December 2016 Cuba signed a Political Dialogue and Cooperation Agreement (PDCA)

with the EU that is set to expand the economic and political relationships between the two parties (European External Action Service, 2016). The aim of the agreement is to generate a more transparent atmosphere between the two that will help the economic operators of both parties and lead to more jobs and trade. Previous EU-Cuban relations were governed by the EU's Common Position which stated that for there to be full cooperation between the two, Cuba would need to make changes regarding human rights and political freedom. The European Union repealed the Common Position before signing the PDCA. They are, however, continuing to urge Cuba to make changes, but it will no longer be a requirement in order to increase the cooperation between the two. Resulting from the agreement, the EU is encouraging Cuba to diversify its exports to the EU and can offer the cooperation needed for Cuban exporters to get the knowledge vital for improving their access to the EU market. Given the new agreement signed there is hope for more trade between Cuba and the EU from which Cuba has a lot to gain if it manages to increase its exports there.

Figure 1: Cuban trade balance with the EU (million €).



Source: Eurostat (2017)

1.2 Purpose and Research Question

Given the background of the problem, the purpose of this thesis is to identify which of the EU markets that should be prioritised by Cuba in its efforts to increase its exports. Export potential will be calculated towards Cuba's 10 largest export destinations within the EU; the Netherlands, Spain, Belgium, Germany, Croatia, Cyprus, Portugal, France, Finland and Italy, whom account for 90 % of Cuba's exports to the EU. This can aid Cuba to increase its exports by focusing on the countries with which it has the largest unused export potential. The following research question is to be answered:

"Is There Potential for Growth in Cuban Exports to the EU?"

Based on Cuba's balance of trade with the EU and the current trade between Cuba and members of the EU, the hypothesis is that there is room for growth in exports. But, some markets are likely to already be fully penetrated due to the already existing large volumes of exports going there relative to the size of the economies. This topic is important as identifying which of its largest partners in the EU that Cuba should focus on increasing its exports towards is fundamental in order for Cuba to gain as much as possible from the newly signed Political Dialogue and Cooperation Agreement.

This thesis will use a gravity model to calculate Cuba's export potential. It will be set up using panel data containing developing countries' exports towards the 35 OECD members during the period 2010-2014 while controlling for factors such as GDPs, distance, and cultural links. Similar research has been done for the case of Cuba's trade potential with the US by removing the current embargo (McPherson and Trumpbull, 2003). Research has also been done to investigate to what extent Cuba's trade is distorted due to its socialist ideology (McPherson and Trumpbull, 2004). However, no estimations of Cuba's export potential to markets within the EU have been done. Understanding which markets one has not fully penetrated is important when trying to increase one's trade, it is therefore of importance to perform research within this area for Cuba as it is looking to increase its exports. With the newly signed PDCA, putting focus on the EU market is justified and the results of the thesis can assist the policy makers to increase Cuba's exports. Since if there is room for growth in Cuban exports to the EU the Cuban policy makers can enable the growth to happen by for example easing up regulations, increasing the availability of credit or help the exporters to gain crucial info regarding the market that will increase their access to it.

1.3 Structure of the Thesis

The thesis is divided up into six main sections. The first one offers an introduction and background to the subject and the problem at hand along with the purpose of the study. In the second section, insight into the theoretical framework of the thesis is given. Central theories, mainly the gravity model, and earlier research within the subject are reviewed. In the third section details of the gravity model specifications used are given and justified followed by a description of the estimation techniques used. The section ends with a discussion of the data and data-sources. In the fourth section, the results are presented together with an interpretation of the gravity model estimations and export potentials. The fifth section discusses the limitations of the thesis and offers suggestions for future research. Section number six is the final section where conclusions regarding the results are drawn and the research question is answered.

2 Theoretical Framework

In this section the theoretical framework of the thesis is presented. Firstly a few of the main trade theories are described and contrasted to the gravity model. This is followed by an in-depth description of the gravity model and its theoretical foundation. The third sub-section reviews previous literature done using the gravity model and how it in some cases has been applied to Cuba.

2.1 Trade Theories

Earlier trade theories were mainly focused around the benefits of trade and the reasons behind trading, amongst them the more influential theories were the theory of absolute advantage by Adam Smith, the Ricardian model and the Heckscher-Ohlin model of trade. The theory of absolute advantage was based around countries specializing in the product that they have absolute advantage in producing and to then trade with countries specializing in other products, allowing for all to gain from engaging in international trade. David Ricardo developed the Ricardian model which explains trade through comparative advantage resulting from differences in technology which enables trade. The Ricardian model was further developed by Heckscher and Ohlin and the new model was called the Heckscher-Ohlin model. In the model, they added capital as another factor of production besides labour, and assumed that the only difference between countries was in the factors of production they had at disposal, unlike the case of technology being the only difference in the Ricardian model. Trade was then explained through countries choosing to export the product which in its production intensively uses the factor of production the country has an abundance of, and imports the good which intensively uses the factor of production it does not have abundantly (Koo and Lynn Kennedy, 2005).

The classical theories above could describe the reasons and benefits of trade but are unable to answer questions regarding the volume of trade between countries. That is, however, something the gravity model is able to do as well as generate trade predictions. The gravity model is based on the assumption that trade can be explained through economic mass and distance, seen as a proxy for transportation costs. It has a substantial explanatory power and empirical robustness (Karlaftis et al. 2010) and has since its introduction been given theoretical foundations (see e.g. Anderson, 1979; Deardorff, 1998; Eaton and Kortum, 2002). A computable generalised equilibrium model (CGE) can be used for trade flow modelling and examining FTAs (Karlaftis et al. 2010). However, CGE models have been criticised for performing poorly and lacking strong econometric foundations (Hertel et al. 2007), therefore, the gravity model is the choice of method for this thesis and is described in the following sub-section.

