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Trade Liberalization and Endogenous Quality Choice in Food and Agricultural Trade

Jihyun Eum, Ohio State University, eum.9@osu.edu

Ian Sheldon, Ohio State University, sheldon.1@osu.edu

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INTRODUCTION

Trade standards exist to protect safety and environment. The importance of food safety and its quality has been emphasized.

Stylized facts : (1) Hidden causes and consequences of international trade at country-level can be interpreted with firm heterogeneity (2) Differences in productivity among firms causes changes in trade participation

Related studies:

Trade liberalization and quality sorting: Amiti and Khandelwal (2013), Fan et al. (2014)

Endogenous quality choice model: Baldwin and Harrigan (2011), Johnson(2012), Kugler and Verhoogen (2012)

RESEARCH QUESTION

Illustrate heterogeneous firm trade model with endogenous quality choice

Estimate model with agricultural and food trade data: (1) Evaluate determinants of bilateral trade (2) Analyze effect of non-tariff measures (NTM) as a fixed trade cost

Introduce the impact of selection into exporting with consideration of product quality in agricultural and food trade and use advanced NTM data

THEORETICAL BACKGROUND

PREFERENCES

$$U = \int_{\omega \in \Omega} (q(\omega)x(\omega))^{\sigma-1} d\omega]^{\sigma} EP^{\sigma-1}$$

$$x(\omega) = q(\omega)^{\sigma-1} p(\omega)^{-\sigma} EP^{\sigma-1}$$

PRODUCTION

Firms are heterogeneous in (1) productivity, a (2) product quality, q

- J countries, N_j firms under monopolistic competition

- Marginal cost of production: c_j/a

- Firms choose optimal domestic price (p_j) and export price (p_{ij}^*)

$$p_j = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{c_j}{a}\right) \quad p_{ij}^* = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{c_j T_{ij}}{a}\right)$$

PRODUCTIVITY AND QUALITY

$$q = a^{\theta-1} \text{ where } \theta - 1 > 0$$

$\theta - 1$ is "quality elasticity" or "scope for quality differentiation"

THEORETICAL BACKGROUND (CONT.)

Profit and zero-profit condition

$$\pi_{ij}(a) = \frac{1}{\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \left(\frac{T_{ij} c_j}{a^\theta P_i}\right)^{1-\sigma} E_i - f_{ij}$$

Trade volume

$$V_{ijt} = \begin{cases} \int_{a_{ijt}}^{a_{it}} a^{(\sigma-\theta)} dG(a) & \text{for } a_{ijt} \leq a_{it} \\ 0 & \text{otherwise} \end{cases}$$

Then trade value

$$M_{ijt} = \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \left(\frac{T_{ijt} c_{jt}}{P_{it}}\right)^{1-\sigma} E_{it} N_{it} V_{ijt}$$

EMPIRICAL ESTIMATION

TWO STAGE ESTIMATION (Helpman et al., 2008)

First stage: Selection equation

$$\rho_{ijt} = \Pr(T_{ijt} = 1) = \Phi(\varepsilon_{ijt}^* + \varepsilon_j^* + \varepsilon_i^* + \gamma_1 \ln DIST_{ij} + \gamma_2^* ADJ + \gamma_3^* LANG + \gamma_4^* RTA + \kappa_1^* GOV + \kappa_2^* NTM)$$

Second stage: Trade equation

$$\ln m_{ijt} = \psi_0 + \psi_{it} + \psi_{jt} + \gamma_1 \ln DIST_{ij} + \gamma_2 \ln ADJ_{ij} + \gamma_3 \ln LANG_{ij} + \gamma_4 RTA_{ij} + \ln(\exp[\delta(\hat{Z}_{ijt}^* + \hat{\lambda}_{ijt}^*) - 1] + \beta_{unt} \hat{\lambda}_{ijt}^* + \varepsilon_{ijt})$$

- Correction for absence of extensive margin (# of exporting firms via expected probability)
- Inverse Mills ratio for correcting sample selection error

