Modelling Methods for Trade Policy II: Introduction to OLS Regression Analysis

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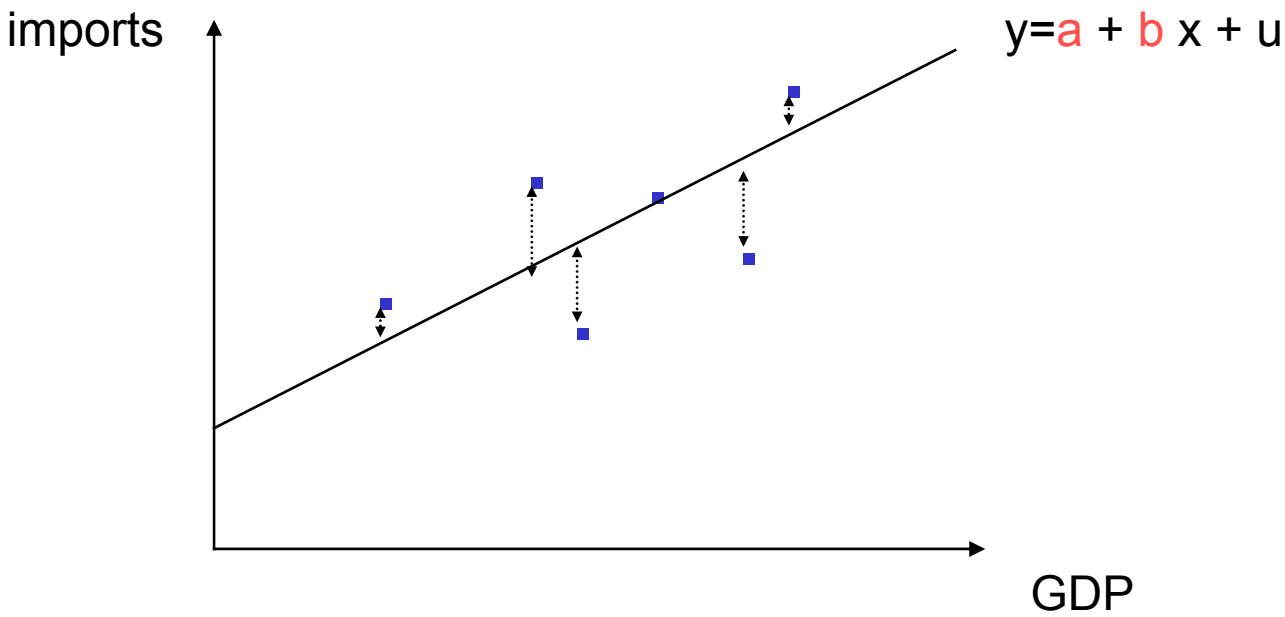
Bangkok, 19 April 2006

Outline

A. What is an OLS regression?
B. The interpretation of the regression results: coefficients and the R-square
C. Specification of the OLS regression equation

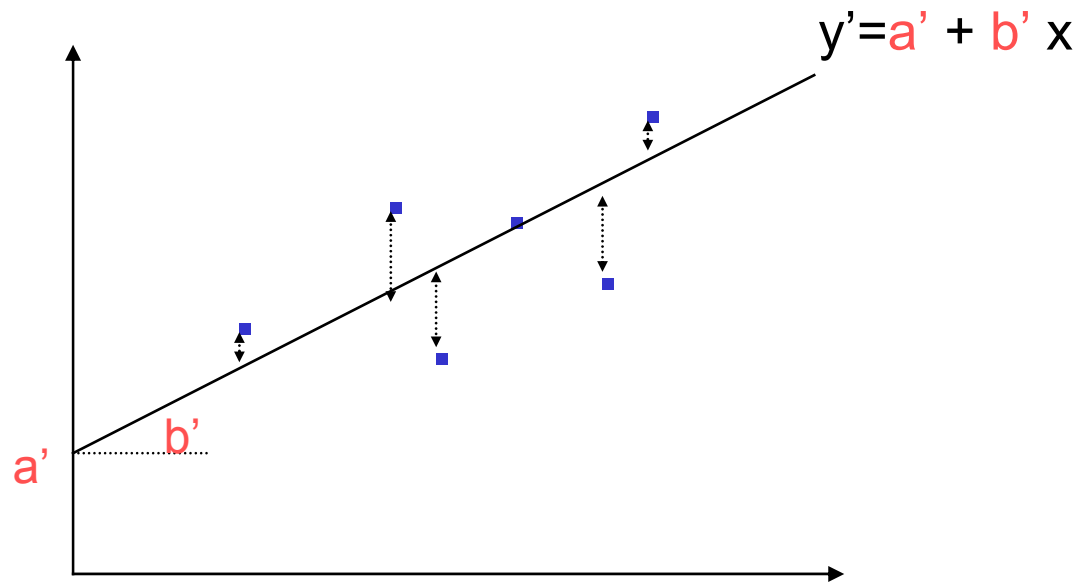
A. What is an OLS regression?

