The Role of E-governance on Agricultural Trade

By

Trina Biswas and Dr. P. Lynn Kennedy

Department of Agricultural Economics and Agribusiness

Louisiana State University

Baton Rouge, LA - 70803

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Abstract:

Using an augmented gravity model this paper examines how different aspects of trade facilitations affect the export performance of the nations. The main objective of this paper is to evaluate the effect of one of the main pillars of trade facilitations namely e-governance on international trade. The augmented gravity model is estimated using pooled and cross-sectional, OLS and Instrumental Variable regression. The paper studies the impact of e-governance on agricultural exports for the years 2003 − 2005. The results suggest that better e-governance positively affects the volume of agricultural exports when controlled for endogeneity.

Keywords: trade facilitation; gravity model; e-governance; bilateral agricultural trade

1. INTRODUCTION:

International trade plays an important role in the economic wellbeing of a nation. With the continuing growth in international trade and falling tariff barriers in the recent years, an increased concern is placed on non-tariff barriers affecting the volume of cross border trade. The trade across border face obstacles in the form of capacity constraints given limited facilities, inefficient port operations, burdensome customs procedures, excessive documentation requirements, low quality of human capital and corruption at the borders etc. All these factors serve to increase cost and delays in international trade. To solve this problem, governments and businesses use various measures to modernize and simplify transactions procedures at national borders. Therefore the trade facilitation reform to reduce transaction costs associated with

international trade has significant relevance in terms of policies. Trade facilitations can be defined as a tool to reduce the complexities of international trade in a cost-effective way while ensuring transparent and efficient trade deals. Some researchers define trade facilitation simply as the tool that helps in reducing the "volume and impact of red tape – a term traditionally associated with wasteful and time-consuming bureaucracy found in international trade operations." (Grainger, 2011). Trade facilitation also involves reducing the transaction costs associated with the enforcement, regulation and administration of trade policies (Staples, 2002). The WTO defines the term trade facilitation as: 'The simplification and harmonization of international trade procedures' where trade procedures are the 'activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade' (WTO 1998).

The objective of this paper is therefore to determine the impact of variables that can influence trade facilitation measures and thereby can affect the trading time and cost across borders. This study examines the effect of a trade facilitation variable, namely e-governance on trade in agricultural commodities. Because of the perishable nature of the agricultural commodities, delay in trade has a large impact on the price of traded goods. Thus, studying or examining the variables that can affect trading time along with affecting transaction costs has important policy implications. Also there has been little research done on agricultural trade involving the impact of this trade facilitation variable. Therefore it is necessary to study the impact of e-governance on agricultural trade performance of a country.

2. TRADE FACILITATION LITERATURE:

This paper follows a rich existing literature studying the relationship between several trade facilitation variables and the volume of bilateral trade by Wilson, Mann and Otuski (henceforth WMO, 2003, 2005). In their seminal paper WMO (2003) deviate from the traditional computable general equilibrium (CGE) approach to measure the impact of trade facilitation on trade performance and instead employ a gravity model to examine the relationship for the first time. They consider four measures of trade facilitation: port infrastructure, customs environment, regulatory environment and e-business infrastructures and examine their effect on trade for APEC countries. They do the study for a single year by applying single averages to 13 primary variables. WMO (2005) extend this model for 75 countries by using the same gravity model approach. They examine the effect of trade facilitation on the volume of trade in manufacturing goods for the years 2000-2001 and further investigate the stability of the estimated relationships across South-to-South and North-to-South trade. In both these papers they found an increased trade in commodities from improvements in all four trade facilitation variables.

Wilson and Perez (2010) contribute to the trade facilitation literature by constructing four new aggregate indicators related to trade facilitation from a wide range of primary indicators using factor analysis. These indicators are i). Physical infrastructure; ii). Information and communications technology (ICT); iii). Border and transport efficiency; and iv). Business and regulatory environment. They also employ an augmented gravity model to assess the impact of different aspects related to trade facilitation, as measured by these four indicators, on export performance. Their results also support the previous findings that improvement in trade facilitation variables increase the volume of trade.

Iwanow and Kirkpatrick (2007) also use a gravity model to examine the effect of regulatory quality and trade facilitation on export performance. They use the gravity model to provide quantitative assessment of the potential contribution of trade facilitations in improving export performance by reducing export costs. Their results suggest that along with trade facilitations reform, border reform, better regulatory environment and better transport and communication infrastructure are necessary to facilitate export growth.

