Mutual recognition of standards and international trade: what can we learn from the Organic Equivalency Policies?

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Master's thesis (one year)
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August 2017

ABSTRACT

The development of product standards and their widespread adoption can play a vital role in facilitating transactions and enhancing trade, both domestically and internationally. This paper aims to examine whether mutual recognition of product standards could facilitate international trade of organic products. The measure of mutual standards used in this thesis is a number of organic equivalency arrangements between the United States and five of its trading partners. The relationship is estimated by applying Pseudo-Poisson Maximum Likelihood and Ordinary Least Squares to the gravity model of trade. The data sets include organic trade data between the United States and around 60 of its trade partners during 2011-2016. This study does not find an effect on imports. However, my findings suggest that there may be a positive impact of an equivalence of standards on exports.

Key words: *Gravity model, United States, Organic equivalency policies, Organic trade, Mutual recognition standards.*

ACKNOWLEDGEMENT

I would first like to thank my thesis supervisor Professor Joakim Gullstrand of the Economics Department at Lund University. Prof. Gullstrand was always helpful and gave invaluable advice whenever I encountered problems or had questions regarding my research or writing. He has allowed this paper to be my own work, but steered me in the right the direction whenever he thought I needed it.

I must also express my very profound gratitude to my mother for providing me with unfailing support and constant encouragement throughout my years of study at Lund University and through the process of researching and writing this thesis. This accomplishment would not have been possible without her. Thank you.

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1. INTRODUCTION

In the past decades, trade policy reforms together with improved communication channels have led to deeper international economic integration. Due to this, domestic policies affecting the competitiveness on the world market have become more scrutinized. At the same time, concerns regarding environmental damage and pollution have become a growing issue. This has led to discussions between policy makers on how to slow down the exploitation of world resources and to enforce stricter regulations regarding environmental standards. These developments do not only affect the domestic market but the entire international marketspace and have led to more interlinked trade policies. Product standards play a significant role in facilitating transactions and has become more prominent on the agenda in international trade policy discussions. Adopting common standards may lead to a greater possibility in trade of organic products and reduce trade frictions.

This study contributes to existing research by focusing on the equivalence of organic standards rather than the harmonization of standards. More specifically, this thesis examines the impact of the organic equivalency arrangements between the United States and five of its trade partners. Organic agriculture has experienced rapid growth worldwide in recent years. As consumer demand increases, the market for organic goods grows bigger every year. Differences in standards and certification systems can constitute a barrier to trade and prevent growth of the organic import and export market. Transaction costs and concerns about the quality of food and logistic procedures are key determinants in organic trade. The hypothesis is that the equivalence of organic standards can facilitate international trade in organic products. The Organic equivalency arrangements aim to lower the barriers to international trade while not compromising with the standards of organic products.

The aim of this essay is to empirically assess the impact of an equalization of standards on trade. This is done by investigating how U.S. imports and exports have been influenced by the organic equivalency arrangements with Canada, South Korea, Japan, Taiwan and the European Union. The assessment of these agreements is done with the help of the gravity equation using the trade pattern with other countries as a bench mark. The essay is structured as follows: Chapter 2 provides a background of standards and trade and information of the organic equivalency policies. Chapter 3 reviews previous literature related to this field. Chapter 4 covers the empirical strategy and provide information about the data sets. Chapter 5 presents the econometric estimations of the impact of the organic equivalency arrangements on organic imports and exports and compare the results obtained using different estimation methods. This is followed by a conclusion in Chapter 6.

2. STANDARDS AND TRADE

This chapter present the relationship between standards and international trade, a background on U.S. organic trade as well as information about the organic equivalency arrangements.

2. 1 WHAT ARE STANDARDS AND WHY DO WE HAVE THEM?

In the past decades, the importance of bilateral and regional free trade agreements has increased as the world becomes more integrated. These types of agreements have eliminated some of the barriers to trade but there are still issues concerning the facilitation of international trade. Difference in standards are one of these obstacles. Standards are different from other trade barriers since the aim is to protect against market failures such as negative externalities that could have negative implications on people's health and/or the environment (Chen and Matteo 2008). Standards are often associated with what the World Trade Organization refers to as "Non-Tariff Barriers". Non-tariff barriers can be divided into two subgroups: technical barriers to trade (TBT) and Sanitary and phytosanitary (SPS) measures (WTO, 2016, p. 12). TBT cover issues regarding technical regulation, conformity assessment procedures and standards. Figure 1 below presents information on each subgroup. Both governmental and non-governmental entities can develop standards. SPS measures concerns risks threatening "human health and animal/plant health or life or protection from pests" (ibid).

Figure 1: TBT measures according to the WTO

Technical regulations	Standards	Conformity assessment
Technical regulation is a document which lays down product characteristics or their related processes and production methods, including the applicable administrative provisions. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.	Standard is a document approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.	Conformity assessment is any procedure used, directly or indirectly, to determine that relevant requirements in technical regulations or standards are fulfilled.

Source: (WTO, 2016, p.14)

Regional differences in standards can be horizontal or vertical. An example of horizontal differences is a country's voltage requirement in power outlets and an example of vertical differences is the level of pesticides that are allowed in production of agricultural goods (Chen and Matteo 2008). Standards could impact international trade both positively and negatively. On one hand, production costs could increase as producers have to comply with different regulations. The costs increases with stricter requirements as the variable costs of production increases (WTO, 2005, p.55). As a result, it could have a negative effect on trade. On the other hand, it is costly for firms to enter new markets and research information regarding necessary requirements. The regulations make the information available on what the consumer's demand which in turn reduce costs. Consumers also know that foreign products follow the national standards which can increase demand (ibid).

There are two common methods of reducing the potential negative effects of standards on trade: mutual recognition and harmonization of standards (Chen and Matteo 2008). The two concepts are related although not identical. Mutual recognition is process by which a country recognize that the rules and regulations of another country are different but compatible with its own, harmonization is when countries converge rules (ibid). The organic equivalency policies is a type of mutual recognition agreement and is therefore the procedure that this study focus on. Mutual recognition of standards imply that a product produced in one country according to their standards can be sold without altercation to another country and vice versa. Common standards reduces asymmetry in product quality and simplifies the production and facilitate trade by eliminating costly and inefficient costs associated with duplicate testing and certification (WTO, 2015, p. 99). It can also promote efficiencies and allow for economies of scale since producers do not have to alter their production or labeling processes in order to comply with different standards in other market (FAO and WTO, 2017, p. 15).

2.2 U.S. ORGANIC EQUIVALENCY ARRANGEMENTS

The Organic Foods Production Act of 1990 served to establish uniform national standards for organic farming in the United States. These regulations cover the processing, handling and production of organic agricultural goods (Gold, 2007). Products that satisfy the conditions get an USDA organic seal and guarantees the consumer that all necessary the requirements are met. The organic regulations was implemented in 2002 when the set of standards were fully developed. It was the first national legislation implementing a set of uniform standards for the definition of "organic" (OTA, 2016b). Prior to 2002, each U.S. state had their own practices and "organic" had a different meaning depending on where the certification was issued (ibid). An organic producer must demonstrate that they are "protecting natural resources, conserving biodiversity, and using only approved crop, livestock and processing inputs" " (OTA, 2016:b) . Once verified, they receive a USDA organic certificate and are allowed to label products as "organic".

The U.S. Organic Equivalency Arrangements aim is to reduce trade barriers in organic products and facilitate the sale of organic products between the arrangement countries (USDA:g). These trade arrangements give access to increased market access for producers and facilitates trade in organic products while still protecting organic standards. It also leads to increased availability and variety of organic products for the consumers. The first organic equivalency agreement was signed between the United States and Canada in 2009. It was then followed by agreements with Taiwan, the European Union, Japan, South Korea and Switzerland. All but the one is bilateral. The US-Taiwan arrangement only covers exports from the United States to Taiwan. The equivalence agreement with Switzerland was implemented in late 2015. Due to its recent effective date, the US-Switzerland arrangement is excluded from this study.

TABLE 1: ORGANIC EQUIVALENCY AGREEMENTS

County	**Commencement**	**Type of Agreement**
Canada	January 1, 2009	Bilateral
Taiwan	2009	Unilateral (only exports)
European Union	June 1, 2012	Bilateral
Japan	January1, 2014	Bilateral
South Korea	July 1, 2014	Bilateral

Table 1 presents the organic equivalency agreements signed with the United States. Table 8 in the Appendix provides a summary of the scope and requirements regarding each organic arrangement.

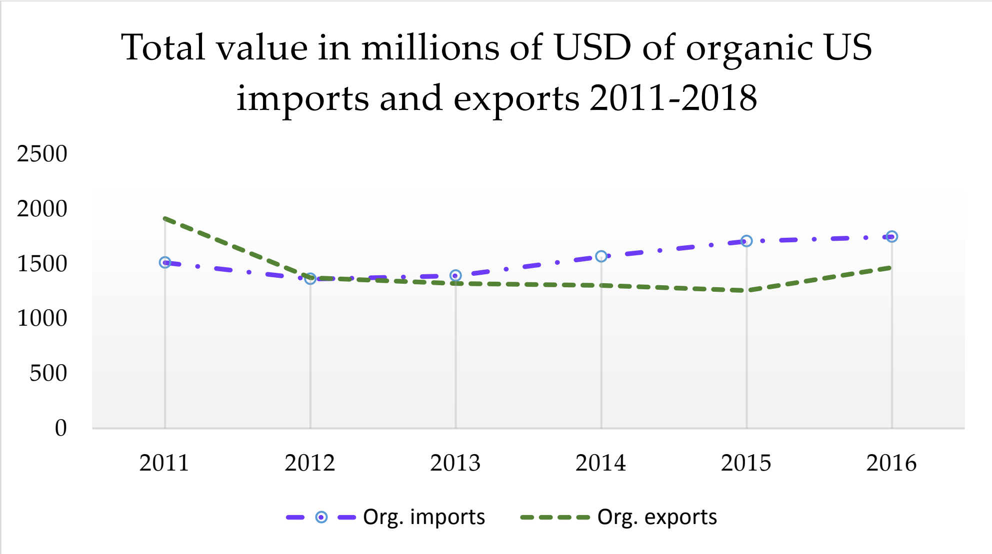
The organic equivalence arrangements are not necessarily identical but they acknowledge two systems for organic production as compatible and veritable. In general, as long as the products meet the standards set by their respective nation, it is allowed to be exported to the other market and vice versa. In other words, organic agricultural products in one country are allowed to be sold as organic in the other as long as it complies with the origin country's standards. The production does not have to be modified in order to be sold on the foreign market. Without an equivalency agreement, foreign producers that want to export to the U.S. have to follow USDA regulations and become certified by an agency recognized by the USDA.

