“Has Distance Died? Update and Policy Implications”

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OUTLINE

1. Some facts and some doubts: *Has distance Died?*

1. Is there a puzzle (in a properly estimated standard gravity model)?

2. Attempts to Explain the puzzle

=> Understand the relationship between transport costs, distance and trade is of prime interest.

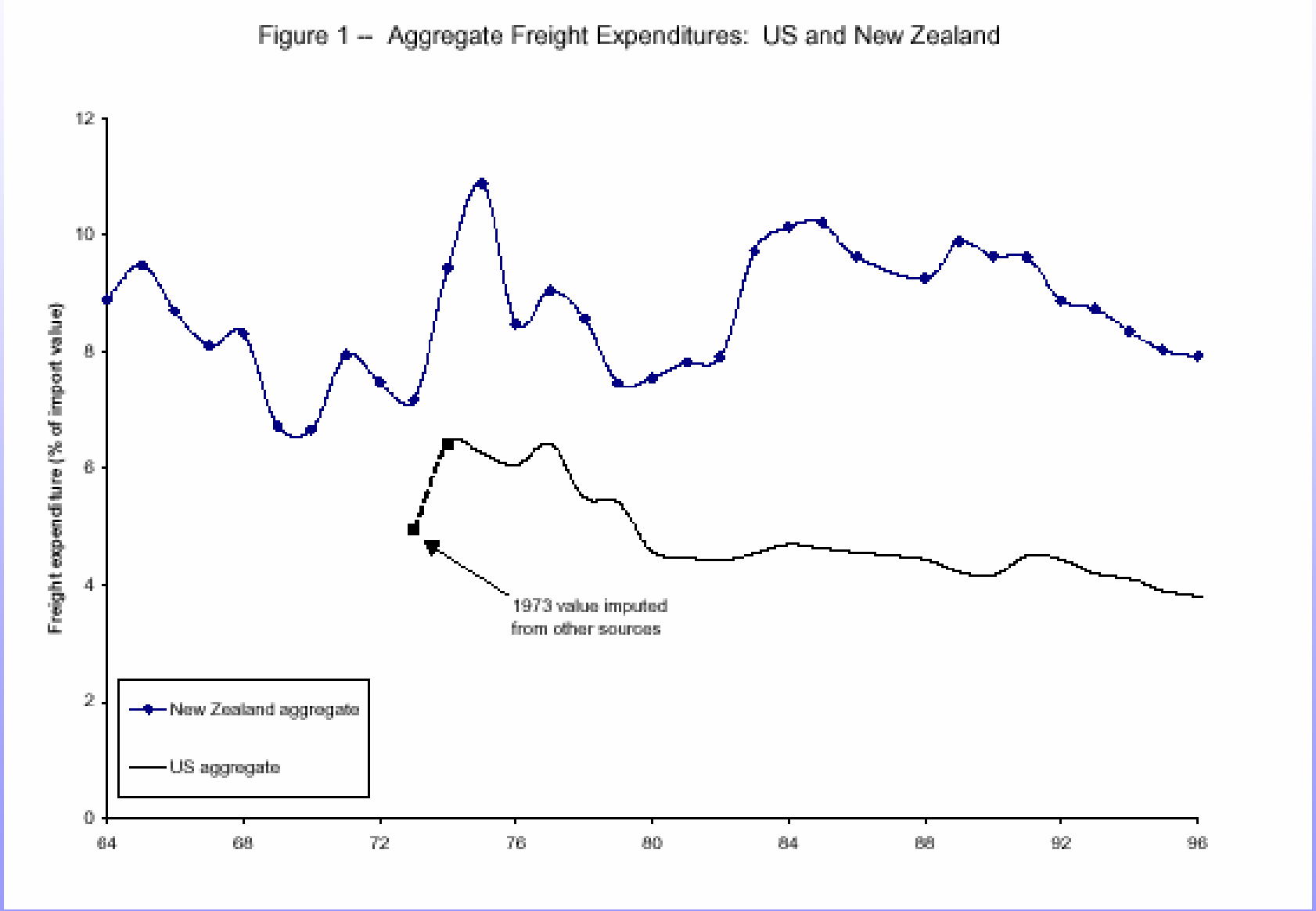
Some Facts (and some doubts!)

