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A DETERMINATION OF FACTORS INFLUENCING SUGAR TRADE

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Abstract

A variety of factors influence U.S. sugar imports. Although the U.S. tariff-rate import quota restricts trade, other factors also influence sugar trade. In order to determine the impact of the U.S. tariff rate quota and other factors on sugar trade, this analysis adapts the standard gravity model for a single-commodity. Estimation of the model is carried out using panel data and includes the Unites States and 13 western hemisphere countries. Variables are chosen to augment the standard gravity model in order to identify and capture the effects of transactional costs and productivity on the sugar industry. This research demonstrates that although quotas have been important in determining U.S. sugar imports, relative factor endowments, domestic production, and free trade agreements are key factors influencing sugar trade.
Key Words: International Trade Model; Trade Agreements; Trade Barriers; Gravity Equation; United States; Americas; Sugar
Jel Codes: F14, Q17, Q18

1. Introduction

Sugar trade with the United States is complicated due to the political strength of domestic producers and the resulting policies used to support the domestic price. A majority of trading partners are located in the western hemisphere and are efficient sugar producers that are in close proximity to the U.S. market. Other factors, however, have changed the sugar market trade. This includes external policies, of which the tariff rate quota (TRQ) is chief. Distortions in this market occur if an efficient and large producing country is not included among the countries that are allowed to export sugar through TRQs and must then incur a prohibitive over-quota tariff to access the U.S. market.

As its name indicates, the TRQ is a quota that the United States applies to sugar imports at a low or zero duty. The United States Trade Representative annually establishes the TRQ according to U.S. obligations within the World Trade Organization (WTO). The United States also allows additional market access to some countries through other trade agreements, such as to Mexico through the North American Free Trade Agreement (NAFTA). Approximately 54% of the total TRQ allocation is given to western hemisphere countries. Current legislation limited U.S. sugar imports to 2.839 million metric tons, raw value, in Fiscal Year 2016 (USDA/ERS, 2017).

The use of tariff rate quotas allows importing countries to support their domestic prices at levels above the world price. From the exporting country perspective, however, TRQs limit their access to lucrative markets and eliminate potential gains from trade. Similarly, non-tariff trade barriers prevent price signals from inducing market adjustment. As a result, trade is not based on the comparative advantage of countries but is distorted due to obstructions in the market.

The ability of the U.S. sugar TRQ to support domestic prices at levels greater than the world market price has brought with it an increased desire on the part of sugar exporting countries to market their product in the United States. Since the Uruguay round of world trade discussions, sugar and the U.S. TRQ have been a point of contention in a number of U.S. trade negotiations, including GATT and the WTO (Koo & Kennedy, 2002), the North American Free Trade Agreement (NAFTA) (Petrolia & Kennedy, 2003), and more recently with respect to the suspension agreement to trade disputes under NAFTA (Zahniser et al., 2016). The U.S. sugar TRQ has been examined to determine its impact on production (Kennedy & Schmitz, 2009) as well as price (Salassi et al., 2003). Several studies have focused their analysis in the effect of lobbying activities in the sugar industry (Krueger, 1988), and on the elimination of the TRQ (Devadoss & Kropf, 1996). Different trade models have been applied to evaluate this industry. Cororaton (2013) used the Global Trade Analysis Project (GTAP) under the assumption of a Computable General Equilibrium (CGE) model, and Koo (2002) utilized a simulation model.

This analysis seeks to quantify the importance of TRQs and other factors in determining U.S. sugar imports. To accomplish this, a gravity model is adapted for a single commodity analysis. Estimation of the model is carried out using panel data and includes the Unites States and thirteen western hemisphere countries. The variables used to create a reliable single-commodity gravity model include domestic and world production indicators, two GDP-based indicators, yield, distance and transportation costs, population, import quotas, and trade agreements. These factors supplement the standard gravity model in order to detect and determine the effects of transactional costs and productivity in the sugar industry.

An overview of the gravity model is given in the following section along with an explanation of the single commodity analysis. The econometric estimation, data sources and a description of the variables are then presented. The final section includes the results of the analysis and provides implications of the research.

