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

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

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

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

Model

- **Equilibrium**
  - Price index

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

  - Trade share across countries

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

  - Constraints: Trade balance and aggregated production requirements

$$\sum_{i \neq n} X_{in} = \sum_{i \neq n} X_{ni}$$

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

Empirical Analysis

- **Estimation of trade elasticity**

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

$$where \ln\left(\frac{P_i \tau_{ni}}{P_n}\right) = \frac{max2\left\{lnP_n(j) - lnP_i(j)\right\}}{(1/J)\sum_{j=1}^{J}(lnP_n(j) - lnP_i(j))}$$

- **Estimation of destination effects: define θ as 2.5**

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

$$= \bar{S}_i - \hat{S}_n - \theta\left(b_{ni} + l_{ni} + RTA_{ni} + \sum_r d_{r_{ni}} + \upsilon_{ni}\right)$$

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

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

Empirical Analysis

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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
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

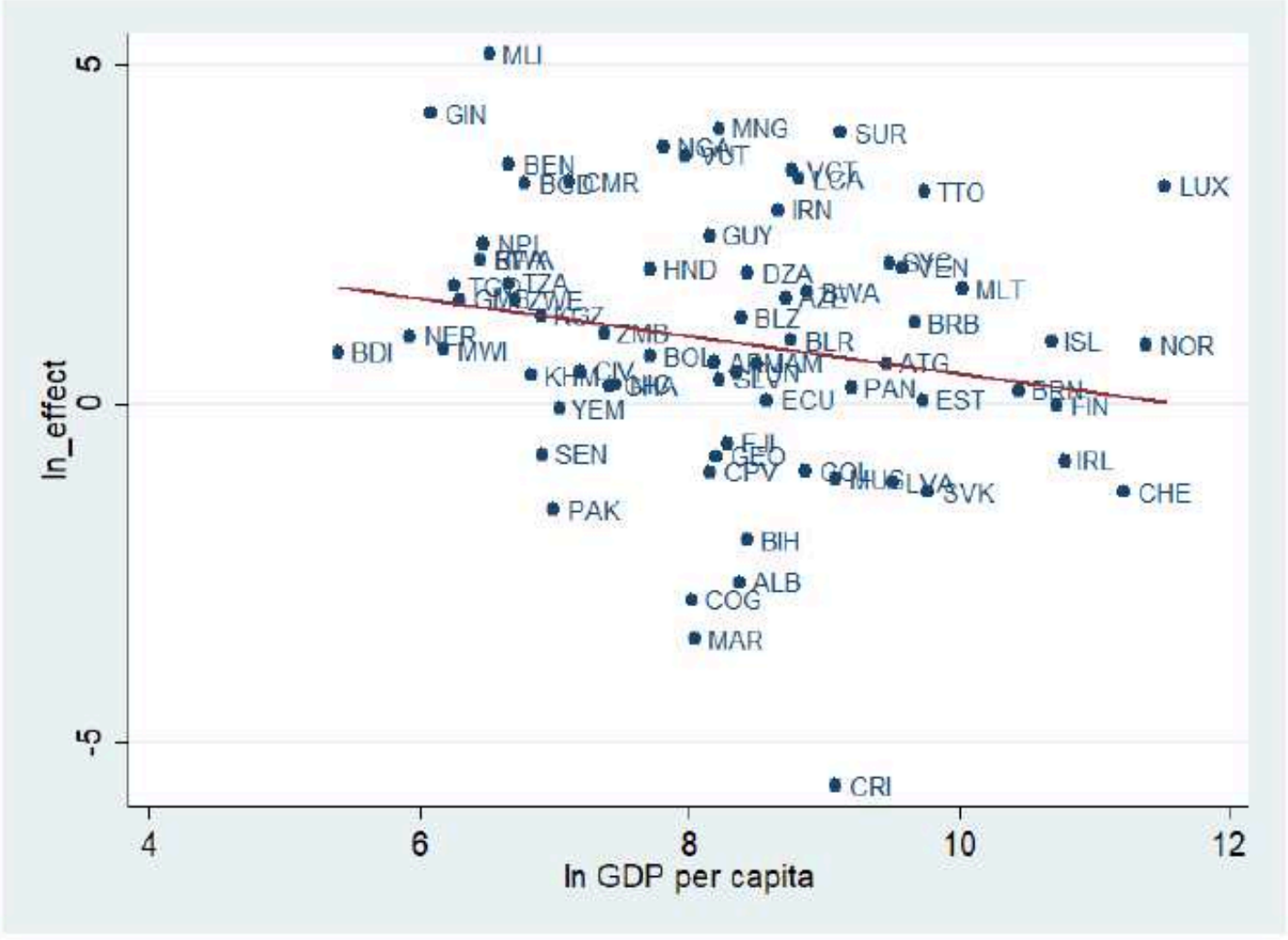
Obs #: 9,709 /(128 countries) / Adj R squre: 0.523