The market for organic goods in the United States is large. According to a survey conducted by the Organic Trade Organization (OTA), sales of organic food products in 2016 totaled over $40 billion and is the largest dollar gain recorded in that sector (Bizzozero, 2017). It was an increase of 8.4 percent from the previous year. Organic non-food sales totaled $4 billion, up 8.8 percent from 2015. Furthermore, organic food accounted for 5.3 percent of all food sold in the United States 2016. Organic fruits and vegetables are was dominating organic category with sales over $15 billion. Organic fruits and vegetables accounts for almost 40 percent of all organic foods sold in the U.S and 15 percent of the total sales of fruits and vegetables (ibid). The supply of organic products is falling behind the increasing demand for organic goods (OTA, 2016). Organic equivalency arrangement may be a way to mitigate this issue.

Figure 2 presents total value[1] of organic imports to/exports from the United States during 2011-2016. The trend for U.S. imports display a small increase while the one for exports display a decrease. The large drop in exports in 2012 may be explained by the drought that affected most of the United States during 2012-2013 (Rippey, 2015). The drought was one of the worst in American history and severely affected the whole agricultural sector, organic products included. The total losses of the drought, mostly in agriculture, have been estimated to $30 billion (ibid). The negative trend continues until 2015 where we see an increase in exports. Of all organic products used in this study, apples, grapes, spinach, lettuce and strawberries top the list of the five most exported products (in monetary value) and apples, avocados, coffee (Arabica and Non-Roast Decaffeinated coffee) and soybeans are the five most imported.

[1] Total as in the total value of the organic data in this study.

FIGURE 2: TOTAL VALUE OF ORGANIC IMPORTS AND EXPORTS IN USD



Figures 3 and 4 display U.S. trade data for organic imports and exports. It is divided into regions or single countries that the U.S. has an organic equivalency agreement with. Figure 3 show that the main regions the U.S. imports from are Asia and Central and South America. Asia is the continent where the increase in trade between 2011 and 2016 is the highest. Canada and the EU are the only countries with an organic equivalency policy that experienced an increase in organic trade during 2011-2016. Furthermore, when comparing between the year of implementation and 2016, imports to the U.S. has increased from all policy partners. Figure 4 presents the destination countries for U.S. exports. Canada is the dominant destination for U.S. organic products. All countries with an organic equivalency arrangement with the United States have experienced an increase of organic trade during 2011-2016. This trend is unchanged when comparing between the year that each policy was implemented and 2016.

FIGURE 3: COUNTRIES OF ORIGIN: U.S. IMPORTS

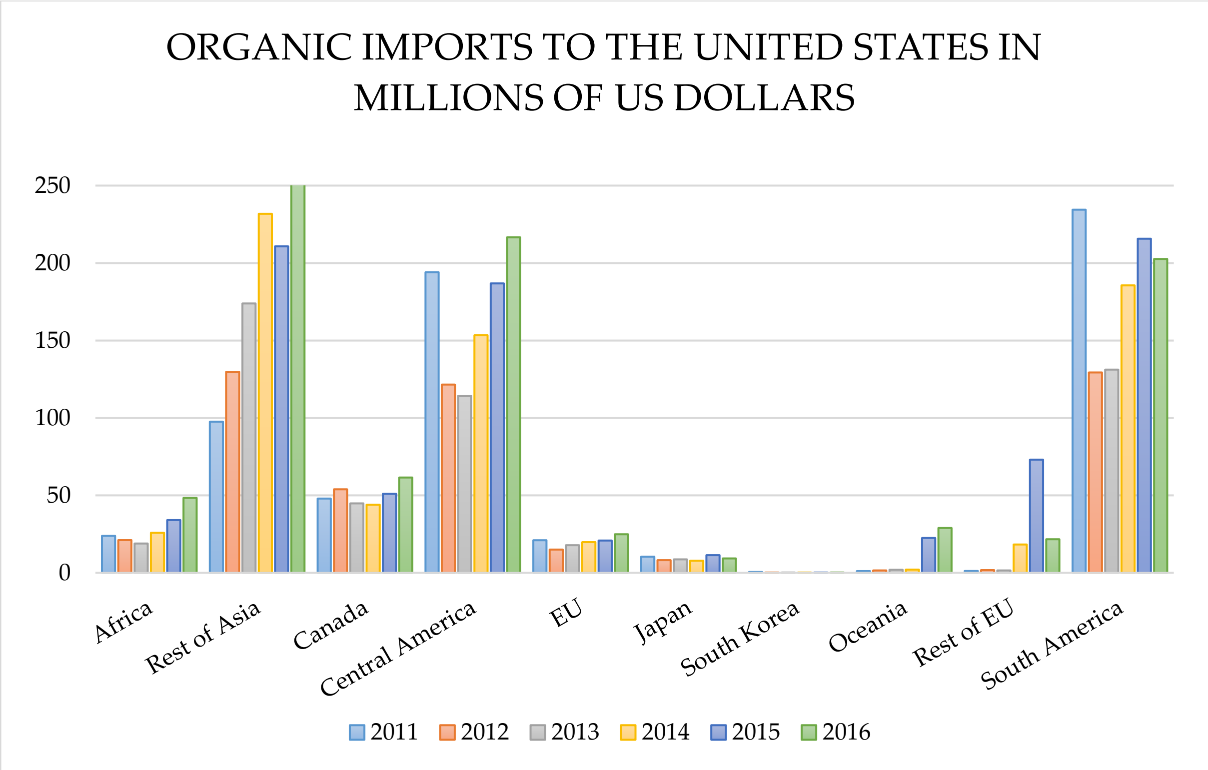
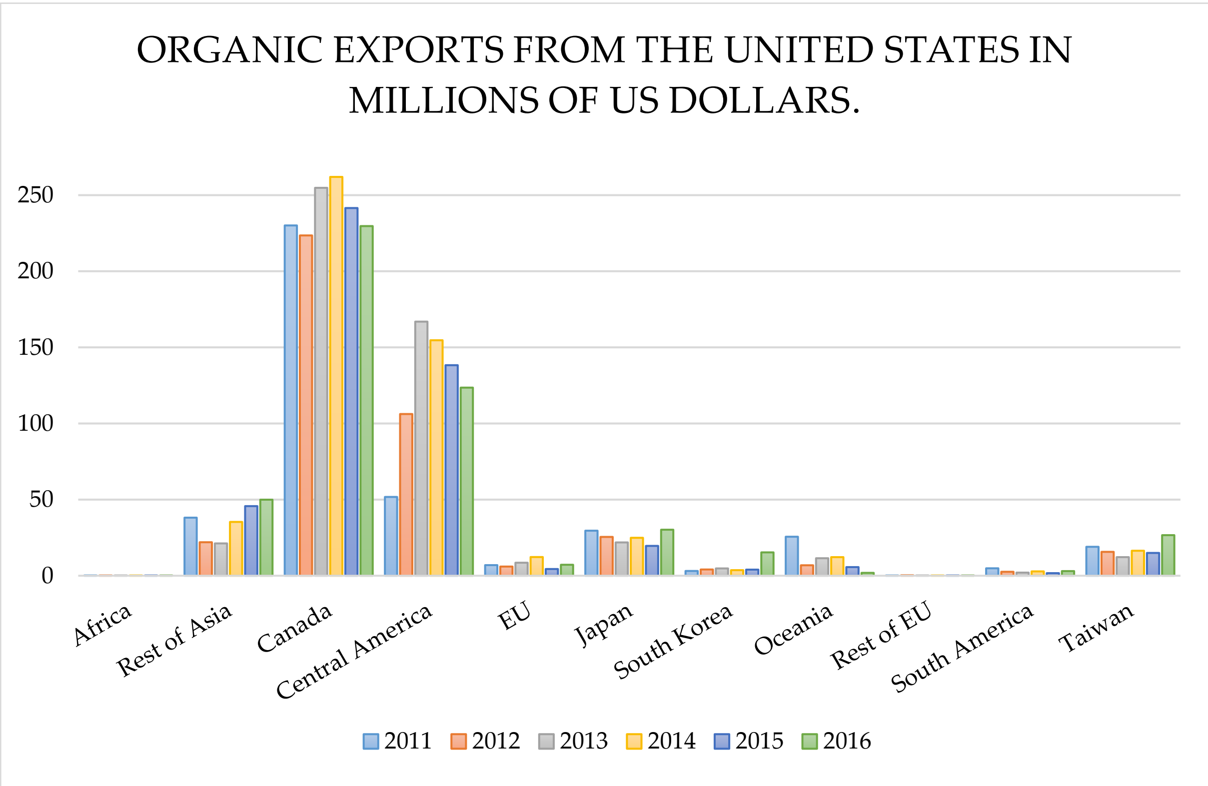


FIGURE 4 COUNTRIES OF DESTINATION: U.S. EXPORTS



3. PREVIOUS LITERATURE

The following chapter presents the results from previous empirical studies regarding international standards and trade.