2. The Gravity Model

The gravity model has been an effective tool for measuring the impact of regional trade agreements (Grant & Lambert, 2005). Research has shown reliable results and a considerable number of studies have accepted the relevance of the gravity model in identifying important factors affecting international trade. The first adaptations of Newton's law in international trade were made by Tinbergen (1962) and Pöyhönen (1963). They concluded, independently, that the amount of trade between a pair of countries increases as their income increases and decreases by their geographical distance. Around the same time, Pulliainen (1963) included more variables that could affect positively or negatively the trade flow model. After these two studies the model came to be known as the Gravity Model. Later, Linnemann (1966) enriched the model by adding key variables, such as population, relative factor endowments, resistance factors to trade, economic distance and trade preferences. Srivastava & Green (1986) made an extension to Linneman's analysis in which they provided further analysis on product differentiation by giving independent measures for individual product categories, which was a first approach to individually evaluate each product or sector. Their study was able to account for the commodity composition of trade between nations and it extended the gravity model by determining whether the identified factors are better at explaining trade flows in some categories than in others (Srivastava & Green, 1986).

The log-linear form is the most utilized functional form for the gravity model. Anderson (1979) proposed the log-linear specification, which allows interpreting the coefficients as elasticities. Later on, additional factors were included to improve the explanatory ability of the model. Some later contributions came from Bergstrand (1989) who associated the gravity equation with simple monopolistic competition model. Eichengreen & Irwin (1998) concluded that countries with a trading history with each other, whether for reasons related to politics, policies, or other factors, generally continue doing so. Deardorff (1998) provided proof that the gravity model could be derived from neoclassical economic theories, such as the Ricardian and Heckscher-Ohlin models. Anderson and Wincoop (2003) included multilateral resistance variables strengthening the micro-foundation of the gravity equation, and Egger (2000) added to the development of the model by solving multilateral resistance terms with fixed effects.

The gravity model has been used to explain different effects on international trade and to measure the impact of the variables that affect trade between countries. Some of the variables that have been included in the gravity model in order to explain trade between a pair of countries are the barriers to trade, such as the TRQs, and the participation on FTAs. Wall (1999) determined the effect of protection on trade and identified welfare effects.

The gravity equation indicates that the volume of exports from one country to another is a function of their incomes (GDPs), the population, the distance between their economic centers and a set of dummy variables.

The standard gravity model has the following specification:

$$X_{ij} = \beta_0 \, Y_i^{\beta_1} Y_j^{\beta_2} D_{ij}^{\beta_3} N_i^{\beta_4} N_j^{\beta_5} F_{ij}^{\beta_6} e_{ij} \qquad (1)$$

where X_{ij} is the volume of trade from country i to country j, which is a function of Y_i and Y_j that represent the GDP of the importer / exporter country; D_{ij} which measures the distance between the main economic centers of the countries; N_i and N_j that represent the population of the importing/exporting country; F_{ij} includes all the other factors that enhance or prevent trade; and e is the error term.

Summary (1989) and McCallum (1995) used Gross Domestic Product of both exporting and importing countries in their models. The GDP is a proxy for the productivity capacity of the exporting country and the acquisitive capacity of the importing country (Dascal et al., 2002). Bougheas et al. (1999) found that greater income in the exporting country results in a higher level of production, which results in greater export capacity. Similarly, a higher level of income in the importing country is associated with increased imports. The expected relationship between trade and income is positive, since the greater the productive and consumptive capacity, the greater the level of trade between the country pair.

Bergstrand (1989), Sanso et al. (1993), and Tamirisa (1999), among others employed per capita GDP in the gravity model. Linder (1961) suggested that a similarity with respect to the level of per capita income would result in a similar level of demand. This was supported by Gross and Gociarz (1996), who found that as income increases, the share of tradables would also increase.

As opposed to traditional aggregate gravity models, a single-commodity gravity model can easily incorporate the singularities that directly affect the particular commodity. The trade barriers, policies, idiosyncrasies and individual characteristics of the importing and exporting countries are some of the benefits that a single-commodity model can expose in a model.

Numerous studies have been conducted related to trade flows between economic blocs, most are macro-level based, in which distinction is not made between commodities. However, empirical literature has demonstrated that the gravity model can be applied to a single commodity. For example, Phren & Brümmer (2011) show the advantages of a single commodity gravity model and the issues when estimating the model. However, little research has been conducted concerning the applicability of an individual commodity under the gravity model; this analysis intends to apply an individual commodity gravity model to U.S. sugar trade within the western hemisphere.