Table 1. Benchmark Gravity and Baseline Results

	Baseline		Heterogeneous firms model		Bias Decomposition	
	OLS	PPML	Probit	MLE	Sample selection Heckman	Firm Heterogeneity
	(1)	(2)	(3)	(4)	(7)	(8)
Ln dist	-1.260***	-0.650***	-0.547***	-0.900***	-1.316***	-0.901***
dist	(0.0338)	(0.050)	(0.0199)	(0.0946)	(0.0366)	(0.0948)
ADJ	0.880***	0.580***	0.176	0.742***	0.883***	0.776***
	(0.129)	(0.137)	(0.114)	(0.137)	(0.133)	(0.133)
LANG	0.876***	0.265**	0.395***	0.642***	0.941***	0.616***
	(0.0629)	(0.120)	(0.0319)	(0.0899)	(0.0650)	(0.0897)
RTA	0.668***	0.640***	0.361***	0.428***	0.715***	0.461***
	(0.0706)	(0.119)	(0.0488)	(0.0949)	(0.0686)	(0.0942)
IMR				-0.341*	0.408***	
				(0.173)	(0.0865)	
W				0.765***		
				(0.165)		
\hat{Z}_{ijt}^*						0.655***
						(0.163)
N	44477	73116	73116	44477	44477	44477
R-sq	0.944	0.784	0.528	0.679	0.678	0.678

DATA

Panel data from 2010 to 2013

Food and agricultural product trade value and quantity from FAO, trade cost data from CEPII, standards data from World Bank/ WTO

Exclusion restrictions should determine the probability of exporting but not influence trade value : Government efficiency (World Bank) and Freedom to Trade (Fraser Inst) Non-tariff measures data (WITS/I-TIP)

RESULTS

Trade determinants (distance, adjacency, language) follow theoretical expectation.

Good governance facilitates trade but NTM negatively influence trade participation.

Introducing non-linear coefficient w and inverse Mills ratio makes coefficient of trade determinants consistent.

Inverse Mills ratio: control sample selection error

w : control unobservable firm heterogeneity

According to bias decomposition result, most of the bias driven by unobserved heterogeneity (proportion of exporting firms). Accordingly, ignoring firm heterogeneity in standard gravity model induces significant bias.

Table 2. Estimation: Baseline, heterogeneous firm trade model, bias decomposition

	Baseline		Heterogeneous firms model		Bias Decomposition	
	OLS	MLE	Sample selection Heckman	Firm Heterogeneity	Sample selection Heckman	Firm Heterogeneity
	(1)	(2)	(3)	(4)	(3)	(4)
Panel A. Bilateral trade value towards OECD member countries						
Ln dist	-1.380***	-1.650***	-1.745***	-1.700***		
	(0.0550)	(0.279)	(0.0702)	(0.280)		
ADJ	0.566**	1.036**	0.908***	0.935*		
	(0.223)	(0.480)	(0.313)	(0.477)		
LANG	0.601***	0.672***	0.720***	0.639***		
	(0.0990)	(0.176)	(0.112)	(0.176)		
RTA	-0.111	-0.284*	-0.300*	-0.248		
	(0.111)	(0.160)	(0.153)	(0.160)		
IMR		0.609*	0.714***			
		(0.318)	(0.135)			
W		0.105				
		(0.302)				
\hat{Z}_{ijt}^*						-0.0811
						(0.301)
N	16187	12463	12463	12463		
R-sq	0.761	0.684	0.684	0.682		

Panel B. Bilateral trade value towards non-OECD member countries				
Ln dist	-1.299***	-0.955***	-1.350***	-0.974***
	(0.0375)	(0.117)	(0.0458)	(0.117)
ADJ	0.744***	0.662***	0.869***	0.704***
	(0.140)	(0.160)	(0.151)	(0.157)
LANG	0.910***	0.745***	1.020***	0.730***
	(0.0693)	(0.105)	(0.0750)	(0.104)
RTA	1.016***	0.766***	1.076***	0.794***
	(0.0873)	(0.129)	(0.0905)	(0.128)
IMR		-0.122	0.626***	
		(0.230)	(0.123)	
W		0.785***		
		(0.221)		
\hat{Z}_{ijt}^*				0.534**
				(0.216)
N	30161	28290	28290	28290
R-sq	0.638	0.641	0.641	0.640

INCOME & PRODUCTIVITY THRESHOLD

Effect of trade frictions on bilateral trade flow towards OECD importers becomes stronger when we consider proportion of exporting firms, since productivity threshold is relatively higher than in other markets.

Effect of trade frictions towards non-OECD member countries becomes weaker after consideration of extensive margin, because exporting firms are able to enter market relatively easily thanks to lower export threshold

Importers who require import high-quality products have relatively higher productivity threshold restrict exporting firms, whereas importers with relatively lower productivity threshold allow more firms to enter export market.

CONCLUSIONS

Selection into exporting should be considered in evaluation of effect of trade frictions in food and agricultural trade

Our new approach is to use freedom to trade, governance indicators, and non-tariff measures as proxies for fixed trade costs in food and agricultural trade

Estimation results confirm that controlling extensive margins, alternative model specification, is better fitted to the data and produces unbiased and consistent estimates.