The 83rd Annual Conference of the Agricultural Economics Society
Dublin

30th March to 1st April 2009

Communication Costs and Agro-Food Trade in OECD Countries

Štefan Bojnec* and Imre Fertő**

* Associate Professor, University of Primorska, Faculty of Management Koper

** Senior Research Advisor, Institute of Economics, Hungarian Academy of Sciences

Paper for presentation at the Annual Conference of the Agricultural Economics Society,

Irish Management Institute, Dublin, Ireland, , 31 March – 1 April, 2009

Communication Costs and Agro-Food Trade in OECD Countries

Abstract

The paper analyses the effects of communication costs for agro-food trade in OECD countries between 1995 and 2003 using gravity model. We find that the link between the communication costs and agro-food trade flows in developed countries is significantly stronger for agricultural than for food products. The improved communication services reduce trade transaction costs. The estimations also confirmed importance of the economy size, level of development in importer countries, and trade distance. The other traditional gravity variables like contiguity, language and regional free trade agreements have significant impacts in the majority of specifications.

Keywords: Communication costs; Agro-food trade; Gravity model

JEL classification: F14; F23; Q17

I. Introduction

Trade costs as a determinant of global trade competition might play significant role mitigating distances between origin of goods and demands for goods at different locations (e.g. Rauch, 2001, Anderson and van Vincoop, 2004). Literature has classified few factors that determine trade costs and their different significance over time (e.g. Feenstra, 2004, de Groot et al., 2004). Geographical, historical, language and cultural factors have been often specified as explanatory variables of trade costs in gravity

equation models. One strand of literature underlines the effects of the reduction of trade barriers and free trade agreements on the greater increase of trade in differentiated goods than for homogenous ones due to the greater reduction of trade barriers for the former. Another strand of literature explains the increase of trade in differentiated goods by the decrease in transportation costs. The most recent studies diversify gravity model equations underlining few other factors causing changes towards reduction in different components of trade costs due to the advanced information and communication technologies and improvements in infrastructure leading to decreasing communication and transaction costs (e.g. Tang, 2006). We aim to identify factors of trade costs in gravity model for agro-food trade patterns in OECD countries.

The paper is motivated by significant changes in agro-food trade flows that have been caused by trade policy developments and technological changes since the mid-1990s. First, the analyzed period captures the implementation of GATT/WTO agreements as one of the reasons that barriers to international trade have become smaller over time, which might reduce trade costs and increase agro-food trade. Second, trade liberalization and free trade agreements have been particularly stipulated among the world most developed countries. Most of them are OECD member countries, which might lead to further world agro-food trade concentration. Third, the rapid technological changes are seen in information and communication technologies and in infrastructure development all over the world reducing the role of communication costs on international trade (e.g. Fink et al., 2002; Freund and Weinhold, 2004; Tang, 2006). More specifically we investigate how the decline of communication costs affects the pattern of agro-food trade in OECD countries.

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 consistent 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 communcation costs, 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 communication costs of importers and exporters that we expect to impact on trading costs.

Second issue is how to deal with zero-valued bilateral trade flows. 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 as a dummy variable, 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 (1979) sample selection model to deal with zero

values (Francois and Manchin, 2007; 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 is positively associated with their national incomes and negatively associated with 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 *i* and destination *j* countries from the World Development Indicators (WDI) database), geographical factors like the distance (DIST) between capital cities and common border (CONTIG) 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 communication costs (IT) in agricultural and food trade, respectively. We specify the following empirical gravity model:

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

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

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

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 communication costs (IT) including number of fix telephone lines per 100 persons, number of mobile phones per 100 persons and number of internet hosts per 10000 persons from the WDI database.

III. Empirical results

We present our results for agricultural and food products separately. Table 1 shows our estimations for agricultural products. The significant inverse Mills' ratios confirm the existence of selection bias for all specifications, thus we focus on the probit model results. The gravity models indicate that the size of GDP has negative impact for

[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.

exporting countries and positive impact for importing countries irrespective to types of communication costs. The level of development measured by GDP per capita has positive impact on bilateral agricultural trade but it is significant only for importer countries except model with fix telephone lines. As expected, the distance has negative and statistically significant impact on bilateral agricultural trade. The contiguity has no significant impacts on agricultural trade, while the coefficients of language are positive and statistically significant only for agricultural products. The coefficient for membership of regional free trade agreement has positive and significant impact on agricultural trade. All types of communications costs have positive and significant effects. Interestingly the better IT endowment is more important in importing than exporting countries.

Table 2 reports our results for food products. Again, the significant inverse Mills' ratios confirm the existence of selection bias for all specifications, thus we focus on the probit model results. The estimations imply that the size of GDP has negative impact for exporting countries only for fix telephone lines model, while it influences positively and significantly the importing countries irrespective to types of communication costs. The level of development has positive impact on bilateral food trade but it is significant only for importer countries. The coefficients of distance variable are negative and significant implying that the distance reduces the bilateral food trade. The contiguity, language and RFTA have no significant impacts on food trade. The fix telephone lines and mobile phones have positive and significant effects, while the internet use has no influence on food trade. Interestingly the better IT endowment is more important in importing than exporting countries.

IV. Conclusions

We investigate the impact of communication costs on the patterns of bilateral trade in agricultural and food products with the gravity equation. Results confirmed that the communication cost have a significant impact on bilateral trade in agricultural and to a lesser extent in food products. Better endowment in IT services increases trade as lowers transaction costs. The gravity models also confirmed importance of the economy size, level of development in importer countries, and trade distance. The other traditional gravity variables like contiguity, language and regional free trade agreements have significant impacts in the majority of specifications.

