Lecture 6: International trade and growth

Seminario Avanzado de Comercio

José Pulido

Universidad del Rosario

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Trade and growth

- In this section of the course we will tackle the question: Do countries that trade more have higher income?
- The most important reference is Frankel and Romer (1999, FR hereafter): "Does trade cause growth?" (presented by a group of students in class)
- It is a very influential paper (6010 Google Scholar citations on 4/10/2018)
- However, Rodriguez and Rodrik (2000) show that FR results are not robust to controlling for omitted variables such as distance to the equator or institutions:
  - Although FR's instrument is free of reverse causality, it violates exclusion restriction

Recent improvements to FR(1999) approach

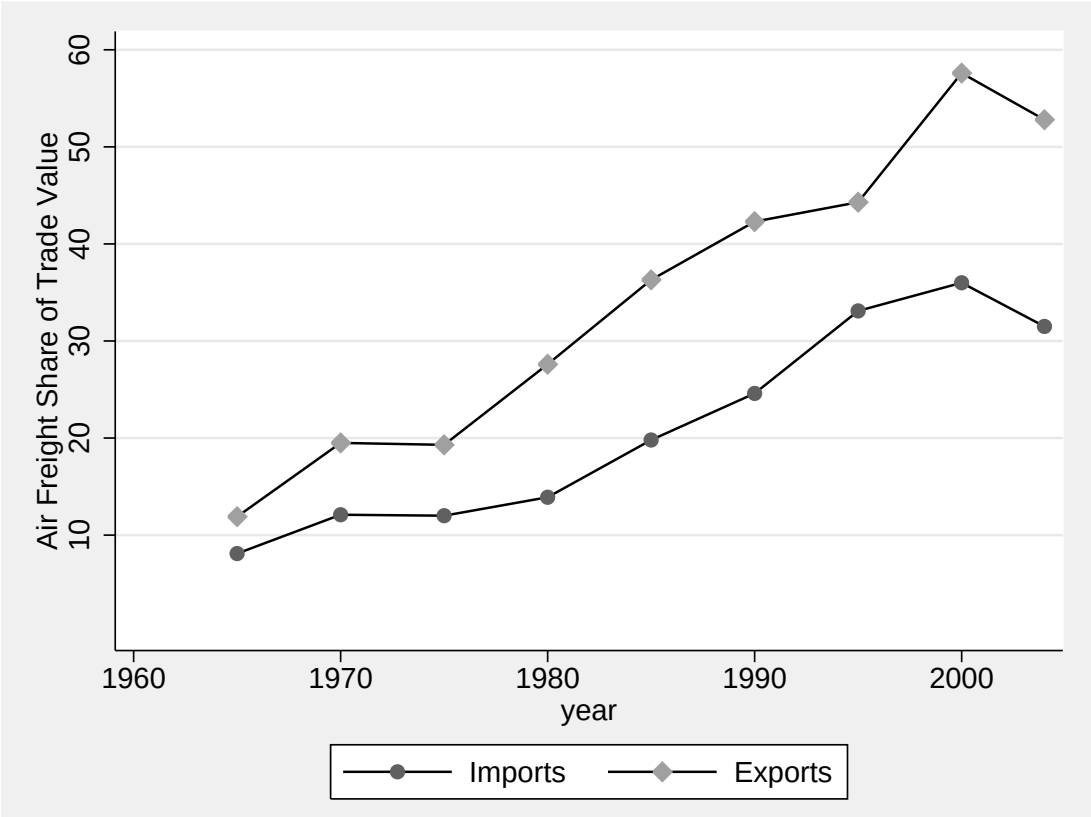
- Two papers by Jim Feyrer (still on R&R)
- "Trade and Income – Exploiting Time Series in Geography"
  - He employs relative change of price of air transport vs sea transport to create a time- and pair-varying component of trade costs
- "Distance, Trade, and Income – The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment"
  - He employs closure of Suez Canal to create a shock to transportation costs for specific country pairs (those with trade routes going through the Suez Canal)

Feyrer (2009a)

