Organic certification systems and international trading of agricultural products in gravity models

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Abstract

Recent literature about gravity models points out the importance of institutional frictions in the international market of agricultural products beyond the traditional economics variables as transport costs reducing the mass of trade in bilateral relationships. In particular, previous contributions stress that harmonization of food standards could decrease transaction costs in trading relationships by stimulating international market. In a previous work we hypothesized that the acknowledgment of equivalence in organic standards may represent a reliable signal of affinity in bilateral relationships which may be useful to identify areas in which transaction costs for both conventional and organic standards are lower.

This article represents a step forward, since it assumes that the acknowledgment of equivalence in identifying areas with lower transaction costs in trading relationships for the whole produce could be a strong assumption that may be relaxed through the hypothesis that affinity in market exchange could be simply signaled by the presence of organic standards for the involved countries. Therefore, in our analysis we test if countries setting specific rules for organic standards are more "affine" in trading relationships because of a low common cultural, law and political distance but also if differences in organic standards themselves can be useful to differentiate the level of affinity among regions. Interesting insights for policy makers about the identification of relevant variables for international business arise from an econometric analysis.

JEL codes: Q11, Q 13

Keywords: Gravity models, organic standards, transaction costs, international market, agricultural trade, food products.

Introduction

International business relationships are strongly affected by the traditional variables expressing demand and supply factors such as in the perfect competition theory (preferences, on the consumer side and technology in the supply side) and by those variables which typically represent frictions in the free exchange of goods such as the transaction costs.

Whereas models explaining international business relationships easily introduce economic variables such as Gross Domestic Product (GDP) and GDP per capita to identify the main factors influencing import and export exchanges, the most challenging issue is to correctly consider variables describing transaction costs. Frictions in the international business often depend on factors which are hardly measurable such as the differences in language, religion or political systems. An article by Dow and Karunaratna (2006) uses the Hofstede Index as continuous variable to capture the cultural distance among countries and its impact on business. Tadesse and White (2008) interpret cultural distance as the contrast between societies showing deference to authority and interest to the Survival values such as the hard work and societies characterized by individualism and a greater attention paid attributed to the quality of life.

Even more difficult it is the attempt to find and measure transaction costs in specific economic sectors, such as the agricultural one. The contribution from Henry de Frahan and Vancauteren (2006) specifically recognizes differences in food standards as barriers in international business. In a forthcoming paper (Canavari and Cantore 2008) we implemented an econometric analysis to test if countries granting equivalence in organic standards and privileged import procedures to partners are more likely to develop an international business concerning conventional products. In other words, we hypothesized that only when trust relationships arise in the market about conventional food, countries would stipulate agreements about the higher quality products such as the organic ones. The acknowledgement of equivalence of the organic certification would represent a "signal" of affinity in international bilateral trading relationships. The findings actually support this hypothesis.

This article represents a step forward. We test the assumption that the acknowledgment of equivalence to identify low transaction costs areas is a restrictive one and that the simple presence of implemented rules for organic standards could be a valid signal to find bilateral business exchanges characterized by lower transaction costs and trust relationships. As outlined by a recent IFOAM publication (Willer and Yussefi 2004), in 2003 only 39 countries had a regulation in place about organic standards[1]. This means that in 2003 in only about 25% of the world countries specific organic standards were available. Therefore, our assumption is that the presence of organic standards is a signal of cultural affinity and among these countries it is more likely to establish fruitful trading, counting on a lower level of frictions.

Moreover, we test the assumption that though countries showing organic standards are characterized by lower transaction costs and higher mass of trading between them, the extent to which transaction costs decrease also depend on the level of "similarity" between international organic standards. In other words, our hypothesis is that countries providing organic standards are more "affine" in bilateral trading rather than countries that are late in setting regulations for organic food. Among countries that regulated the organic sector, however, the most "affine" ones are the countries in which standards are more similar.