3.1 STANDARDS AND ORGANIC TRADE

The literature on standards and organic trade is relatively scarce. There are a few studies investigating equivalence in standards and international trade in organic agricultural products. Canaveroi and Cantore (2010) conduct a gravity model analysis on Italian agricultural trade. They examine trade between Italy and extra-European countries and use the equivalency of organic standards as a proxy for the affinity in bilateral trading relationships in the agricultural sector. Their findings suggest that countries with dissimilar equivalence in organic standards decreases the level of bilateral trade between Italy and non-European countries as trade costs are higher. Their results are general for all agricultural products as their data set could not distinguish organic foods from non-organic. Studies conducted by Kristiansen (2014) and Jaenicke and Demko (2015) use trade data from USDA GATS to perform gravity analysis of the organic equivalence agreements effect on organic trade. Kristiansen (2014) examines U.S. import data during 2011-2013 for three organic crops: wheat, corn, and soy. However, the author does not find that the equivalency agreements have an impact on organic imports into the United States. The paper by Jaenicke and Demko (2015) conducts a more robust analysis by including a greater number of products. The authors use OLS and a negative binomial estimation method and find that the organic equivalency arrangement increased annual exports with 58 percent. The impact on imports is ambiguous. When analyzing imports in 2011's Harmonized System (HS) organic product codes their findings suggest an annual reduction of trade by 45 per cent. However, when they include 2013's HS product codes they find that the organic policies increased annual imports by 110 percent. Oberholtzer et al (2013) find that most of the products imported to the United States are often products that cannot be produced domestically such as tropical fruits and coffee. A common issue in organic international trade is differences in national organic regulation and certification, especially for producers in developing countries (Barrett et al 2002). Despite the additional costs faced by foreign farms in the developing world of complying with complex organic standards, investing in organic certification tends to increase revenues as the higher prices of organic foods compensate for the lower output of organic farms (Kleemann et al, 2014: Bolwig et al, 2009).

3.2 NON-TARIFF MEASURES AND INTERNATIONAL TRADE

While the literature on standards and international organic trade may be scarce, there are several studies investigating the effect on Non-tariff measures (NTM) and trade performance. A recent study by Cadot and Gourdon (2016) examines the impact of different NTM's measures on trade performance. They find that mutual recognition of conformity assessment procedures have a positive effect on trade. They remove the cost of adapting the product to foreign markets as well as gaining access to foreign markets. Their findings also indicate that mutual recognition of conformity assessment procedures is preferable to harmonization of standards for developing regions. Many developing nations lack the necessary safety regulation against harmful and poisonous products and could therefore constitute a threat for people's health. A paper by Chen and Matteo (2008) further support these findings. Their results suggest that mutual recognition and harmonization of standards have a positive impact on the willingness to trade as well as the levels of trade. However, they point out that mutual recognition is not viable option if there are significant differences in the countries initial standards. Frahan and Vancauteren (2006) analyses the trade impact of harmonizing food regulations in the EU. They find that harmonizing food regulation has a large positive effect on intra-EU trade, both at aggregate and sub-sector levels of the food industry.

To summarize, previous research indicate that the equivalence of standards have a positive impact on organic exports. However, the effect on imports is ambiguous. Entering a mutual recognition of standards or conformity assessment agreement also suggest that there is a positive relationship between common procedures and international trade.

4. EMPIRICAL STRATEGY

This chapter explains the empirical strategy used in this study. In order to investigate the organic equivalency agreements effect on organic trade the gravity model of trade is used. I provide the intuition of the model and present a general and specific application of the model. This is followed by a section providing information about the data set and the estimation method.

4.1 THE GRAVITY MODEL OF TRADE

The Gravity model of trade is widely used in international trade literature in order to estimate the impact of trade-related policies. It was first introduced to empirical trade research by Tinberger (1962). He used an analogy of Newton's universal law of gravity to describe bilateral trade flows between to geographical units as proportional to their masses and inversely related to the distance between them. The intuition is that exports are proportional to the trade partners "economic mass", often measured by GDP, and inversely proportional to the distance between them (Shepard, 2013). Thus, trade partners with large economies are expected to trade more and countries far apart to trade less as trade costs increase with distance. Initially, the model experienced criticism of lacking theoretical foundation. However, studies by Anderson (1979), Bergstrand (1989) and Deardorff (1995) have provided theoretical support to the model. One of the most standard formulations of the gravity model was formulated by Anderson and Van Wincoop:

[1] $$X_{ij} = \frac{y_i y_j}{y_w} \left[\frac{\tau_{ij}}{P_i P_j}\right]^{1-\sigma}$$

Xij denotes the monetary value of trade between country *i* and *j. Yi* and *Yj* are country *i's* and country *j's* GDP and used as a proxy for economic mass. *Yw* is world GDP. *Pi* is the price level in country *i*. *Pj* is the price level in country *j*. τ_{ij} is a measure of trade cost. The most common measure of trade costs is geographical distance between two economic units. Other frequently used measures of trade costs are dummy variables indicating whether the trade partners share a common language or colonial past, if the country is landlocked or if they are in the same trade agreement.

4.2 GRAVITY MODEL AND STANDARDS

Building from a gravity model framework, factors commonly used to explain bilateral trade flows in gravity models are assumed to affect organic trade similarly. I have expanded τ and included additional variables to incorporate other trade-related costs and differences in standards. The variables included in the specification are frequently used in research using the gravity model[2] and are described in detail below. I build my specifications on the work of Jaenicke and Demko (2015). The specifications, expressed in its logarithmic form, are as follows:

[2] $$\ln(Imports)_{ijpt} = \beta_0 + \beta_1 Ln(GDP/Capita)_{jt} + \beta_2\, Ln\,(Distance)_{ij} + \beta_3\, NAFTA_j + \beta_4\, S.Hemisphere_j + \beta_5 Landlocked_j + \beta_6\, English_j + \beta_7\, Org.Policy_{ij} + \gamma_p + \tau_t + \varepsilon_{ijpt}$$

[3] $$\ln(Exports)_{ijpt} = \beta_0 + \beta_1\, Ln(GDP/Capita)_j + \beta_2\, Ln\,(Distance)_{ij} + \beta_3\, NAFTA_j + \beta_4\, S.Hemisphere_j + \beta_5\, English_j + \beta_6\, Org.Policy_{ij} + \gamma_p + \tau_t + \varepsilon_{ijpt}$$

[2] It is also common in gravity analysis to include a dummy variable indication if the trade partners share colonial ties/history. However, it is excluded from this study since the US only have colonial ties with one of the countries included in this study.

See Table 9 in the Appendix for information about the variables and their data sources. β_0 is a constant, *Ln* is the natural logarithm and ε_{ijpt} is the error term.

The dependent variables $Imports_{ijt}$ and $Exports_{ijt}$ are organic imports to or organic exports *(p)* from the United States *(i)* to each individual trading partner *(j)* in year *t*. It is measured in nominal U.S. Dollars (in thousands).

$GDP/capita_j$ is the trading partners GDP per capita. The economic mass of the trade partners has been translated into GDP per capita in nominal US Dollars. It is often used as a proxy for the trading partner's supply (of exports) and demand (for imports). The variable is included as it is likely to affect preferences of goods, such as the demand for luxury or ordinary goods (Markusen, 2010). Organic products, as they are more expensive, fall into the category of luxury goods. Thus, consumer income (i.e. GDP per capita) affects demand for organic products which could increase levels of organic trade. Hence, richer countries are expected to import/export more organic products. The variable is therefore expected to be positive in the regressions with U.S. exports as richer countries are more likely to import organic foods. The expected coefficient for regressions with U.S. imports is unclear and could be either positive or negative since the relationship between the production of organic goods and GDP per capita is not straight forward. GDP figures are only relevant to include for U.S. trade partners since the destination of imports and the origin of exports is the United States.

$Distance_{ij}$ is a variable indicating the bilateral distance in kilometers between the two countries largest cities. It is a proxy for trade costs and is expected to be negative as trade costs increase with distance.

Landlocked$_j$ is a dummy variable that is equal to unity if the trade partner is enclosed by land. It is intended to capture trade costs and is expected to be negative as countries without access to ports are likely to experience higher transportation costs. The variable is excluded from the regressions with export data since it only contains one country that is landlocked.

NAFTA$_j$ is a dummy variable equal to unity if the trade partner is a member of the North American Free Trade Agreement, and zero otherwise. It can also be interpreted as a dummy indicating if the countries share a common border since the members of NAFTA share a border with the United States. It is expected to be positive as members of the same free trade union (or share a common border) are likely to trade more with each other than with other countries as trade barriers and transaction costs are lower.

S. Hemisphere$_j$ is a dummy variable that is set to one if the trade partner is located in the Southern Hemisphere. Jaenicke and Demko (2015) includes this variable in their study in order to capture the potential effect that opposite growing seasons may have on levels of organic trade. Trade with a country with an opposite growing seasons could either be positive or negative as it could both stimulate and dampen demand depending on reasons such as personal tastes and type of product.

English$_i$ is a dummy variable that is equal to unity if both countries have English as their official language. Sharing a common language is often used as a proxy for cultural and historical links and hence, is expected to increase trade levels.