- Key idea: distance does not change over time, but the costs of transportation do and they affect certain country pairs more than others
- For countries that are far by sea, but relatively closer by air, improvements in air transport can boost trade
- One can predict *change* in trade and then relate to changes in income per capita
- Important to establish that *initial* share of trade by air vs sea is not correlated with income

Change in air transport share

Figure 1: Air Freight Share of US Trade Value (excluding North America)



Variation in air share by country

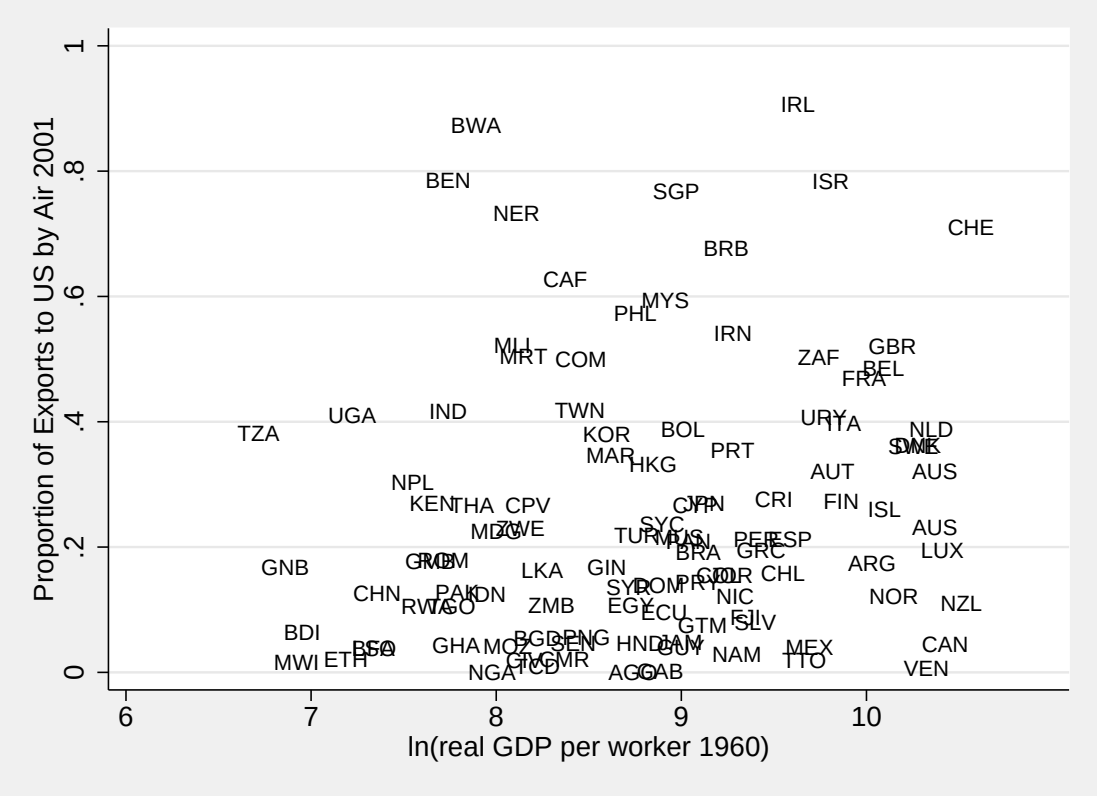
Table 2: Top 20 Countries for US Imports by Air

Country	Air Import Value (billion $)	Percent by Air
Japan	34.1	26.9%
UK	21.5	52.0%
Germany	17.8	30.2%
Ireland	16.8	90.7%
France	14.2	47.0%
Taiwan	14.0	41.9%
South Korea	13.4	37.9%
Malaysia	13.3	59.3%
China	13.0	12.7%
Singapore	11.5	76.8%
Canada	9.8	4.5%
Italy	9.5	39.7%
Israel	9.4	78.3%
Switzerland	6.8	71.1%
Philippines	6.5	57.2%
Mexico	5.3	4.0%
Belgium	4.9	48.6%
India	4.1	41.7%
Thailand	3.9	26.7%
Netherlands	3.7	38.8%

source: US Census Bureau – US Imports of Merchandise 2001.