2.2 The Gravity Model

The trade gravity model was first formulated by Jan Tinbergen (1962). It is based on Sir Isaac Newton's law of universal gravitation explaining how the pull between two objects is proportional to the product of the objects' masses and inversely proportional to the squared distance between them. The foundational trade gravity equation can be seen in equation (1) where the trade between two entities is a function of their economic masses and the geographical distance between them.

$$F_{ij} = G \frac{Mi^{\beta 1} Mj^{\beta 2}}{D_{ij}^{\beta 3}} \quad (1)$$

Where F_{ij} is Total flow of trade from origin i to destination j
G is a constant term
M_i and M_j represents the economic masses of the two entities.
D_{ij} is the distance between i and j.
β_1, β_2, and β_3 are parameters to be estimated.

The original gravity model consists of three fundamental determinants for trade. The economic mass variables for the exporting and importing countries are commonly measured in GDP and capture the export supply and import demand respectively. The third fundamental determinant consists of transportation costs which are proxied through the distance variable, whereas the transportation cost is assumed to increase as the distance between the two entities increases. A large distance between countries means not only higher costs in terms of fuel but also imposes restrictions of what can effectively be transported, as perishable goods' chances of reaching the destination in an intact form decreases with time. Some of the problems discussed by Cheng and Wall (2005) that come up when using the distance variable are the assumption of transportation costs being the same overland as over sea and which cities to choose to measure the distance between, should it be the capitals or perhaps the ones with the largest populations. The distance variable has in later applications of the gravity model been complemented by, for example, common language, shared border and colonial link variables.

The gravity model was, at first, just seen as a description of an empirically proven relationship, lacking theoretical ground; however, the gravity model's ability to explain bilateral trade flow gave rise to numerous studies aiming to use economic theory to explain the gravity model. Amongst the first to have a significant impact in this field was Anderson (1979) whom later was followed by the likes of Deardorff (1998). Anderson's theoretical explanation for the model resorts to the properties of expenditure systems while assuming that the consumers' preferences are homothetic across the countries; this together with products getting differentiated by region of origination suggests that a country would consume a positive amount of goods from each country. While all countries trade and all goods are traded the total demand for a country's product results in the national income. A share of the total expenditure is then spent in different proportions on other countries' goods, suggesting that larger countries trade more than small ones. Meanwhile Deardorff (1998) provided evidence that the gravity model could be developed from two scenarios in the Heckscher-Ohlin theory. The first one is without trade barriers in which trade with a foreign producer costs the same as a domestic one. Consumers are then indifferent about where they purchase homogenous products, if markets are then allowed to be randomly settled the trade flows will fall into a frictionless gravity model structure. The other case of the Heckscher-Ohlin theory is one with trade barriers.

2.3 Literature Review

Since the introduction of the gravity model, it has been applied in several different areas within international trade. Some of the applications are: to find determinants of bilateral trade (see for example, Liu et al. 2010; Martinez-Zarzoso and Nowak-Lehmann, 2003), to analyse the effect of regional trade agreements (see for example Egger, 2004; Soloaga and Winters, 2001) and, as in this thesis, predict trade flows (see Brulhart and Kelly, 1999; Montanari, 2004; Nilsson, 2000).

There have been two different approaches to calculate trade potential using the gravity model, the so called in-sample-method and the out-of-sample one. To use the out-of-sample approach, one develops a gravity model containing trade between market economies while excluding the trade flows of interest. The parameters of the gravity model are then used to project the natural trade relations between the countries of interest. The difference between the predicted and actual trade between the two countries is considered the unexhausted trade potential (see Brulhart and Kelly, 1999; Hamilton and Winters, 1992). On the other hand, the in-sample-method includes the countries of interest in the gravity model. The difference between the predicted and observed trade is then interpreted as the difference between the potential and actual bilateral trade relations, this approach has been used by e.g. Nilsson (2000) and Montanari (2005).

Montanari (2005) used it to examine the development in trade between the EU and the Balkan countries following the fall of the Iron Curtain by estimating the potential for trade growth between them. His gravity model was estimated using ordinary least squares (OLS) on trade observations between all the EU, OECD and Balkan countries. The trade potential was calculated using the following equation:

$$TRADEPOT_i = \frac{FITTRADE_i}{ACTTRADE_i} \quad (2)$$

Where $FITTRADE_i$ is the fitted trade flow resulting from the gravity model, $ACTTRADE_i$ is the real trade flow between the two countries and $TRADEPOT_i$ is the trade potential between them. A value above one indicates that there is room for growth. Whereas a value less than one implies that one has already fully penetrated the market and should not expect any immediate growth, but neither should one expect a decrease in trade as it just implies that the trade flow is above the norm. A value close to one indicates that the predicted trade is close to the actual trade. Montanari's results suggested that there was a large potential for trade growth between the western Balkan countries and the EU. However, for Bulgaria and Romania the gravity model suggested that their trade with the EU was close to, or exceeded what should be expected. The situation the eastern European countries were put in after the fall of the Soviet Union was similar to Cuba's, analysing papers looking at their trade is therefore useful when making decisions regarding method and model specifications.