Koo et al. (1994) employ a specific commodity gravity model with meat trade in which panel data was used. They conclude that trade policies must be a variable included in every single-commodity gravity model. They also identify the importance of the exchange rate in determining trade flows. Dascal et al. (2002) examined wine trade in the EU and showed that the gravity model was the best theoretical framework to combine all the variables that they introduced in the model. Eita & Jordaan (2007) based their research on South African wood's exports capacity showed that distance was not significant in their model that not all trade agreements encourage trade flows between the member countries and that common language promotes wood exports. In the model presented in this study, the GDP of each exporting country and importing country is used to measure the size of the economies and as a proxy to calculate endowments. Sugar production capacity measured as domestic production and yield of each country are included. The other variable used that is directly associated with each country's characteristics is the sugar yield, that contributes to the competitive advantage of each exporting countries. Additional variables accounting for barriers and resistance factors are also added to account for the unique characteristics of each trade country partner. Given the objectives of this research, inclusion of these variables will help determine the impact of TRQs and other factors on trade.

3. Econometric Procedures and Data Source

Based on to the theoretical literature regarding the gravity model and understanding the importance of an appropriate specification, the model employed in this study will take the log-log form, using standard OLS regression analysis. Given that most of the literature focuses in aggregated data, the specification for a sugar gravity model should be modified to allow a disaggregated micro-level analysis. However, this process can generate a problem of excess of zeros and over-dispersion (Santos Silva & Tenreyro, 2006). The zeros and excess of zeros is a consequence when data is taken to be disaggregated from an aggregated dataset. The collected dataset for this paper was specifically selected for sugar exporting countries in a time lapse where no zero entries took place. Even in the presence of zeros, the logarithm form tackles the problem (Phren & Brummer, 2011). The over-dispersion issue is caused by unobserved heterogeneity that normally occurs due to an omitted variable problem. The inclusion of fixed effects will account for unobserved heterogeneity among countries.

Finally, according to Baltagi (2008) cross-sectional dependence is a common problem in panel data with long time series. Given that, a Breusch Pagan LM test of independence was conducted where the hypothesis is that the residuals across entities are not correlated. The test confirmed that there is not dependence among panel countries in the data. According to Pesaran (2012) even a test for weak dependence does not pose serious estimation and inferential problems.

Throughout this analysis the exporting country is denoted as country *i*, and the importer (the United States) is denoted as country *j*. The empirical gravity model for sugar trade is specified as follow:

$$lnX_{ij} = \alpha_i + \beta_1 \ln(SimSize_{ij}) + \beta_2 \ln\left(Endow_{ij}\right) + \beta_3 \ln(Dom.Production_i) + \beta_4 \ln(W.Production) + \beta_5 ln(Yield_i) + \beta_6 ln(TRQ_{ij}) + \beta_7 \ln(Distance_{ij}) + \beta_8 FTA_{ij} + e_{ij} \quad (2)$$

where log x_{ij} represents imports from country *i* to *j*; α_i is the intercept term; *ln(SimSize*$_{ij}$*)* is the log of the proxy in similarity of countries' economic size; *Endowment* accounts for relative factor endowments (GDP per capita); *Dom.Production*$_i$ is the domestic sugar production of the exporting country; and *W. Production* accounts for the world's sugar production. *Yield*$_i$ is country *i*'s sugar yield. *TRQ*$_{ij}$ is the tariff rate quota assigned to each country. *Dist*$_{ij}$ is the proxy of distance between countries *i* and *j* times the Deep-Sea Freight index. *FTA* is a dummy representing free trade agreements between countries *i* and *j* (1 if there is an FTA; 0 otherwise), while e_{ij} is a normally distributed error term.