Corr. 2001 air share and income

Figure 2: 2001 Air Imports to the US versus 1960 GDP per capita



US Census Bureau – US Imports of Merchandise 2001, Penn World Tables 6.1.

Two steps as in FR (1999)

- Predict trade flows between country pair ij :

$$\begin{aligned}\ln\left(trade_{ijt}\right) &= \alpha + \gamma_i + \gamma_j + \gamma_t + \beta_{sea,t}\ln\left(seadist_{ij}\right) \\ &\quad + \beta_{air,t}\ln\left(airdist_{ij}\right) + \delta X_{ij} + \varepsilon_{ijt}\end{aligned}$$

- Aggregate trade for each country i (notice typos in the paper):

$$\widehat{trade}_{it} = \sum_{j \neq i} \widehat{trade}_{ijt}$$

- Regress y_{it} (gdp per capita) on trade:

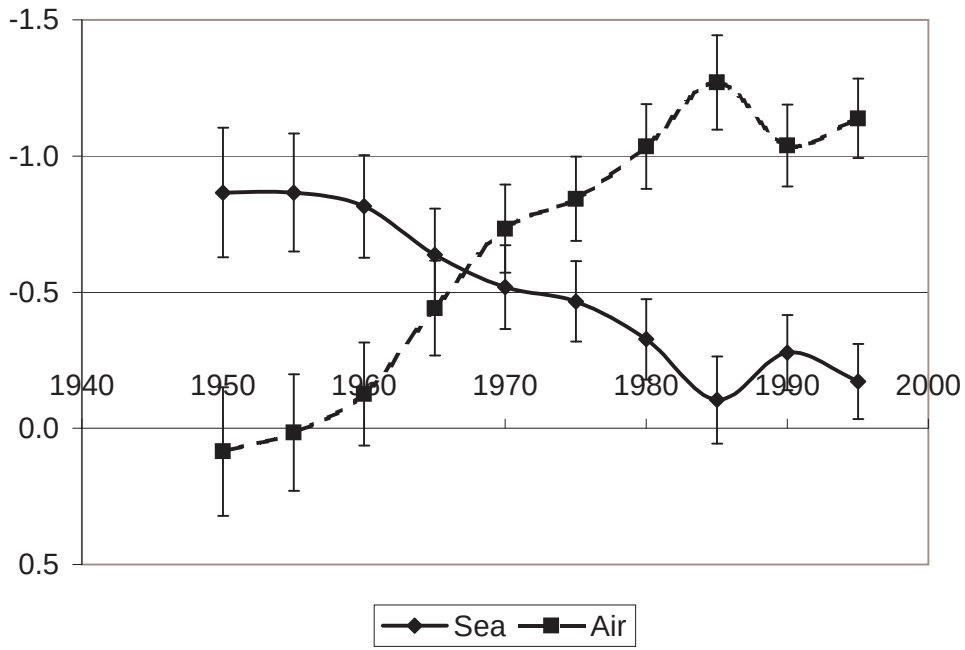
$$\ln\left(y_{it}\right) = \gamma_i + \gamma_t + \beta \ln\left(\widehat{trade}_{it}\right) + \varepsilon_{it}$$

Data

- From IMF Direction of Trade (DoT)
  - Bilateral trade for each year (average of imports and exports)
- Bilateral great circle distances (air travel) (available from CEPII)
- Bilateral sea distance
  - shortest time needed to travel between two points (taking into account currents)
- Plot $\beta_{sea,t}$ and $\beta_{air,t}$ over time

Elasticity to air and sea distance

Figure 3: The Change in Elasticity of Trade with Respect to Sea and Air Distance over Time



source: Coefficients from regression table 9 column 2.

Each point represents the coefficient on (sea or air) distance over a 5 year interval. Estimates are from a gravity model with country fixed effects.