Brulhart and Kelly (1999) investigated the impact the potential accession of several Central and Eastern European countries into the EU would have on Ireland. They calculated the trade potential between Ireland and these countries, in particular Czech Republic, Estonia, Hungary, Poland and Slovenia, using a gravity model set up to estimate the "normal" volume of trade between Ireland and these countries. Brulhart and Kelly estimated their gravity model based on cross section trade data from 1994 between thirteen members of the OECD and eleven countries considered to be outward oriented developing countries. By having these model specifications, they avoided yielding results based on trade between exclusively industrialized countries. They highlighted that this is an important distinction as for industrialized countries the cost of trade relative to distance could be lower due to the quality of infrastructure. There could also be differences in the determinants of trade compared to a gravity model set up solely between rich industrialized countries. Their results showed that the Irish exports to the targeted countries in 1994 were near the "normal" level, where both countries acted market-oriented, but that Ireland's imports were less than half of the estimated normal value. Their gravity model predicted that if these countries also were to join the EU this value would increase further and the estimations suggest a 70% boost in trade compared to the situation in 1994.

McPherson and Trumpbull (2004) examined the trade distortion of Cuba caused by the socialist ruling of its economy. Their objective was to calculate Cuba's trade potential towards its partners and see how it changes as Cuba frees up its economic system. They used an in-sample method to calculate the trade potential as they included the trade between Cuba and its partners in their gravity model, where the residuals are then interpreted as the difference between potential and actual bilateral trade. A variable based on each country's level of economic freedom called the Heritage Foundation's Index of Economic Freedom was included in their gravity model. By adjusting this variable for Cuba, making it have a freer economic system, while keeping everything else constant they could see how its trade potential adjusted based on this variable. From their results they could conclude that, over the period observed, Cuba has significant export potential towards capitalist countries and is trading too much with its socialist partners. By changing the freedom variable for Cuba they could see that this distortion increases, even more potential towards capitalist countries and even more excess trade with socialist countries as the economic system gets freer.

In another paper, McPherson and Trumpbull (2003) attempted to assess the effect on Cuba's trade of removing the US-Cuba embargo. They explored different estimation techniques to find the one best fitting their data to calculate Cuba's trade potential towards the US in a scenario without the embargo. They made out-of-sample gravity model estimations using OLS, fixed effects, random effects, and the Hausman-Taylor method. The percentage of Cuba's total trade that was estimated to occur with the US was then compared to the percentages from 1958, before the embargo, as well as the percentage for other similar countries to Cuba in order to analyse which estimation technique was the best. Their results suggested that the Hausman-Taylor method was best as the estimation using that technique was closest to the trade percentage numbers of Cuba in 1958 and to the current numbers of the Dominican Republic, the most similar country in the region. While assuming that 50 % of Cuba's trade with other countries would be replaced by trade with the US, their estimations suggest that Cuba would get 61 % of its imports from the US and send 82 % of its exports there. The existence of the US-Cuba embargo has a large impact on Cuba's trade and if it was to be removed it would cause a change in Cuba's trading pattern which would also affect its trade with the EU; however, this aspect is not covered in this thesis.

Egger (2002) aims to give understanding in the importance of having the right estimation technique when wanting to employ in-sample trade predictions using a gravity model. While calculating the export potentials of the EU members towards 10 central and eastern European countries he highlights three main issues related to in-sample trade predictions. Firstly, he argues that the standard time-averaged cross-section gravity models have a tendency to be misspecified due to not considering the aspect of exporter and importer effects. Secondly, he suggests caution when comparing estimation results of different econometric concepts, in particular the models which estimate short-run parameters to those generating parameters reflecting the long-run. Lastly, he argues that any major systematic difference in observed and projected trade values generated from an in-sample gravity model is the cause of a misspecification of the model rather than a situation in which there is unexhausted, or overused, trade potential.

3 Method

The method section starts by describing the gravity model and the variables specified for this thesis along with their expected signs. This is followed by a description of the three estimation techniques used to estimate the gravity model, the pooled OLS, fixed effect and random effect. Lastly, an explanation of the data selection is given along with the data-sources.

3.1 Gravity Model Specifications and Variables

In order for the gravity model to be easily estimated, one can take the natural logs of equation (1) and end up with a linear relationship between log trade flows and the other logged variables as shown below.

$$\ln F_{ij} = \beta_0 + \beta_1(\ln M_i) + \beta_2(\ln M_j) - \beta_3(\ln D_{ij}) + \varepsilon \quad (3)$$

For which ε is a normally distributed error term with E(ε) = 0. In this thesis, an augmentation of equation 3 will be used where a panel framework is used to set up a gravity model containing the exports of developing countries classified as upper-middle-income countries towards the 35 OECD countries for the period 2010-2014. The gravity model of this thesis along with its variables is shown in equation 4.

$$\ln F_{ijt} = \beta_0 + \beta_1(\ln M_{it}) + \beta_2(\ln M_{jt}) - \beta_3(\ln D_{ij}) - \beta_4(LL_{ij}) + \beta_5(Border_{ij}) + \beta_6(ComLang_{ij}) + \beta_7(Colony_{ij}) + \varepsilon \quad (4)$$

Where
i = 1,2, …, 24 (developing upper-middle-income countries)
j = 1,2, …, 35 (OECD countries)
t = 2010, 2011, …, 2014.

$\boldsymbol{F_{ijt}}$**:** Total value of exports from origin i to destination j in period t.
$\boldsymbol{\beta_0}$: A constant term.