Djankov et al. (2006) find that on average each additional day that a product is delayed prior to being shipped reduces trade by at least 1 percent. They have also found a larger effect on time-sensitive agricultural products. According to their findings, on average, a day's delay reduces a country's relative exports of products by 6 percent. Liu and Yue (2013) investigate how time delays affect product quality, product price, trade flow, and social welfare. They use data on the number of days it takes for customs clearance in different countries for agricultural commodities with different levels of perishability. Their results suggest that longer time delays at the border significantly decreases highly perishable agricultural products' quality and price. They further find that for highly perishable agricultural products, improved and simplified customs delays increases trade flows and social welfare of importing countries.

Using the World Bank's "Doing Business" database, Zaki (2010) determines the predicted time related to trade facilitation aspects in developed and developing countries. In his paper a gravity model is used to estimate AVEs of the administrative barriers to trade. The paper finds that internet, bureaucracy, corruption and geographic variables have a significant effect on the transaction time to import and to export. Also time to import has a higher negative impact on trade than time to export.

Using bilateral trade panel data Francois et al., (2013) explore the influence of infrastructure and institutional quality on patterns of trade. In a gravity model setup using a Poisson estimator they extended the Baier and Berstrand method for multilateral resistance and accounting for firm heterogeneity and firm selection. Their result suggests that export performance, and the propensity to take part in the trading system, depends on institutional quality and access to well developed transport and communications infrastructure of both the countries involved in trade.

This paper also builds on the same gravity model framework where we will try to understand the relationship between few trade facilitation variables and the volume of agricultural trade across border. Here we raise the following questions and try to determine them empirically.

Q. How is the trade performance of a country in agricultural commodities affected by e-governance?

3. THE ROLE OF E-GOVERNANCE ON AGRICULTURAL TRADE

The sonorous message at the United Nations Economic Commission Global Trade facilitations conference was "*Governments should embrace the digital revolution of international trade. Simplifying lengthy paper processes and cutting red tape by going digital means sustainable, faster, and more efficient trade."* (Christian Van Der Valk, World Policy Blog, March 2014)[1]. Echoing the same message many countries have adopted technology to make trade easier across border. They have adopted or improved electronic data interchange systems to make trade more time efficient. This system allows traders to file, transfer and process custom information online.

[1]http://www.worldpolicy.org/blog/2014/03/11/globe-trade-going-paperless

It also allows them to submit their documents and to pay duties online from anywhere in the world. Therefore this system improves efficiency as it is cost effective and also saves time. At the same time this system reduces the probability of direct interaction between the traders and the custom officials thereby reducing the incidence of bribery.

One such variable that captures how each country has advanced in introducing or adopting new technology over time is the e-government index constructed by United Nations. According to United Nations e-government survey report (2001), e-government is defined as – "utilizing the internet and the world-wide-web for delivering government information and services to citizens." With rapid growth of Information and Communication Technology (ICT) and globalization governments are increasingly taking advantages of e-governance to deliver improved and transparent services to the public. The main idea behind the e-government survey was to estimate how governments are relying on the power of information and communication technology to deliver better service to the people and also to increase the overall welfare of the state.

As mentioned by the e-government survey report, the success of e-governance depends upon three pre-requisites: a minimum threshold level of technological infrastructure, human capital and e-connectivity for all the citizens. To construct the e-government index the study therefore focused on how each country relies upon information technology to provide service to its citizen.

The e-government index also measures the quality of a country's human capital. The e-government index constructed by the United Nations has two primary indicators i). The state of e-government readiness and ii). The extent of e-participation.

According to United Nations e-government survey report (2003) the e-government readiness index is “The generic capacity or aptitude of the public sector to use ICT for encapsulating in public services and deploying to the public, high quality information (explicit knowledge) and effective communication tools that support human development”. The e-government readiness index is a composite index comprised of the following indices: a). The Web Measure Index b). The Telecommunication Infrastructure Index and c). The Human Capital Index.