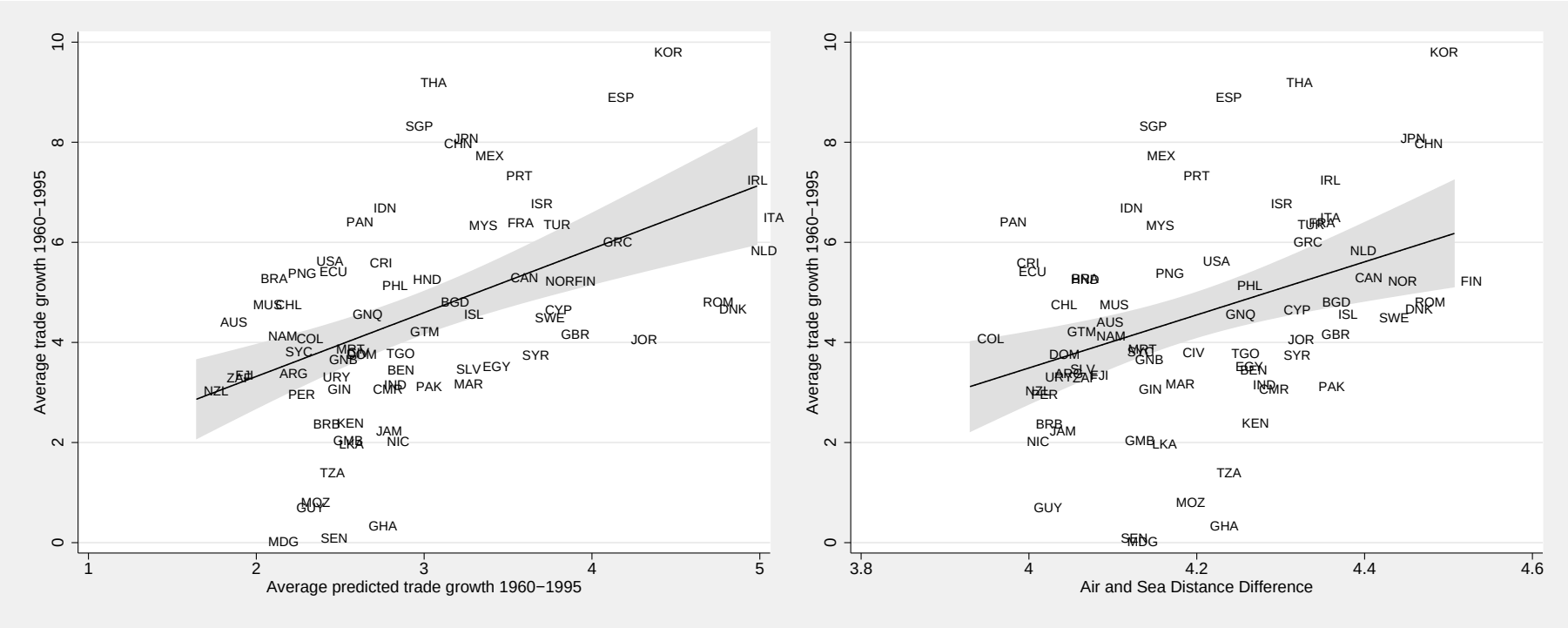
Error bars represent plus or minus two standard errors for each coefficient.

Interpretation

- Air transport has become more important, so air distance explains more of recent trade
- The opposite for sea transport: sea distance explains less of recent trade
- One caveat: the graph looks strangely symmetric, but I cannot think of anything mechanical driving the relationship between $\beta_{sea,t}$ and $\beta_{air.t}$

Long-run change: sea-air distance

Figure 6: First Stage: Actual Trade Growth 1960-1995 versus Instruments



source: IMF Direction of Trade database, author's calculations.