We develop our analysis applying gravity models, which represent a fruitful strand of research. Since the first attempts (Tinbergen 1962; Pöyhönen 1963) data strongly fitted the model assumptions framework. The basic idea behind the gravity model is that the flow of bilateral trading is positively related to economic variables such as GDP (expressing the capacity of economies to produce or absorb production) and GDP per capita (expressing the

[1] In the Appendix 1 a list of the countries with a certification system is provided.

capacity to pay for goods) and negatively related to the distance representing transport costs. A wide literature developed to validate the model by a theoretical approach (Bergstand 1985; Anderson and Wincoop 2003) or by empirical models in order to enrich the original model set up (Frankel and Rose 2002).

A more restricted literature specifically focuses on the agricultural sector (Ševela 2002; Dascal, Mattas, and Tzouvelekas 2002; Atici and Guloglu 2006) and as we said the attempts to investigate institutional factors like food regulations and standards are even more sporadic (Nardella and Boccaletti 2006; Disdier, Fontagne, and Mimouni 2008). This is another relevant reason for which we deem our article may represent an original contribution in this field of literature.

The article is organized as follows. First we present the methodological framework about the model and variables construction. Then we describe the data and present the results. Finally we draw some conclusions.

Model set up

To run our econometric analysis we start from the basic gravity model (BGM) as found in most part of the previous published literature as follows:

1) $\log V_{ij} = \alpha + \beta_1 \log(Y_i * Y_j) + \beta_2 \log((Y_i / L_i) * (Y_j / L_j)) + \beta_3 \log(D_{ij}) + \varepsilon_{ij}$

where V = total import/export flow of agricultural products for the generic countries *i* and *j*, where *i* is Italy and *j* is a partner country,

Y = level of GDP,

L = population

Y/L = GDP per capita

D = distance

Therefore, in this model we include as explanatory variables only GDP, GDP per capita, both expressed as the interaction between Italy and the corresponding commercial partner, and the geographical distance.

Then we enrich our model by including two dummy variables which are able to identify those countries implying low transaction costs with Italy about trading relationships. In order to reach our aim we implement a first modified gravity model (MGM1) as follows:

2) $\log V_{ij} = \alpha + \beta_1 \log(Y_i * Y_j) + \beta_2 \log((Y_i / L_i) * (Y_j / L_j)) + \beta_3 \log(D_{ij}) + \beta_4 DEU + \beta_5 DCERT + \varepsilon_{ij}$

where DEU = binary variable representing the inclusion of Italy's trading partners in the European Union,

DCERT = binary variable representing all those extra-European countries providing an organic certification system and having organic regulation in place.

The thought behind the variable DEU is that if a country is included in the European Union, business relationships with Italy are easier because of a common culture, laws and political institutions.

The variable DCERT represents the important difference with the model framework developed in Canavari and Cantore (2008), which included a binary variable representing only the extra-European countries enjoying privileged export procedures of organic products to Italy through equivalence agreements.

The main idea concerning the variable DCERT is that if countries share a common culture about food quality and they feel to devote specific rules to regulate organic standards are more likely to be "affine" also in business relationships concerning conventional food.

Finally we estimate a second extended gravity model by modifying the design of the variable DCERT and by transforming it from a categorical into a continuous variable labelled as L_CERT. To reach our aim we set up a second version of the MGM model (MGM2) as follows:

3) $\log V_{ij} = \alpha + \beta_1 \log(Y_i * Y_j) + \beta_2 \log((Y_i / L_i) * (Y_j / L_j)) + \beta_3 \log(D_{ij}) + \beta_4 DEU + \beta_5 \log(DCERT * HARM\_INDEX) + \varepsilon_{ij}$

The variable HARM_INDEX is a harmonization index and it represents the extent to which certification systems are "similar". The underlying concept is that countries with a solid organic certification system are more likely to set up more intense business relationships of conventional and organic food and that among those countries the widest trading exchanges will be developed by those countries showing more "similar" organic standards.

