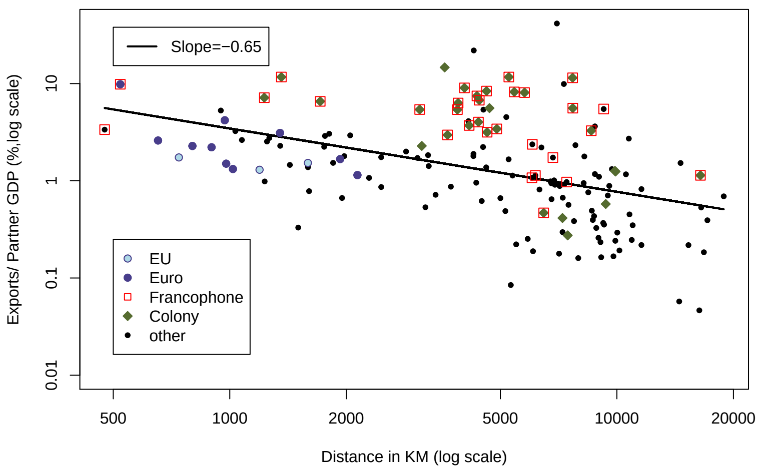
Master EPP, International Macroeconomics
Lecture 3
New trade models for new international macroeconomics

1 The Gravity Equation

Motivation: The Gravity equation is one of the most stable relationship in economics. It shows that trade flows are negatively correlated with the extent of trade barriers, approximated by distance and other cultural and geographical proximity indicators.
This relation is illustrated in Figures 1 and 2 for French data. The figures suggest that both nominal imports and nominal exports are negatively correlated with the distance between France and its partner. Moreover, France tends to trade more with former colonies and French-speaking countries.

Figure 1: France's exports in 2000



This result is generally interpreted as reflecting the impact of trade costs on the volume of trade. Note that this goes beyond the impact of trade barriers as the relation also holds true when considering trade inside a single country (Figure 3).
Historically, the gravity equation has first been a purely empirical result. The development of new trade models following Krugman (1991) has however permitted a rationalization in a theoretical framework. This exercise aims at deriving a "theoretical" gravity equation before estimating it.

Theoretical Framework (Redding & Venables, 2003):
The theoretical framework is based on a standard multi-country new trade theory model. The world consists of $i = 1, ..., R$ countries, and we focus on the manufacturing sector, composed of firms that operate under increasing returns to scale and produce differentiated products. On the demand side, each firm's product is differentiated from that of other firms. There is a constant elasticity of substitution, σ, between pairs of products, so products enter utility through a CES aggregator taking the

Figure 2: France's imports in 2000

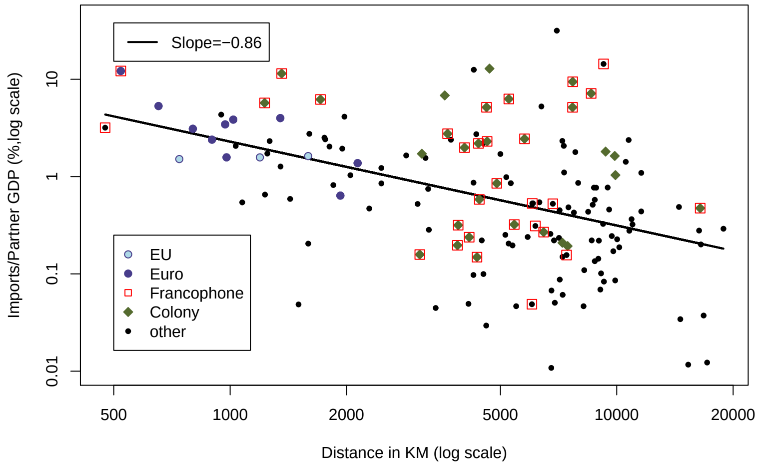
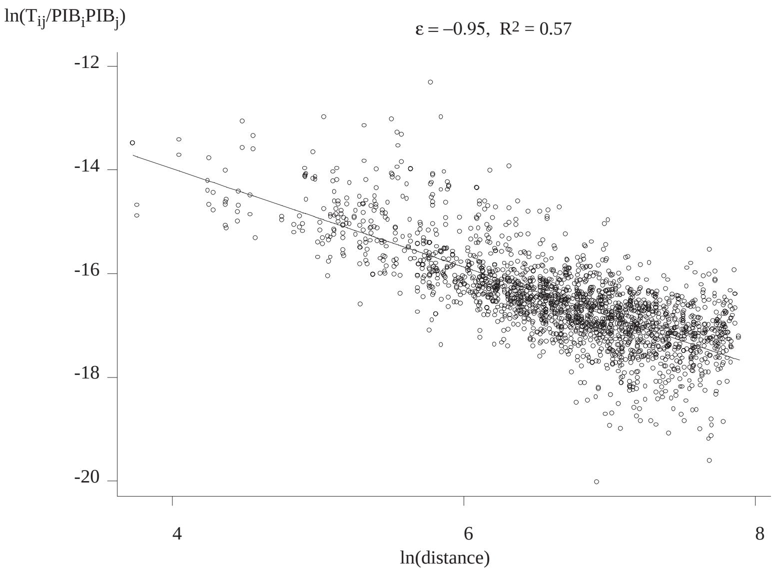


Figure 3: Trade within the USA in 1997



form:

$$U_j = \left[\sum_{i=1}^{R} \int_{n_i} x_{ij}(z)^{\frac{\sigma-1}{\sigma}} dz \right]^{\frac{\sigma}{\sigma-1}} = \left[\sum_{i=1}^{R} n_i x_{ij}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

where z denotes manufacturing varieties, n_i is the set of varieties produced in country i, and $x_{ij}(z)$ is the country j demand for the z^{th} product from this set. The second equation makes use of the fact that, in equilibrium, all products produced in each country i are demanded by country j in the same quantity.