Long-run OLS results

Table 3: The Effect of Trade on GDP in Long Differences

	(1)	(2)	(3)	(4)	(5)
	Annual per capita real GDP growth 1960-1995				
	OLS	IV			
		Gravity	Simple Instrument		
		Instrument	Trade Weight	Pop Weight	Area Weight
Average trade growth	0.558***	0.688***	0.732***	0.668***	0.596*
	(0.0665)	(0.111)	(0.146)	(0.165)	(0.247)
R^2	0.464				
Observations	76	76	76	76	76
	FIRST STAGE				
		Annual trade growth 1960-1995			
Trade Instrument		1.275***	1.062***	0.821***	5.429*
		(0.235)	(0.266)	(0.235)	(2.170)
Instrument F-Stat		29.45	15.95	12.22	6.26
First Stage R^2		0.242	0.151	0.097	0.071

Simple instrument for i: $\log\left(\sum \text{weight}_j \times \text{seadist}_{ij}\right) - \ln\left(\sum \text{weight}_j \times \text{airdist}_{ij}\right)$

Panel results (5 year intervals)

Table 5: Panel Estimates of Trade on per capita GDP

	(1)	(2)	(3)	(4)	(5)	(6)
			IV RESULTS			
			ln(Real GDP per Capita)			
ln(trade)	0.578	0.589	0.427	0.429	0.459	0.417
	(0.082)**	(0.090)**	(0.078)**	(0.075)**	(0.097)**	(0.092)**
			FIRST STAGE			
			ln(trade)			
ln(predicted trade)	0.993	0.942	2.055	2.033	1.385	1.696
	(0.144)**	(0.145)**	(0.418)**	(0.410)**	(0.251)**	(0.365)**
R^2	0.975	0.975	0.958	0.958	0.973	0.954
F-stat on Instrument	47.6	42.2	24.2	24.6	30.4	21.6
Instrument Partial R^2	0.170	0.163	0.216	0.223	0.100	0.145

Interpretation

- Elasticity of income to trade is about 0.5 so for an increase in 1% in trade, income per capita goes up by 0.5%
- Smaller number than FR, but also different RHS variable:
  - in FR trade is measured as trade/GDP to adjust for scale
  - here we have country fixed effects that take care of size so no need to rescale trade (?)

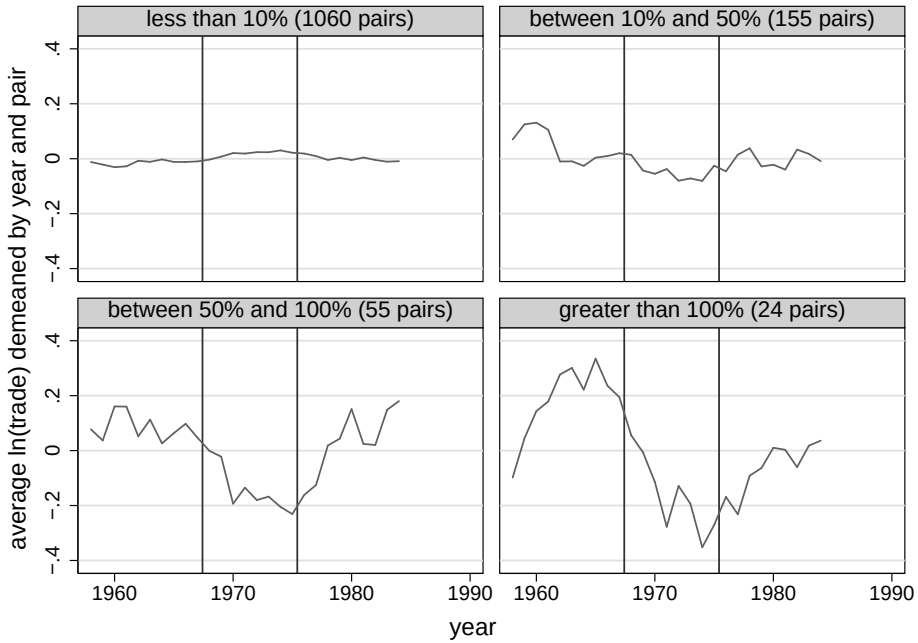
The closure of the Suez Canal

- In the second paper, Feyrer exploits the closure (1967) and reopening of the Suez Canal (1975)
- Changed the sea distance for some country pairs (Italy-India), but not for others (Canada-Japan)
- Main differences with respect to the first paper:
  - short-term changes: identify effect of trade variation in short run
  - only identifies effect of change in sea distance on trade in goods
    - ⋆ not identifying effect of flow of ideas and people (most of those would happen by plane)
  - Elasticity of income to trade is 0.25 (half the value of Feyrer, 2009a)
- Interestingly elasticity to distance is much smaller than in a standard gravity equation
  - larger elasticity when using closing (asymmetry, capacity constraints? anticipation of reopening?)