To estimate the parameters we used the transformed linear model described in 3) as follows

4) $$LTRADE = \alpha + \beta_1 LPROD\_Y + \beta_2 LPROD\_YPC + \beta_3 LDIST + \beta_4 DEU + \beta_5 L\_CERT + \varepsilon_{ij}$$

Where LTRADE = logVij;

C = constant term;

LPROD_Y = log(Yi*Yj);

LPROD_YPC = log((Yi/Li)*(Yj/Lj));

LDIST=log(Di,j);

L_CERT=log(DCERT*HARM_INDEX).

In the next section we briefly describe the dataset and our strategy for data collection.

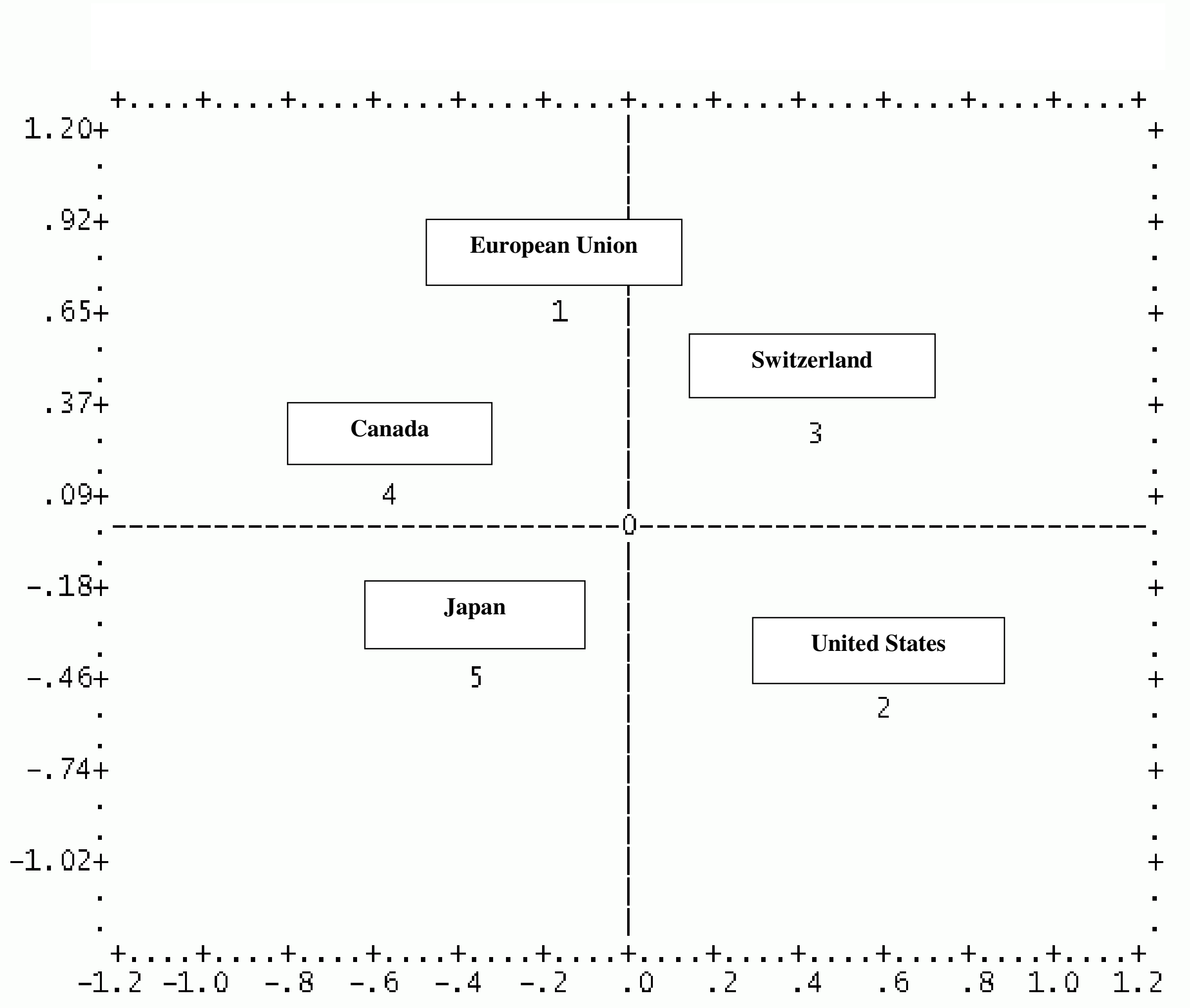
Data

The analyses are driven by a 65 cross country (2003) and a balanced panel (period 1996 – 2003) dataset. The dataset used in this article is a restricted sample of the one used by Canavari and Cantore (2008). A list of our dataset countries is provided in the Appendix 2.