- **Conventional wisdom that transport costs have declined in recent decades but little systematic evidence documenting this decline.**

- **Ocean liner freight rates (Hummels, JEP 2008)**

Maritime **liner price index** focusing on those liners loading and unloading in Germany and Netherlands **have increased since the 1950s**

Ad Valorem Measure of Transportation Costs (Hummels 2008)



- **Difficulties: Not possible to have direct evidence on transport costs evolution in the long term** and for a large number of countries as no data on transport costs available.

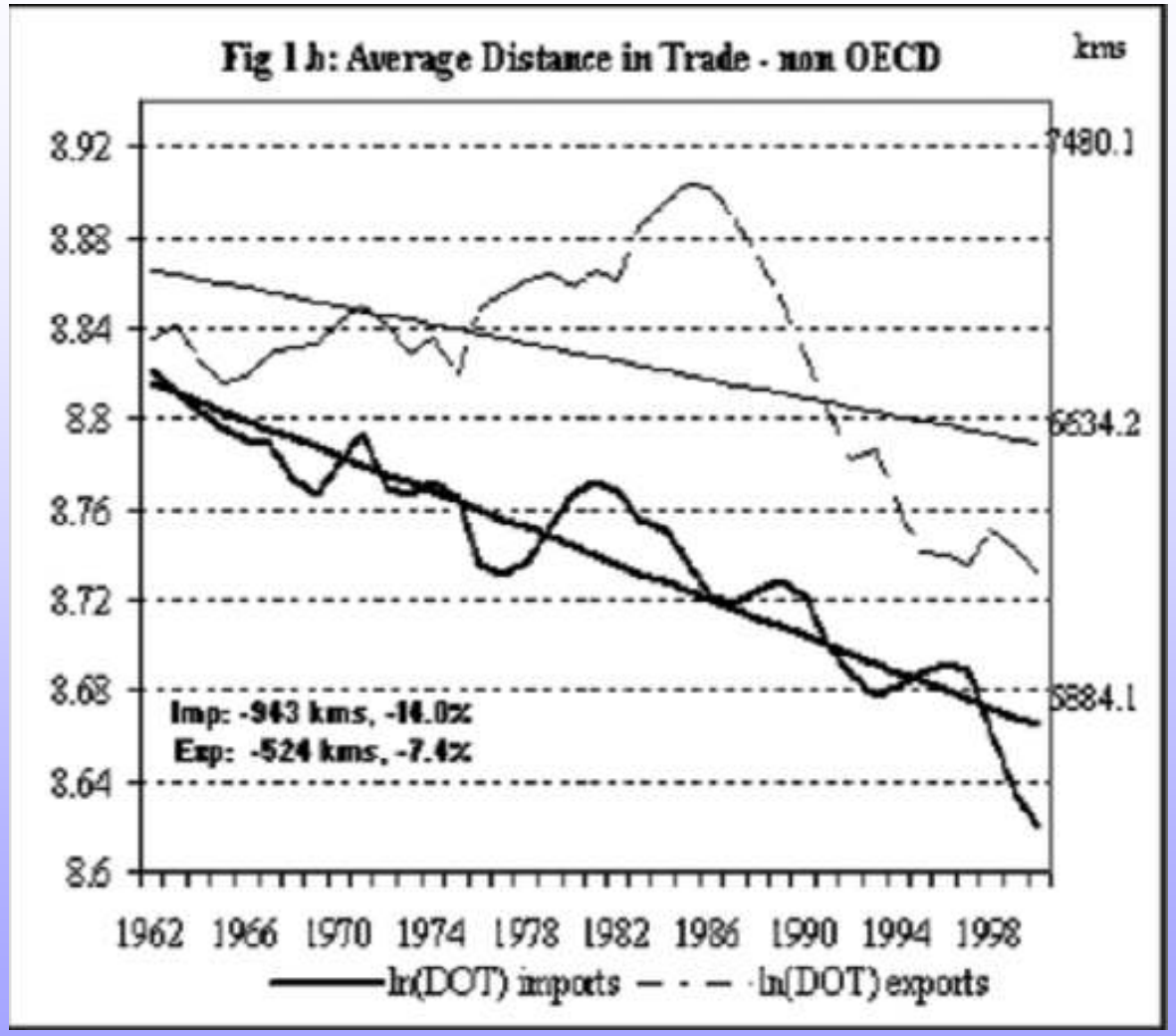
⇒ **Cif/Fob ratios** as indirect measure of transport costs but contain no useful information for time series variation, quite noisy (Hummels and Lugovsky RIE, 2006)

