The Institutional Determinants of Bilateral Agricultural and Food Trade

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Abstract

The effects of the institutional determinants on trade in agricultural and food products are analyzed using a gravity model approach. We focus on the impact of the quality of governance and the similarity of institutions in explaining variation in bilateral agricultural and food trade patterns among the OECD countries. Results confirmed the separate effects for the institutional similarity and the institutional quality on trade patterns. The institutional similarity has positive and significant impact on trade in a similar institutional framework for agricultural, but less for food products. The institutional quality has significant positive impact on trade in both agricultural and food products for importing countries.

Key-words: Institutions; international trade; gravity model.

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I. Introduction

The research in international trade has focused at the role of tariffs and quotas as barriers to trade (e.g. Baier and Bergstrand 2006, Anderson and van Wincoop 2004). The most recent research have underlined at the importance of informal trade barriers (McCallum 1995), information distance costs (Rauch 2001), and unobserved trade costs (Obstfeld and Rogoff 2000). In addition, some papers emphasise the impacts of institutions on transaction costs in bilateral international trade (e.g. Anderson and Marcouiller 2002, Dollar and Kray 2002, de Groot et al. 2004, Francois and Manchin 2006, Depken and Sonora 2005, Levchenko 2004). Expect by Olper and Raimondi (2007), the research on the effects of institutions on bilateral agricultural and food trade is neglected. We employ gravity equations to identify the effects of institutions on bilateral agricultural and food trade. So far such a study has not been conducted yet as motivation for our research.

This paper aims to contribute to literature in three ways. First, we employ extended gravity model to investigate the effect of the quality of institutions on agricultural and food trade, respectively, which so far has been neglected in literature. Second, we investigate the effect of the institutional similarity of governance on agricultural and food trade and the bilateral influence of institutional distance on patterns of agricultural and food trade, respectively. Third, we employ the estimations using two-step Heckman (1979) model proposed by Linders and de Groot (2006) and the estimations for the general quality of institutions applying a composite index for agricultural and food trade.

The rest of the paper is organized as follows. Section II presents the methodology and data used focusing at the institutional quality measures in the gravity regression analysis.

Section III presents and discusses the regression results for alternative specifications of gravity models. Final section IV concludes.

II. Methodology and data

The estimating the gravity model and assessing trade patterns on the basis of the empirical results has been a subject to several econometric challenges. Recent literature has addressed issues concerning the correct specification and interpretation of the gravity equation in empirical estimation. We concentrate on two problems. First, several research papers have argued that standard cross-sectional methods yield biased results because they do not control for heterogeneous trading relationships (e.g. Feenstra 2004). Because of this, these papers introduced fixed effects into the gravity equation. Fixed-effect models allow for unobserved or misspecified factors that simultaneously explain trade volume between two countries such as the probability that the countries will be in the same regional integration regime (e.g. Matyas 1997; Egger 2002). Although the arguments underlying the use of fixed effects as a solution to unobserved heterogeneity are roughly the same in the literature, there is little agreement about how to actually specify the fixed effects. Cheng and Wall (2005) show the correct fixed effect methods in which country-pair and period dummies are used to reflect the bilateral relationship between trading partners. For our purposes, we cannot use both fixed importer and exporter effects in our panel regressions. This is because we want to conduct analysis with time-varying country-specific variables related to institutions, which preclude the use of time-varying country dummies. Instead, we include time specific and partner (exporter) country specific dummies. This forces us to include variables that are likely to be important determinants of the reduced-form exporter effects dummies in standard gravity equation. From the gravity literature, we expect trade flows to be a function of importer and exporter income size, as well as of determinants of bilateral trade costs like distance,

common border, and common language. We also include variables of specific interests. These are measures of institutional aspects of importers and exporters that we expect to impact on trading costs.

