Trade Gravity Equations

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Gravity equations

Newton's law of universal gravitation: used to explain the force intensity between two bodies (F_{ij}) as a function of their masses (m_i, m_j), and distance (r_{ij})

$$F_{ij} = G\frac{m_i m_j}{r_{ij}^2}$$

where G is a constant

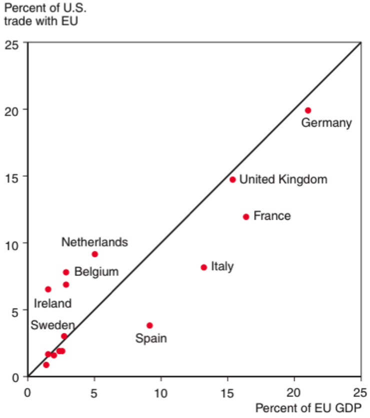
Gravity model of trade used to explain the value of trade between country i and j (T_{ij}) as a function of their GDP (Y_i, Y_j) and distance (D_{ij}):

$$T_{ij} = A\frac{Y_i Y_j}{D_{ij}}$$

where A is a constant

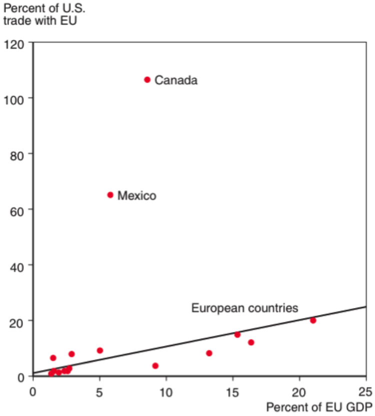
Some data on gravity equations (Krugman et al 2012)

The size of EU economies and the value of trade with the US - note that larger economies have higher trade intensity



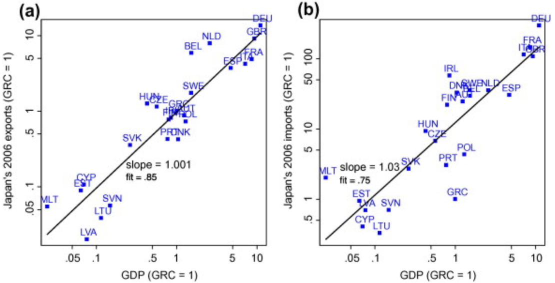
Some data on gravity equations (Krugman et al 2012)

The size of EU economies and the value of trade with the US - note that closer economies have higher trade intensity



Some data on gravity equations (Head and Mayer, 2014)

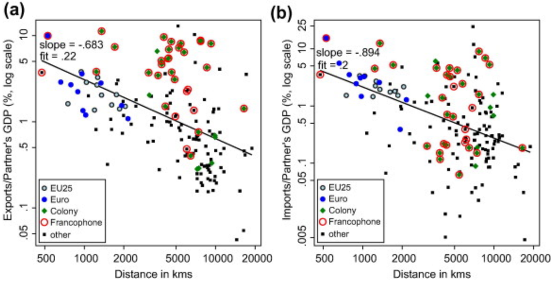
The same relationship happens for other countries as well



Trade is Proportional to Size; (a) Japan's Exports to EU, 2006; (b) Japan's Imports from EU, 2006. GRC: Greece

Some data on gravity equations (Head and Mayer, 2014)

The same relationship happens for other countries as well



Trade is Inversely Proportional to Distance; (a) France's Exports (2006); (b) France's Imports (2006)

A simple Armington model provides the theory for the gravity equation

$$\underbrace{x_{fh}p_{fh}}_{\textit{imports home}} = \underbrace{X_f X_h \left(\tau_{fh}\right)^{1-\sigma}}_{\textit{gravity}} \cdot \underbrace{\frac{P_h^{\sigma-1}\alpha_{fh}}{\alpha_{ff}\left(\frac{\tau_{ff}}{P_f}\right)^{1-\sigma} X_f + \alpha_{fh}\left(\frac{\tau_{fh}}{P_h}\right)^{1-\sigma} X_h}}_{\textit{general equilibrium}}$$

- $x_{fh}p_{fh}$ is our T_{ij} trade variable
- X_f, X_h is our $Y_i Y_j$ GDP variable
- τ_{fh} is our D_{ij} distance variable
- $\frac{P_h^{\sigma-1}\alpha_{fh}}{\alpha_{ff}\left(\frac{\tau_{ff}}{P_f}\right)^{1-\sigma} X_f + \alpha_{fh}\left(\frac{\tau_{fh}}{P_h}\right)^{1-\sigma} X_h}$ is our constant A