Org.Policy$_{ij}$ is the main variable of interest. I have used several specifications. The first specification treats all organic equivalency policies as identical policies. In this specification it is defined as a dummy variable set to 1 if the trade partner is a Policy-country and from its respective year of commencement. For example, the policy variable is set to 1 if the country is Japan, Taiwan (for exports only), South Korea, EU and Canada during their effective organic equivalency agreement and zero otherwise. The second approach is to treat each organic equivalency policy as separate. That is, a separate variable for each country. Since I use annual trade data, the EU and South Korea policies will be specified as effective from 2013 and 2015, respectively.

I employ two additional data sets that include both organic and non-organic products. This allows for a more robust testing of how an equivalence of standard impacts organic trade. The data sets cover the top five traded organic products in monetary value as well as their non-organic equivalent. It adds another dimension to the analysis by allowing for comparison of trade between organic products and its conventional counterpart. By only examining the potential change in organic trade we may exclude other possible explanations that affects supply or demand such as climate conditions or changes in consumer tastes that is expected to affect organic and conventional foods similarly. In order to test this I include two additional specifications of the Org.Policy variable. The third approach is an interaction policy variable set to unity if two conditions apply. 1. If a country has an effective organic equivalency arrangement and 2. If the product is organic. The fourth specification is a separate interaction policy variable for each organic equivalency policy that meet the two conditions above. I will also estimate equation (3) and (4) including one additional variable, the target country's GDP. The reason for this is to include a similar version of the gravity equation as the one by Anderson and van Wincoop described in section 4.1.

4.3 DATA

The study is conducted using annual data for U.S. organic import and exports during 2011-2016. The unit of analysis used in this study to represent common standards are the organic equivalency arrangements between United States and five of its trade partners. The trade data is collected from the United States Foreign Agricultural (USDA) Sevice's Global Agricultural Trade System (GATS). USDA GATS collects information on imports to and exports from the United States and its trade partners. The GATS database reports the monetary value of the volume of bilateral trade expressed in thousands of U.S. Dollars for organic and non-organic agricultural products in the Harmonized Tariff Schedule of the United States (OTA:a). A problematic issue with analyzing trade in organic products is the lack of detailed data. Most internationally recognized organizations that provide trade data such as the International Monetary Fund, The Word Bank and Eurostat do not distinguish between organic and conventional agricultural products. It was not until 2011 that harmonized codes for organic products were first issued. In order for an organic product to receive a HS code it has to be traded for more than 1 million USD annually (Jaenicke and Demko, 2015). In other worlds, the lack of HS products codes does not necessarily indicate that there is no organic trade in that good. In 2011, only twenty different product groups were reported for imports. In general, import data is considered to be reported with better accuracy than exports. Due to the small data sample I extend the study to cover exports as well. I include a data set containing exports from the 2011's product groups, which contain more data points than imports. Exports are reported in 23 different product groups in 2011. See table 7 in the Appendix for a list of U.S. export and import products.

I include additional data sets that cover the top 5 traded organic products and its non-organic equivalent. It is measured in monetary value and the products are mentioned in section 2.2. The non-organic products is gathered from USDA GATS database.

Statistics on GDP, population, bilateral distance, as well as different dummy variables indicating bilateral similarities and differences were extracted from the

Centre d'etudes Prospectived et d'Information Internationales (CEPII) gravity and distance databases. The GDP/capita variable is interpolated for 2016 as these figures, as of May 2017, had not yet been made available.

Statistics for Serbia and the Democratic Republic of the Congo cannot be linked to the CEPII's gravity database and is replaced by statistics from the World Bank's World Development Indicators. Distance and bilateral dummies are in these cases calculated by the author. Since CEPII do not aggregate data on geographical or economic region, data for European Union is aggregated by the author.

All available trading partners that are found in the USDA GATS database are included in the study with two exceptions. Countries that are either too small (e.g. small oceanic island) or contain too few observations are excluded. See Table 10 in the Appendix for a complete list of the countries included in this study.

4.4 METHOD OF ESTIMATION

The main estimation method for the baseline gravity equation is a fixed effects Pseudo-Poisson Maximum Likelihood (PPML) model. A Hausman test has been conducted in order to establish weather fixed or random effects should be used in the estimations. The result of the Hausman test is found in Figure 5 in the Appendix and suggests that a fixed effects estimator is preferred.

I conduct two different fixed effects PPML estimations: PPML with year and country-product fixed effects and PPML with year fixed effects and product fixed effects. In order to distinguish between the two specifications the former one will be referred to as PPML FE and the later PPML. The PPML FE treats data as panel and the fixed effects controls for all sources of all time-invariant differences between individuals that could explain the level of trade. All time-invariant variables are hence omitted which could be problematic if the variable of interest does not change over time. Since the variable of interest in this study do have time-variation, this approach can be applied. However, since the policy for Canada and Taiwan was introduced in 2009 (i.e. prior to when USDA started recording trade data on organic products) the policy variables for these countries are omitted when using PPML FE. In order to be able to include these policies in my analysis, I conduct a general PPML. This approach treats the data as cross-sectional and the time-invariant variables does not get omitted. In order to control for time and product heterogeneity I include year and product dummies. Furthermore, I include a simple Ordinary Least Squares (OLS) estimator for comparison.

The PPML estimators have shown to have many desirable properties for studies using gravity models. First, the technique is consistent when using fixed effects. Most nonlinear maximum likelihood estimators does not have this property (Shepard, 2013, p. 52). Second, the estimator provides consistent parameters in presence of heteroscedasticity, and hence could bias the results. This is particularly important as heteroscedasticity constitutes a common problem in trade data analysis (ibid). Another suggestion to fix the problem of arbitrary heteroscedasticity is to include robust standard errors in the regressions (ibid). Third, the PPML estimator performs strongly when dealing with data containing large numbers zero values (Santos Silva and Tenreyro, 2006). Naturally, this is common in trade data since not all countries trade all products with other countries. It is particularly common in organic trade since trade data is relatively scarce[3]. The PPML estimator includes zero values due to its multiplicative form. By using log-linear models such as Ordinary Least Squares (OLS) these observations are dropped since the logarithm of zero is undefined. This could lead to sample selection bias (Shepard, 2013, p. 55). A study by Santos Silva and Tenreyro (2011)

[3] USDA GATS is the only database, known to the author, which provides statistics on organic data free of charge to the public.

provides support that the PPML technique is consistent even in datasets containing large numbers of zero values. Lastly, the estimated coefficients can be interpreted as elasticities, exactly as in log-linear models. The only difference is that the dependent variables (exports and imports) are specified in its original trade value rather than the logarithm of trade. Thus, the estimated coefficients of any independent variables entered in its logarithmic form can be interpreted as elasticities (Shepard, 2013, p. 52).

Some studies that investigate organic trade use alternative estimation methods such as the negative binomial model. The reason to why the PPML estimator is used, is because the negative binomial model exhibits some undesirable features in a trade context. One disadvantage of the negative binomial model is that it is sensitive to scale such that the results could differ depending on if the dependent variable is in dollars or in thousands of dollars which could be problematic when the gravity model is used. (Shepard, 2013, p. 54).

4.5 ZERO TRADE AND MISSING VALUES

A large number of observations were either reported as zeros or missing values. This could constitute an estimation issues as it can bias the estimations. As can be seen in Table 2 below, trade data on organic imports have more observations with zero values than exports. Thus, trade data for exports is of higher quality which should be taken into consideration when interpreting the results.

There are many ways to deal with zero trade flows. A common method in trade literature is to use a Pseudo-Poisson Maximum Likelihood estimator that does not require the observations to be in its logarithmic form. Westerlund and Wilhelmson (2011) have found that the PPML model is more efficient than log-linearized models when the data contains zero values. There are two commonly used approaches in order to handle zero trade flows in log-linearized models. One option is to drop them and another is to add a small constant to the value of trade before taking the logarithm (WTO, 2012, p. 112). The former approach may be problematic due to loss of information and yield biased estimates if the zeroes are not randomly distributed (Heckman, 1979). Thus, the second procedure is used in this study. The OLS coefficients could lead to significant biases if the data contains a large number of zero trade flows (Santos Silva and Tenreyno, 2006). Because of this, the main focus in this study is on the PPML estimations.

TABLE 2: MISSING VALUES AND ZERO TRADE FLOWS

Dataset	Total number of obs.	Missing values	Reported as zero	Total	% of obs.
Organic imports	7220	5286	771	6057	0.73/0.84
Organic exports	7728	4668	1445	6113	0.61/0.79
Organic and non-organic imports	3660	2466	362	2887	0.69/0.77
Organic and non-organic exports	3360	1578	543	2121	0.46/0.63

In the last column (% of obs), the figure to the left display missing values as a percentage of all observations and the figure to the right display the sum of missing values and zero trade flows as a percentage of all observations.

5. RESULTS

In this chapter the results from the various regressions and robustness tests are presented and discussed.

5.1 IMPORTS

The results are found in Table 3 below. The results from the first group of regressions (1-3) on organic imports data set are ambiguous. The results for the explanatory variable of interest, *Org.Policy*, is negative in all but one, the OLS, estimation. However, neither of the two PPML estimations is statistically significant. The second group of regressions (displayed as regressions 4-6) is performed using the same data. The only difference is that each policy is treated separately. The results are similar, the only difference is that the estimate of the South Korea policy in the PPML regression suggests a large negative and significant effect. The other Policy variables are negative, but not significant, except for the OLS estimates. However, the reason to the ambiguous results may be due to the poor quality of the organic imports data.