=>Average Distance of trade (Carrère and Schiff, 2003)
(as transport costs fall, a larger share of country's trade would take place further away from its border)
= DOT estimated as a trend over 1962-2000 for 150 countries

$$\bar{D}_{it} = \sum_{j=1}^{n} D_{ij} \cdot \frac{T_{ijt}}{T_{it}} \quad ; \; T_{it} = \sum_{j} T_{ijt}$$

Dij = distance between countries *i* and *j*
Tij = value of the *non-fuel* trade flow between countries *i* and *j* at *t*

Average distance to trade (Carrère-Schiff, 2003)



Latin America /

Export: -10% & Imports: -23%

Asia /

Export: -34% & Imports: -24 %

52% of countries in the world have significant negative change in their average distance in *both* Imports and Exports

(but 26 % with both significant positive changes)

=> Distance in standard gravity equation

Cross-section gravity model

$$\ln M_{ij} = \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln N_i + \alpha_4 \ln N_j + \beta \ln D_{ij} + \alpha_5 \ln R_i + \alpha_6 \ln R_j$$
$$+ \alpha_7 \ln L_{ij} + \alpha_8 \ln E_i + \alpha_9 \ln E_j + \omega_{ij}$$

M_{ij} : total bilateral imports of country i from country j.
$Y_{i\,(j)}$: GDP of country i (j), ($\alpha_1>0$, $\alpha_2>0$);
$N_{i\,(j)}$: total population of country j ($\alpha_3<0$ $\alpha 3<0$);
$R_{i(j)}$: multilateral resistance terms (called "remoteness") ($\alpha_4>0$, $\alpha_5>0$);
D_{ij} : distance between the countries i and j ($\beta<0$).
L_{ij} : takes the value 1 if i and j share a common border, otherwise 0 ($\alpha_7>0$) / common Language/ colonial/
$E_{i(j)}$: takes the value 1 if the country i (j) is landlocked; otherwise 0 ($\alpha_8<0$, $\alpha_9<0$). / island/ etc.

$\Rightarrow\beta$ Estimates are at best indirect estimates of flow responses to transport cost, yet widely used

2. Is there a puzzle (in a properly estimated standard gravity model)?

The Gravity puzzle: Using the standard gravity model, the estimated (negative) impact of distance on the volume of trade is generally found to increase rather than decrease through time.

This paradoxical result seems now well established. Disdier and Head (2007) show, using a meta-analytical approach on 1,467 distance effects estimated in 103 papers, that "*estimated distance effects are not diminishing over time and in most specifications they seem to be rising*" .

- **Puzzle initially explicitly investigated by Brun et al.,** 1999 and 2005. Their results suggest marginalization of low-income countries as transport cost increase through time relative to other countries

We ask here whether results of Brun et al. (2005) hold in larger sample/longer time period

We take largest possible sample of 138 countries over 45 years (1962-2006).

Application of random effects panel procedure with correction for endogeneity of some explanatory variables.

Better specification of the standard transport cost function we call it an « augmented » transport cost function.