Second issue is how to deal with zero-valued bilateral trade flows (e.g. Santos Silva and Tenreyro 2006). The standard gravity model cannot easily deal with zero flows. This has resulted in a widespread practice in the literature to ignore zero flows in the analysis of bilateral trade. However, zero-valued observations contain important information for understanding the patterns of bilateral trade, and should not be discarded *a priori*. Several approaches have been applied or suggested in the literature to address the problem of zero flows. The most common solution in the literature confines the sample to non-zero observations to avoid the estimation problems related to zero flows. Alternatively, (part of the) zero values may be substituted by a small constant, so that the double-log model can be estimated without throwing these country pairs out of the sample. Several studies have used the standard Tobit model to estimate the gravity equation with zero flows (e.g., Rose, 2004; Anderson and Marcouiller, 2002). Finally, recent papers use Heckman sample selection model to deal with zero values (Francois and Manchin, 2006; Linders and de Groot 2006) arguing that the sample selection model is preferred both theoretically and econometrically. This approach is also applied in this paper.

Traditional gravity trade theory points that bilateral trade to be positively associated with their national incomes and negatively associated of their geographical distance (e.g. Frankel and Rose, 2002). We apply standard gravity model variables including market size (real gross domestic product (GDP) of host and destination countries from the WDI database), geographical factors like the distance between capital cities and common border (from the CEPII database), cultural linkage (common language), and dummy for Regional Free Trade Agreement (RFTA) membership as explanatory variables. Particularly, we are interested in

at the role of institutions in agricultural and food trade, respectively. We specify the following empirical gravity model:

$$\ln X_{ij,t}=\alpha_0+\alpha_t+\alpha_i+\alpha_1 \ln GDP_{i,t}+\alpha_2 \ln GDP_{j,t}+\alpha_3 \ln GDPCAP_{i,t}+\alpha_4 \ln GDPCAP_{j,t}+\alpha_5 \ln DIST_{ij}+$$
$$\alpha_6 CONTIG_{ij}+\alpha_7 Language_{ij}+\alpha_8 RFTA_{ij}+\alpha_9 Governance_{it}+\alpha_{10} Governance_{jt}+u_1 \quad (1)$$

and for the selection estimation we assume that $X_{ij,t}$ is observed when we have:

$$\ln X_{ij,t}=\beta_0+\beta_t+\beta_i+\beta_1 \ln GDP_{i,t}+\beta_2 \ln GDP_{j,t}+\beta_3 \ln GDPCAP_{i,t}+\beta_4 \ln GDPCAP_{j,t}+\beta_5 \ln DIST_{ij}+$$
$$\beta_6 CONTIG_{ij}+\beta_7 Language_{ij}+\beta_8 RFTA_{ij}+\beta_9 Governance_{it}+\beta_{10} Governance_{jt}+u_2 >0 \quad (2)$$

In equations (1) and (2), u_1 and u_2 have correlation ρ. Equation (1) assesses the determinants of the bilateral trade and shows the main factors influencing the amount of trade that occurred between the two trading partners. Equation (2) sets out the selection criteria and provides information on the factors that determine whether or not we observe trade between country pairs. $X_{ij,t}$ is country i exports to country j at time t.. The trade data are supplied by the OECD Bilateral Trade Database at the two-digit level of the ISIC in US dollars. We use data for the agricultural goods and food products separately. The sample contains 29 OECD countries[1] between 1995 and 2003 resulting 7,308 observations.

GDP is a proxy for the market size, and GDPCAP is the per capita GDP, which is a general proxy for economic development for both exporter and importer countries. The distance between i and j ($DIST_{ij}$) dummies reflect whether i and j share: a land border ($CONTIG_{ij}$), their primary language (Language), and membership in a RFTA. The variables of particular interest are the level of subjective institutional quality (Governance).

Our data set includes indices produced by the Fraser Institute for institutions. The institution indices are from the 'Economic Freedom of the World' (EFW) database. The EFW indices are themselves based on several sub-indices designed to measure the degree of

[1] List of countries included in the data sample: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Mexico, the Netherlands, the New Zealand, Norway, Poland, Portugal, Spain, Slovakia, Sweden, Switzerland, Turkey, the United Kingdom and the United States of America.