The estimated coefficients of the trade partners bilateral distance, membership of NAFTA and if the country is enclosed by land are statistically significant and consistent with theory. GDP per capita is positive in all but the two PPML FE regressions. According to theory it could be either positive or negative. The variable indicating if the country is located in the Southern Hemisphere and if the trade partners have English as their official language is mostly positive which is in line with theory. However, neither is statistically significant.

TABLE 3. ORGANIC IMPORTS

Dependent variable: Organic imports	PPML (1)	PPML FE (2)	OLS (3)	PPML (4)	PPML FE (5)	OLS (6)
Ln GDP/cap	0.017	-0.459	0.084***	-0.015	-0.465	0.041*
	(0.05)	(0.42)	(0.02)	(0.05)	(0.42)	(0.02)
Ln Distance	-0.853***		-0.588***	-0.907***		-0.556***
	(0.12)		(0.06)	(0.14)		(0.06)
NAFTA	1.133***		1.630***	1.237***		1.875***
	(0.24)		(0.29)	(0.23)		(0.37)
S.Hemisphere	0.373		0.069	0.384		0.058
	(0.20)		(0.06)	(0.20)		(0.06)
Landlocked	-1.756***		-0.222***	-1.762***		-0.262***
	(0.30)		(0.05)	(0.30)		(0.05)
English	-0.060		0.115	0.090		0.095
	(0.27)		(0.06)	(0.29)		(0.06)
Org Policy (any)	***-0.420***	***-0.268***	***1.261****			
	(0.31)	***(0.29)***	***(0.22)***			
Canada				***-0.768***		***0.988****
				(0.42)		***(0.48)***
EU				***0.696***	***-0.160***	***3.340****
				(0.41)	***(0.33)***	***(0.35)***
Japan				***0.162***	***-0.467***	***0.255***
				(0.56)	***(0.34)***	***(0.34)***
S.Korea				***-4.070****	***-0.480***	***-0.243***
				(0.63)	***(0.62)***	***(0.26)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	No	Yes	Yes	No	Yes
Country-product fixed effects	No	Yes	No	No	Yes	No
constant	13.567***		5.129***	14.289***		5.216***
	(1.15)		(0.58)	(1.30)		(0.58)
R-sqr			0.183			0.196
Obs	7200	7200	7200	7200	7200	7200

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. Robust standard errors are presented within parenthesis. The dependent variable is organic imports in nominal US Dollars in all cases except for the OLS regression where the natural log of imports is used. Estimates from the three models of which the OLS is specified as the natural logarithm as in equation 2 and the PPML and PPML FE is in its multiplicative form. All policies treated the same in regression 1-3 and separate in regressions 4-6. EU refer to the European Union's 28 member countries.

5.2 EXPORTS

The results from the first group of regressions (7-9 in Table 4 below) of the organic exports data set indicates that there may be positive trade effect when entering an organic equivalency agreement. However, it is only statistically significant in the OLS and the general PPML cases. When country fixed effects is included, as in PPML FE, the positive relationship is no longer clear. We cannot rule out that the positive trade effects in PPML and OLS may reflect supply effects, i.e. that some countries produce and supplies a larger quantity and variation of organic products than others.

The second group of regressions (10-12) is similar to the first, the only difference is that each organic trade agreement is treated as separate. All but the Canada policy are positive in the PPML regression. The positive trade effect is statistically significant for all but the EU. However, since the PPML FE estimation is not statistically different from zero, we cannot disregard that the positive trade gain in the PPML estimations reflects supply effects.

The majority of the remaining explanatory variables are consistent with theory, the only variable that largely differs the theoretical expectation is *Distance.* The estimated coefficients suggest that there is a significant positive relationship between distance and trade volume. I cannot find an explanation for this result other than that it may capture some positive trade effect unknown to me.

TABLE 4: ORGANIC EXPORTS

Dependent variable: Organic exports	PPML (7)	PPML FE (8)	OLS (9)	PPML (10)	PPML FE (11)	OLS (12)
Ln GDP/cap	0.452***	2.138	0.213***	0.584***	2.198	0.241***
	(0.06)	(1.39)	(0.02)	(0.06)	(1.57)	(0.02)
Ln Distance	2.246***		0.220***	1.148***		0.165***
	(0.36)		(0.03)	(0.25)		(0.03)
NAFTA	7.921***		5.364***	6.885***		5.757***
	(0.68)		(0.17)	(0.48)		(0.21)
S. Hemisphere	-0.022		-0.236***	-0.221		-0.236***
	(0.26)		(0.04)	(0.26)		(0.04)
English	-0.844**		0.166***	0.352		0.243***
	(0.26)		(0.05)	(0.19)		(0.05)
Org. Policy (any)	***1.219****	***0.608***	***2.125****			
	(0.27)	***(0.47)***	***(0.14)***			
Canada				***-0.466***		***1.124****
				(0.45)		***(0.30)***
S. Korea				***1.674****	***0.495***	***1.746****
				(0.48)	***(0.43)***	***(0.41)***
Taiwan				***2.176****		***2.813****
				(0.25)		***(0.24)***
EU				***0.047***	***0.424***	***1.308****
				(0.42)	***(0.52)***	***(0.27)***
Japan				***2.632****	***0.689***	***2.850****
				(0.40)	***(0.65)***	***(0.36)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	No	Yes	Yes	No	Yes
Country-product fixed effects	No	Yes	No	No	Yes	No
constant	-18.916***		-1.598***	-10.459***		-1.387***
	(3.78)		(0.35)	(2.55)		(0.35)
R-sqr			0.457			0.463
Obs	7728	7728	7728	7728	7728	7728

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. Robust standard errors are presented within parenthesis. The The dependent variable is organic exports in nominal US Dollars in all cases except for the OLS regression where the natural log of exports is used. Estimates from the three models of which the OLS is specified as the natural logarithm as in equation 3 and the PPML and PPML FE is in its multiplicative form. All policies are treated as equal in regressions 7-9 and as separate in regressions 10-12. EU refer to the European Union's 28 member countries.

5.3 ROBUSTNESS CONTROL

5.3.1 ROBUSTNESS TEST I: ORGANIC AND NON-ORGANIC IMPORTS

I use additional specifications and data sets in order to test the robustness of the results. The first method is to include additional data sets to compare organic and conventional products. I perform six additional regressions. In regressions 16-18 the organic policies with Japan, Korea and Taiwan are excluded since many data points are missing and would produce misleading results. Since PPML FE only provides estimations of time-varying variables, the Canadian policy gets omitted. Hence, the PPML FE (14) and (17) regressions only gives us an estimate of the EU policy. As seen in Table 5 the results are ambiguous. The estimated policy coefficients vary greatly among the different approaches and specifications. A reason to why the additional non-organic data does not provide a more robust result may be that the organic trade data is not sufficient enough. The other estimated coefficients are stronger and has a higher level of significance as in Table 4. The estimated coefficient of *English* in the PPML estimations is the only variable that differs from theory.

TABLE 5: REGRESSION OUTPUT: ORGANIC AND NON-ORGANIC IMPORTS

Org. and non-org imports	PPML (13)	PPML FE (14)	OLS (15)	PPML (16)	PPML FE (17)	OLS (18)
Org. Policy (any)	*-0.052*	*0.497*	*0.101*			
EU				*-0.256*	*0.497*	*2.841****
Japan						
Canada				*0.080*		*-1.332*
S. Korea						
Taiwan						

Estimates from the three models of which the OLS is specified as the natural logarithm as in Equation 2 and the PPML and PPMLE FE is in its multiplicative form. In regressions 13-15, the variable of interest is specified as the third approach described in section 4.2 under $Org.Policy_{ij.}$ and 16-18 as the fourth. EU refers to the European Union's 28 member countries. In regressions 16-18 the organic policies with Japan, Korea and Taiwan are excluded since many data points are missing and would produce misleading results. For a complete table of the regression output, see Table 11 in the Appendix.

5.3.2 ROBUSTNESS TEST II: ORGANIC AND NON-ORGANIC EXPORTS

I performed the same regressions as described in section 5.3.1 but with organic and non-organic exports. When comparing with non-organic products, the estimates suggest that organic exports has increased. The estimates of all six regressions are positive, only some of them statistically significant. PPML FE is the estimator that provides the strongest results as it incorporates all fixed effects. The Policy coefficient in regression 20 has a significant positive elasticity of 0.615 which suggest that entering an organic equivalency agreement increases U.S. exports by 67.2 percent on average[4]. When treating each policy separately in regression 22-24, the estimated policy effect is still positive and significant most cases. The PPML FE indicates that the EU, Japan and South Korea policies have had a positive effect on organic trade. The US-Japanese policy is the only that is statistically significant in all models. The results from regression 23 indicate that the EU and South Korea arrangements have the largest, and most robust, impact. The estimated impact on organic trade is a 60.1 and a 400 percentage increase respectively. The estimation of the impact from the South Korea policy may seem unrealistically large. However, as seen in Figure 4 in section 2.2, the monetary value of exports to Korea is low compared to other regions. Hence, it only takes a relatively small increase of exports (in monetary value) to make up 400 percent.

The positive and statistically significant results of the PPML FE regressions suggest that there may be a positive impact of an equivalence of standards on organic exports. This is further supported by the fact that the data set only includes the most important products as they are less likely to be influenced by idiosyncratic behavior.

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[4] In order to calculate the percentage change I use the following expression: 100[exp(c)-1] where c is the estimated coefficient.