$\boldsymbol{M_i}$and $\boldsymbol{M_j}$**:** GDPs of country i and j in period t. Represent the income of the two countries and was included in the original trade gravity model by Tinbergen (1962), whereas countries with higher income are expected to trade more and those with less income to trade less. Expected sign: positive

$\boldsymbol{D_{ij}}$**:** is the distance between i and j measured in kilometres and is one of the fundamental variables that was included in the original equation by Tinbergen (1962). Due to the problem associated with this variable discussed in section 2.2 a weighted distance term is used. Instead of for example simply measuring the distance between the two capitals, the distance between the biggest cities of the two countries is calculated. Whereas the distances between the cities are weighted depending on the share of the population in the city with respect to the country's total population, the following formula was used (Mayer and Zignago, 2011):

$$D_{ij} = \left(\sum_{k \in i} (pop_k / pop_i) \sum_{l \in j} (pop_l / pop_j)\, d_{kl}^{\theta} \right)^{1/\theta} \quad (5)$$

In which pop_k and pop_l are the populations of the different cities in countries i and j respectively, and the parameter θ is set to 1. The distance variable is a proxy for transportation costs and is expected to have a negative impact on trade.
Expected sign: negative.

$\boldsymbol{LL_{ij}}$**:** A dummy variable indicating if a country is landlocked and has no direct access to open sea. It complements the distance variable as transportation costs are generally higher for landlocked countries and should therefore have a negative impact on trade and has been adopted by for example Batra (2006) to find India's trade potential. It takes a value of one if a country is landlocked, and zero if it is not.
Expected sign: negative.

$\boldsymbol{Border_{ij}}$**:** A common border dummy variable identifying countries that are adjacent to each other. It is included as countries adjacent to each other tend to be engaged in more trade with one another than what is expected simply by the distance and economic mass terms, this is due to a tendency of large amounts of border trade to be ongoing. The variable has been used in similar papers such as Brulhart and Kelly (1999). Value is set to one for country-pairs sharing borders and zero for country-pairs who does not.
Expected sign: positive.

$\boldsymbol{ComLang_{ij}}$**:** A dummy variable indicating when a country-pair share an official language. Sharing a language helps facilitate and potentially speed up trade negotiations and is expected to lower transaction costs, hence to have a positive effect on trade. The variable is commonly used in gravity models and have been found to have a significant impact on trade between developing and developed countries by Brulhart and Kelly (1999). Value set to one when sharing language, zero when not.
Expected sign: positive.

$\boldsymbol{Colony_{ij}}$**:** A dummy variable identifying countries that have a colonial link. The definition used for colonial link is a relationship where one country has governed over the other for a long time period and has had an impact on the state of the country's institutions (Mayer and Zignago, 2011). This can result in similarities in culture and legal systems, both which can reduce transaction costs. A colonial link is therefore expected to reduce transaction costs and aid trade and has been used in a gravity model context by e.g. Melitz (2007).
Expected value: positive

3.2 Estimation Technique

Due to the importance of having a as good as possible estimation technique for one's data, as stressed by Egger (2002), this thesis will run estimations using several different methods and use tests to determine which one is most adequate for the data at hand. Earlier gravity model studies mostly utilized standard cross-sectional or pooled-cross-sectional OLS models for the estimations, but recent studies have come to show that these methods tend to give biased results due to not controlling for heterogeneous trading relationships (see Cheng and Wall, 2005). In the presence of heterogeneity, a country would trade different amounts with two countries that otherwise are equally far away from the trading partner and have the same GDP. The difference in trade could emerge from different political relationships with the trading partner or geographical factors that differ between the otherwise identical countries. If the gravity model is unable to control for these variables and they are correlated with any of the variables included in the gravity model it will give biased results. Following these

findings, it has become more common to introduce fixed effects into the model.

Since panel data is used there are several different estimation techniques available, the ones considered in this thesis are pooled OLS, fixed effect and random effect estimations. The pooled OLS estimation has the following equation:

$$Y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \cdots + \beta_k X_{k_{it}} + \varepsilon_{it} \quad (6)$$

Where Y_{it} is the dependent variable, $X_{1_{it}}$ is an independent variable, and β_1 a parameter to be estimated. The pooled OLS technique ignores the unit and time dimensions of the data set and treats each observation as a unique cross-sectional observation and runs the regression using the ordinary least squared method. This method imposes the restriction that the intercept β_0 is common to all units and over time. The pooled OLS model does not account for individual fixed effects and can therefore, as discussed above, result in biased results. This can be avoided by running a fixed effect model which has the following equation:

$$Y_{it} = \alpha_i + \beta_1 X_{1_{it}} + \cdots + \beta_k X_{k_{it}} + \varepsilon_{it} \quad (7)$$

Unlike the pooled OLS, the fixed effect model allows for the intercept to vary between the units, which in the framework of this thesis are the country-pairs. In equation 7 $\alpha_1, \ldots, \alpha_n$ are the unit specific intercepts to be estimated. The slope coefficients β_k are, like the pooled estimation, assumed to be the same for all units. The intercept α_i can understood as the effect of being unit i, hence the term unit fixed effects (Stock and Watson, 2015). The variation in the unit intercepts then comes from time-invariant variables that vary across the units. The intercepts are allowed to vary by introducing n-1 unit dummies where n is the total amount of units. However, these model specifications imply that the effect of time-invariant variables such as distance, common language and colonial links cannot be estimated as they will be soaked up by the individual intercepts, these variables can however be considered important for analytical purposes. This problem can be avoided by instead using a random effect model, or, as suggested by Cheng and Wall (2005), running a second regression after having done the initial fixed effect regression. As the intercepts in the fixed effect model will include all observable and unobservable variables that are unit-specific and time-invariant one can indirectly find the effect of these variables by running the second regression on the unit intercepts.

$$\alpha_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon \quad (8)$$

Where α_i are the unit specific intercepts, and X_1 and X_2 are time-invariant variables.