Puzzle is still there for the lowest third (in terms of income per capita) group of countries in the sample when they trade with one another

The Standard Estimated Gravity Equation

Shift to the current popular version of the gravity model

$$M_{ijt} = \left(\frac{Y_{it}Y_{jt}}{Y_w}\right) \cdot \left(\frac{\theta_{ijt}}{\widetilde{P}_{it}\widetilde{P}_{jt}}\right)^{1-\sigma} \qquad \textbf{(1)}$$

where θ_{ijt} is bilateral transport costs, and $\tilde{P}_{it}$ $\tilde{P}_{jt}$ are "multilateral trade resistance" indices

$$\widetilde{P}_{it}^{1-\sigma} = \sum_j \frac{Y_{it}}{Y_w}\left(\frac{\theta_{ijt}}{\widetilde{P}_{jt}}\right)^{1-\sigma}$$

Add the "augmented" transport cost function θ ijt

$$\theta_{ijt} = (K_{it})^{\rho_1} (K_{jt})^{\rho_2} (P_{Ft})^{\rho_3} (\pi_{jt})^{\rho_4} (D_{ij})^{\gamma_1+\gamma_2 t+\gamma_3 t^2} \qquad (8)$$

K_i, K_j = Infrastructure index (as in Limao and Venables 2001)

P_{Ft} = price of oil (affects marginal costs of transportation)

π_{jt} = share of primary exports of j, (regardless of destination)

Expected signs: $\rho_1<0$; $\rho_2<0$; $\rho_3>0$; $\rho_4>0$

Note on Infrastructure index

level of infrastructure of country i (j) is computed as an unweigthed average of the density of road, railway and the number of telephone lines per capita . Will check for alternative construction of index in later work

Data: Canning 1962-1995 completed by WDI until 2006

Assume a quadratic time trend for the elasticity of transport costs to distance

$$\gamma_t \equiv (\partial\theta_{ijt}/\theta_{ijt})/(\partial D_{ij}/D_{ij}) = \gamma_1 + \gamma_2 t + \gamma_3 t^2$$

Plug the augmented transport costs +the quadratic elasticity into the theoretical equation

$\Rightarrow$ "Augmented" Gravity Equation (Brun et al- and here)

$$\ln M_{ijt} = \alpha_0 + \alpha_1 \ln Y_{it} + \alpha_2 \ln Y_{jt} + \alpha_3 \ln N_{it} + \alpha_4 \ln N_{jt} + \alpha_5 \ln R_{it} + \alpha_6 \ln R_{jt}$$
$$+ \beta_1 \ln D_{ij} + \beta_2 t.\ln D_{ij} + \beta_2 t^2.\ln D_{ij} + \alpha_7 \ln K_{it} + \alpha_8 \ln K_{jt} + \alpha_9 \ln P_{oilt} + \alpha_{10} \ln X_{jt} + \omega_{ij}$$

Panel data technique

$$\varepsilon_{ijt} = \mu_{ij} + \nu_{ijt}$$

$$\mu_{ij} = bilateral\ random\ effects$$

$$\nu_{ijt} = i.i.d.\ error\ term$$

Necessary to keep Distance in the model, and let it change over time as în (2), but also....