Empirical Analysis

- **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

Empirical Analysis

- Effects on trade costs decrease in GDP per capita

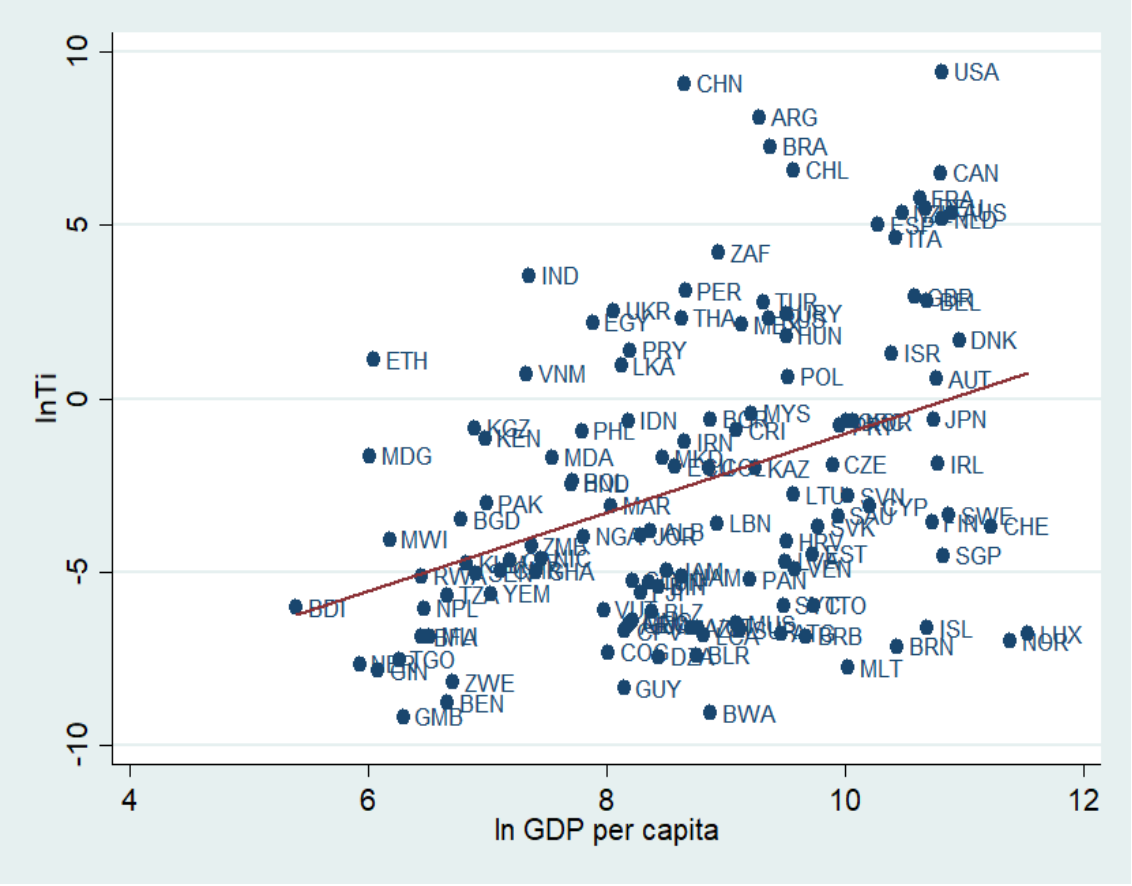


Empirical Analysis

- 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

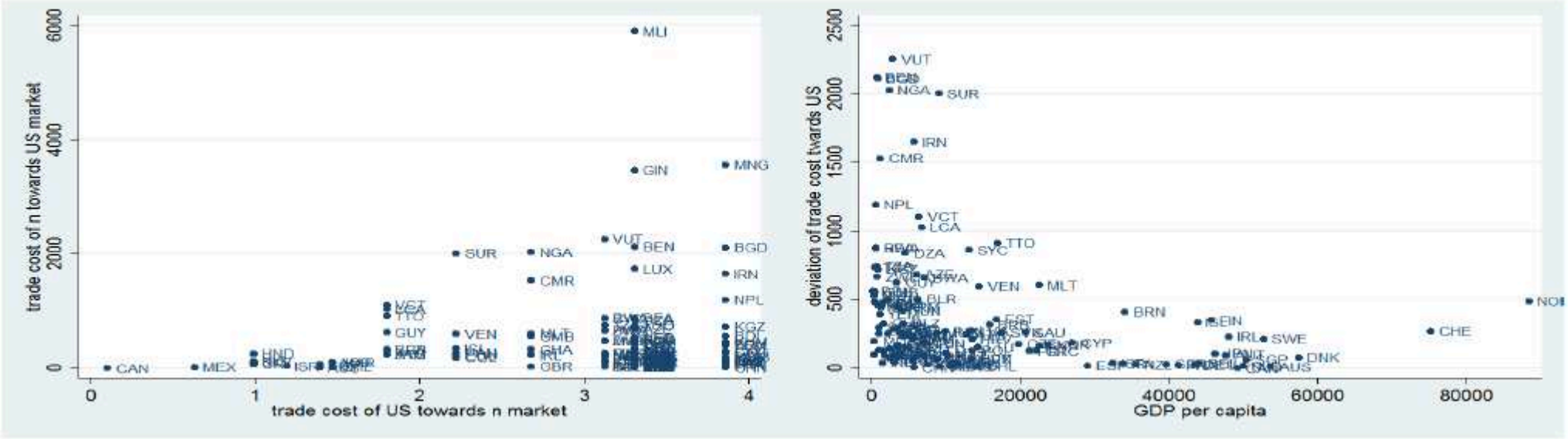


Empirical Analysis

- **Asymmetric trade costs**

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

  - Developing countries' trade costs towards developed is greater than that of developed towards developing
    - $\tau_{us-zbw} = 6$ vs. τ_{zbw-us} =31672



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