The fixed effect model assumes that the individual effect is correlated with the independent variables. Unlike the fixed effect model, the random effect model assumes them to be uncorrelated. The random effect model can estimate the time-invariant variables that data has been gathered for as well as the other variables that could be estimated in the fixed effect model. If the assumption in the random effect model holds, the results from it are more efficient than the fixed effect model; however, if it does not hold then the estimations from the random effect model are inconsistent.

To determine which of the fixed and random effect models are best suited for the data at hand, the Hausman test will be used. In the Hausman test, the null hypothesis is that both the fixed and random effect model gives consistent results but the random effect model's results are more efficient. The alternative hypothesis is that the random effects yields inconsistent results

and the fixed effect model is to be preferred. To see the necessity of running a fixed effect regression versus the pooled OLS the F test will also be carried out. The null hypothesis of the F test is that all the intercepts in the fixed effect model are the same, hence no need to run a fixed effect model over the pooled OLS one. Rejecting the null hypothesis means that one needs to take into account individual heterogeneity by running the fixed effect model.

To calculate the export potential of Cuba, the same method as conducted by Montanari (2005) will be applied (equation 2). The fitted export value is attained from the estimated gravity model by inserting data to the variables for the two countries in focus. The ratio between the fitted and actual export value is then calculated. As the fixed effect model results are used to find the fitted values of exports, the individual constants will be used. The coefficients for the variables distance, landlocked, common border, common language and colonial links will therefore not be used as the effect of these variables are already controlled for in the individual constant along with all other observable and unobservable time-invariant variables that differs between the country-pairs. Meaning that for the fixed effect model, the predicted exports are based on the individual constant and the GDP coefficients. But, as Croatia and Cyprus are not included in the regression, no constants for them with Cuba have been estimated. Instead, the constants of Italy and Greece with Cuba will be used for Croatia and Cyprus respectively. These countries were chosen as there exists economic and geographical similarities between them and Croatia and Cyprus. However, this greatly lowers the credibility of the export potential towards these countries.

3.3 Data and Data-sources

The countries chosen as exporting countries are countries that are classified as developing according to the UN, and belongs to the upper-middle-income group. The classification to be in the upper-middle-income group is to have a GNI per capita between $4 036 and $12 475, as calculated by the world bank atlas method (World Bank, 2017). The reason why these requirements were made on the exporting countries is because Cuba belongs to both groups and the gravity model should be built up on exporting countries in a similar economic situation in order to give a fair estimation of the export potential towards the EU. The importing markets in the gravity model are the 35 OECD countries and have been chosen because their membership in the OECD suggests that they have reached a high level of development that is comparable to most countries in the European Union. As pointed out by Brulhart and Kelly (1999), this kind of model specification allows the gravity model to avoid yielding results based on trade exclusively between highly industrialized and developed countries. However, the inclusion of developing countries could also raise a problem in the sense that their trading patterns are unpredictable due to policy distortion. A decision was made not to include the UK in the results as they in the current situation are negotiating their withdrawal from the EU. And due to the time it takes to improve trading relations and increase trade, including the UK in the calculation did not seem justified as the results would not prove helpful to increase Cuba's exports to the EU, as by the time Cuba could increase its exports, the UK are likely to have left the EU, given the current situation.

The selected time period used in the regression is 2010-2014. Data on exports are gathered from the comtrade database (www.comtrade.un.org), data on GDPs have been taken from the World Bank's World Development Index (www.data.worldbank.org). Distance between countries have been gathered from CEPII's database (www.cepii.fr), along with information regarding the dummy variables landlocked, common language and colonial links. In order to avoid inconsistencies in the data each variable has been collected from a single source.

4 Results

In this section the gravity model results for the different estimation techniques are presented and justification is given for which technique was most suitable for the data at hand along with a brief discussion and interpretation of the gravity model estimates. The second sub-section explains the results of the export potential and its implications.

4.1 Gravity Model Estimations

In table 1 the estimation results on exports from developing countries towards the OECD countries are given. White's test was used to test the regression for heteroscedasticity, when the variance of the error term changes across observations, which can cause OLS to not be the best linear unbiased estimator anymore. The test has a null hypothesis that heteroscedasticity is not present, and an alternative hypothesis that it is present. The test has a p-value lower than 0.05 and the null hypothesis is therefore rejected in favour of the alternative hypothesis, suggesting that the OLS assumption regarding homoscedasticity has been violated. Following these results, the estimations were done using robust standard errors. To further analyse the validity of the model, a variance inflation factor test (VIF) was ran. It checks for multicollinearity amongst the variables. In the presence of imperfect multicollinearity (two independent variables are highly correlated) at least one of the variables will be imprecisely estimated (Stock and Watson, 2015). A value larger than 10 in the VIF test would indicate a collinearity problem but all the variables showed good results (for details see Appendix III, table 6). Summary statistics for the variables used in the regression are also presented in Appendix III, table 5.

The F test had a p-value lower than 0.05, evidently the null hypothesis is rejected, indicating that a pooled OLS model is not the optimal choice as individual heterogeneity needs to be controlled for. The Hausman test was carried out and had a p-value of 8.40843e-011, as it is less than 0.05 it indicates that the null hypothesis is rejected in favour of the alternative hypothesis, suggesting that the random effect model gave inconsistent results and the fixed effect model is preferred. Given these results, the main analysis will be done on the fixed effect model results. All the variables in table 1 have the expected signs, however some coefficients are insignificant or only significant at the 5 % level. The variables selected are proven to have a high capacity of explaining the variation in exports. According to the adjusted R^2 value the pooled OLS gravity model is able to explain 68 % of variations in export flow. Meanwhile the fixed effect model can explain 96 % of it.