The web measure index captures the web presence of a government in providing services to its citizens. It captures whether a public office has any official website, a national portal or an official home page, if the necessary information is available online. It measures if these websites allow users to complete entire tasks electronically at any time or to submit forms online. It takes into account whether these websites are equipped to allow citizens to pay taxes or to apply for ID cards, birth certificates/passports, license etc.

The Telecommunication Infrastructure Index is a weighted average index of the following primary indices: a). PCs/1,000 persons b). Internet users/1,000 persons c). Telephone Lines/1,000 Persons d). On-line population/1,000 persons e). Mobile phones/1,000 persons f). TVs/1,000 persons. The human capital index is a composite measure of the adult literacy rate and the combined gross enrolment ratio, with higher weight given to adult literacy and one third to the gross enrolment ratio.

The same report defines the extent of e-participation as follows: “The willingness, on the part of the government, to use ICT to provide high quality information (explicit knowledge) and effective communication tools for the specific purpose of empowering people for able

participation in consultations and decision making, both in their capacity as consumers of public services and as citizens."

Therefore, the e-government readiness index already takes into account the quality of variables such as port efficiency in terms of technological infrastructure and the quality of human capital. It also takes into account the infrastructure of the country to enable the effective use of information and communication technology (ICT) for e-business. It considers how each country takes advantage of using internet to ease or reduce the time and transaction costs associated with international trade. Therefore this e-government index transforms different aspects of trade facilitation into a single indicator which helps to reduce multicolinearity in the model. According to Wilson et. al (2010) " From an econometric point of view, including variables related to trade facilitation, measuring similar aspects on the right-hand side of a model, such as a gravity specification, can be conducive to multicolinearity. A way of circumventing multicolinearity is to reduce the dimension of the data by aggregating highly correlated indicators into a single indicator." We also consider how the trading partner performs in terms of an e-government readiness index, as a country's trade flow depends both on its own trade facilitation reforms as well as the reforms of its trading partners.

As mentioned before, this system allows traders to file, transfer and process custom information online. It also allows them to submit their documents and to pay duties online from anywhere in the world. Therefore this system is efficient as it saves time and reduces costs. At the same time this system reduces the probability of direct interaction between the traders and the custom officials thereby reducing the incidence of bribery. Therefore, the better the port efficiency in terms of technological infrastructure and the higher the use of ICT for e-business in a country, the higher the probability of trade. Based on the above mentioned facts, we

hypothesize the following − H1: The trade performance of a country in agricultural commodities will be affected by better e-governance.

To summarize, here in this paper we use this novel e-government readiness index to assess the effect of trade facilitation on the trade performance of a country. The relationship between this trade facilitation parameter and trade performance is examined using an augmented gravity model that includes trade agreements, tariff and other standard variables. Despite being one of the most important policy indicators, in trade literatures very little work had been done on assessing the effect of trade facilitation on agricultural trade. Our paper tries to fill this gap. Another contribution of this paper is that this is the first paper, according to our knowledge, to estimate the impact of e-governance on agricultural trade.

4. METHODOLOGY /GRAVITY MODEL:

The relationship between the trade facilitation parameter and export performance is examined using an augmented gravity model. Gravity model of international trade is a most commonly used approach to measure the bilateral trade between trading partners. Tinbergen (1962) pioneered the use of gravity equations in empirical estimations of bilateral trade flows. A standard gravity model assumes that the volume of trade between two countries is positively related to the size of the economies and negatively related to the trade costs between them. The size of the economy is usually measured by the GDP of the country. The distance between the countries is used as a proxy for trade cost. Also to capture the trade costs a number of variables are included in the gravity equation. For variables such as if a country is landlocked, if it's an island economy, whether the countries share a common language, common border or colonial

heritage, whether the country pair belongs to a currency union or a custom union which captures the trade costs, a dummy is included in the model.

The basic gravity equation is given by the following equation:

$$Y_{ij}^{t} = \beta_0 + \Sigma\beta_k z_{k,ij} + \epsilon_{ij}^{t} \quad (1)$$

Where, Y_{ij}^{t} is value of trade flows or the amount of export from country i to country j at time period t , $z^{t}_{k,ij}$ (k = 1, 2, . . . , K) corresponds to the gravity variables like GDP, GDP per capita, population, distance etc.

