
2017 IATRC Annual Meeting

**Asymmetric Trade Costs:
Agricultural Trade among Developing
and Developed Countries**

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THE BANK OF KOREA

- ◆ 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

◆ **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

- ◆ **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

$$F_i(z) = \exp \left\{ -T_i z_i^{-\theta} \right\}$$

- ◆ **Trade share**

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

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

◆ Equilibrium

◆ Price index

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

◆ 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

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

◆ Estimation of trade elasticity

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

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

◆ Estimation of destination effects: define θ as 2.5

$$\left(\frac{X_{ni}/X_n}{X_{nn}/X_n}\right) = S_i - S_n - \theta(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{rni} + ex_i + v_{ni})$$

$$= \bar{S}_i - \hat{S}_n - \theta(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{rni} + v_{ni})$$

$$\text{where } \bar{S}_i = \hat{S}_i - \theta \hat{ex}_i$$

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

Empirical Analysis

Panel A			Effect on trade cost ($\theta=2.5$)
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

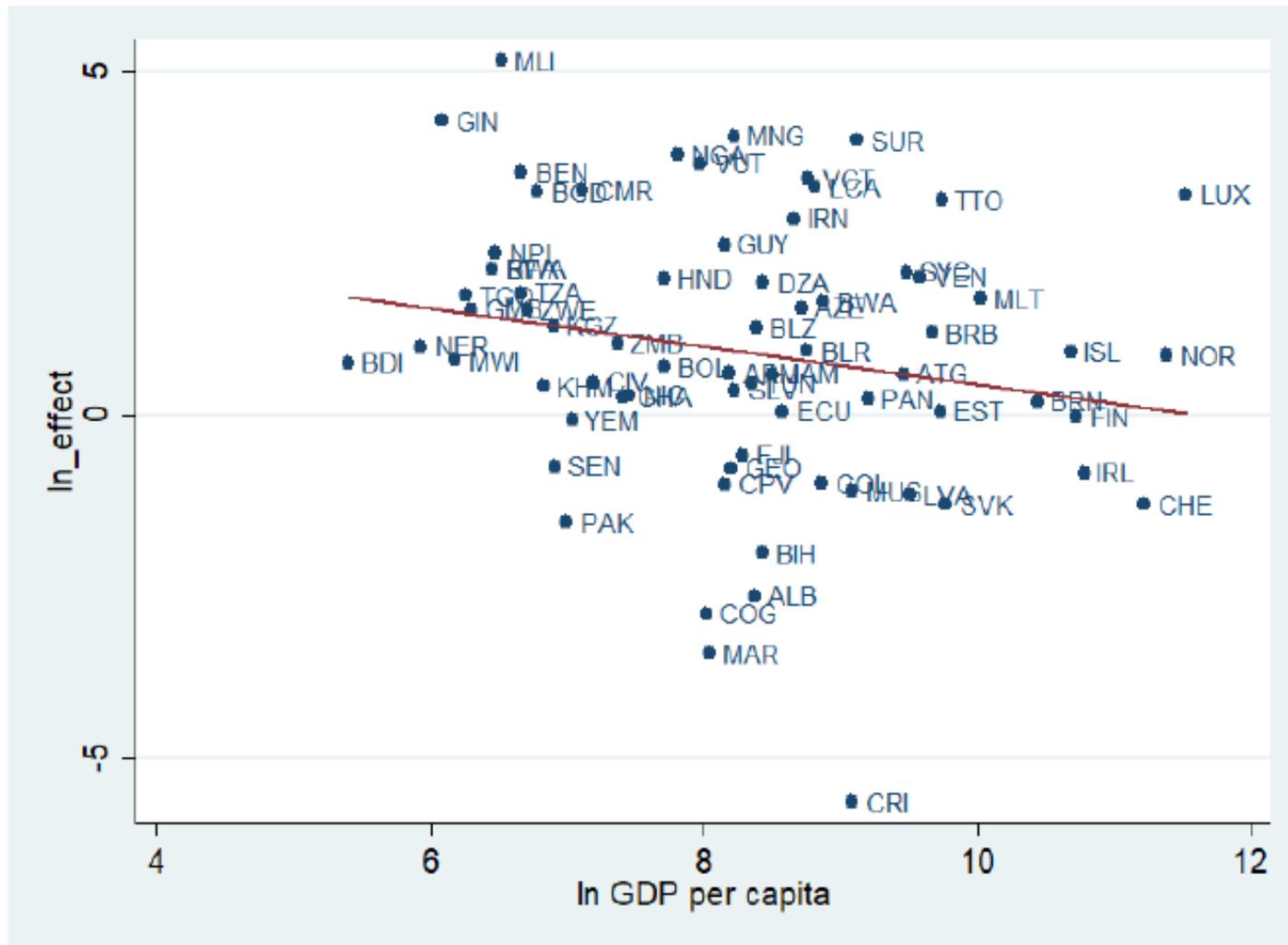
Panel B	Destination	Source	Effect on cost	Destination	Source	Effect on Cost	
Canada	3.377	12.69	-0.99	Argentina	-0.927	9.95	-0.98
China	3.511	14.45	-1.00	Bangladesh	-7.689	-8.24	25.99
Germany	1.009	8.62	-0.97	Brazil	-1.777	7.91	-0.96
France	1.038	9.05	-0.97	Nigeria	-8.447	-9.55	44.66
Rep. of Korea	0.921	1.93	-0.54	Thailand	1.390	6.31	-0.92
USA	5.212	17.15	-1.00	Senegal	0.573	-0.97	0.47
UK	1.930	7.08	-0.94	Zimbabwe	0.137	-4.32	4.62