Trade declined for country pairs impacted

- Classify pairs according to distance increase due to Suez shock

Figure 1: Average bilateral trade residuals grouped by Suez Distance Increase



Source: IMF direction of trade database, author's calculations.
The vertical lines mark the closing and reopening of the Canal in 1967 and 1975.
Residuals from a regression with country pair and year dummies.

Gravity equation with time-varying distance

- Specification:

$$ln\left(trade_{ijt}\right) = \alpha + \gamma_{ij} + \gamma_t + \beta ln\left(seadist_{ijt}\right) + \varepsilon_{ijt}$$

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- What does this tell us? Country pairs that are "close" trade more for other reasons. Could β increase when run with country-pair fixed effects?
- Effect takes about 3 years to fully realize

Panel gravity: smaller elasticity

Table 1: Trade Versus Sea Distance with the Closure of Suez 67-75

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pairwise ln(trade)							
ln(sea dist)	-0.149+	-0.266**	-0.312**	-0.458**				
	(0.084)	(0.091)	(0.074)	(0.083)				
ln(sea dist) (67)					-0.330**	-0.402**	-0.473**	-0.558**
					(0.111)	(0.123)	(0.106)	(0.116)
ln(sea dist) (74)					-0.024	-0.147	-0.155	-0.329**
					(0.114)	(0.119)	(0.104)	(0.108)
Test 67 == 74 (p-value)					0.04	0.11	0.03	0.13
Pairs	2,605	2,605	1,294	1,294	2,605	2,605	1,294	1,294
Observations	60,920	46,726	34,938	27,174	60,920	46,726	34,938	27,174
R-squared	0.871	0.866	0.906	0.902	0.871	0.866	0.906	0.902
Balanced Panel	No	No	Yes	Yes	No	No	Yes	Yes
Omit Transition	No	Yes	No	Yes	No	Yes	No	Yes

** p<0.01, * p<0.05, + p<0.1

Regressions include country pair and year dummies.

Standard errors clustered by country pair

Years 1967-1969 and 1975-1977 are the transition periods.

Second stage

- To generate income-trade regression need predicted trade:

$$predicted\ \ trade_{it} = \sum_{i \neq j} e^{\hat{\gamma}_t + \hat{\gamma}_{ij} + \hat{\beta} \times ln(distance_{ijt})}$$

- Income-trade regression:

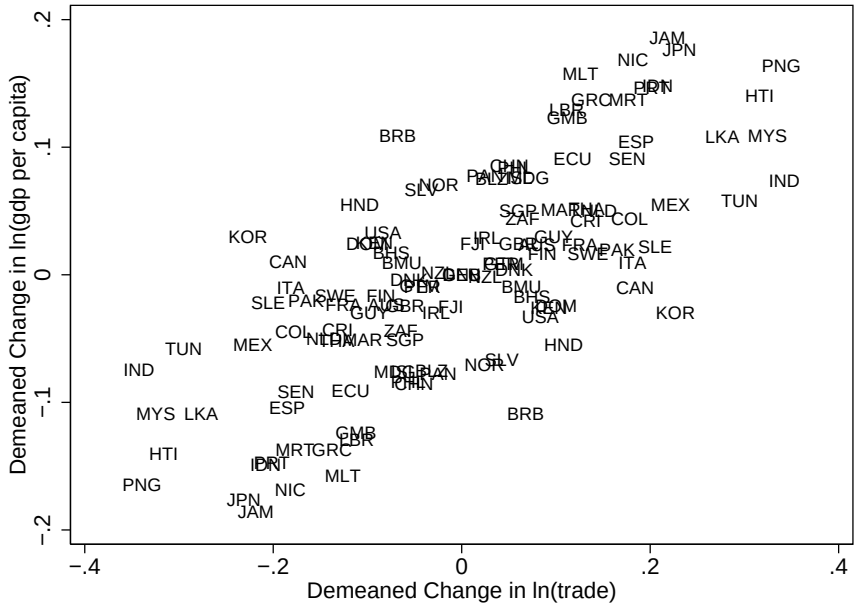
$$ln\left(y_{it}\right) = \alpha + \gamma_i + \gamma_t + \beta ln\left(trade_{it}\right) + \varepsilon_{it}$$