The empirical analysis for this study spans the period from 1986 to 2013. A balanced panel of annual observations covers 13 western hemisphere countries, consisting of Argentina, Bolivia, Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Peru. These countries were chosen based on their sugar trading history with the United States. The data related to imports, sugar yield and production was obtained from the statistical division of the Food and Agriculture Organization of the United Nations (FAOSTAT). The GDP was obtained from the World Bank database and the population from the U.S. Census Bureau. TRQ data was obtained from the Office of the United States Trade Representative (USTR) database. Distance was measured between the capital cities of each country-pair and the Deep-Sea Freight PPI was obtained from the Bureau of Labor Statistics (2018). A dummy variable for common membership in one of four FTAs was constructed based on information obtained from the USTR.

4. The Variables

The logarithmic form of total raw sugar imports, given in tons, by the United States is the dependent variable in this study. The main explanatory variables are described in the following section. A first set of variables that accounts for the importing and exporting countries' economic characteristics, a second set that accounts for the production capacity of both countries and a third that augments the gravity model such as barriers and distance between countries.

The *SimSize* variable is a measure of similarities between a pair of countries, the importing and the exporting countries. *SimSize* values range from -∞, which represents perfect dissimilarity, to -0.69, which represents perfect similarity (Antonucci & Manzocchi, 2006). It is defined as:

$$SimSize_{ij} = ln\left(1 - \left(\frac{GDP_i}{GDP_i + GDP_j}\right)^2 - \left(\frac{GDP_j}{GDP_i + GDP_j}\right)^2\right) \quad (3)$$

The closer to -0.69, the greater the similarities among the countries, the closer to -∞, the less similar the countries are. The intuition behind this variable relies in the fact that larger similarities in terms of the countries' GDPs result in larger chances that the countries exchange similar products belonging to the same industry. This variable might be positive or negative depending on the degree of similarities of both countries.

The *Endow* variable is a measure of relative factor of endowments. The proxy utilized is the GDP per capita in each of the countries. According to Martinez-Zarzoso & Nowak-Lehmann (2003) this variable indicates a possible Linder effect associated with countries' income (i.e., trade between countries is positively correlated to the similarity of their income levels). This proxy to calculate factor of endowments is addressed by Helpman (1987) who stated that GDP is an accurate proxy when only capital and labor are taking into account as factors of production and when all goods are freely traded. The variable is defined as:

$$Endow_{ij} = \left(ln\frac{GDP_i}{Pop_i} - ln\frac{GDP_j}{Pop_j}\right) \quad (4)$$

When there are similarities among endowments of a pair of countries, the coefficient tends to approach zero. Conversely, as similarities among country pairs decrease, this variable will move away from zero.

The *Dom.Production* variable will account for the sugar production capacity of the exporting country. It is expected to positively affect sugar imports to the United States. The inclusion of this variable in the model is relevant given the characteristics of the sugar industry and the U.S. import program that disregard production capacities to allocate the quotas. *W. Production* as described before accounts for the world's sugar quantity produced. This variable is included to control for the world's sugar supply given that there are large sugar producing countries not including in the framework of this study.

Other variables are included as follow: sugar yield is measured in kg/ha, production is given in tons, the sugar TRQ assigned to each country is measured in metric tons raw value (MTRV). A dummy variable, *FTA*, is used where 1 indicates common membership in an FTA, and 0 otherwise. *Distance* was calculated as the distance between the respective capital cities for each country pair, which is a standard practice in the literature. Since distance is a proxy for transportation costs we included the PPI of deep sea freight transportation and the distance in miles between economic centers of each country. As theory states we expect this variable to negatively impacts trade flows between countries.

Table 1 summarizes the description of each variable, the expected sign, and the source from which each of the variables were obtained.

Table 1. Variable Descriptions, Expected Signs, and Sources

Variable	Description	Expected Sign	Source
lnX_{ij}	The logarithm of sugar imports to the United States		FAOSTAT
α_i	Intercept term	(+/–)	
$lnSimSize_{ij}$	The logarithm of sugar production similarities	(+/–)	FAOSTAT
$lnEndow_i$	The logarithm of the difference of per capita GDP	(+/–)	World Bank Database and the U.S. Census Bureau
$lnDom.Production_i$	The logarithm of domestic sugar production in country *i*	(+)	FAOSTAT
lnW.Production	The logarithm of the world sugar production	(+/-)	FAOSTAT
$lnYield_i$	The logarithm of sugar yield of country *i*	(+)	FAOSTAT
$lnTRQ_{ij}$	The logarithm of the U.S. sugar import quota for country i	(+)	USTR
$lnDistance_{ij}$	The logarithm of distance between countries i and j	(–)	The website, www.timeanddate.com and Bureau of Labor Statistics
FTA_{ij}	A dummy variable indicating an FTA between countries i and j	(+)	USTR