Table 1. Gravity Model Results.

Dependent Variable: Natural Log of exports in USD (LnExport_US$)

Model	Pooled OLS	Fixed Effect	Random Effect
Variables			
LnGDPi	1.364 ***	0.518**	1.310 ***
LnGDPj	1.239 ***	0.705 **	1.222 ***
LnDistij	−0.548 ***	−0.311 ***	−0.518 ***
LandLocked	−1.090 ***	−1.916 ***	−1.235 ***
CommonBorder	1.732 ***	2.537 ***	1.864
CommonLang.	1.077 ***	0.320 **	1.041 ***
ColonialLink	0.752 *	1.595 ***	0.828 *
Adjusted R^2	0.679	0.958	-
Number of observations:	3724	3724	3724
F Test		0.000	
Hausman Test			8.40843e-011

*****, ** and * represent statistical significance, as suggested by the p-value, at the 1, 5 and 10 percent level, respectively.**

The determinants of exports from developing countries towards the developed countries are according to the estimated gravity model: economic size, distance, common languages, colonial links, shared borders, and whether a country is landlocked. Economic size has a positive and strong impact on exports between two countries, as larger economies can produce more goods and more differentiated goods for exports and the importing country can demand more imports as its income increases. The economic size coefficients indicate that as the GDP of the developing country grows by 1 %, its exports increase by 0.52 % towards the developed country. Similarly, as the target country increases its GDP by 1 %, the exports from developing countries there will increase by 0.7 %. The distance between the countries has, as expected, a negative impact on exports. As suggested by the dummy variables, in the case of the two countries sharing a common language the exports are expected to be 32 % higher than if they did not, and 160 % in the case of a colonial link.

4.2 Export Potential

The ratios between the predicted trade and actual trade resulting from the gravity model are seen in table 2. On the aggregate level, there is room for roughly a 6 % increase in Cuban exports to its top 10 export partners in the EU. However, at the country level one can see that there is plenty of unexploited export potential towards for example Italy, which the gravity model suggests should be on the receiving end of roughly 117 % more exports from Cuba. On the other hand, in the case of Portugal the predicted volume of exports is 19 % lower than the actual one.

The general trend seems to be that there exists unused export potential towards the larger economies such as Germany, Spain, Netherlands, France and Italy. Meanwhile, the smaller economies, Croatia, Cyprus and Finland, have already been over penetrated by Cuba and are the markets where one would expect the least growth to come from, if any at all. However, it is important to highlight, as explained earlier, that a decline in exports to these markets should not be expected either as the values merely indicate that the exports to these markets are above the norm and Cuba is exploiting its export potential there as defined by the model. The value for Belgium is close to one so the level of Cuban exports going there is near its full potential although there is room for marginal growth.

Table 2. Cuba's Export Potential.

Country	**Fixed Effect**
Netherlands	1.210
Spain	1.399
Belgium	1.093
Germany	1.393
Croatia	0.093
Cyprus	0.031
Portugal	0.812
France	1.324
Finland	0.070
Italy	2.176
Aggregate for top 10	1.063

5 Discussion

The fifth section offers a discussion of the results obtained in the previous section. Followed by a discussion of the limitations of the thesis and suggestions for future research within the subject.

5.1 Result Discussion

The magnitudes of the coefficients in the pooled OLS and random effect models are different to the fixed effect one. The differences are likely to have resulted from not controlling for individual heterogeneity in the pooled estimation, yielding biased results and the random effect model giving inconsistent estimates due to the correlation of the individual effects and the independent variables, as suggested by the tests ran. The gravity model coefficients are consistent with Brulhart and Kelly (1999), whom used a similar gravity model set up between developing and developed countries and found the GDP coefficients to be around 0.7, distance at -0.37, common language at 0.7 and common border 1.42. The high explanatory power of the fixed effect model is consistent with other empirical works within the field (see e.g. Jakab et al. 2001).

As discussed in section 3.2, the replacements of the individual constants for Croatia and Cyprus greatly lowers the accuracy and credibility of the export potential to these markets. However, it does not have a significant impact on the main results as it is clear that Cuba has over penetrated these markets, which has been re-affirmed by the export potential of the Pooled OLS and random effect models (see appendix IV for details), and knowing exactly by how much is not necessary to fulfil the purpose of the thesis.

When it comes to the export potential, one reason for Cuba having over penetrated the Portuguese market could be due to Portugal being the nearest market within the EU for Cuba, which together with its large ports for cargo makes it an attractive trading partner, resulting in Cuban exports to Portugal being larger than the norm. Regarding the overtrading situation with Croatia, it could be the result of cultural ties from when Croatia belonged to Yugoslavia in the eastern bloc. If, in fact, the over penetration of the Croatian market is a result of its socialist past, then these results would coincide with the findings of McPherson and Trumpbull (2004), who found that Cuba has over penetrated the markets of socialist countries whilst having trade potential mostly with capitalist countries. In the case of Cyprus, while it has no clear ties to socialism the unusually large imports from Cuba can be explained by its large demand for tobacco products. In fact, 98 % of Cuba's exports to Cyprus are classified by the harmonized system as tobacco and manufactured tobacco substitutes (Comtrade, 2017). Amongst the EU members, Cyprus has the highest proportion of smokers in its population aged 15 and over, and was in 2014 15 % above the EU average which was 22 % (Eurostat Statistics Explained, 2017), which goes to show for its large demand of tobacco products.

