Trade Flows and Trade Policy Analysis

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Dhaka, Bangladesh

Witada Anukoonwattaka

(ESCAP)

Cosimo Beverelli

(WTO)

The gravity model in international trade

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a. What is it?

- Econometric model (ex-post analysis)
- Models many social interactions (migration, tourism, trade, FDI)
- For decades, social scientists have been using a modified version of [Isaac Newton's Law of Gravitation](#) to predict movement of people, information, and commodities between cities and even continents
- The gravity model takes into account the population size of two places and their distance. Since larger places attract people, ideas, and commodities more than smaller places and places closer together have a greater attraction, the gravity model incorporates these two features
- Initially, no theoretical foundations
- Why so popular?
  - High explanatory power (R^2 between 0.65 and 0.95)
  - Easy access to relevant data
  - Estimation standards and benchmarks clearly established

Newton

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2}$$

- Where *F* is the attraction force, *G* is the gravitational constant, *M* is mass, *D* is distance, *i* and *j* index point masses

Gravity

$$X_{ij} = G \frac{Y_i^{\alpha} Y_j^{\beta}}{T_{ij}^{\theta}}$$

- Where X_{ij}= exports from country *i* to *j* or total trade; *Y*=economic size (GDP, POP) and *T*= Trade costs

The effects of size and distance

- More bilateral trade the larger the countries
- Less bilateral trade the more the distance between them
- A and B are predicted to trade more than C and D
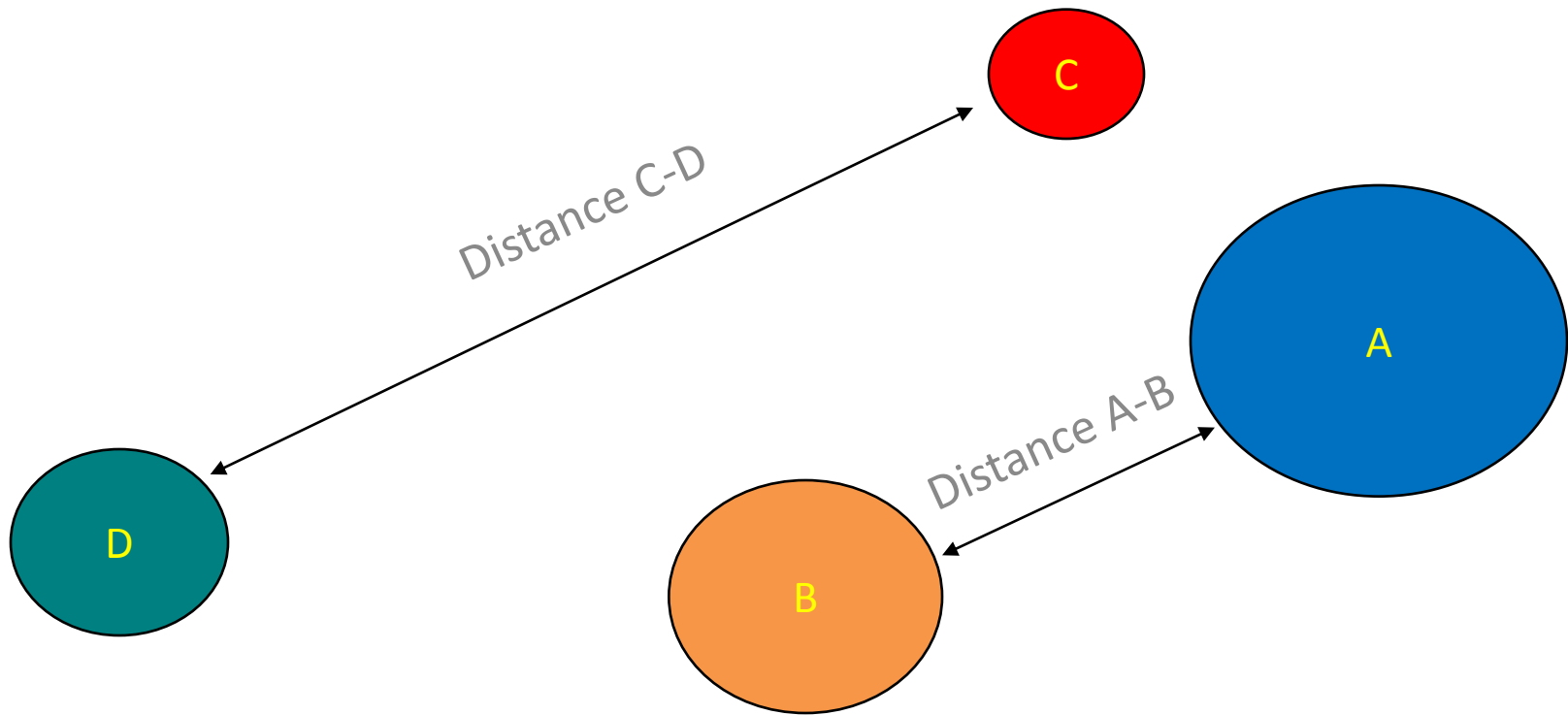
Proxies for trade costs

- Distance
- Contiguity
- Common language
- Colonial links
- Common currency
- Island, landlocked country
- Institutions, infrastructure, migration flows,…
- Surprisingly enough, tariffs are very often omitted
- Main reason: endogeneity issue
  - Do tariffs reduce trade or does more trade induce tariff reductions? (reverse causality problem)

b. Naïve gravity estimation

- Naïve estimation of the gravity regression is

$$\ln(Trade_{ij}) = \alpha + \beta_1 \ln(GPD_i) + \beta_2 \ln(GPD_j) + \beta_3 \ln(dist_{ij}) + \varepsilon_{ij}$$

- This regression fits the data very well
  - R-squared of 0.7 in cross-section data (*ij* dataset)

- However this naïve version can lead to very biased results
  - Serious omitted variable bias: any *i*- or *j*- characteristic that correlates both with trade and GDP ends up in the error term. The basic OLS assumption of orthogonality between the error term and the explanatory variables is