Given 6 observations on imports and income. What is their relationship?



B. The interpretation of the regression results

- 1 unit increase in GDP will increase imports by b units
- a= imports if GDP = 0

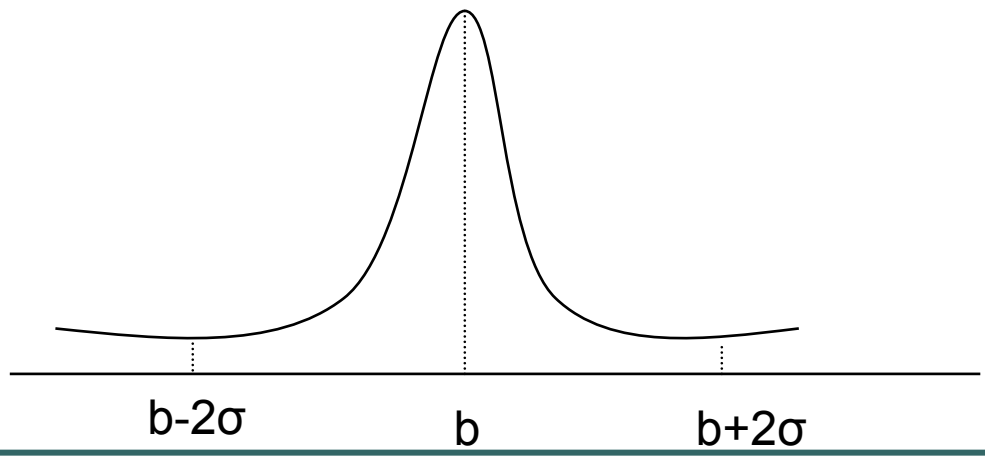


- R^2 = % of variation explained R^2=1 if y=y'

B. The significance of estimated coefficients

- a' and b' are estimated on a sample of observations. A different sample would have given different results.

- Most estimates of a and b will lie within 2 standard deviation from b: the confidence interval



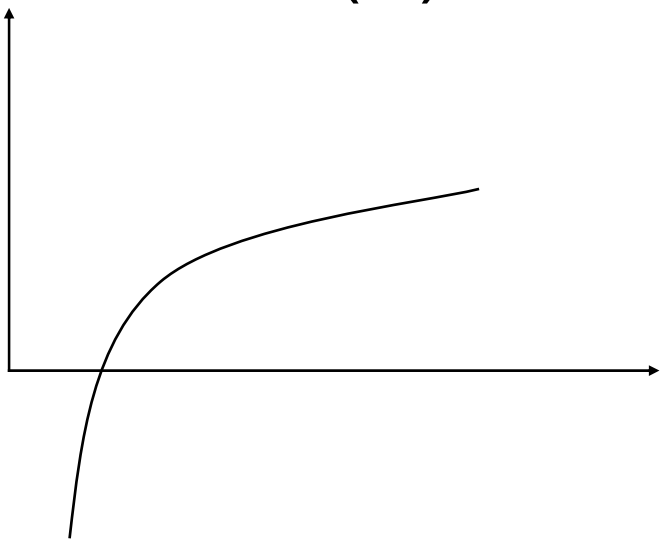
B. Hypothesis testing

- When we run a regression using a computer the result will be the value of a' and b' and the result of the test that b=0
- If b=0, then b' will fall in the confidence interval with a probability of 95%
- We will say that imports depend on GDP if the hypothesis is rejected