5. Empirical Results

The primary objective of this analysis was to determine the extent to which certain factors affect sugar trade between the United States and select western hemisphere sugar producing countries, with special focus on the impact of the TRQ and other competitive factors. The factors that the gravity model includes to better understand international trade, and the modification of the model for the study of a specific commodity, are the basis to analyze the results of the present study. This section estimates the gravity model, the influence of variables included to augment the model, and determines the impact of each of the variables on the amount of sugar imported by the United States. The method applied to analyze the model is the Ordinary Least Square Regression, using STATA as the software mechanism.

The estimated augmented gravity model is as follow:

$$\begin{aligned} \ln(\text{Imports}_{ij}) = 4.605 &- 0.199 \ln(\text{SimSize}_{ij}) + 0.553 \ln(\text{Endow}_{ij}) \\ &+ 0.745 \ln(\text{Dom.Production}_{i}) - 0.670 \ln(\text{W.Production}) \\ &+ 0.011 \ln(\text{Yield}_{i}) + 0.637 \ln(\text{TRQ}_{ij}) + 0.076 \ln(\text{Dist}_{ij}) \\ &+ 0.568\,\text{FTA}_{ij} + e_{ij} \end{aligned}$$

Table 2 presents statistical information on the parameters. The results presented in this study were first tested for heteroskedasticity (Breusch-Pagan / Cook-Weisberg test), which was corrected by applying the robust standard errors. A Hausman test was conducted to determine if the panel data exhibited either fixed or random effects. Fixed effects (FE) were selected for the accuracy of the results of the estimator. FE accounts for unobserved heterogeneity across the countries included due to multilateral resistance. The inclusion of the multilateral terms in the model is ideal given that it provides more efficient estimates. However, as stated by Feenstra (2002) the FE estimator is consistent and gives similar efficiency in the model.

Table 2. Regression Results

Variable	Estimate	Standard Error	t-value	p-value
Intercept	4.605	9.9475	0.46	0.644
ln (TRQ)	0.6371	0.2457	2.59	0.01**
ln (SimSize)	-0.1990	0.6187	-0.32	0.748
ln (Endowment)	0.553	0.2688	2.06	0.04*
ln (Dom. Production)	0.745	0.3023	2.46	0.01**
ln (W.Production)	-0.670	1.1184	-0.60	0.549
ln (Yield)	0.011	0.3218	0.04	0.971
ln(Distance)	-0.076	0.4846	0.16	0.875
FTA	0.568	0.2026	2.81	0.005**
Number of Observations	317			
F-value	0.00			

Notes: * signifies p < 0.05; ** signifies p < 0.01; and *** signifies p< 0.001

The coefficients had the expected signs that are consistent with economic theory. U.S. sugar imports are negatively affected by $SimSize_{ij}$, which suggests an inter-industry structure for sugar cane exchanges. However, it is not significant in the model. The coefficient $Endow_{ij}$ is significant and has a positive sign, which suggests that similarities in the factors of endowments in both the importing and exporting countries enhance U.S. imports.

Domestic Sugar Production ($Dom.Production_i$) has the expected positive sign and the effect on sugar imports to the U.S. The importance of this variable in the model lies in the role that comparative advantage influences this industry. Notably, the countries with larger sugar production have more negotiate capacity, less cost of production and hence better chances to obtain a good deal in the sugar market. A 10% increase of sugar production in the exporting country leads to an increase of imports to the U.S. in approximately 7.4%. The world's sugar production (W. Production) has a negative sign indicating that as the world's sugar production increases the amount imported decrease. However, the variable is not statistically significant.

Sugar $Yield_{ij}$ is positive, as expected, but is not statistically significant. This finding is important given the structure of the sugar industry and the barriers to trade addressed in this paper. Without the import quota and other multilateral resistance terms, where free trade takes place it is expected that yield of the exporting country would have an important impact in its sugar exports. This result was somewhat expected, since the import quota was assigned independently of the productivity advantages of the importing countries.