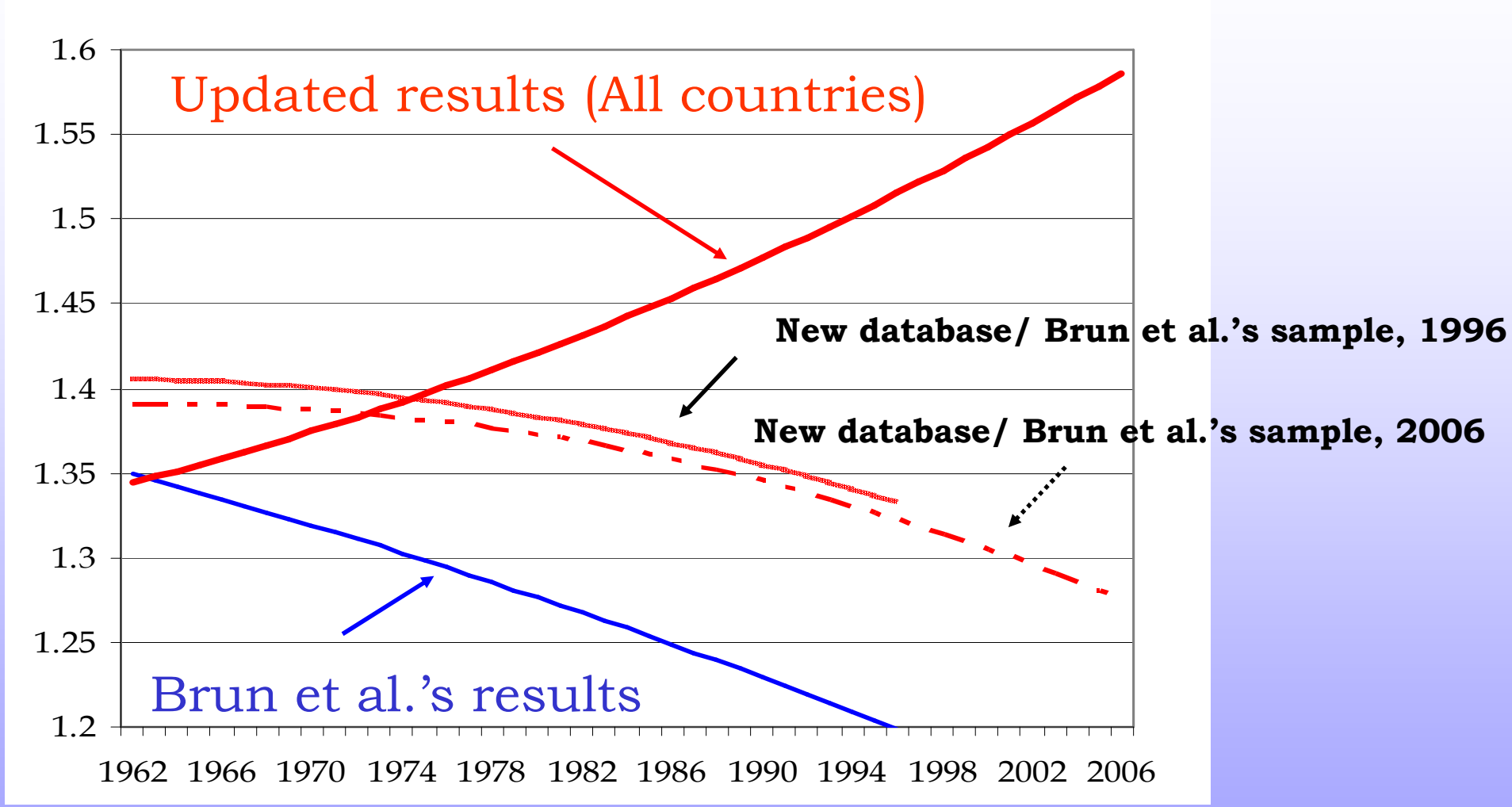
- **Captures better unobserved heterogeneity;**
- **Correct for endogeneity (GDPs, infrastructure, remoteness variables)**
- **Control for potential selection bias**

Results

All variables used in standard gravity equation have expected signs and plausible coefficient values, in particular:

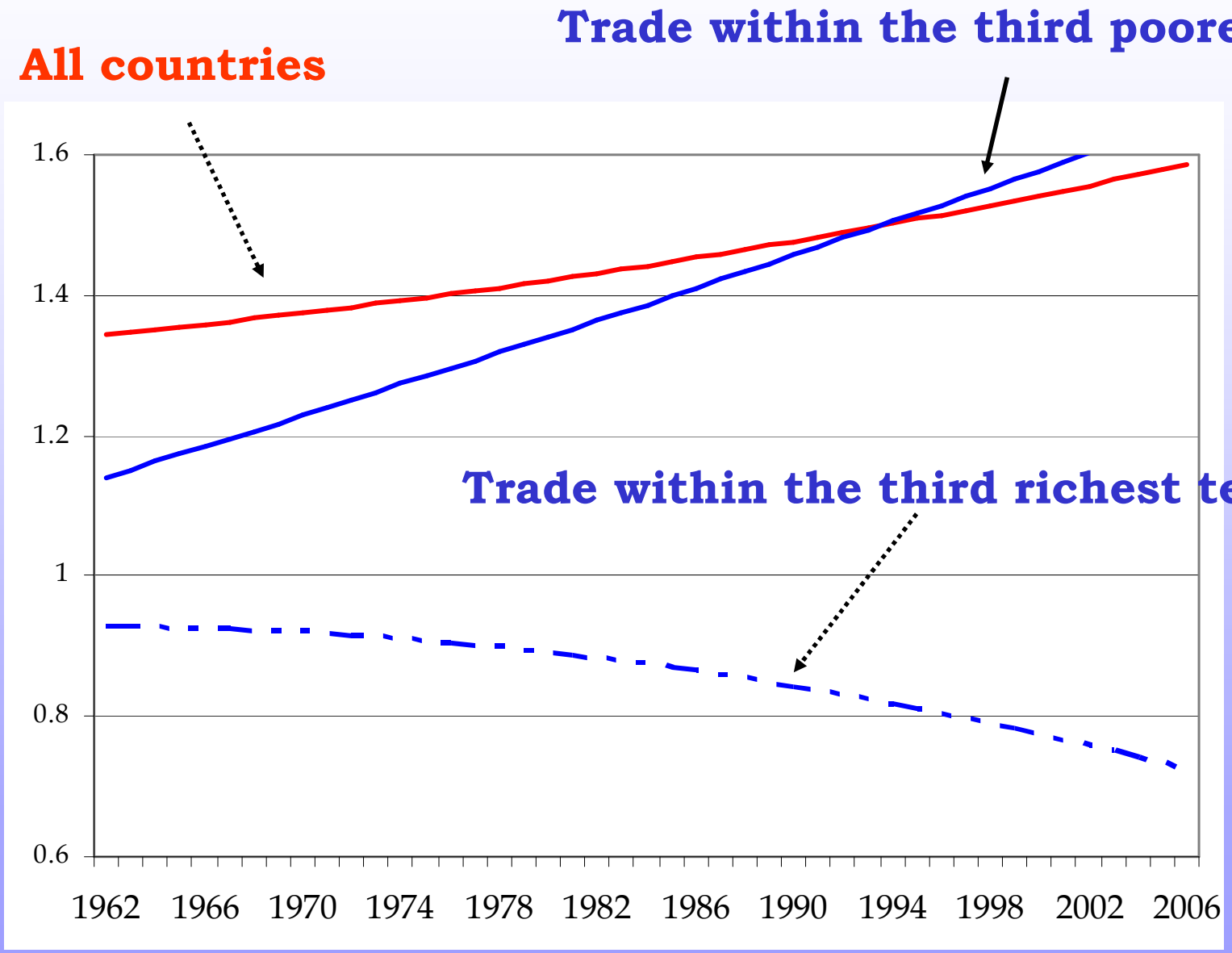
- Coefficient on oil price is negative and significant
- The share of primary products in total export has a significant negative impact on trade
- Infrastructure improvement significantly increases the volume of trade;