In this paper the gravity equation takes the following form:

$$Y_{ij}^{t} = \beta_0 + \beta_1 TF_i + \beta_2 TF_j + \beta_3 GDP_i + \beta_4 GDP_j + \beta_7 POP_i + \beta_8 POP_j + \beta_9 DIST_{ij} + \beta_{10} LANG + \beta_{11} COLONY + \beta_{12} BORDER + \beta_{13} TARIFF + \beta_{14} Di + \epsilon_{tij} \quad (2)$$

Where,

- Y^{t}_{ij} denotes exports in agricultural products from country i to country j at time t.
- TFi and TFj denote the trade facilitation variable of country i and j respectively.
- GDPi and GDPj are the real GDPs of exporting and importing country respectively.
- POPi and POPj denote population of exporting and importing country respectively.
- DISTij is the distance between i and j.
- LANG is a binary ‘dummy’ variable which is unity if i and j have a common language and zero otherwise.
- BORDER is a binary ‘dummy’ variable which is unity if i and j share a common border.
- TARIFF is a simple weighted average tariff applied by country j on importing products.
- D stands for the set of dummies representing the income group or the region.

- ϵ_{tij} is the error term that is assumed to be normally distributed with mean zero.

Along with the main variable of interest, the e-government readiness index, this paper controls for few other variables that facilitate trade. It is widely recognized that infrastructure and institutions of a country play an important role in implementing the policy reform measures in an economy (Francois et al., 2013)[2]. As a proxy for infrastructure, the data depicting how many registered "Air transport carriers departures worldwide" each countries have. The higher the value of this variable, the better will be the infrastructure. The regulatory environment of an economy that represents each country's quality of institution is also included in the model.

In our augmented gravity model e-governence can be endogenous to the export volume of agricultural trade because of the possibility of omitted variable bias. Endogeneity can also arise because of the possibilities of reverse causality. For example, a country facing a higher volume of trade might find it beneficial to adopt the e-platform to efficiently provide service to the trades. Also, efficient e-governance might positively influence the volume of trade. To deal with this problem of endogeneity we use a newly constructed variable on historical technological adoption from the Cross-country Historical Adoption of Technology or CHAT dataset (Comin and Hobijn; 2009). Comin et al. (2010) compute indices of technology adoption in 1000 BC, 0 AD and 1500 AD. Out of these three time periods they found that there is a positive and significant association between the technology adoption indices in 1500 AD and technology adoption today. This relationship was found to be robust at the sector level even after controlling for geographical and institutional factors. Also there was a considerable level of cross country variation in technology adoption in 1500 AD. This measure of historical technological adoption was computed in five different sectors namely − agriculture, transportation, military, industry

[2] Rodrik (2006) include institutions as a trade facilitation variable in the model.

and communication. In our model, we include technology adoption in communication in 1500 AD as an instrument for e-governance (technology adoption) today. That is, we do a pooled IV regression to the measure the effect of e-governance on bilateral agricultural exports. We also perform a cross-country instrumental variable analysis separately for each individual year 2003, 2004 and, 2005.

5. DATA:

The bilateral trade flow data for the dependent variable is collected from the Commodity and Trade Database (COMTRADE) of the United Nations Statistics Division for 2003- 2005. Agricultural goods are defined as commodities in categories 0 at the one-digit level of the Standard International Trade Classification (SITC Revision 1). A weighted average of applied tariff rates weighted by the values of bilateral agricultural trade is used in this paper. The tariff data were derived from the Trade Analysis and Information System (TRAINS) of the United Nations Conference on Trade and Development (UNCTAD).

This paper uses the e-government readiness index published by the United Nations as the main explanatory variable. This data is derived from the United Nations Global e-readiness reports and the e-government Surveys which are produced by the Division for Public Administration and Development Management (DPADM) of the United Nations Department of Economic and Social Affairs (DESA)[3]. The data is used for the years 2003, 2004 and, 2005. The e-government readiness index takes a value between zero and ten where zero suggests a low quality of e-governance and ten suggests a better quality of the same.

[3] http://unpan3.un.org/egovkb/en-us/Data-Center

We use Gross Domestic Product (GDP) as a measure of country size. The data for GDP and GDP per capita (log (GDPPC)) for those years has been taken from the World Development Indicators published by the World Bank. Population (log (Population)) data also comes from the World Bank dataset. Variables capturing the variation in trade costs between country pairs such as distance, common language, common border, colonial pasts, and regional trade agreement membership are collected from the UNCTAD database. The data on infrastructure comes from World Bank. The data for regulatory quality, corruption comes from World Bank's World Development Indicators (WDI) database. The data for the regional dummy and the income category dummy was created using data from the World Bank.