The variable $ln(Dist_{ij})$ does not exhibit the expected sign, nor is it significant in the model, which in this case indicates that the transactional costs related to transport costs do not affect the amount of sugar imported into the United States. As mentioned, this result was expected given the allocation of the TRQ by the United States.

Membership in an FTA is expected to increase trade. The FTA_{ij} coefficient displays a positive sign as expected and it is statistically significant. During the negotiation rounds of FTAs with the United States, sugar has been one of the most sensitive commodities, and in negotiations the most that can generally be accomplished is to gradually increase the TRQ for member countries within an FTA. The results of this analysis indicate that the impact of the negotiations of FTAs regarding the TRQs assigned on the sugar industry is significant.

The coefficient that accounts for the impact of TRQs on sugar imports is significant and positive as expected. As the TRQ increases by 10%, sugar imports increase by 6.3%, holding all else constant. Consistent with prior expectations regarding its importance and relevance for sugar trade, the TRQ is found to be a dominant variable in the U.S. sugar imports model.

6. Conclusions

The primary objective of the study was accomplished in the sense of understanding the effects that the variables considered have on the total amount of sugar imports to the United States. It is important to clarify that not all of the sugar imported into the United States is captured by the variable that accounts for the TRQ. Countries are also allowed to export above the TRQ level or outside of the TRQ, such as in the case of Mexico.

There are several implications in the results obtained from the model proposed. The variables that are statistically significant are the ones initially hypothesized and the ones that were not significant draw important insights of the particularities of the sugar industry.

In an open market with no barriers, one might expect that variables such as productivity and yield would contribute to an increase in trade flows, while distance would decrease trade flows. *Dist* did not exhibit the expected sign nor did it prove to be statistically significant, thus indicating the irrelevance of distance in the allocation of the TRQ. *Yield*, which would be expected to increase export capacity was not significant, giving insights into the lack of importance of these factors in the quantity exported to the United States.

The four variables that did prove to be statistically significant have important implications for this analysis. First, both the *FTA* and *TRQ* coefficients were positive and significant. We expected these policy variables to be a positive and dominant factor; these expectations were met. However, the positive and significant coefficients for *Endow* and *Dom.Production* help to answer the question as to whether the use of the TRQ would stifle the impact of competitiveness- and efficiency-related factors on trade. As suggested by Martinez-Zarzoso & Nowak-Lehmann (2003), a positive coefficient for *Endow* indicates an inter-industry trading structure that is commonly attributed to comparative advantage. Thus, the existence of a positive and significant sign on *Endow* in this study indicates that the United States tends to import from countries who possess a comparative advantage in the production of sugar.

Similarly, *Dom.Production* shows a positive and significant sign. Although this factor does not provide for a comparison with the sugar production in the United States, the positive sign and statistical significance of this variable, combined with the lack of statistical significance for yield, supports the notion that the United States tends to import from countries who are the largest producers of sugar rather than from those with the greatest yields or levels of efficiency.

This study has shown that the U.S. tariff-rate-quota has been an important factor in regulating the flow of sugar into the United States. The coefficients on *Endow* and *Dom.Production* suggest that, despite the presence of the TRQ, trade tends to follow patterns consistent with economic efficiency. However, this likely occurs despite, rather than because of, U.S. trade policy. It must be remembered that whether TRQs have been granted based on political or economic criteria, the use of non-tariff trade barriers mask market signals and inhibit the efficient functioning of the market.

While we may find evidence of economic efficiency, there is also evidence of the deleterious effects of TRQs. For example, the lack of significance of variables such as distance could be the result of the inability of the market to send clear signals with the existence of a TRQ. Future work should seek to determine whether it is the TRQ which negates the importance of distance or some other event.

In addition, this analysis was restricted in that it was limited to western hemisphere countries which export to the United States. Future work that considers all sugar-producing countries from around the world would provide additional insight into the relationship between competitive advantage and trade flows in the presence of quantitative trade restrictions.

References

Anderson, J.E. (1979). "A Theoretical Foundation for the Gravity Equation." *American Economic Review* 69:106-116.