The under penetration of the Spanish market might come as a surprise given the close cultural link between the two countries. However, in 2015 a deal to refinance Cuba's short-term debt was reached between the two parties along with the signing of numerous agreements regarding cooperation between the two in terms of economic and industrial policies. Spanish companies are now set to expand investment and trade with the island (Scanlan, 2015). There is therefore hope that the new agreements made can revitalize their trading relationship and help the Cuban exports to reach their potential in the Spanish market.

The unused export potential towards countries such as the Netherlands, Germany, France and Italy is a potential result from the pressure the US put on its NATO allies to cut their ties to Cuba during the Cold War. While the EU started strengthening its relations with Cuba during the 1990s, it is possible that it has not yet reached a level that is comparable to other developing countries. As the US-Cuban relations improved during the Obama administration, there is hope that the EU-Cuban relations will accelerate, which the newly signed PDCA is a testimony of. However, in the current situation, Cuba might have problems reaching its full potential to several of the markets due to existing trade barriers, for example the tariff-rate quotas on its sugar exports to the EU which is Cuba's largest exporting good. Meanwhile, the EU has granted duty and quota-free access, to the sugar market, for the world's least developed countries (LDC) and ACP (African, Caribbean and Pacific) countries that were former members of the Sugar Protocol, which Cuba was not. The EU is also importing sugar through Free Trade Agreements, with e.g. Colombia, Panama, and Central America, where the parties do not get full access to the EU market but are given a zero-duty tariff-rate quota (SugarCane, 2017). Another large export good that might be facing problems expanding in the EU is Cuba's tobacco products as the reform of the EU's GSP meant a considerable increase of the custom fees for those goods since 2014 (European External Action Service, 2016).

5.2 Limitations of the Study

While the gravity model and the export potential both showed rather expected and significant results, there are still some issues and limitations one should keep in mind with this thesis and the results should be interpreted with caution. The limitations to be discussed are the problem of zero trade values, the United States' embargo on Cuba, and the arguable socialist trading patterns of Cuba.

In the regression, the observations with zero trade values have been removed as they in the log specification becomes undefined which essentially makes the data set truncated and could cause bias in the results. An estimation technique such as a Tobit model could correct for this and therefore be advantageous.

In 1958, before the US-Cuba embargo, Cuba did roughly 70 % of its trade with the US (McPherson and Trumpbull, 2003). Assuming a similar amount a few years after the potential removal of the embargo, or even a slightly lower number due to today's globalization, the US are set to, once again, become Cuba's largest trading partner. This is bound to have a large impact on Cuba's trade with its other major trading partners such as the EU. However, how Cuba's trading patterns and potential would adjust after a possible removal of the embargo is not covered in the thesis but should be kept in mind.

The inclusion of Cuba in the regression is another potential limitation as its trading patterns could be argued to be an outlier in the sense that it does not fully follow the traditional patterns of market economies. Cuba has, due to the socialist governing of its economy, a history of importing what it is unable to be self-sufficiently supply and export in order to pay for the imports. However, in more recent years reforms have been made by the Cuban government to move more towards a market economy. The main reason for why Cuba has been included is due to it allowing for a more accurate export potential calculation using a fixed effect model.

5.3 Future Research

While it is important for Cuba to increase its exports, and this thesis having limitations and weaknesses in the methodology, more research with similar purpose to this thesis is encouraged. Adjustments in the model specification, estimation techniques and data collection could help determine if the unused export potential towards the larger economies and the over penetration of the smaller markets in the EU is the actual pattern of Cuba's exports or rather the result of some systematic bias.

Finding the export potential of the different major product sectors that Cuba exports could be useful and would be done by running a regression done on a disaggregate level compared to the one done on an aggregate level of all products in this thesis. It would offer a more detailed report, for the policy makers, regarding which of Cuba's product sectors it should expand in terms of exports and it could help when examining, for example, the large exports towards Cyprus, Croatia and Finland. While these are advantages, new challenges will also prevail from it as the number of zero trade values will vastly increase and the trade of product groups does not necessarily follow the classical patterns suggested by a gravity model.

It could also prove useful to do research regarding trade in the Caribbean, enabling an analysis of Cuba's trading situation with its closest neighbours and calculating export potential there. However, there is a possibility that due to the US-Cuba embargo Cuba is over-trading with the countries nearby to compensate for the trade it would otherwise have with the US. While the nearest countries surrounding Cuba are fairly small in terms of GDP, such as Jamaica, the Bahamas and Haiti, the close proximity between them and cultural ties still indicates that large values of trade should occur between them.

6 Conclusion

The aim of this thesis is to identify which markets in the EU that should be prioritised by Cuba in its efforts to increase its exports. To achieve this, a gravity model was estimated based on exports from developing countries towards developed countries using panel data for the period 2010-2014. The resulting gravity model suggests that exports from developing countries are driven by factors such as economic size, access to open sea, cultural links and distance to the trading partner. Achieving economic growth by, for example, creating an attractive environment for business with stabilization policies is therefore key for developing countries wanting to develop their trading relationships.