Acknowledgements

The authors are grateful for financial support from the bilateral project between the Hungarian and Slovenian Academies of Sciences entitled 'Agro-food trade between Central-European Countries and the European Union.' Imre Fertő gratefully acknowledges financial support from the Hungarian Scientific Research Fund No. 37868 ‘The International Agricultural Trade: Theory and Practice’.

References

Anderson, J.E. and Marcouiller, D. (2002). Insecurity and the Pattern of Trade: An Empirical Investigation, *Review of Economics and Statistics*, 84: 342-352.

Anderson, J. and van Vincoop, E. (2004). Trade Costs. *Journal of Economic Literature*, 42: 691-751.

Cheng I-H. and Wall, H. J. (2005) Controlling for Heterogeneity in Gravity Models of Trade and Integration. *Federal Reserve Bank of St. Louis Review*, 87: 49-63.

Egger, P. (2002). An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials. The World Economy, February 25(2): 297-312.

Feenstra, R. (2004). Advanced International Trade: Theory and Evidence. Princeton University Press: Oxford.

Fink, C., Matto, A. and Lleana, N. (2002). Assessing the Impact of Communication Costs on International Trade. World Bank Policy Research Working Paper No. 2929

Frankel, J. and Rose, A. (2002). An Estimate of the Effect of Common Currencies on Trade and Income. *Quarterly Journal of Economics*, 2002: 437-466.

Francois, J. and Manchin, M. (2007). Institutions, Infrastructure, and Trade. Development Studies Working Papers No. 224. Milano: Centro Studi Luca D'Agliano.

Freund, C.L. and Weinhold, D. (2004). The Effect of the Internet on International Trade. Journal of International Economics, 62: 171-189

de Groot, H.L.F., Linders, G-J. M, Rietveld, P. and Subramanian, U. (2004). The institutional determinants of bilateral trade patterns. *Kyklos*, 57(1): 103-124.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. Econometrica 47: 153-161.

Linders, G-J. M and de Groot, H.L.F. (2006). Estimation of the gravity equation in the presence of zero flows. Tinbergen Institute Discussion Paper, TI 2006-072/3.

Matyas, L. (1997). Proper Econometric Specification of the Gravity Model. *The World Economy, 20*: 363-368.

Olper, A. and Raimondi, V. (2007). Patterns and Determinants of International Trade Costs in the Food Industry. LICOS Discussion Paper 188/2007. Leuven: Katholieke Universiteit Leuven.

Rauch, J.E. (2001). Business and Social Networks in International Trade. *Journal of Economic Literature*, 39: 1177-1203.

Rose, A.K. (2004). Do We Really Know That the WTO Increases Trade?, *American Economic Review*, 94, 98–114.

Tang, L., 2006, Communication costs and trade of differentiated goods, Review of International Economics 14, 54-68.

Table 1 The Effects of Communication Costs on Agricultural Trade

	Fix telephone lines		Mobile phones		Internet	
	OLS	probit	OLS	probit	OLS	probit
GDPx	-2.159**	-3.359	-2.065**	-2.250	-2.192***	-3.226
GDPm	0.952***	0.740***	0.952***	0.701***	0.945***	0.725***
GDPCAPx	2.571***	3.248	2.310***	2.008	2.452***	3.272
GDPCAPm	0.205***	0.038	0.533***	0.603***	0.611***	0.630***
DIST	-1.226***	-0.819***	-1.238***	-0.876***	-1.231***	-0.899***
CONTIG	0.885***	5.839	0.871***	6.439	0.874***	5.199
Language	0.282***	2.235***	0.278***	2.353***	0.268***	2.317***
RFTA	0.710***	0.293	0.691***	0.248	0.696***	0.350*
IT	-0.183	0.656*	0.032	0.257***	0.045	0.095
Itm	0.502***	1.294***	0.060*	0.381***	-0.007	0.263***
Mills lamda		-1.028***		-0.947***		-0.978***
N	7308					
censored N	467					

Note: * p<0.1; ** p<0.05; *** p<.001. x stands for exporters and m for importers.

Source: Own calculations based on OECD database.

Table 2 The Effects of Communication Costs on Food Trade

	Fix telephone lines		Mobile phones		Internet	
	OLS	probit	OLS	probit	OLS	Probit
GDPx	-1.694	-9.733**	-1.390	-4.633	-1.669	-6.868
GDPm	0.853***	0.774***	0.850***	0.715***	0.870***	0.703***
GDPCAPx	1.485	6.261	1.092	0.862	1.478	5.357
GDPCAPm	0.357**	0.816***	0.811***	0.942***	0.451***	1.381***
DISTp	-0.655***	-0.666***	-0.671***	-0.715***	-0.694***	-0.711***
CONTIG	1.070***	3.194	1.048***	3.275	1.003***	3.646
Language	0.656***	3.880	0.648***	3.592	0.657***	4.184
RFTA	0.817***	5.957	0.793***	5.354	0.833***	5.196
IT	0.106	2.722***	0.093	0.451***	0.088	-0.124
ITm	0.629***	1.125***	0.053	0.495***	0.233***	0.119
Mills lamda		-2.892***		-2.648***		-2.770***
N	7308					
censored N	109					

Note: * p<0.1; ** p<0.05; *** p<.001. x stands for exporters and m for importers.

Source: Own calculations based on OECD database.