TABLE 6: REGRESSION OUTPUT: ORGANIC AND NON-ORGANIC EXPORTS

Org and non-org Exports	PPML (19)	PPML FE (20)	OLS (21)	PPML (22)	PPML FE (23)	OLS (24)
Org. Policy (any)	*0.412*	*0.615**	*1.750****			
EU				*0.400*	*0.474***	*1.246**
Japan				*1.400***	*0.340**	*2.011**
Canada				*0.384*		*1.703****
S. Korea				*0.900*	*1.608****	*0.932*
Taiwan				*0.421*		*2.226****

Estimates from the three models of which the OLS is specified as the natural logarithm as in Equation 3 and the PPML and PPMLE FE is in its multiplicative form. In regressions 19-21, the variable of interest is specified as the third approach described in section 4.2 under Org.Policy$_{ij.}$ and in 22-24 as the fourth. EU refers to the European Union's 28 member countries. For a complete table of the regression output, see table 12 in the Appendix.

5.3.3 ROBUSTNESS TEST III AND IV: ADDING A GDP VARIABLE

I perform a second type of robustness control by adding a GDP variable to equation [2] and [3]. GDP is a common variable used in the gravity equation to denote economic mass of a country. I perform regressions with organic and conventional products and the results can be found in Table 13 and 14 in the Appendix. The results are similar to Robustness test I and II. Organic imports do not seem to have increased due to the organic equivalency policies. The results for organic export is ambiguous and depends on what fixed effects is used. The most robust result of the two PPML estimations is obtained from PPML FE (32) and suggests an increase of exports with 83.7 percent when treating all policies as equal. The other explanatory variables are in line with the findings in Robustness test I and II.

7. CONCLUSION

The aim of this paper is to analyze whether mutual agreements of product standards can facilitate trade. It is analyzed by examining the U.S. organic equivalency agreements effect on bilateral trade. This analysis is driven by a balanced data set covering 57 and 60 countries respectively during 2011-2016. Due to a large number of zero values, I employ fixed effects Pseudo-Poisson Maximum Likelihood model to the gravity equation.

Entering a mutual recognition of standards agreement have an ambiguous effect on trade. This study cannot find that imports to the U.S. has increased due to the organic equivalency arrangements. The poor quality of the import data could explain the lack of result of these regressions. The impact on organic exports are unclear and depends on what fixed effects is used. The positive trade effect for organic exports becomes stronger when conducting robustness estimations with additional data sets and different variable definitions. The most robust results from exports is found when I compare organic products with conventional products. The positive effect on organic exports is an indicator that there may be a trade gain from entering a mutual recognition of standards agreement. The findings in this study are in line with previous research. U.S. imports tends to be relatively unaffected by equivalence in product standards while exports seems to have increased (Kristiansen [2014); Jaenicke and Demko (2015)]. Studies on TBT measures and trade suggest that there should be an increase in trade when entering a mutual recognition of standards agreement. However, this study cannot find a general trade effect of adopting an equivalency agreement of standards.

The demand for organic products have resulted in supply shortages in the United States. The U.S. has become increasingly dependent on organic imports to fill the gap between domestic supply and consumer demand. There are potential welfare gains for both the producer and consumer by entering a mutual recognition of standards agreement. The producers gain access to larger markets and are able to scale up their production. The consumers experience higher availability, more varieties and lower prices as a result. The issues concerning the U.S. supply of organic goods can also be reduced if organic imports acts as substitute for the domestic supply. Although the impact of the organic equivalency arrangements is unclear, it is possible that the organic arrangements entail positive externalities that are difficult to measure such as contributing to improved soil quality and lower greenhouse gas emissions. However, this not investigated in this paper but would be interesting to study further. Furthermore, as organic trade data continue to be collected by USDA GATS a more thorough analysis may be possible in the future. Future research with more data points ranging over a longer time period will improve the analysis of the organic equivalency arrangements impact on trade.

7. REFERENCES

Anderson, J. (1979) "A Theoretical Foundation for the Gravity Equation" *American Economic Review*, 1979, vol. 69, issue 1, 106-16

Anderson, J., and van Wincoop, E., (2003). "Gravity with Gravitas: A Solution to the Border Puzzle" *The American Economic Review*, Vol. 93, No. 1, (Mar., 2003), pp. 170-192

Barrett, H.R., A.W. Browne, Harris, P.J.C. and Cadoret, K., (2002). 'Organic Certification and the UK Market: Organic Imports from Developing Countries.' *Food Policy* 2002 27(4):301-318

Bergstrand, J.H., (1985). "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence". *The Review of Economics and Statistics,* Vol. 67, No. 3. (Aug., 1985), pp. 474-481.

Bizzoero, J., (2017) "U.S. Organic Food Sales Hit Record $43 Billion in 2016" *Food Insider Journal.* Available at: http://www.foodinsiderjournal.com/blogs/clean-label-insights/2017/06/us-organic-food-sales-hit-record-43-billion-in-2016.aspx Site visited: 2017-08-05

Bolwig, S., Gibbon, P., and Jones, S., (2009). "The Economics of Smallholder Organic Contract Farming in Tropical Africa" In *World Development* 2009 37(6):1094-1104

Cadot, O., and Gourdon, J. (2016). "Non-tariff measures, preferential trade agreements, and prices: new evidence". *Review of World Economics*, 1–23.

Canavar,i M. and N. Cantore. 2010. 'Equivalence of Organic Standards as a Signal of Affinity: A Gravity Model of Italian Agricultural Trade.' *Journal of International Food and Agribusiness Marketing*, 22(3-4): 314-327.

CEPII (2017).

a. Gravity dataset. Available at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8. Site visited: 10/04/2017.

b. Distance dataset. Available at: http://www.cepii.fr/cepii/en/bdd_modele/download.asp?id=6. Site visited: 17/04/2017.

Chen, M. X., and Mattoo, A. (2008). "Regionalism in Standards: Good or Bad for Trade?" *The Canadian Journal of Economics / Revue canadienne d'Economique*, 8/1/2008, Vol. 41, Issue 3, p. 838-863

Deardorff, A.J., (1995). "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" *NBER Working Paper* No. 5377. Issued in December 1995

(FAO and WTO, 2017)

Food and Agriculture Organization and World Trade Organization, (2017). "TRADE AND FOOD STANDARDS". Available at: http://www.fao.org/3/a-i7407e.pdf Site visited: 2017-08-14

Frahan, B.H., and Vancauteren, M., (2006). "Harmonization of Food Regulations and Trade in the Single Market: Evidence from Disaggregated Data." *European Review of Agricultural Economics*, 3383): 337-360

Gold, M., (2007). "Organic Production/Organic Food: Information Access Tools" *United States Department of Agriculture.* Available at: https://www.nal.usda.gov/afsic/organic-productionorganic-food-information-access-tools.Site visited: 2017-08-30

Heckman, J. J., (1979). "Sample Selection Bias as a Specification Error". Econometrica, Vol. 47, No. 1 (Jan., 1979), pp. 153-16

Kleemann,L., Abdulai, A. and Buss, M. (2014).” Certification and Access to Export Markets: Adoption and Return on Investment of Organic-Certified Pineapple Farming in Ghana” In *World Development* December 2014 64:79-92

Kristiansen, D. M., (2014). “The Effect Of Organic Price Premia And Equivalence Agreements On Select Organic Imports Into The United States”. Master thesis. Available at: https://conservancy.umn.edu/bitstream/handle/11299/165554/Kristiansen_umn_0130M_14979.pdf?sequence=1&isAllowed=y Site visited: 2017-06-01

Markusen, James R. (2010). “Putting Per-Capita Income Back Into Trade Theory”. NBER Working Paper 15903.

Oberholtzer, L., Dimitri, C., and Jaenicke, E. C.,(2013) ”International trade of organic food: Evidence of US imports.” *Renewable Agriculture & Food Systems*. Sep2013, Vol. 28 Issue 3, p255-262. 8p.

OTA

a. “Trade Data”. *Organic Trade Association.* Available at: https://www.ota.com/resources/global-market-opportunities/trade-data Site visited: 2017-07-10

b. “Organic Standards”.

Available at: https://www.ota.com/advocacy/organic-standards Site visited: 2017-08-03

OTA, (2016). ” U.S. organic sales post new record of $43.3 billion in 2015”. Available at: https://www.ota.com/news/press-releases/19031

Site visited: 2017-07-30

Rippey, B. P., (2015). ” The U.S. drought of 2012” U*SDA Research and Programs on Extreme Events, Weather and Climate Extremes* December 2015 10 Part A:57-64

Santos Silva, J., and Tenreyro, S. (2005). "The Log of Gravity". *The Review of Economics and Statistics,* 11/1/2006, Vol. 88, Issue 4, p. 641-658

Santos Silva, J., and Tenreyro, S. (2011). "Further Simulation Evidence on the Performance of the Poisson Pseudo-Maximum Likelihood Estimator." *Economics Letters*, 112(2): 220-222.

Shepard, B., 2013. "The Gravity Model of International Trade: A User Guide" *ARTNeT Gravity Modeling Initiative and UN publications.*

The World Bank, World Development Indicators (2017). GDP and *GDP per capita* (Serbia and the Democratic Republic of Congo). Available at: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators Site visited: 2017-04-10

Tinbergen, J. (1962). Shaping the World Economy; Suggestions for an International Economic Policy. Books (Jan Tinbergen). Twentieth Century Fund, New York. Available at: http://hdl.handle.net/1765/16826 Site visited: 2017-05-10

(USDA)

a. "International Trade Partners". Available at: https://www.ams.usda.gov/services/organic-certification/international-trade Site visited: 2017-07-15

b. United States Department of Agriculture. International Trade Policies: Canada. Available at: https://www.ams.usda.gov/services/organic-certification/international-trade/Canada Site visited: 2017-07-15

c. "International Trade Policies: European Union". Available at: https://www.ams.usda.gov/services/organic-certification/international-trade/European%20Union Site visited: 2017-07-15

d. "International Trade Policies: Taiwan." Available at: https://www.ams.usda.gov/services/organic-certification/international-trade/Taiwan Site visited: 2017-07-15

e. "International Trade Policies: Japan" Available at: https://www.ams.usda.gov/services/organic-certification/international-trade/Japan. Site visited: 2017-07-15

f. "International Trade Policies: Korea" Available at: https://www.ams.usda.gov/services/organic-certification/international-trade/Korea. Site visited: 2017-07-15

g. "Trade & Equivalency Arrangements" Available at: https://www.ams.usda.gov/rules-regulations/organic/trade. Site visited: 2017-08-01

(USDA, 2017)

USDA's Foreign Agricultural Service's Global Agricultural Trade System. Organic import and export database. Retrieved from: https://apps.fas.usda.gov/gats/default.aspx.