'economic freedom' in five areas: (1) size of government: expenditures, taxes, and enterprises; (2) legal structure and protection of property rights; (3) access to sound money: inflation rate, and possibility to own foreign currency bank accounts; (4) freedom to trade internationally: taxes on international trade, regulatory trade barriers, capital market controls, difference between official exchange rate and black market rate and similar; and (5) regulation of credit, labour, and business. The each index ranges from 0 to 10 reflecting the distribution of the underlying data. Notionally, a low value is bad, and a higher value is good. We employ indices for 1995, 2000, 2001, 2002 and 2003, with interpolated values for years without values. All aspects of governance are interrelated, thus the indicators are highly positively correlated. For that reason, we treat them separately in the empirical analysis, including one dimension of governance in the equation at a time. Using too many indicators simultaneously results in serious problems of multi-collinearity. In addition, we use a composite indicator of institutional quality (*institute*), which captures the overall quality of governance in a country. The simple arithmetic average of the scores on the each separate indicator serves as a composite indicator that reflects overall quality of governance.

III. Empirical results: the role of institutions

Following de Groot et al. (2004), we present our results in two steps focusing on the explanatory role of institutional quality and institutional homogeneity for the intensity of bilateral agricultural and food trade, respectively. First, we focus on the explanatory role of *institutional quality*. We expect that better quality of the institutional framework reduces uncertainty about contract enforcement and general economic governance. This leads to reduction of transaction costs both directly via the increase in the security of property and indirectly through the increase the level of trust in economic transactions. Second, we investigate the role of homogeneity of institutions in international trade. We may argue that

the bilateral familiarity and thus institutional homogeneity of trading partners with similar norms of behaviours and institutions both formal and informal in doing international trade business increase compatibility and trust, reduces adjustment costs and insecurity in international trade. In other words institutional homogeneity is an additional factor affecting relative transaction costs as an explanatory factor in bilateral trade.

The effects of *institutional quality* on bilateral agricultural and food trade, respectively, are presented in Tables 1 and 2. The each model specification includes an indicator for the perceived quality of a country's institutional framework. The variable relevant for the each specification is given in the column headings. The significant inverse Mills' ratios confirm the existence of selection bias for all specifications, thus we focus on the probit model results. Table 1 confirms that the impact of the institutional quality varies according to the direction of theoretical association and statistical significance for primary agricultural products. In the case of exporting countries, the impact pertained to the institutional quality is found to be positive and statistically significant only for the model specifications with variables for the sound money and to a lesser extent for the composite indicator of the overall institutional quality of governance. On the other hand, coefficients of the institutional quality are positive and significant in the case of importing countries, except for the sound money. Moreover, the estimated gravity models indicate that the size of GDP has negative impact for importing countries and positive impact for exporting countries of agricultural products. The level of development measured by GDP per capita has positive and mostly statistically significant impact on bilateral agricultural trade. As expected, the distance has negative and statistically significant impact on bilateral agricultural trade. The other characteristics (contiguity, language and RFTA) have positive and mostly statistically significant impact on bilateral agricultural trade.

Table 2 presents the results for a gravity model supplemented with institutional quality variables for food products. The variables for the institutional quality for the food exporting countries mostly turned out to be statistically insignificant with mixed theoretical signs. The impact of the institutional quality variables is found mostly statistically significant and theoretically consistent for food importing countries. The government size, the regulation and the composite indicator of institutional quality of governance, respectively, positively and statistically significantly increased bilateral food trade for importing countries, and vice versa tariffs, which negatively and statistically significantly reduced bilateral food trade for importing countries.

Second, we focus on the explanatory role of *institutional homogeneity.* We constructed the dummy variable to reflect the effect of institutional similarity. If the absolute difference in institutional effectiveness between the exporting and importing country does not exceed a specified fraction of the sample standard deviation in the relevant index of governance, the quality of governance is regarded as similar in terms of institutional effectiveness in both countries. The effects of *institutional homogeneity* on agricultural and food trade are presented in Table 3. Again, the existence of selection bias for all specifications is confirmed, thus we focus on the probit model results. In Table 3, the specifications for different similarity definitions in the gravity model are estimated when controlling for the level of institutional quality in both countries. The first three main columns present the estimated models in which the specified fraction is varied. In the first main column, each difference below the one standard deviation is associated with institutional homogeneity. The other two columns use 2 and 3 standard deviations as the criterion, respectively, to imply the effects of similarity in institutional effectiveness on bilateral agricultural and food trade. Similar to the finding by de Groot et al. (2004) for merchandise trade, we have also found for agricultural and food trade, respectively, that institutional similarity and