Data about the monetary value of the volume of bilateral trading for the whole agricultural produce are taken from the FAOSTAT (www.fao.org) core dataset, which includes a set of the most important agricultural products expressed in thousands of USD and which does not distinguish between organic and non organic food. The FAOSTAT Core data is a coherent, consistent data set for all countries and for all years (from 1990 onwards) for commodities in their primary equivalent. Panel data are expressed in real terms on the basis of data about national price deflators from the International Monetary Fund (IMF). GDP and population data are taken form the IMF data Set (www.imf.org). Data about physical distance come from the webpage of Andrew Rose (http://faculty.haas.berkeley.edu/arose/RecRes.htm).

Finally, the data regarding the harmonization index are derived from a survey among practitioners multidimensional scaling technique. The most challenging theoretical problem in this analysis is to rationalize the idea of similarity. In order to express a numerical value accounting for similarity we adopted a multidimensional scaling (MDS) technique. We rely upon the evaluations of a set of 12 experts selected among the most important third party certification bodies in Italy. We interviewed practitioners with managerial and/or technical expertise and we asked them to assess the degree of similarity of international organic standards by pair wise comparisons, considering the organic certification systems and regulations in force in the European Union, Canada, Switzerland, USA, and Japan. This technique allowed us creating a plot (Figure 1), in which the distance among the certification systems represents the level of dissimilarity perceived by the interviewees. The level of discrepancies between the Euclidean distances and dissimilarity in interviews are represented by an appropriate STRESS index. Therefore, by this MDS technique we obtained a measurement of "dissimilarity" of organic certification systems with European Union (and Italy) by imposing the generation of a bi-dimensional plot of coordinates.

Figure 1. Similarity in international organic standards by the multidimensional scaling technique.



Source: Our elaboration

To yield an index of similarity we calculated the inverse of the dissimilarity index in order to obtain a "similarity" index. Finally we standardized the values of the "similarity" index in order to obtain our harmonization index (HARM_INDEX) in a [1, e] range by attaching the value e to the most "similar" certification system with European Union and consequently Italy[2].

[2] The coefficient associated to the harmonisation index shows a twofold interpretation. It represents elasticity (% variation of trade flows deriving from % variations of the harmonisation index) or semi-elasticity (% variation of trade flows deriving from absolute variations of the harmonisation index logarithm).

Results

Results of the BGM model by a cross section analysis in 2003 (table 1) are perfectly in line with those found by Canavari and Cantore (2008) with a larger data set (130 countries) and confirm the signs that we expect from a basic gravity model set up (positive sign for GDP and negative sign for distance) within a 5% significance level. We also find a not significant sign for GDP per capita but this finding can be explained by the fact that food products are scarcely elastic to income.

Table 1. OLS. Cross country analysis (65 countries). 2003. BGM model.

Dependent variable: LTRADE				
Variable	Coefficient	Standard error	t-statistics	Prob.
C	-16.57923	5.600730	-2.960190	0.0044***
LPROD_Y	0.766437	0.103096	7.434222	0.0000***
LPROD_YPC	0.082451	0.131502	0.626990	0.5330
LDIST	-1.005470	0.258487	-3.889831	0.0003***
Adjusted R^2 = 0.73				

Now we analyze the results arising from the MGM1 model including dummy variables (table 2). Coefficients associated to both the binary variables DEU and DCERT are significant and show a positive sign.