Anderson, J.E., & Van Wincoop, E. (2003). "Gravity with Gravitas. A Solution to the Border Puzzle." *American Economic Review* 93(1):170-192.

Antonucci, D., & Manzocchi, S. (2006). "Does Turkey have a Special Trade Relation with the EU? A Gravity Model Approach." *Economic Systems* 30(2006):157-169.

Baltagi, B.H. (2008). "Econometric Analysis of Panel Data". John Wiley and Sons Inc. Third Edition

Bell, A., & Jones, K. (2015). "Explaining fixed Effects: Random Effects Modelling of Time-Series Cross-Sectional and Panel Data". Political Science Research and Methods 3:133-153.

Bergstrand, J.H. (1989). "The Generalized Gravity Equation, Monopolistic Competition, and the Factor - Proportions Theory in International Trade." *The Review of Economics and Statistics* 71(1):143-153.

Bougheas, S., Demetriades, P.O., & Morgenroth, E.L.W. (1999). "Infrastructure, Transport Cost and Trade." *Journal of International Economics* 47:169-189.

Breuss, F., & Egger, P. (1999). "How Reliable are Estimations of East-West Trade Potential Based on Cross-Section Gravity Analysis." *Empirica*. Kluwer Academic Publishers 26:81-94.

Cororaton, C.B. (2013). "The Effects of Tariff Reduction in the Philippines-Japan Bilateral Agreement" Chapter 2 in Strengthening the Foundation for Regional Cooperation and Economic Integration (Erlinda Medalla, editor). Manila, Philippines: Philippine Institute for Development Studies. pp. 31-42.

Dascal, D., Mattas, K. & Tzouvelekas, V. (2002). "An Analysis of EU Wine Trade: A Gravity Model Approach." *International Advances in Economic Research* 8(2):135-147.

Deardorff, A. (1998). "The Regionalization of the World Economy. Determinants of Bilateral Trade: Does Gravity Work in a Neoclassic World?" University of Chicago Press: Chicago.

Devadoss, S., & Kropf, J. (1996). "Impacts of Trade Liberalizations under the Uruguay Round on the World Sugar Market" Agricultural Economics 15:83-96.

Egger, P. (2000). "A Note on the Proper Econometric Specification of the Gravity Equation." *Economics Letters* 66(1):25-31.

Eichengreen, B., & Irwin, D.A. (1998). "The Role of History in Bilateral Trade Flows." University of Chicago Press: 33-62. Chicago.

Feenstra, R.C. (2002). "Border Effects and the Gravity Equation: Consistent Methods for Estimation". Scottish Journal of Political Economy, 49, pp. 491—506.

Eita, J.H., & Jordaan, A.C. (2007). "South Africa's Wood Export Potential Using a Gravity Model Approach." Department of Economics: University of Pretoria.

Geraci, V.J., & Prewo, W. (1977). "Bilateral Trade Flows and Transport Costs." *The Review of Economics and Statistics* 59(1):67-74.

Grant, J.H., & Lambert, D.M. (2005). "Regionalism in World Agricultural Trade: Lessons from Gravity Model Estimation." American Agricultural Economics Association Annual Meeting*:* Providence, Rhode Island. July 24-27.

Gross, D., & Gociarz, A. (1996). "A Note on the Trade Potential of Central and Eastern Europe." *European Journal of Political Economy* 12(4):709-721.

Hallak, J.C. (2010). "A Product-Quality View of the Linder Hypothesis." *The Review of Economics and Statistics* VolCXII(3):453-466.

Helpman, E. (1987). *"Imperfect Competition and International Trade: Evidence from fourteen industrial countries, J. Jpn. Int. Econ. 2: 62-81*

Koo, W.W., Karemera, D. & Taylor, R. (1994). "A Gravity Model Analysis of Meat Trade Policies." *Agricultural Economics* 10(1):81-88.

Koo, W.W., & Kennedy, P.L. (2002). "Major Issues in the U.S. Sugar Industry under 2000 WTO Negotiations and NAFTA," in *Agricultural Trade Policies in the New Millennium*, edited by P.L. Kennedy and W.W. Koo, Binghamton, NY: The Haworth Press, 2002.