1. Derive the price index for manufactures in country j.

2. In the following, country j's total expenditure on manufactures is denoted E_j. Write the demand function addressed to an individual producer. What is the functional form for real bilateral trade flows ?

3. Turning to supply, each individual firm has profits $\pi_i(z)$, that depend on aggregate sales and their cost. Technology has increasing returns to scale, represented by a fixed labor requirement a_iF and marginal labor requirement a_i, these technology parameters potentially varying across countries. Last, exporting involves an iceberg trade cost τ_{ij}. What is the optimal price set on each market under these assumptions? Derive the analytical condition under which firms from country i find it profitable to enter export market. Conclude on the equilibrium number of producing firms in each country.

4. Finally, conclude on the determinants of bilateral trade.

Empirical Implementation:

1. Use the previous theoretical framework to derive a testable equation explaining bilateral trade flows.

In the following, you are asked to run different gravity estimations and compare results together. The data are stored in a Stata table called col_regfile.dta. It contains the following variables: year, country codes for the exporter (iso_o, iso2_o) and the importing country (iso_d, iso2_d), distance between partners (distw=population-weighted average of the distance from the main cities to the main exit points+average distance between exit points), time difference between partners (tdiff in hours), different dummies for contiguity (contig), the fact a country is landlocked (landlocked_o, landlocked_d), the fact they share the same language (comlang_off, comlang_ethno), the fact they have been in a colonial relationship (col_hist, comcol, col45, col_cur, indepdate), the fact they are in war (conflict), different dummies for trade agreements (rta, custrict, gatt_o, gatt_d), size of their population (pop_o, pop_d in millions), GDPs (gdp_o, gdp_d), GDP per capita (gdpcap_o, gdpcap_d), area (area_o, area_d in square kms), and the value of bilateral trade flows (flow in current US dollars, taken from the IMF-Dots).

2. The first generation of gravity models used GDPs to approximate supplier and market capacities. Run estimations and comment.

3. In the previous "old fashion" regressions, estimations can suffer from an omitted variable bias as price levels in the origin and destination country are not controlled for. As a consequence, all variables entering $\tau_{ij}^{1-\sigma}$ that affect trade positively will tend to be biased downwards if they are negatively correlated with remoteness, and vice-versa. Since Harrigan (1996) practice has thus been moving towards using fixed effects for these terms instead. Run fixed effects estimations and discuss results.
Warning: With panels, importer and exporter fixed effects should be time-varying as well. The same is true if the data pooled over several industries.

An important problem arising with the fixed-effect model is that the number of coefficients to be estimated can become huge when working on panel data.

4. An alternative to fixed-effect models is to use the model in relative terms (Head & Mayer, 2000). Show how the use of trade flows in relative terms allows to get rid of the market and supplier capacities terms. Conclude.

2 Gravity within and between Canada and the United States (Feenstra, 2004)

A famous example of the sensitivity of gravity estimations with respect to the methodology concerns the so-called "border-effect". Feenstra provide on his website data allowing to illustrate this controversy (http://www.econ.ucdavis.edu/faculty/fzfeens/textbook.html).

Table 1 illustrates the results of estimates proposed by Feenstra. Comment.

Table 1: Gravity equation on trade within and between Canada and the United States, 1993 data

	(1)	(2)	(3)	(4)
ln GDP, exporter	1.219[a]	1.128[a]	1.133[a]	
	(.033)	(.020)	(.020)	
ln GDP, importer	.980[a]	.982[a]	.974[a]	
	(.033)	(.020)	(.020)	
ln distance	-1.353[a]	-1.082[a]	-1.111[a]	-1.252[a]
	(.069)	(.035)	(.034)	(.037)
Canada dummy	2.802[a]		2.752[a]	
	(.142)		(.109)	
US dummy		.406[a]	.398[a]	
		(.058)	(.057)	
Border effect				-1.551[a]
				(.059)
Constant	3.743[a]	2.660[a]	2.912[a]	
	(.772)	(.449)	(.427)	
Observations	679	1421	1511	1511
R^2	0.762	0.853	0.852	0.664
Method	OLS	OLS	OLS	M/X FE
Sample	Can-Can Can-USA	Usa-Usa Usa-Can	Can-Can Usa-Usa Can-Usa Usa-Can	Can-Can Usa-Usa Can-Usa Usa-Can
Within premium	16.5	1.5	15.7/1.5	4.7

t statistics in parentheses

[c] p<0.1, [b] p<0.05, [a] p<0.01