Table 2. OLS. White Heteroscedasticity-Consistent Standard Errors & Covariance. Cross country analysis (65 countries). 2003. MGM1 model.

Dependent variable: LTRADE				
Variable	Coefficient	Standard error	t-statistics	Prob.
C	-10.13880	5.607726	-1.808005	0.0757*
LPROD_Y	0.625858	0.096640	6.476205	0.0000***
LPROD_YPC	-0.010307	0.130827	-0.078787	0.9375
LDIST	-0.730074	0.314992	-2.317753	0.0239**
DEU	1.772256	0.681580	2.600217	0.0118**
DCERT	1.452879	0.614555	2.364115	0.0214**
Adjusted R^2 = 0.74				

Note: White test for OLS standard estimation (F-test: 0.00184).

The finding about the DEU variable is easily interpretable: more intense trading relationships of agricultural produce with Italy are developed with countries included in the European Union because of common habits, culture and laws. More interestingly (with a White heteroscedasticity correction implemented after the diagnostics arising from the usual White test) we find a significant and positive value also for the coefficient associated to the DCERT variable.

The interesting insight coming from the estimation showed in the table 2 is that countries expressing regulation for organic products show more intense trading relationships with Italy. Those countries are therefore characterized by a higher level of “affinity” in business relationships which is reflected in a wider exchange of conventional and organic products. The problem now is to verify if among the countries with great similarity in organic standards develop higher level of commerce mass. Results of the table 3 show that this hypothesis is confirmed by the empirical analysis of data. The variable L_CERT is significant and with a positive sign. The interpretation of this finding is that countries showing “similar” organic standards if compared to those set by Italy develop more intense bilateral trading relationships. Affinity in organic standards represents affinity in culture, trust and habits in business relationships involving also the market of conventional food. Harmonization of organic standards represents therefore a signal of affinity concerning the whole food market.

Table 3. OLS. White Heteroscedasticity-Consistent Standard Errors & Covariance. Cross country analysis (65 countries). 2003. MGM2 model.

Dependent variable: LTRADE				
Variable	Coefficient	Standard error	t-statistics	Prob.
C	-11.44038	5.121371	-2.233850	0.0293**
LPROD_Y	0.645983	0.090618	7.128675	0.0000***
LPROD_YPC	-0.009102	0.132011	-0.068951	0.9453
LDIST	-0.697667	0.320593	-2.176172	0.0336**
DEU	1.727971	0.692410	2.495591	0.0154**
L_CERT	1.584261	0.629280	2.517577	0.0146**
Adjusted R^2 = 0.75				

Note: White test for OLS standard estimation (F-test: 0.00404).

Interestingly, results are robust across time. By estimating equation 4) with a panel approach in the lapse of time 1996-2003 and after the usual redundant fixed effects test and Hausman test to set the best model specification we find results which substantially confirm our cross-country estimations[3]. An appropriate F-test applied to DEU and L_CERT confirms that those variables enrich the traditional gravity model and are not redundant (table 4). The usual adjusted R^2 index shows a good model performance.

Table 4. Panel analysis (65 countries. Time period: 1996-2003). White cross-section standard errors and covariance 1996-2003. Random time period effects. MGM2 model.

Dependent variable: LTRADE.				
Variable	Coefficient	Standard error	t-statistics	Prob.
C	-12.84166	1.236782	-10.38312	0.0000***
LPROD_Y	0.723289	0.035206	20.54424	0.0000***
LPROD_YPC	-0.005606	0.034689	-0.161597	0.8717
LDIST	-1.013797	0.077308	-13.11371	0.0000***
DEU	0.916221	0.153618	5.964277	0.0000***
L_CERT	0.802496	0.233336	3.439235	0.0006***
Adjusted R^2 = 0.76				

Note: Redundant fixed effects test (F-test: 0.0001); Hausman test for random effects (F-test: 1.0000). Redundant variables test on the DEU and L_CERT variables (F-test: 0.00085)

Conclusions

In this article we focused on institutional factors related to the international marketing of agricultural produce. We identified the main variables which can affect bilateral trade flows. Not surprisingly, we find that results obtained using the traditional gravity model are quite robust for Italy's agricultural trade. The most interesting part of our contribution is the attempt to interpret institutional factors determining frictions in commercial exchange among countries. In particular, we tried to turn our attention to the level of “affinity” in international relationships which in our article is interpreted as similarity in culture, habits, politics and trust that are contained in the concept of psychic distance. Psychic distance can be defined as “The sum of factors preventing the flow of information from and to the market. These include difference in language, education, business practices, culture, and industrial development.” (Johanson and Vahlne 1977).

