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2017 IATRC Annual Meeting

Asymmetric Trade Costs: Agricultural Trade among Developing and Developed Countries

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Introduction

 Low agricultural trade value(less than US\$ 2 tril.) compared to manufacturing goods (US\$ 13 tril.) in 2013

Research Question

- Search reasons why developing countries trade fewer agricultural products
- Analyze two main causes: (1) productivity differences (2) high trade costs

Contribution

- Examine cross-country differences in productivity and trade costs using a neo-Ricardian trade model
- Estimate elasticity of trade for agricultural sector
- Asymmetric trade costs are found between North and South

Summary

Related studies

- Productivity differences: Gollin et al.(2013), Lagakos and Waugh(2013)
- Transportation costs: Gollin and Rogerson(2014), Adamopoulos(2015)
- Tombe(2015) and Xu(2015)

Findings

- Low value of trade elasticity in ag sector, implying high power of degree of comparative advantage
- Asymmetric trade cost is main cause of low bilateral trade share between North and South

Model

 Productivity is a random draw from country-specific probability distribution

- Country *i* has average productivity *T_i* (location of the distribution)
 & dispersion of productivity θ
- θ indicates degree of comparative advantage's power on trade patterns

$$F_i(z) = exp\left\{-T_i z_i^{- heta}
ight\}$$

Trade share

- Exporter *i* and importer *n*
- Trade share is the probability that i offers the lowest price to n

$$\Pr[\Pr_{ni}(j) \leq \Pr_{ni} \forall l \neq i] = \frac{T_i(\gamma_i \tau_{ni})^{-\theta}}{\sum_{i=1}^N T_i(\gamma_i \tau_{ni})^{-\theta}} = \frac{X_{ni}}{X_n}$$

Model

♦ Equilibrium

Price index

$$P_n = \left[\Gamma\left(\frac{\theta + 1 - \gamma}{\theta}\right)^{1/(1 - \sigma)} \left[\sum_{i=1}^N T_i(\gamma_i \tau_{ni})^{-\theta}\right]^{-1/\theta} \text{ where } \theta > \sigma - 1$$

Trade share across countries

$$\ln\left(\frac{X_{ni}/X_n}{X_{nn}/X_n}\right) = \frac{T_i}{T_n} \left(\frac{r_i}{r_n}\right)^{-\theta} \tau_{ni}^{-\theta}$$

• Constraints: Trade balance and aggregated production requirements $\sum_{x_i} - \sum_{x_i} \sum_{x_i$

$$\sum_{i \neq n} X_{in} = \sum_{i \neq n} X_{ni}$$
$$Y_i = \sum_{n=1}^{l} X_{ni}$$

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Estimation of trade elasticity

$$\left(\frac{X_{ni}/X_n}{X_{ii}/X_i}\right) = \left(\frac{P_i\tau_{ni}}{P_n}\right)^{-\theta}$$

where $\ln\left(\frac{P_i\tau_{ni}}{P_n}\right) = \frac{\max\{\ln P_n(j) - \ln P_i(j)\}}{(1/J)\sum_{j=1}^J(\ln P_n(j) - \ln P_i(j))}$

Estimation of destination effects: define θ as 2.5

$$(\frac{X_{ni}/X_n}{X_{nn}/X_n}) = S_i - S_n - \theta(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{r_{ni}} + ex_i + v_{ni})$$
$$= \bar{S}_i - \hat{S}_n - \theta(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{r_{ni}} + v_{ni})$$
$$where \bar{S}_i = \hat{S}_i - \theta \hat{e}_{i}$$