Obs #: 9,709 /(128 countries) / Adj R square: 0.523

◆ 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

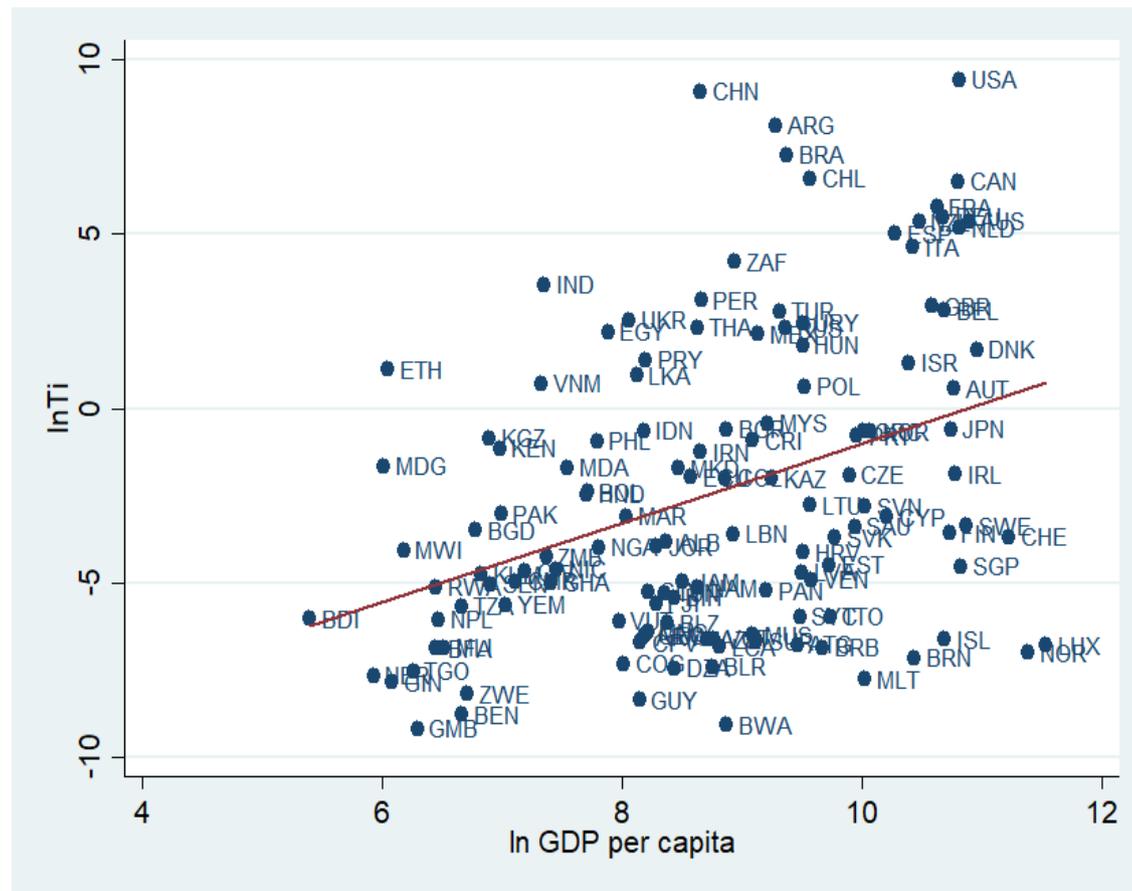
- ◆ Effects on trade costs decrease in GDP per capita