Kennedy, P.L., & Schmitz, A. (2009). "Production Response to Increased Imports: The Case of U.S. Sugar," *Journal of Agricultural and Applied Economics*, 41,3(December 2009): 777-789.

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

Liãmo, N., & Venables, A. (2002). "Geographical Disadvantage: A Heckscher–Ohlin–von Thunen Model of International Specialization." *Journal of International Economics* 58(2):239-263.

Linder, S.B. (1961). "An Essay on Trade and Transformation." *John Wiley and Sons Ltd. Almqvist and Wiksell* 167:90s.

Linnemann, H. (1966). "An Econometric Study of International Trade Flows." *Amsterdam: North-Holland Pub. Co.* Pp.xiv:234.

Martinez-Zarzoso, I., & Nowak-Lehmann, F. (2003). “Augmented Gravity Model: An Empirical Application to the Mercosur-European Union Trade Flows.” *Journal of Applied Economics* VI(2):291-316.

McCallum, J. (1995). “National Borders Matter: Canada-US Regional Trade Patterns.” *The American Economic Review* 85(3):615-23.

Pesaran, M. (2012). “Testing Weak Cross-Sectional Dependence in Large Panels”, No 3800, CESifo Working Paper Series, CESifo Group Munich.

Petrolia, D.R., & Kennedy, P.L. (2003). “Increasing the U.S. Tariff-Rate Sugar Quota for Cuba and Mexico: A Partial-Equilibrium Simulation,” *Journal of Agricultural and Applied Economics*, 35,3(December 2003): 589-597.

Phren, S., & Brümmer, B. (2011). “Estimation Issues in Single Commodity Gravity Trade Models.” GEWISOLA Halle 28:Bis 30.

Pulliainen, K. (1963). “A World Trade Study: An Econometric Model of the Pattern of the Commodity Flows of International Trade in 1948-60.” *Economiska Samfundets Tijdskrift* 16:78-91.

Pöyhönen, P. (1963). “A Tentative Model for the Volume of Trade between Countries.” *Weltwirtschaftliches Archiv* 90:93–99.

Salassi, M., Kennedy, P.L., & Breaux, J. (2003). “Impact of Increased Sugar Imports from Potential Free Trade Agreements on Raw Sugar Prices,” *The Sugar Bulletin*, 82(November 2003):12-15.

Sanso, M., Cuairan, R., & Sanz, F. (1993). “Bilateral Trade Flows, the Gravity Equation, and Functional Form.” *The Review of Economics and Statistics* 75:266-75.

Santos Silva, J.M.C., & Tenreyro, S. (2006). “The Log of Gravity.” The review of Economics and Statistics. 88: 641-658

Soloaga, I., & Winters, L.A. (1995). “How Has Regionalism in the 1990s Affected Trade?” Bank Policy Research Working Paper No. 2156.

Srivastava, R.K., & Green, R.T. (1986). “Determinants of Bilateral Trade Flows.” *The Journal of Business* 5(4):623-640.

Summary, R.M. (1989). “A Political-Economic Model of US Bilateral Trade”. *Review of Economics and Statistics* 1:179-82.

Tamirisa, N. (1999). “Exchange and Capital Controls as Barriers to Trade.” *International Monetary Fund.* 46(1):68-88.

Tinbergen, J. (1962). “Shaping the World Economy: Suggestion for an International Economic Policy”. Twentieth Century Fund.

USDA-ERS (2017). Sugar and Sweeteners Yearbook Tables, Table 1—World production, supply, and distribution, centrifugal sugar. Web Accessed: https://www.ers.usda.gov/ data-products/sugar-and-sweeteners-yearbook-tables/. Updated: June 16, 2017.

Wall, H.J. (1999). “Using the Gravity Model to Estimate the Costs of Protection.” Federal Reserve Bank of Saint Louis *Review*:33-40.

WTO (2015). World Trade Organization. Regional Trade Agreements: Facts and Figures. Web accessed: https://www.wto.org/english/tratop_e/region_e/regfac_e.htm. June 28, 2015.

Zahniser, S., Kennedy, P.L., Nigatu, G., & McConnell, M. (2016). “A New Outlook for the U.S.-Mexico Sugar and Sweetener Market,” *USDA Economic Research Service Outlook Report* SSSM-335-01. Washington, DC, August 2016.