• Effects on trade costs: $e^{\left(-\frac{1}{\theta}\right)*\beta} - 1$

Panel A	Effect on trade cost (θ=2.5)						
Dist ₁	-13.75***	(0.437)		243.59			
Dist ₂	-15.38***	(0.299)		468.07			
Dist ₂	-18.21***	(0.208)		1455.20			
Dist ₂	-20.18***	(0.161)		3205.25			
Dist ₂	-21.83***	(0.106)		6197.16			
Dist ₂	-22.41***	(0.153)		7831.21			
Border	1.74***	(0.456)		-0.50			
Language	0.823***	(0.215)		-0.28			
RTA	3.286***	(0.225)		-0.73			
Panel B	Destination	Source	Effect on cost		Destination	Source	Effect on Cost
Panel B Canada	Destination 3.377	Source 12.69	Effect on cost -0.99	Argentina	Destination -0.927	Source 9.95	Effect on Cost -0.98
Panel B Canada China	Destination 3.377 3.511	Source 12.69 14.45	Effect on cost -0.99 -1.00	Argentina Bangladesh	Destination -0.927 -7.689	Source 9.95 -8.24	Effect on Cost -0.98 25.99
Panel B Canada China Germany	Destination 3.377 3.511 1.009	Source 12.69 14.45 8.62	Effect on cost -0.99 -1.00 -0.97	Argentina Bangladesh Brazil	Destination -0.927 -7.689 -1.777	Source 9.95 -8.24 7.91	Effect on Cost -0.98 25.99 -0.96
Panel B Canada China Germany France	Destination 3.377 3.511 1.009 1.038	Source 12.69 14.45 8.62 9.05	Effect on cost -0.99 -1.00 -0.97 -0.97	Argentina Bangladesh Brazil Nigeria	Destination -0.927 -7.689 -1.777 -8.447	Source 9.95 -8.24 7.91 -9.55	Effect on Cost -0.98 25.99 -0.96 44.66
Panel B Canada China Germany France Rep. of Korea	Destination 3.377 3.511 1.009 1.038 0.921	Source 12.69 14.45 8.62 9.05 1.93	Effect on cost -0.99 -1.00 -0.97 -0.97 -0.54	Argentina Bangladesh Brazil Nigeria Thailand	Destination -0.927 -7.689 -1.777 -8.447 1.390	Source 9.95 -8.24 7.91 -9.55 6.31	Effect on Cost -0.98 25.99 -0.96 44.66 -0.92
Panel B Canada China Germany France Rep. of Korea USA	Destination 3.377 3.511 1.009 1.038 0.921 5.212	Source 12.69 14.45 8.62 9.05 1.93 17.15	Effect on cost -0.99 -1.00 -0.97 -0.97 -0.54 -1.00	Argentina Bangladesh Brazil Nigeria Thailand Senegal	Destination -0.927 -7.689 -1.777 -8.447 1.390 0.573	Source 9.95 -8.24 7.91 -9.55 6.31 -0.97	Effect on Cost -0.98 25.99 -0.96 44.66 -0.92 0.47
Panel B Canada China Germany France Rep. of Korea USA USA	Destination 3.377 3.511 1.009 1.038 0.921 5.212 1.930	Source 12.69 14.45 8.62 9.05 1.93 17.15 7.08	Effect on cost -0.99 -1.00 -0.97 -0.97 -0.97 -0.54 -1.00 -0.94	Argentina Bangladesh Brazil Nigeria Nigeria Senegal Senegal Zimbabwe	Destination -0.927 -7.689 -1.777 -8.447 1.390 0.573 0.137	Source 9.95 -8.24 7.91 -9.55 6.31 -0.97 -4.32	Effect on Cost -0.98 25.99 -0.96 44.66 -0.92 0.47 4.62

Empirical Analysis

- Bilateral trade flow data for agricultural products among 128 countries for the year 2013
- Geographic barriers (distance, language, border, RTA) follow expectations
- Destination effects reflect a unit cost for a producer with the average technology level: North and South are similar in terms of unit production costs
- Effects on trade costs decrease in GDP per capita
- State of technology(average productivity) increase in GDP per capita

Effects on trade costs decrease in GDP per capita



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◆ State of technology(country's average productivity) is defined as $lnT_i \equiv \hat{S}_i + \theta lnr_i$

Country's average productivity increase with GDP per capita



Asymmetric trade costs

$$\tau_{ni} = exp\left(-\frac{\widehat{b}_{ni}}{\theta}\right) * exp\left(-\frac{\widehat{l}_{ni}}{\theta}\right) * exp\left(-\frac{\widehat{rta}_{ni}}{\theta}\right) * exp\left(-\frac{\sum \widehat{d}_{r_{ni}}}{\theta}\right) * exp\left(-\frac{\widehat{ex}_{i}}{\theta}\right)$$

 Developing countries' trade costs towards developed is greater than that of developed towards developing



Conclusion

- Based on estimated trade elasticity, effects of relative average productivity differences and asymmetric bilateral trade costs on trade shares are estimated
 - Value of trade elasticity is lower than that of other sectors, implying comparative advantage plays a significant role
- Relative productivity differences and trade costs explain low trade flow in agricultural sector from developing countries
 - South trades fewer agricultural goods due to relatively higher bilateral trade costs
 - Relatively higher trade costs as well as differences in productivity are main cause of low trade flow