- ◆ State of technology(country's average productivity) is defined as

$$\ln T_i \equiv \hat{S}_i + \theta \ln r_i$$

- ◆ Country's average productivity increase with GDP per capita

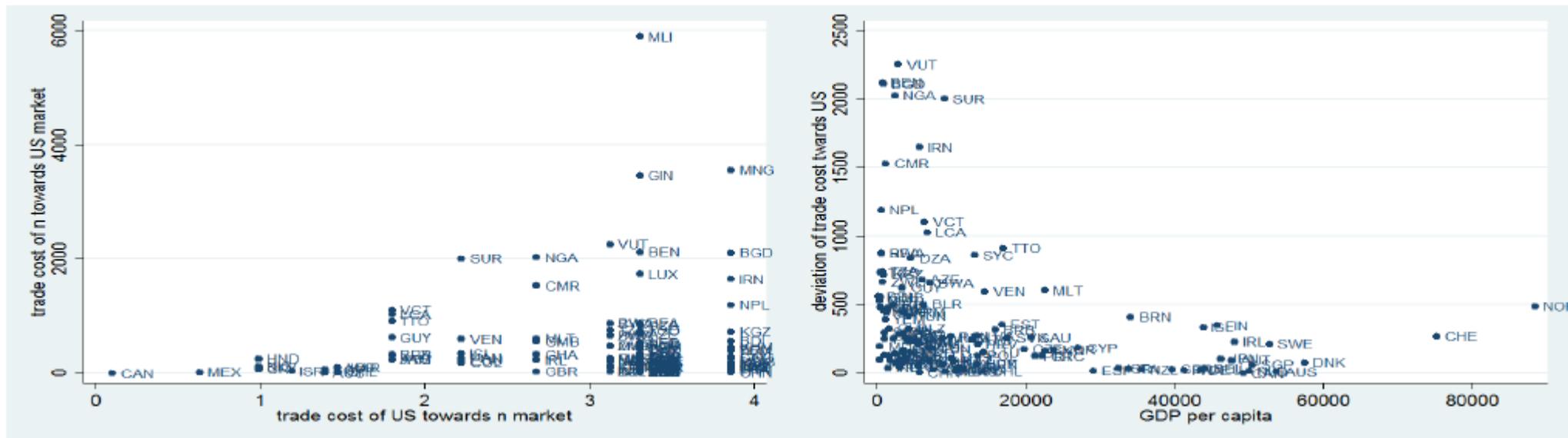


◆ Asymmetric trade costs

$$\tau_{ni} = \exp\left(-\frac{\hat{b}_{ni}}{\theta}\right) * \exp\left(-\frac{\hat{l}_{ni}}{\theta}\right) * \exp\left(-\frac{\hat{r}t\hat{a}_{ni}}{\theta}\right) * \exp\left(-\frac{\sum \hat{d}_{rni}}{\theta}\right) * \exp\left(-\frac{\hat{e}x_i}{\theta}\right)$$

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

◆ $\tau_{us-zbw} = 6$ VS. $\tau_{zbw-us} = 31672$



- ◆ 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