institutional quality have separate effects. The institutional similarity has positive and significant impact for bilateral agricultural trade in the case of one and two standard deviations, respectively, but not significant are parameters for bilateral trade in food products and for bilateral trade in agricultural products when three standard deviations criterion is used. When the institutional quality variable for exporting countries is used, the results are found to be mixed. As interesting, positive and statistically significant associations are found between the institutional quality variable and trade in food products and agricultural products (for probit model) for the importing countries. The impact of GDP for importing countries remains negative for agricultural products, but the parameters are statistically not significant. The impact of GDP for exporting countries remains largely unchanged with its positive and significant impact for both agricultural and food products. The GDP per capita has positive impact on agricultural and food trade, respectively, for both importing and exporting countries, but significance has worsened for agricultural products. As before, significant and negative associations are found for the parameters pertained to the distance variable. The other explanatory variables for contiguity, language and RFTA remain with positive impacts on bilateral agricultural and food trade, respectively, but the parameters are not significant.

IV. Conclusions

We have investigated the impact of the institutional quality and institutional similarity as determinants of informal barriers to trade on the patterns of bilateral trade in agricultural and food products with the gravity equation. Results confirmed that the institutional determinants have a significant impact on bilateral trade in agricultural and to a lesser extent in food products. Institutional homogeneity in international trade increases trade as lowers transaction costs. The gravity models also confirmed importance of the economy size, level

of development, trade distance, contiguity, language and regional free trade agreements. The impact of the level of development on the patterns of bilateral trade is biased by the institutional determinants. The positive relation between the quality of institutions and the level of economic development implies importance of good governance for international trade as a factor of economic growth and development, including in agriculture and the food sector.

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Table 1 Heckman selection model estimations for agricultural products

	government size		legal system		sound money		tariff		regulation		institute	
	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit
Log gdp importer	-2.087**	-3.409	-2.165**	-3.070	-2.165**	-1.566	-2.243***	-1.842	-1.695*	-3.979	-2.120**	-2.204
Log gdp exporter	0.925***	0.675***	0.932***	0.716***	0.952***	0.676***	0.939***	0.657***	0.936***	0.786***	0.943***	0.733***
Log gdp/capita importer	2.377***	3.649	2.435***	3.290	2.482***	1.623	2.540***	1.882	1.960**	4.245	2.405***	2.323
Log gdp/capita exporter	0.634***	1.242***	0.857***	0.527***	0.268***	0.951***	0.705***	1.035***	0.732***	0.701***	0.613***	0.185
Log distance between capita	-1.262***	-1.014***	-1.231***	-0.889***	-1.250***	-0.861***	-1.257***	-0.836***	-1.210***	-1.015***	-1.223***	-1.105***
contiguity dummy	0.863***	5.872	0.874***	5.115	0.856***	5.457	0.829***	5.303	0.869***	5.586	0.877***	5.810
language dummy	0.212***	2.307***	0.286***	2.165***	0.269***	2.320***	0.327***	2.205***	0.319***	2.110***	0.273***	2.018***
RFTA dummy	0.717***	0.229	0.697***	0.317*	0.653***	0.298*	0.761***	0.302*	0.685***	0.355*	0.699***	0.204
governance exporter	0.013	0.014	-0.033	-0.007	-0.015	0.235***	-0.031	0.252	0.104	0.030	0.006	0.345*
governance importer	0.072***	0.176***	-0.085***	0.190***	0.116***	0.047	-0.201***	0.123**	-0.101***	0.384**	-0.014	0.680***
Inverse Mills' ratio		-1.229***		-0.923***		-0.940***		-1.006***		-1.003***		-1.083***
N	7308											
censored observations	467											