The estimates resulting from the fixed effect model was compared to the actual exports of Cuba towards its 10 largest export markets in the EU. Given the purpose of the thesis, a research question was formulated and the implied answer from the main results is that there is room for growth in Cuban exports to the EU. The Netherlands, Spain, Germany, France, Italy and Belgium are the markets that have unused export potential and should be prioritised as it could increase Cuba's exports significantly as well as contribute to the diversification of Cuban exports. Meanwhile, the markets of Portugal, Cyprus, Croatia and Finland have been over penetrated and further growth within the coming years should not be expected there. These results should, however, be taken into account with caution due to limitations of the thesis and weaknesses in the method, especially in terms of the potential towards Croatia and Cyprus for which nothing more than that the markets have been over penetrated can be confidently said. The results suggest that the hypothesis of the thesis holds true as there is room for growth in exports towards the EU although some markets have already been fully penetrated.

While the Cuban exports towards the EU have not experienced any increase in the last couple of years, it is clear that it is not because Cuban exports have already reached its full potential. However, the full potential of Cuban exports could in the current situation be hard to reach due to existing trade barriers for some of Cuba's major exporting goods meanwhile other competing countries have better access to, for example, the EU's sugar market. There are also political barriers that even though they are easing up can be a factor preventing Cuba from reaching its full potential in the EU market. The signing of the Political Dialogue and Cooperation Agreement is a good start for enhancing trade between Cuba and the EU. However, further bilateral trade agreements could be suggested together with other measures to improve the Cuban exporters' access to the EU market in order to further bolster Cuban exports and make sure the full potential is reached. The uprising of the tourism sector in Cuba gives motivation for developed countries to increase investments and improve their relations with Cuba, which also can be an important factor that enables Cuba to increase its exports. In light of the limitations of the thesis, further research regarding Cuba's export potential is encouraged. As it is pivotal for Cuba to increase its exports, both to be able to pay for its imports and render growth in its domestic economy, suggestions have been given to look for export potential in other geographical areas and find the potential per product group.

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Appendix I: Cuba's Top Export Markets

Table 3. Cuba top 20 exporting partners 2015.

COUNTRY	EXPORT IN USD
CANADA	407 086 423
CHINA	330 656 133
NETHERLANDS	161 765 934
SPAIN	138 715 960
BELGIUM	53 499 052
BRAZIL	50 696 538
RUSSIAN FEDERATION	48 437 367
GERMANY	45 932 515
CROATIA	44 835 903
CYPRUS	42 094 603
CHINA, HONG KONG SAR	33 748 813
SWITZERLAND	32 665 490
BELARUS	30 973 600
PORTUGAL	29 741 969
FRANCE	28 276 765
UNITED KINGDOM	27 411 665
FINLAND	27 274 721
ITALY	24 614 110
DOMINICAN REP.	24 089 957
ARGENTINA	22 136 189

Source: Cometrade (2017)

Appendix II: Countries

Table 4. Countries included in the gravity model.

Exporter – Developing countries classified as upper middle income	**Importer – OECD members**
Algeria	**Australia**
Angola	**Austria**
Argentina	**Belgium**
Botswana	**Canada**
Brazil	**Chile**
China	**Czech Republic**
Colombia	**Denmark**
Costa Rica	**Estonia**
Cuba	**Finland**
Dominican Republic	**France**
Ecuador	**Germany**
Equatorial Guinea*	**Greece**
Gabon*	**Hungary**
Guyana	**Iceland**
Iran*	**Ireland**
Iraq*	**Israel**
Jamaica	**Italy**
Jordan	**Japan**
Lebanon	**South Korea**
Libya	**Latvia**
Malaysia	**Luxembourg**
Mauritius	**Mexico**
Namibia	**Netherlands**
Panama	**New Zealand**
Paraguay	**Norway**
Peru	**Poland**
South Africa	**Portugal**
Thailand	**Slovak Republic**
Venezuela*	**Slovenia**
	Spain
	Sweden
	Switzerland
	Turkey
	United Kingdom
	United States

*Note, countries marked with * has been excluded due to no data available.*

Appendix III: Summary Statistics and VIF

Table 5. Summary statistics of variables used.

Variable	Definition	Mean	Median	Minimum	Maximum
LnExport_US$	Natural log of exports measured in USD.	17.062	17.519	0.000	26.707
$LnGDP_i$	Natural log of GDP (exporter)	25.268	24.965	21.538	29.981
$LnGDP_j$	Natural log of GDP (importer)	26.899	26.935	23.308	30.487
$LnDist_{ij}$	Natural log of distance measured in kilometers	8.980	9.102	4.741	9.859
LandLocked	Landlocked country = 1 otherwise = 0	0.234	0.000	0.000	1.000
CommonBorder	Country-pair sharing borders = 1 otherwise = 0	0.004	0.000	0.000	1.000
CommonLang.	Country-pair sharing official language = 1 otherwise = 0	0.111	0.000	0.000	1.000
ColonialLink	Country-pair that has/had a colonial link = 1 otherwise = 0	0.028	0.000	0.000	1.000

Table 6. Variance Inflation Factors.

Variable	Value
$LnGDP_i$	1.060
$LnGDP_j$	1.067
$LnDist_{ij}$	1.105
LandLocked	1.064
CommonBorder	1.102
CommonLang.	1.225
ColonialLink	1.169

Appendix IV: Export Potential from all Models

Table 7. Cuban Export Potential Results from all Models.

Country	***Pooled OLS***	***Fixed Effect***	***Random Effect***
Netherlands	0.252	1.210	0.245
Spain	3.350	1.399	3.359
Belgium	0.411	1.093	0.403
Germany	5.575	1.393	5.290
Croatia	0.028	0.093	0.029
Cyprus	0.008	0.031	0.009
Portugal	0.283	0.812	0.281
France	6.178	1.324	5.886
Finland	0.330	0.070	0.328
Italy	4.732	2.176	4.543