Westerlund ,J., and Wilhelmsson, F., (2011). "Estimating the Gravity model without Gravity Using Panel Data". *Applied Economics,* Vol 43, No 6

(WTO, 2005)

World Trade Organization, 2005. "WORLD TRADE REPORT Exploring the links between trade, standards and the WTO" Available at: https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report05_e.pdf Site visited: 2017-08-10

(WTO, 2012)

WTO AND UNCTAD. (2012). "A Practical Guide to Trade Policy Analysis". Chapter 5 pp. 101-136. Available at: https://www.wto.org/english/res_e/publications_e/practical_guide12_e.htm Site visited: 2017-05-10

(WTO, 2016)

World Trade Organization, 2016. "The WTO Agreements Series, Technical Barriers to Trade". Pp. 10-14. Available at: https://www.wto.org/english/res_e/publications_e/tbttotrade_e.pdf Site visited: 2017-07-15

8. APPENDIX

TABLE 7: HS ORGANIC PRODUCTS

ORGANIC EXPORTS (2011)	**ORGANIC IMPORTS (2011)**
1. Potatoes	1. Peppers, Sweet Bell
2. Cherry Tomatoes	2. Peppers - Other
3. Roma Tomatoes	3. Hass- Like Avocados
4. Tomatoes, Other	4. Apples
5. Onion Sets	5. Pears And Quinces
6. Cauliflower	6. Pears And Quinces - Other
7. Broccoli	7. Blueberries
8. Head Lettuce	8. Coffee, Arabica
9. Lettuce, Other	9. Coffee - Not Decaf, Not Roasted
10. Carrots	10. Coffee, Decaf Not Roasted
11. Celery	11. Coffee, Roasted, Not Decaf <2Kg
12. Peppers	12. Coffee, Roasted, Not Decaf
13. Spinach	13. Coffee, Decaf. <2Kg
14. Oranges	14. Green Tea Flavored <3Kg
15. Lemons	16. Green Tea Not Flavored <3Kg
16. Grapes	17. Green Tea Not Flavored, Other <3Kg
17. Apples	18. Black Tea <3 KG
18. Pears And Quinces	19. Durum Wheat
19. Cherries	20. Rice
20. Strawberries	21. Soybeans
21. Blueberries	
22. Coffee	
23. Tomato Sauce	

TABLE 8: SUMMARY OF ORGANIC EQUIVALENCY AGREEMENTS

<table>
<tr><td>Canada</td><td>Scope. The equivalence arrangement includes all USDA organic products, whether they are produced and certified in the U.S. or around the world. USDA-authorized certifying agents may not certify Canada-based operations to USDA organic standards.

In order to be sold, labeled, or represented as organic in Canada, USDA organic products must meet the following additional requirements.

Agricultural products produced with the use of sodium nitrate shall not be sold or marketed as organic in Canada.

Agricultural products produced by hydroponic or aeroponic production methods shall not be sold or marketed as organic in Canada.

Agricultural products derived from animals (with the exception of ruminants) must be produced according to livestock stocking rates as set out in CAN /CGSB32.310-2006</td></tr>
<tr><td>S. Korea</td><td>Scope. Beginning July 1, 2014, the arrangement covers products which:

• Are certified to the USDA or Korean organic regulations
• Are "processed products" as defined by the Korean Food Code
• Contain at least 95 percent organic ingredients
• Have their final processing (as defined in the Korean Food Code) occur in the U.S. or Korea
• U.S. products: do not contain apples or pears produced with the use of antibiotics
• Korean products: do not contain livestock products produced with the use of antibiotics</td></tr>
<tr><td>Japan</td><td>Scope: Beginning January 1, 2014, all certified organic plant and plant based processed products that are produced in the U.S. and Japan, or which have final processing, packaging, or labeling in the U.S. or Japan, may access either market. Other USDA-certified organic products, such as meat, dairy products, and alcoholic beverages, continue to enjoy access to both markets.</td></tr>
<tr><td>European Union</td><td>Scope. Beginning June 1, 2012, the equivalence arrangement only covers products exported from and certified in the United States or the European Union.

Requirements. The following limitations apply to organic agricultural products traded under the arrangement:

The following U.S. organic products may not be exported to the EU
• Crops produced using antibiotics (streptomycin for fire blight control in apples and pears).
The following EU organic products may not be exported to the U.S.
• Agricultural products derived from animals treated with antibiotics.
• Aquatic animals (e.g. fish, shellfish).</td></tr>
<tr><td>Taiwan</td><td>Scope. The trade arrangement includes all USDA organic products produced in the United States or its territories. USDA organic products produced outside the United States are not included in this arrangement.</td></tr>
</table>

Further information about the organic equivalency agreements can found at the United States Department of Agriculture's website.

Source: United States Department of Agriculture (USDAb-f).

TABLE 9: VARIABLES AND DATA SOURCES

VARIABLE	**DESCRIPTION**
Organic and non-organic imports	Imports in nominal US Dollars. Data Source: USDA (2017).
Organic and non-organic Exports	Exports in (nominal) thousands of US Dollars. Data Source: USDA (2017).
GDP per capita	GDP per capita in nominal US dollars. Source: CEPII (2017a), The World Bank (2017).
GDP	GDP in nominal US dollars. Source: CEPII (2017a), The World Bank (2017).
Distance	Bilateral distance between two trading partners expressed in kilometers between the largest cities in each country. Source: CEPII (2017b)
English	Dummy variable that is equal to one if two countries share English as their official language. Source: CEPII (2017a)
Landlocked	Dummy variable that is equal to one if a country is enclosed by land. Only for imports since only (1) country in the export data set is landlocked. Source: CEPII (2017a)
NAFTA	Dummy variable that is equal to one if a country is a member of NAFTA, i.e. Canada and Mexico. Source: Made by author.
S. Hemisphere	Dummy variable that is equal to one if a country is located in the Southern Hemisphere. It is to capture the potential effect different growing seasons can have on trade. Source: Made by author.
Org. Policy	1. Dummy variable that is equal to one if a country has an organic equivalency agreement with the United States and from the year of its commencement and onwards. 2. Separate dummy variable for each effective agreement. 3. An interaction dummy variable that is equal to one if the product is organic, if a country has an organic equivalency agreement with the United States, from the year of its commencement and onwards. 4. Separate dummy variables for each effective organic agreement. The conditions in (3) need to be satisfied. Source: Made by Author.

TABLE 10: DESTINATION AND ORIGIN COUNTRIES

U.S. EXPORTS		**U.S. IMPORTS**	
Argentina	Nicaragua	Argentina	Laos
Australia	Nigeria	Australia	Lebanon
Bahrain	Norway	Bangladesh	Macedonia
Bangladesh	Oman	Bolivia	Madagascar
Belize	Pakistan	Bosnia and Herzegovina	Malaysia
Brazil	Lebanon	Brazil	Mexico
Cambodia	Malaysia	Cambodia	Morocco
Canada	Mexico	Canada	Namibia
Chile	New Zealand	Chile	Nepal
China	Nicaragua	China	New
Colombia	Nigeria	Colombia	Zealand
Costa Rica	Norway	Democratic Republic of	Nicaragua
Ecuador	Oman	the Congo	Pakistan
Egypt	Pakistan	Republic of the Congo	Panama
El Salvador	Panama	Costa Rica	Peru
European Union	Peru	Ecuador	Philippines
Guatemala	Philippines	Egypt	Russia
Guyana	Qatar	El Salvador	Rwanda
Honduras	Russia	Ethiopia	Saudi
Hong Kong	Saudi Arabia	European Union	Arabia
Iceland	Sierra Leone	Guatemala	Serbia
India	Singapore	Honduras	South Africa
Indonesia	South Africa	Hong Kong	Sri Lanka
Israel	Sri Lanka	India	Taiwan
Japan	Suriname	Indonesia	Tanzania
Jordan	Taiwan	Israel	Thailand
Kazakhstan	Thailand	Japan	Turkey
Korea, South	Turkey	Jordan	Uganda
Kuwait	United Arab	Kazakhstan	Ukraine
Lebanon	Emirates	Kenya	United Arab
Malaysia	Uruguay	South Korea	Emirates
Mexico	Venezuela		Uruguay
New Zealand	Vietnam		Vietnam

FIGURE 5: HAUSMAN TEST

A Hausman test is a commonly used for panel data in order to test whether fixed or random test should be used. The null hypothesis is that a random effects estimator is an appropriate estimator of the true parameter value. The alternative hypothesis is that the fixed effects model is appropriate. As seen in below, the p-value is 0.00 and the null hypothesis is rejected. Thus, a fixed effects estimator is preferred.

```
. hausman fixed random
```