The data source for our instrument is Comin et al. (2010). As already mentioned, they used a number of historical information sources to compute an index of cross-country technology adoption in 1000 BC, 0 AD, and 1500 AD. They found that technology adoption in 1500 AD to be more accurate predictor of technology adoption today. This measure of historical technological adoption was computed in five different sectors namely – agriculture, transportation, military, industry and communication. In our model we use the communication index as an instrument for the quality of e-governance. The communication index is constructed using four variables - the use of movable block printing, the use of woodblock printing', the use of books and the use of paper. This variable takes a value between 0 and 1, where a value closer to zero implies lower level of technology adoption in 1500 AD and a value closer to one suggests that the level of technology adoption in a country was high during 1500 AD.

6. RESULTS:

The first column in Table 1 represents the results for pooled OLS regression after controlling for heteroscedasticity. None of the variables in this regression were significant. The second column in this table gives the result for instrumental variable regression for the pooled data where we include the standard gravity model variables along with e-governance readiness index. The result suggests that the presence of better e-governance in both the exporting country and the importing country positively affects the volume of agricultural exports. In the next two columns we control for a number of variables in order to minimize the omitted variable bias. After controlling for these variables the effect of exporting country's e-governance becomes more prominent and significant. The quality of e-governance in the importing country in the last two specifications has no significant impact on the volume of agricultural exports. In all these instrumental variable regression the instrument used appears to be a strong instrument for the e-government readiness index.

The three columns in Table 2 represents the result for the cross sectional IV regression for the years 2003, 2004 and 2005 respectively. The results for 2003 suggests a positive and significant impact of the level of e-governance in the exporting country on the volume of agricultural exports. The impact of the quality of e-governance in the importing country appears to be positive but insignificant. The result further suggests that the instrument used in this regression is a strong determinant of e-governance. The result for both 2004 and 2005 were insignificant and the instrument appeared to be a weak one. The same analysis was done using only the data for web-measure index which is assumed to be a more direct predictor of the volume of agricultural exports. The results (not shown in the table) appeared to be almost as same as the results we found using the e-government readiness index.

TABLE 1. Pooled Regression results with log volume of total agricultural exports as dependent variable

ltrade	Pooled OLS	Pooled IV1	Pooled IV2	Pooled IV3
Egov	-0.0001	83.8484***	156.4869***	207.7119***
	(0.0002)	(9.8391)	(34.2734)	(61.8655)
Egov2	0.0002	4.5910**	4.4231	6.0192
	(0.0001)	(2.3171)	(3.3249)	(4.5221)
com_lang	0.9807***	0.9740***	0.5014	0.2650
	(0.0593)	(0.1639)	(0.3231)	(0.4510)
logDist	-2.7993***	-2.7941***	-2.6174***	-2.3415***
	(0.0518)	(0.1539)	(0.3032)	(0.4224)
border	0.9318***	1.1474***	0.5123	0.6430
	(0.0959)	(0.2656)	(0.4902)	(0.6342)
ldlock	-1.0659***	-0.8779***	-0.0825	-0.1588
	(0.0679)	(0.1719)	(0.3873)	(0.5042)
island	-0.0467	-5.1844***	-10.7806***	-13.1868***
	(0.0540)	(0.6651)	(2.4708)	(4.0665)
lGDP1	-0.5574***	-5.5892***	-13.1223***	-17.2112***
	(0.0565)	(0.7385)	(2.9653)	(5.2481)
lGDP2	0.6879***	0.4731***	0.6379***	0.5610***
	(0.0198)	(0.1738)	(0.1264)	(0.1743)
lPopulation1	1.0511***	5.0263***	9.0974***	11.3433***
	(0.0534)	(0.6073)	(1.9863)	(3.3614)
EECAS	-0.3578***	3.0918***	9.6397***	12.1339***
	(0.1067)	(0.5919)	(2.4746)	(4.0922)
EPASI	-0.3859***	5.2691***	11.3392***	12.8714***
	(0.0681)	(0.6414)	(2.4991)	(3.8367)
ESAFR	-1.3642***	4.9740***	13.2021***	17.6961***
	(0.0985)	(0.7574)	(3.2149)	(5.6771)
MEAST	-1.5179***	6.3335***	15.0995***	22.4021***
	(0.0876)	(0.9247)	(3.5977)	(7.0766)
NNAFR	-2.2089	10.2879***	23.0555***	30.2285***
	(0.1005)	(1.4383)	(5.4454)	(9.5120)
RSTEU	-0.5659***	6.0006***	14.4582***	17.5305***
	(0.0694)	(0.7829)	(3.3201)	(5.4196)
SOASI	-1.0906***	7.8283***	19.9131***	25.7146***
	(0.1080)	(1.1283)	(4.7338)	(8.1391)
WWAFR	-1.2772***	10.3943***	24.1523***	32.5530***
	(0.1755)	(1.4114)	(5.7251)	(10.2785)