3 Japan set up organic regulations in 1999. Canada is not included in the IFOAM list of the countries that until 2003 had fully implemented rules for organic products but was involved in the process of drafting regulations and set up national standards in 1999. We considered these aspects in the construction of our dataset.

Notwithstanding we acknowledge that further research is needed to check more accurately results robustness through appropriate tests and by widening the sample our article provides a twofold original contribution. Previous literature outlined that agreements about equivalence in importing procedures for organic standards can be considered as a reliable signal of affinity among countries enhancing international business. In this analysis we make a step forward by finding that the existence of rules for organic products rather than equivalence can be interpreted as signal of higher affinity, leading to wider commercial exchanges. Moreover we find that among those countries providing standards for organic products and which are generally more inclined to set up bilateral trading relationships, the most intense exchanges are developed by those countries with "similar" certification systems.

This is a very interesting finding provoking sound arguments for policy makers. The existence of organic regulations provides information about the agricultural sector, which is wider than the one concerning only organic products. Differences in international organic standards or their absence may represent the synthesis of cultural and social behaviors, which concern purchases and exchanges of food in the international market. Moreover, interestingly we get the conclusion that the issue of organic standards harmonization cannot be adequately tackled if it is not dealt with in the general agricultural and food markets context. Trust regarding organic food products is an issue that can be hardly separated from to trust in conventional food. This is a relevant issue we deem policy makers should consider when implementing policies and actions aimed at regulating both the organic and conventional food industry.

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Appendix 1. List of the 39 countries with a fully implemented regulation until October 2003.

European Union (15)	Rest of Europe (13)	Asia and Pacific Region (7)	Americas and Caribbean (3)	Africa and Middle East (1)
Austria	Bulgaria	Australia	Argentina	Tunisia
Belgium	Cyprus	India	Costa Rica	
Denmark	Czech Republic	Japan	USA	
Finland	Hungary	Philippines		
France	Iceland	Korea		
Germany	Lithuania	Taiwan		
Greece	Norway	Thailand		
Ireland	Poland			
Italy	Serbia and Montenegro			
Luxembourg	Slovak Republic			
The Netherlands	Slovenia			
Portugal	Switzerland			
Spain	Turkey			
Sweden				
United Kingdom				

Source: IFOAM (2004)

Appendix 2. List of the 65 countries in our dataset.

European Union (10)	Rest of Europe (2)	Asia and Pacific Region (17)	Americas and Caribbean (14)	Africa and Middle East (22)
Austria	Malta	Bahrain	Antigua and Barbuda	Algeria
Belgium	Switzerland	Bangladesh	Bahamas	Angola
Denmark		Fiji Islands	Barbados	Burkina Faso
Finland		Iran	Bolivia	Central African Republic
France		Japan	Canada	Djibouti
Germany		Jordan	Dominica	Gabon
Greece		Kuwait	Dominican Republic	Ghana
Netherlands		Laos	El Salvador	Guinea
Spain		Myanmar	Ecuador	Kenya
United Kingdom		Oman	Panama	Mali
		Pakistan	Paraguay	Mauritania
		Papua New Guinea	Seychelles	Mauritius
		Qatar	Suriname	Mozambique
		Saudi Arabia	United States of America	Nigeria
		Singapore		Rwanda
		United Arab Emirates		Senegal
		Yemen		Sierra Leone
				Sudan
				Togo
				Uganda
				Zambia
				Zimbabwe