The elasticity of Bilateral Trade to Distance $|\beta_t|$



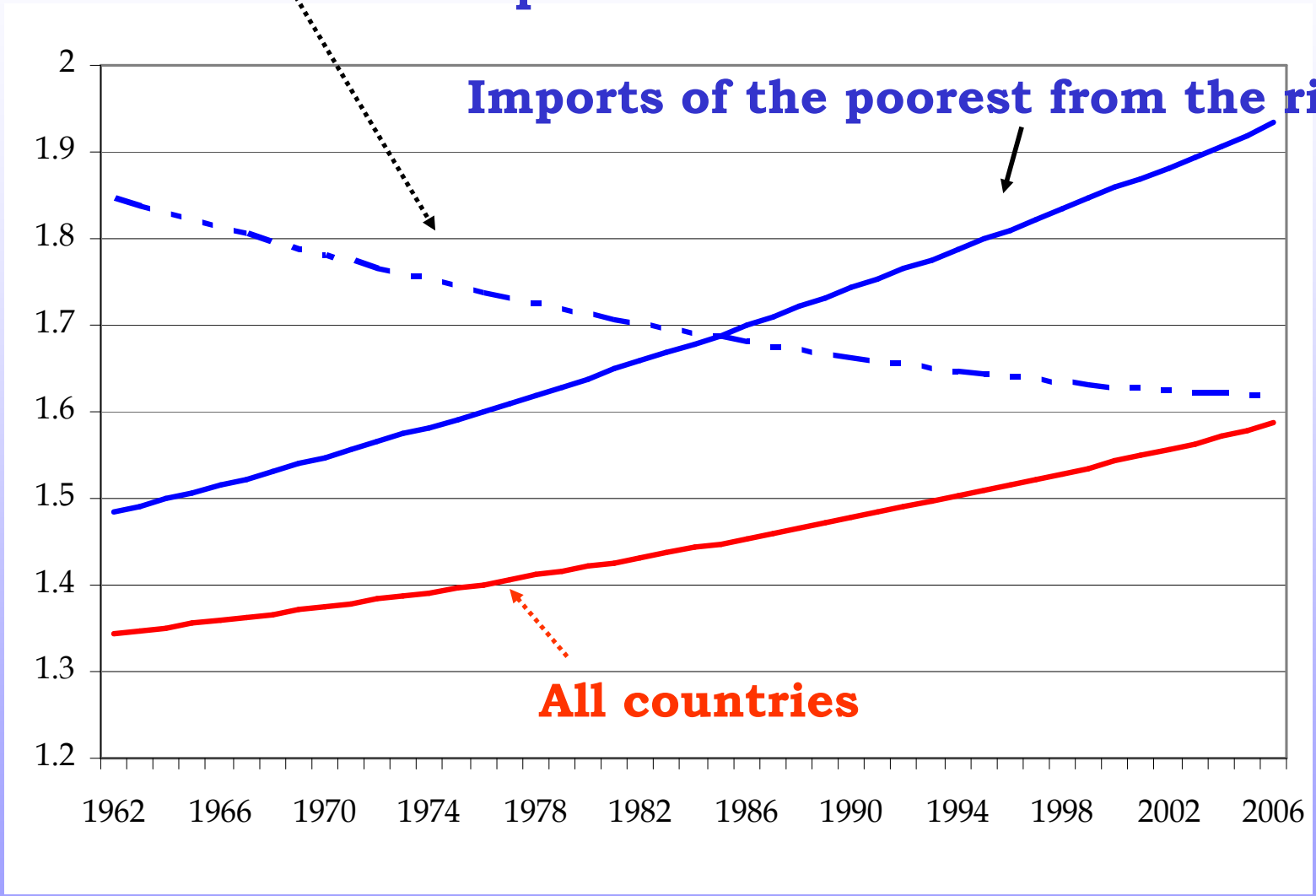
New results: 10% increase in distance reduces trade by 13.5% in 1962 and around 16% in 2006

The elasticity of Bilateral Trade to Distance $|\beta_t|$



The elasticity of Bilateral Trade to Distance $|\beta_t|$

Imports of the richest from the poorest



3. Attempts to Explain the puzzle

Several explanations of rising distance effects on the aggregate bilateral trade flows

Usual Suspects:

- **Changes in the composition of trade** that might be biased towards goods with high distance costs (e.g. Duranton and Storper, forthcoming) / Berthelon and Freund (2004) find no support for this argument.

- The influence of **time on trade** is increasing: greater use of "just-in-time" could raise distance costs (Hummels 2001, Deardorff 2003, Djankov, Freund and Pham, 2006).

- Freund and Hummels (2003) find that **FDI growth** has contributed to increasing proximate trade but has had little impact on the elasticity of trade with respect to distance.

Further investigations

- explanation proposed by Brun et al. (2005) and Carrère and Schiff (2005): the elasticity of transport costs with respect to distance could increase **if the fixed cost component** (dwell costs such as port storage costs, loading and unloading costs, time in transit, tariffs on imports, etc.) **were falling sufficiently faster than the variable component** (e.g. fuel costs, costs of manning and leasing ships).

- Ignoring the **zero-trade data** can generate a positive time trend in distance coefficient instead of negative as much higher share of country pairs trade positive amounts now than did in the 1950s.

- **Extensive versus intensive margin:** the estimation of the gravity equation confounds the effects of trade barriers on firm-level trade with their effects on the proportion of exporting firms, which induces an upward bias in the estimated coefficient (Helpman, Melitz and Rubinstein, 2008)