- Real per capital income y_{it} from World Development Indicators (World Bank)
- Years: 1958-1984 (confusingly starts in 1960 for some specifications)

OLS results

- Plot changes in trade and changes in income per capita (demeaned by country and time)

Figure 5: The Relationship between output and trade



ce: IMF direction of trade database, World Development Indicators, author's calculatic
Changes based on average for three periods, 1960-1966, 1970-1974, 1978-1984.

Note: two observations per country: pre-to-closure and closure-to-post

OLS Table

Table 4: Trade versus GDP per capita – OLS

	(1)	(2)
	ln(GDP per capita)	
ln(trade)	0.300**	0.318**
	(0.053)	(0.051)
Countries	80	80
Observations	1,771	1,351
R-squared	0.994	0.994
Transition Years Included	Yes	No

** p<0.01, * p<0.05, + p<0.1

Years 1967-1969 and 1975-1977 are the transition periods.

Regressions include country and year dummies.

Standard errors clustered by country

Note: OLS coefficient smaller than air-travel paper (different sample in terms of years)

IV Table

Table 5: Output and Trade

	(1)	(2)	(3)	(4)	(5)	(6)
IV RESULTS						
	ln(GDP per capita)					
ln(trade)	0.228*	0.253**	0.157**	0.170**	0.179**	0.159**
	(0.087)	(0.094)	(0.052)	(0.063)	(0.062)	(0.057)
FIRST STAGE						
	ln(trade)					
Suez Shock	-0.941**			-1.318**		
	(0.245)			(0.263)		
ln(Predicted Trade)		3.301**			4.817**	
		(0.950)			(0.941)	
ln(Predicted Trade) dynamic			3.341**			3.022**
			(0.676)			(0.651)
Instrument R-squared	0.010	0.010	0.023	0.018	0.019	0.020
Instrument F-Stat	14.8	11.9	24.4	25.1	26.1	21.5
REDUCED FORM						
	ln(GDP per capita)					
Suez Shock	-0.215+			-0.224+		
	(0.120)			(0.116)		
ln(Predicted Trade)		0.834+			0.863*	
		(0.472)			(0.423)	
ln(Predicted Trade) dynamic			0.525*			0.480+
			(0.252)			(0.254)
Countries	80	80	80	80	80	80
Observations	1,771	1,771	1,771	1,351	1,351	1,351
Transition Years Included	Yes	Yes	Yes	No	No	No

** p<0.01, * p<0.05, + p<0.1

Years 1967-1969 and 1975-1977 are the transition periods.

All regressions include a set of country and year dummies

Remarks

- Focus on columns 2 and 5 (other are variations, please see paper)
- Instrument is strong: F-stat>10 in the first stage
- Coefficient on ln(trade) is 0.25
- IV estimate smaller than OLS (why?)
- Compare with β in Frankel and Romer (1999): Donaldson (An.Rev.Econ. 2015) transforms into comparable coefficients
  - $\beta_{FR} = 1.97$
  - $\beta_{Feyrer-air} = 1.15 - 5.65$
  - $\beta_{Feyrer-Suez} = 0.31 - 0.53$

Note on comparing coefficients

- From Donaldson (ARE, 2015)
- Regression in FR:

$$lnGDP_d = \beta OPEN_d$$

- Regression in Feyrer:

$$lnGDP_d = \gamma lnIMP_d$$

- With approximately balanced trade $IMP_d = \frac{OPEN_d GDP_d}{2}$
- So Feyrer regression becomes:

$$lnGDP_d = \frac{\gamma}{1-\gamma} lnOPEN_d$$

- So, calculated at average country in terms of $OPEN$:

$$\frac{\gamma}{1-\gamma} \approx \beta * \overline{OPEN}$$