	---- Coefficients ----			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
ln_gdpcap_o	.7328183	.7345488	-.0017305	.000262
Policy	.2070277	.208376	-.0013483	.00017

```
                   b = consistent under Ho and Ha; obtained from xtpoisson
    B = inconsistent under Ha, efficient under Ho; obtained from xtpoisson

    Test:  Ho:  difference in coefficients not systematic

                  chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       84.55
                Prob>chi2 =      0.0000
```

TABLE 11. ROBUSTNESS I: ORGANIC AND NON-ORGANIC IMPORTS

Dependent variable: Organic and non-organic imports	PPML (13)	PPML FE (14)	OLS (15)	OLS (16)	PPML FE (17)	PPML (18)
Ln GDP/cap	0.052	0.017	-0.038	0.052	0.017	-0.069
	(0.07)	(0.26)	(0.04)	(0.07)	(0.26)	(0.04)
Ln Distance	-1.328***		-1.920***	-1.327***		-1.930***
	(0.17)		(0.12)	(0.17)		(0.12)
NAFTA	1.815***		2.293***	1.815***		2.686***
	(0.40)		(0.49)	(0.40)		(0.54)
S.Hemisphere	1.612***		0.850***	1.612***		0.847***
	(0.20)		(0.13)	(0.20)		(0.13)
Landlocked	-1.549***		-0.294*	-1.549***		-0.307**
	(0.24)		(0.12)	(0.24)		(0.12)
English	-1.795***		0.472***	-1.802***		0.506***
	(0.35)		(0.12)	(0.35)		(0.12)
Org Policy (any)	***-0.052***	***0.497***	***0.101***			
	(0.39)	***(0.66)***	***(0.42)***			
E1				***-0.256***	***0.497***	***2.841******
				(0.52)	***(0.66)***	***(0.71)***
C1				***0.080***		***-1.332***
				(0.45)		***(0.89)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	No	Yes	Yes	No	Yes
Country-product fixed effects	No	Yes	No	No	Yes	No
constant	18.640***		18.169***	18.633***		18.517***
	(1.78)		(1.20)	(1.78)		(1.20)
R-sqr			0.297			0.301
Obs	3660	3660	3660	3660	3660	3660

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. Robust standard errors are presented within parenthesis. The dependent variable is imports to the U.S. measured in millions of US Dollars of the five most traded organic products (in monetary value) and its non-organic equivalent except for the OLS regressions where the natural log of imports is used. All policies treated the same in regression 13-15 and separate in regressions 16-18. EU covers the European Union's 28 member countries. In regressions 16-18 the organic policies with Japan, Korea and Taiwan are excluded since too many data points are missing and would produce misleading results.

TABLE 12: ROBUSTNESS II: ORGANIC AND NON-ORGANIC EXPORTS

Dependent variable: Organic and non-organic exports	PPML (19)	PPML FE (20)	OLS (21)	PPML (22)	PPML FE (23)	OLS (24)
Ln GDP/cap	0.243***	-0.018	0.438***	0.243***	-0.028	0.444***
	(0.04)	(0.20)	(0.03)	(0.04)	(0.20)	(0.03)
Ln Distance	0.971***		0.231**	0.970***		0.225**
	(0.14)		(0.08)	(0.14)		(0.08)
NAFTA	4.337***		6.567***	4.340***		6.572***
	(0.23)		(0.38)	(0.23)		(0.43)
S.Hemisphere	-0.612**		-0.826***	-0.609**		-0.823***
	(0.19)		(0.11)	(0.19)		(0.11)
English	0.957***		0.019	0.962***		
	(0.12)		(0.11)	(0.12)		
Org Policy (any)	***0.412***	***0.615****	***1.750*****			
	(0.28)	***(0.26)***	***(0.29)***			
EU				***0.400***	***0.474*****	***1.246****
				(0.41)	***(0.17)***	***(0.60)***
Japan				***1.400*****	***0.340****	***2.011****
				(0.46)	***(0.16)***	***(0.91)***
Canada				***0.384***		***1.703******
				(0.29)		***(0.50)***
S. Korea				***0.900***	***1.608******	***0.932***
				(0.77)	***(0.08)***	***(1.05)***
Taiwan				***0.421***		***2.226******
				(0.35)		***(0.46)***
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Product Fixed Effects	Yes	No	Yes	Yes	No	Yes
Country-product fixed effects	No	Yes	No	No	Yes	No
constant	-2.849*		0.372	-2.831*		0.374
	(1.21)		(0.81)	(1.22)		(0.81)
R-sqr			0.512			0.513
Obs	3360	3360	3360	3360	3360	3360

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. Robust standard errors are presented within parenthesis. The dependent variable is exports from the U.S. measured in millions of US Dollars of the five most traded organic products (in monetary value) and its non-organic equivalent except for the OLS regressions where the natural log of exports is used. All policies treated the same in regression 19-21 and separate in regressions 22-24. EU refers to the European Unions 28 member countries.

TABLE 13: R OBUSTNESS III: ORGANIC AND NON-ORGANIC IMPORTS

Dependent variable: Org. and non-org. imports	PPML (25)	PPML FE (26)	OLS (27)	OLS (28)	PPML FE (29)	OLS (30)
Ln GDP	0.329***	1.003	0.398***	0.329***	1.003	0.389***
	(0.06)	(4.01)	(0.04)	(0.06)	(4.01)	(0.04)
Ln GDP/cap	-0.231**	-0.993	-0.351***	-0.231**	-0.993	-0.377***
	(0.07)	(3.97)	(0.05)	(0.07)	(3.97)	(0.05)
Ln Distance	-1.330***		-2.139***	-1.329***		-2.140***
	(0.19)		(0.12)	(0.19)		(0.12)
NAFTA	1.200**		1.591**	1.199**		1.891***
	(0.42)		(0.49)	(0.42)		(0.55)
S.Hemisphere	1.231***		0.849***	1.231***		0.849***
	(0.21)		(0.13)	(0.21)		(0.13)
Landlocked	-1.284***		0.174	-1.283***		0.149
	(0.24)		(0.12)	(0.24)		(0.12)
English	-1.532***		0.436***	-1.545***		0.458***
	(0.32)		(0.12)	(0.32)		(0.12)
Org Policy (any)	***-0.098***	***0.531***	***-0.151***			
	(0.38)	***(0.66)***	***(0.42)***			
EU				***-0.474***	***0.531***	***2.492******
				(0.52)	***(0.66)***	***(0.71)***
Canada				***0.149***		***-1.086***
				(0.45)		***(0.89)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	No	Yes	Yes	No	Yes
Country-product fixed effects	No	Yes	No	No	Yes	No
constant	12.758***		12.631***	12.744***		13.102***
	(2.75)		(1.33)	(2.75)		(1.32)
R-sqr			0.321			0.324
Obs	3660	3660	3660	3660	3660	3660

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. One additional variable, GDP, is included in the regressions. Robust standard errors are presented within parenthesis.The dependent variable is imports to the U.S. measuured in millions of US Dollars of the five most traded organic products (in monetary value) and its non-organic equivalent except for the OLS regressions where the natural log of imports is used. All policies treated the same in regression 25-27 and separate in regressions 28-30. EU covers the European Union's 28 member countries. In regressions 16-18 the organic policies with Japan, Korea and Taiwan are excluded since too many data points are missing and would produce misleading results.

TABLE 14: ROBUSTNESS IV: ORGANIC AND NON-ORGANIC EXPORTS

Dependent variable: Org. and non-org. exports	PPML (31)	PPML FE (32)	OLS (33)	PPML (34)	PPML FE (35)	OLS (36)
Ln GDP	0.298***	1.309	0.259***	0.299***	1.266	0.257***
	(0.03)	(1.35)	(0.03)	(0.03)	(1.35)	(0.03)
Ln GDP/cap	0.109**	-1.301	0.316***	0.111**	-1.269	0.323***
	(0.04)	(1.34)	(0.04)	(0.04)	(1.34)	(0.04)
Ln Distance	0.642***		-0.196*	0.634***		-0.177*
	(0.18)		(0.09)	(0.18)		(0.09)
NAFTA	3.452***		5.540***	3.435***		5.543***
	(0.29)		(0.39)	(0.29)		(0.45)
S.Hemisphere	-0.668***		-1.008***	-0.668***		-0.982***
	(0.19)		(0.11)	(0.19)		(0.11)
English	1.069***		0.191	1.068***		
	(0.13)		(0.11)	(0.13)		
Org Policy (any)	***0.330***	***0.658****	***1.427*****			
	(0.27)	***(0.26)***	***(0.30)***			
EU				***-0.365***	***0.509*****	***0.457***
				(0.38)	***(0.18)***	***(0.61)***
Japan				***0.765***	***0.392****	***1.358***
				(0.46)	***(0.16)***	***(0.91)***
Canada				***0.334***		***1.714******
				(0.29)		***(0.50)***
S. Korea				***0.575***	***1.629******	***0.551***
				(0.77)	***(0.09)***	***(1.05)***
Taiwan				***0.418***		***2.129******
				(0.35)		***(0.46)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	No	Yes	Yes	No	Yes
Counutry-product fixed effexts	No	Yes	No	No	Yes	No
constant	-6.470***		-1.318	-6.451***		-1.478
	(1.56)		(0.81)	(1.56)		(0.81)
R-sqr			0.523			0.524
Obs						

* p<0.05 ** p<0.01 *** p<0.001 denotes level of significance. One additional variable, GDP, is included in the regressions. Robust standard errors are presented within parenthesis. The dependent variable is exports from the U.S. measured in millions of US Dollars of the five most traded organic products (in monetary value) and its non-organic equivalent except for the OLS regressions where the natural log of exports is used. All policies treated the same in regression 31-33 and separate in regressions 34-36. EU refers to the European Union's 28 member countries.