C. Specification of the OLS regression equation

- The linear model
- Non-linear relationships

eg. $Y = a + b \ln(X) + u$



C. Specification of the OLS regression equation and the ELASTICITY

- The linear model

  $y = a + b\,x + u$

  $\text{Elasticity} = b\,x/y$

- Log-log model often the preferred specification. This is

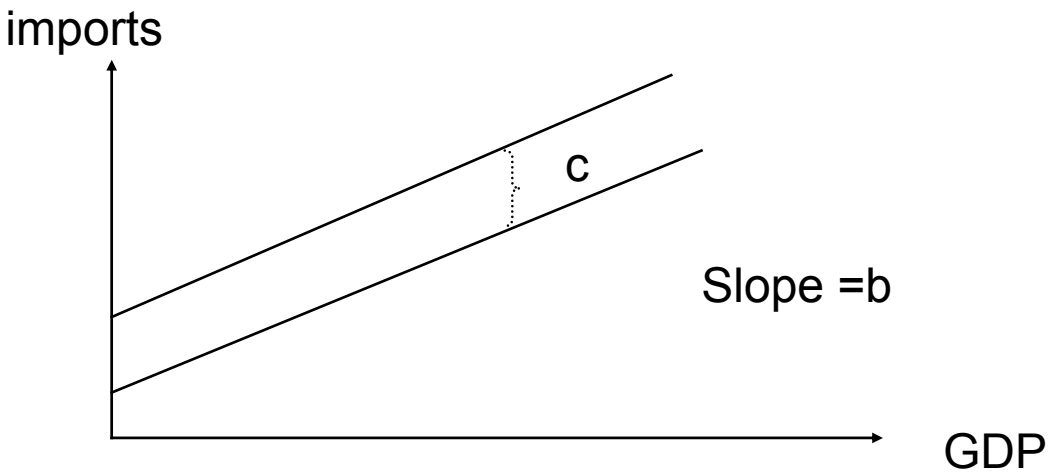
$\ln(y) = a + b\,\ln(x) + u$

$\text{Elasticity} = b$

C. Specification of the OLS regression ... (cont')

- Also implies choosing the explanatory variables (theory, purpose, experience)
- Dummy Variables= 0,1 variable

Ex. Imports = a + b GDP + c D + u D=island



Modelling Methods for Trade Policy II: Gravity Models

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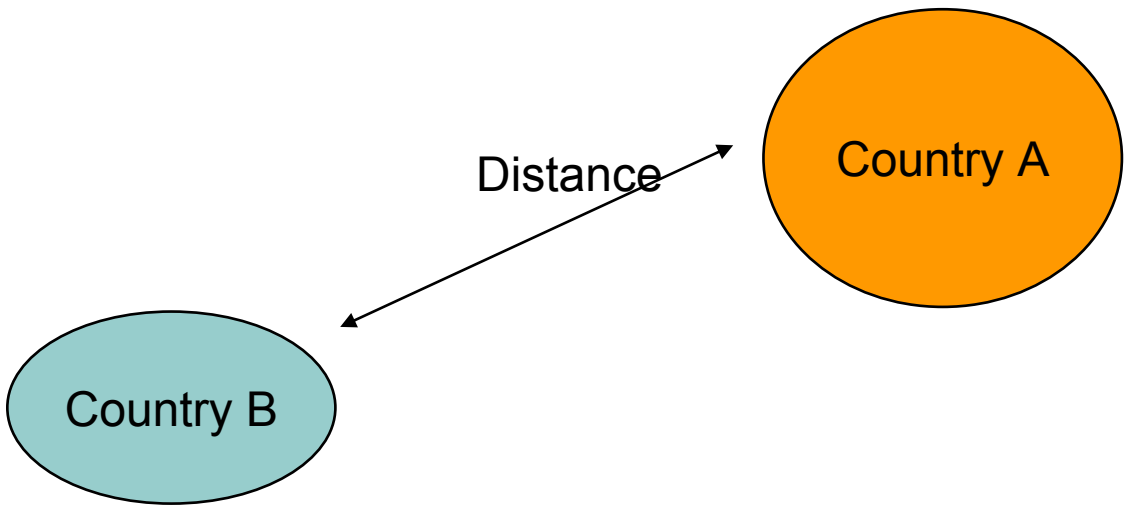
2.A The theoretical foundations of gravity models: Newton's Law

- Econometric model (ex-post analysis)
- Initially, NO theoretical foundations.
- Distance and Size determine bilateral trade



2.A The theoretical foundations of gravity models: Newton's Law

- Specification similar to Newton's Law

$$F_{ij} = K \frac{M_i^{\alpha} M_j^{\beta}}{D_{ij}^{\theta}}$$

M= Size (GDP, POP) D =distance

2.B Estimated gravity equation ...Newton's Law-based Normal Trade

- Normal trade

$$ln\,(Trade_{ij}) = C + a\,ln(GDP_i) + b\,ln(GDP_j) + \\ + c\,ln(distance_{ij}) + \boldsymbol{u}_{ij}$$