Table 2 Heckman selection model estimations for food products

	government size		legal system		sound money		tariff		regulation		institute	
	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit
Log gdp importer	-1.199	-9.835**	-1.599	-7.524*	-1.650	-2.598	-1.518	-25.901***	-0.970	-13.895**	-1.130	-5.943
Log gdp exporter	0.835***	0.661***	0.855***	0.699***	0.848***	0.714***	0.847***	0.831***	0.858***	0.790***	0.852***	0.695***
Log gdp/capita importer	1.029	8.125*	1.441	5.440	1.449	-0.447	1.341	26.076***	0.799	14.658**	0.903	3.742
Log gdp/capita exporter	0.916***	1.851***	0.698***	1.297***	0.676***	2.152***	1.006***	2.035***	0.675***	1.281***	0.601***	0.921***
Log distance between capita	-0.712***	-0.952***	-0.666***	-0.718***	-0.675***	-0.695***	-0.703***	-0.711***	-0.693***	-0.871***	-0.696***	-0.881***
contiguity dummy	1.028***	2.867	1.049***	3.305	1.042***	3.602	0.997***	3.142	1.060***	2.822	1.045***	3.188
language dummy	0.581***	3.519	0.627***	4.088	0.639***	3.955	0.705***	4.632	0.565***	3.479	0.572***	3.568
RFTA dummy	0.820***	5.002	0.802***	5.087	0.775***	5.682	0.871***	5.435	0.818***	4.972	0.790***	4.928
Governance exporter	0.101	-0.060	-0.033	0.309*	0.029	0.670***	0.081	-1.667***	0.156	-0.518	0.191	0.354
Governance importer	0.075***	0.281***	0.056	0.106	0.068	-0.123	-0.233***	-0.499***	0.146***	0.374***	0.187**	0.473***
Inverse Mills' ratio		-2.832***		-2.693***		-2.734***		-2.350***		-2.839***		-2.788***
N	7308											
censored observations	109											

Table 3 Extended Heckman selection model estimations for institutional homogeneity

	Agricultural products						Food products					
	<1 standard deviation		<2 standard deviation		<3 standard deviation		<1 standard deviation		<2 standard deviation		standard deviation	
	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit	OLS	probit
Log gdp importer	-2.171**	-1.975	-2.148**	-1.522	-2.122**	-2.188	-1.132	-6.295	-1.146	-5.703	-1.126	-6.198
Log gdp exporter	0.948***	0.737***	0.948***	0.736***	0.943***	0.733***	0.854***	0.706***	0.850***	0.693***	0.851***	0.697***
Log gdp/capita importer	2.412***	2.081	2.370***	1.574	2.405***	2.299	0.887	4.242	0.950	3.546	0.919	4.096
Log gdp/capita exporter	0.568***	0.144	0.569***	0.088	0.610***	0.183	0.579***	0.958***	0.637***	0.908***	0.618***	0.949***
Log distance between capita	-1.230***	-1.112***	-1.229***	-1.127***	-1.223***	-1.105***	-0.702***	-0.873***	-0.693***	-0.881***	-0.697***	-0.888***
contiguity dummy	0.855***	5.700	0.870***	5.680	0.877***	5.805	1.031***	3.352	1.050***	3.182	1.045***	3.190
language dummy	0.239***	1.845***	0.249***	1.782***	0.272***	2.013***	0.551***	3.730	0.594***	3.361	0.580***	3.628
RFTA dummy	0.673***	0.145	0.683***	0.121	0.699***	0.203	0.771***	5.106	0.806***	4.877	0.793***	4.948
institute similarity	0.126***	0.192**	0.112**	0.316***	0.017	0.016	0.076	-0.233	-0.098	0.081	-0.091	-0.141
institute exporter	-0.023	0.351*	-0.018	0.341*	0.004	0.344*	0.180	0.313	0.208	0.352	0.205	0.354
institute importer	-0.002	0.702***	-0.001	0.734***	-0.013	0.681***	0.193**	0.452***	0.179**	0.482***	0.184**	0.456***
Inverse Mills' ratio		-1.071***		-1.042***		-1.081***		-2.758***		-2.805***		-2.771***
N	7308						7308					
censored N	467						109					