The numbers in the parenthesis represents robust standard error

***, **, * implies significant at 1%, 5% , 10 % level

TABLE 1 continued

ltrade	Pooled OLS	Pooled IV1	Pooled IV2	Pooled IV3
HOTHR	-0.33604***	-5.74482***	-10.42445***	-12.11545***
	(0.094318)	(0.752594)	(2.309229)	(3.616591)
LOW	-1.43066***	-3.57815***	-7.962624***	-10.78318***
	(0.184668)	(0.837177)	(2.369009)	(3.986902)
MIDLW	-0.54128***	-2.1549***	-4.987436***	-6.696476***
	(0.139991)	(0.563785)	(1.5257)	(2.53451)
MIDUP	-0.27688***	-1.80749***	-3.566503***	-5.991298***
	(0.102506)	(0.488711)	(1.226084)	(2.353035)
Govteffectiveness	0.984378***	-7.65281***	-14.96835***	-13.84963***
	(0.05287)	(0.998381)	(3.482408)	(4.377999)
linfra1	0.252323***		2.976746***	3.826119***
	(0.033787)		(0.643889)	(1.122179)
linfra2	0.119861***		-0.095081***	-0.132422***
	(0.022969)		(0.223144)	(0.293811)
Corruption1				-5.785121***
				(1.842583)
Cons	0.434712	24.80304***	71.75492***	102.2715
	(0.723418)	(5.513881)	(18.12272)	(33.61871)
R-squared	0.4796			
R-squared centered		-1.4634	-5.8011	10.5243
R-squared uncentered		0.8827	0.6953	0.4837
Observations	17739	13717	11137	11163

The numbers in the parenthesis represents robust standard error

***, **, * implies significant at 1%, 5% , 10 % level

TABLE 2. Cross-sectional regression with log volume of total agricultural exports as dependent variable

ltrade	IV 2003	IV 2004	IV2005
Egov	156.4869***	258.0757	3560.26
	(34.27337)	(147.982)	(30158.96)
Egov2	4.423097	7.664389	13.43774
	(3.324865)	(9.511647)	(153.5295)
com_lang	0.501357***	0.417963	3.094487
	(0.323104)	(0.93186)	(21.61502)
logDist	-2.61743***	-1.14852	7.947284
	(0.30318)	(1.319712)	(91.93495)
border	0.512256	0.493328	5.27036
	(0.490218)	(1.28867)	(39.62333)
ldlock	-0.08253***	6.755882	-22.527
	(0.387323)	(4.646186)	(181.2793)
island	-10.7806***	-17.8985*	-286.955
	(2.470772)	(10.63405)	(2432.296)
lGDP	-13.1223***	17.14753*	-250.334
	(2.965266)	(-9.98278)	(2127.65)
lGDP2	0.637918***	0.813466***	3.952106
	(0.126436)	(0.284121)	(27.57034)
lPopulation1	9.097401***	10.96863	115.5506
	(1.986318)	(6.286)	(981.9613)
EECAS	9.639715***	16.04398	192.1168
	(2.474578)	(10.24229)	(1642.177)
EPASI	11.33918***	24.45047	261.4913
	(2.499144)	(14.08577)	(2213.725)
ESAFR	13.2021***	31.68705	340.2697
	(3.214937)	(19.05624)	(2893.985)
MEAST	15.09949***	32.00698	331.5764
	(3.597682)	(19.11743)	(2816.98)
NNAFR	23.05548***	47.95252*	495.7393
	(5.445375)	(28.33442)	(4207.561)
RSTEU	14.45819***	23.84437	392.393
	(3.320131)	(14.02348)	(3330.082)
SOASI	19.91311***	35.93176	509.7528
	(4.733778)	(21.4033)	(4329.414)
WWAFR	24.15233***	48.80503	537.8261
	(5.725082)	(29.16038)	(4572.5)