3.A The theoretical foundations of gravity models

- reduced form of a intra-industry trade model

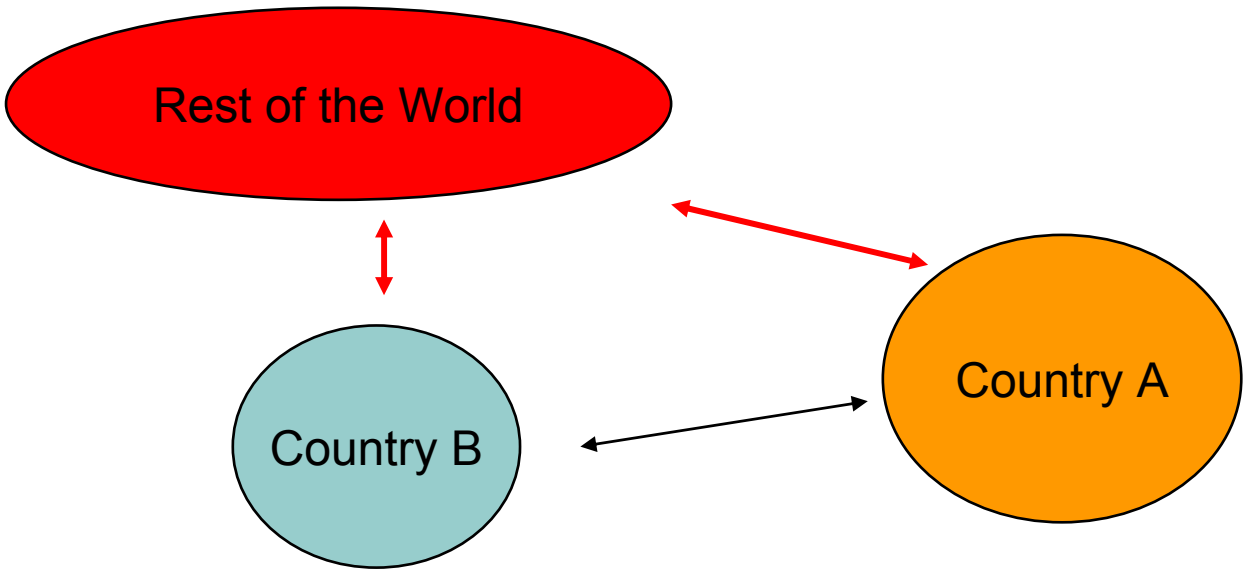
$$F_{ij} = \frac{M_i M_j}{M_w} \left(\frac{T_{ij}}{P_i P_j} \right)^{1-\sigma}$$

P= Resistance Term or Remoteness (trade weighted average distances from the rest of the world)

See Feenstra (2004), Anderson and van Wincoop (2004), Head (2003)

3.A The theoretical foundations of gravity models

- Countries distance from the Rest of the World matters for their bilateral trade



3.B Estimated gravity equation ...Theoretically Founded Normal Trade

- Normal trade with Resistances

$$ln\,(Trade_{ij}) = C + a\,ln(GDP_i) + b\,ln(GDP_j) +$$
$$+c\,ln(distance_{ij}) + d\,ln(Remoteness)_i +$$
$$+ e\,ln(Remoteness)_j + u_{ij}$$

Where the Remoteness term is calculated as:

$$Sum_k\ distance_{kj}/GDP_k$$

3.B Estimated gravity equation ...Normal Trade

- Normal trade with fixed effects

$$ln\,(Trade_{ij}) = C + a\,ln(GDP_i) + b\,ln(GDP_j) +$$
$$+c\,ln(distance_{ij}) + d\,Dummy_i + e\,Dummy_j +$$
$$+ u_{ij}$$

3.B Estimated gravity equation ...Normal Trade

- Normal trade normalizing for a third country

$$ln\,(Trade_{ij}/Trade_{kj}) = C + a\,ln(GDP_i/GDP_k) + c\,ln(distance_{ij}/distance_{kj}) + + u_{ij}$$

“Augmenting” the gravity equations

- Income per capita (higher income countries trade more)
- Adjacency
- Common language, colonial links
- Institutions, infrastructures, labour flows,...
- Surprisingly, bilateral tariff barriers often missing!!!

"Augmenting" gravity model

- To evaluate the impact of RTAs: Trade creation and trade diversion

$$ln\ (Trade_{ij}) = \mathbf{a}\ ln(GDP_i) + \mathbf{b}\ ln(GDP_j) +$$

$$+\mathbf{c}\ ln(distance_{ij,}\ ,adjacency,\ language\ ..) + \mathbf{d}\ (Dummy\ i) +$$

$$+\ e\ (Dummy\ j) +\ \mathbf{g}\ (intra\text{-}RTA) + \mathbf{h}\ (extra\text{-}RTA) +\ \mathbf{u}_{ij}$$

- ***IMPORTANT*** the gravity model does not estimate welfare effects