The numbers in the parenthesis represents robust standard error

***, **, * implies significant at 1%, 5% , 10 % level

TABLE 2 continued

ltrade	IV 2003	IV 2004	IV2005
HOTHR	-10.4245***	-22.9392*	-306.135
	(2.309229)	(13.11018)	(2587.465)
LOW	-7.96262	6.53257	121.6267
	2.369009	0.00715	(1004.402)
MIDLW	-4.98744	-11.8099	38.67414
	1.5257	7.89092	(312.943)
MIDUP	-3.5665***	-10.3303	21.61552
	(1.226084)	(7.172679)	(167.5712)
Govteffectiveness	-14.9684	-32.26	-377.182
	(3.482408)	19.05899	(3201.687)
linfra1	2.976746***	5.008242	86.15774
	(0.643889)	(2.765856)	(729.2382)
linfra2	-0.09508	-0.49383	-1.92557
	(0.223144)	(0.7009)	(16.61512)
cons	71.75492	62.13482	1335.443
	(18.12272)	(40.75549)	(11411.66)
R-squared centered	0.3165	15.3897	0.028
R-squared uncentered	0.9403	0.2795	0.12
Observations	3896	3778	3489
Wald F-stat	26.85	1.827	0.011

The numbers in the parenthesis represents robust standard error

***, **, * implies significant at 1%, 5% , 10 % level

One limitation of using logarithmic transformation is that it's not able to deal with the missing observations that are very common in bilateral trade data. In our cross sectional instrumental variable analysis this problem becomes very prominant as there are many missing values present in the data for the years 2004 and 2005, which make the results insignificant.

One option to deal with the zero values present in the data is to do a panel analysis following Heckman's two step regression. Heckman two-step procedure (Heckman, 1979) helps to deal with the sample selection problem that arises due to missing trade values. In Heckman's two-step procedure, instead of constructing symmetric trade flows by combining exports and imports for each country pair, they used the unidirectional trade value and introduced both

importing and exporting country fixed effect. With these fixed effects every country pair was represented twice: one time for exports from i to j and another time for exports from j to i. Then the initial gravity equation is estimated by a probit model that determines the probability that a country pair engages in trade. In the second stage of estimation, the expected values of the trade flows, conditional on that the countries are trading, are estimated using OLS.

In order to correct the sample selection bias or to identify the parameters on both the equations, an identification variable is required in this two-step analysis. This variable should hold the property that it should influence a country's propensity to engage in trade but shouldn't have any effect on its volume of trade. Previous literature suggests that variables like common religion, common language (Helpman et al. 2006), regulatory quality (Shepotylo 2009) etc. satisfies this conditions (Herrera, 2010). In our future investigation we will apply this two-step procedure proposed by Heckman to reduce the sample selection bias present in our model.

7. CONCLUSION

This paper analyzes the effect of trade facilitation on agricultural trade. The study was done using data between 2003 to 2005 where we examined the impact of better e-governance on the volume of total agricultural exports. It is important to study the effect of these variables as they influence the trading time and cost across border. The study focuses on agricultural commodities as the perishable nature of the agricultural commodities makes them more sensitive to the time it takes to trade across border. Thus analyzing the variables that can influence the trading time and cost has become important for the policymakers. An augmented gravity model was estimated using pooled and cross sectional OLS and instrumental variable regression. The results suggest that a better quality of e-governance positively affects the volume of agricultural exports. The cross-sectional regression shows a positive and significant impact of e-governance on the volume of agricultural exports though results were insignificant for the years 2004 and 20005.

Our analysis was done using pooled and cross-sectional regression of the log-linearized model. This may not the best method while dealing with bilateral trade data where missing values are very common. In our future research we will do a panel analysis using Heckman's two step procedure to reduce the self-selection bias that arises due to missing trade values.

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