The Network Origins of Transport Costs: Evidence from Developing Economies

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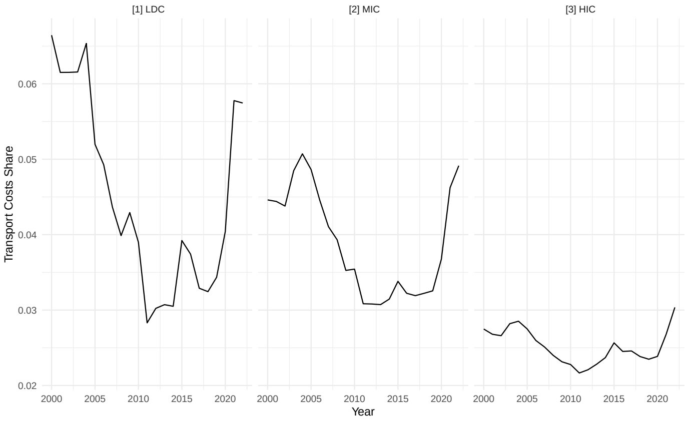
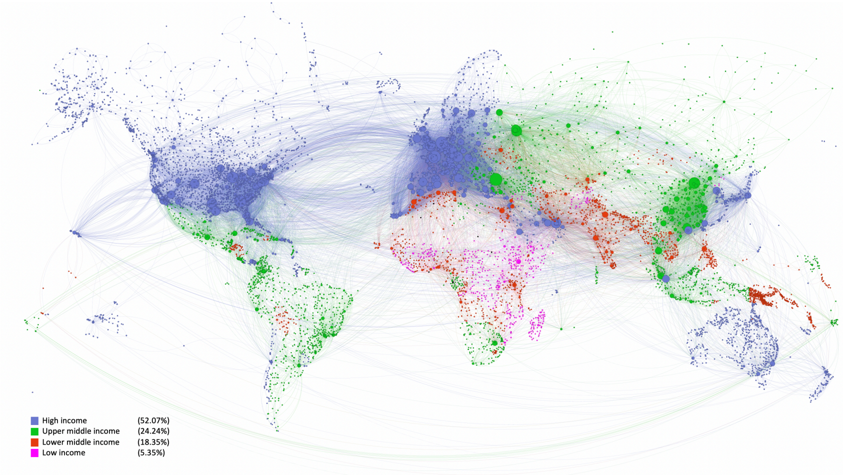
Motivation: Lower Income Countries Face Higher Ad-Valorem Trade Costs

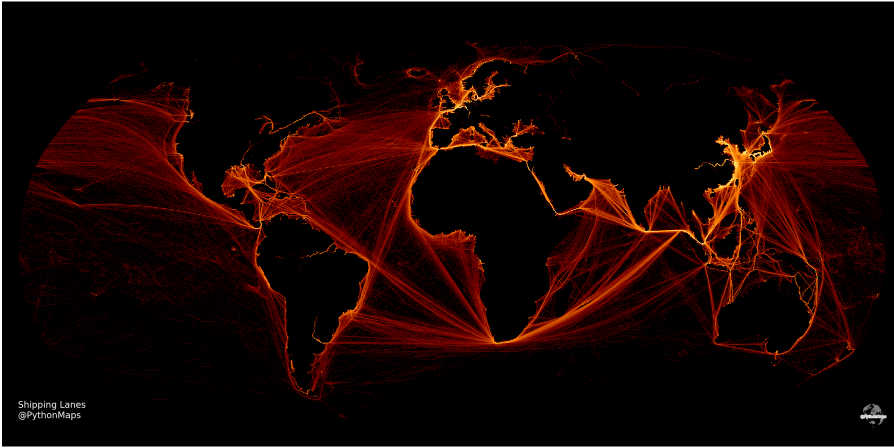


- Source data: US Imports. The pattern is consistent over time

Flight Routes are Usually Not Direct



… and Shipping Routes Too



- Source Credits
  Source data

Prior Literature

- Low income countries face asymmetrically higher trade barriers
  - Waugh (2010), Mora and Olabisi (2020,2023)
- Transport costs becoming greater barrier than tariffs
  - Asturias (2020), Pomfret and Sourdin (2010), Hummels et al. (2009)
- Port and transport infrastructure upgrades have spillovers
  - Brancaccio et al. (2021), Ganapati et al. (2021)

Model Sketch

- Transporters choose routes to maximize profits, conditional on existing networks
- Hub and spoke system emerges
- Costs are lower for shipments between central nodes in hub-and-spoke network
- Developing economies have lower port centralities

Preview of Results

- Poor countries *do* pay higher international transport costs to export (to the US)
- The poor countries exports tend to have lower value to weight ratios
- Notable differences in costs can be attributed to the centrality of air and sea ports,
  - Most exports are not direct
  - They go from the country of origin through a hub (or hubs) to reach destination

US Import data

- From US Census (Dept. of Commerce) - by HS8 code, year and trade partner
  - value of imports by air, and by sea
  - costs-insurance-freight (CIF) charges for each mode
- Ad-Valorem Costs $= \frac{CIF\ \ Charges}{Import\ \ Value}$

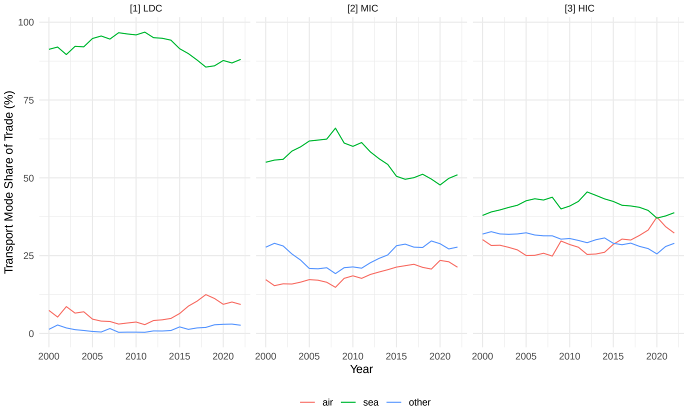
Port Connectivity Index

- Sea port index from UNCTAD
  - Country-level aggregate of port centrality based on traffic each year
  - Ranges from 0-100 (in baseline year)
- Air port index calculated as eigenvector centrality
  - Route data from open-flight

Value-Weight Ratios and Distance

- Calculated annual country-year value-weight ratio averages for each mode of transport in US import data
  - Is a crude index of trade composition
  - Relevant to costs as high-value items tend to use higher cost modes
- Distance to US obtained from CEPII data

Trade Shares of Transport Modes Differ by Group

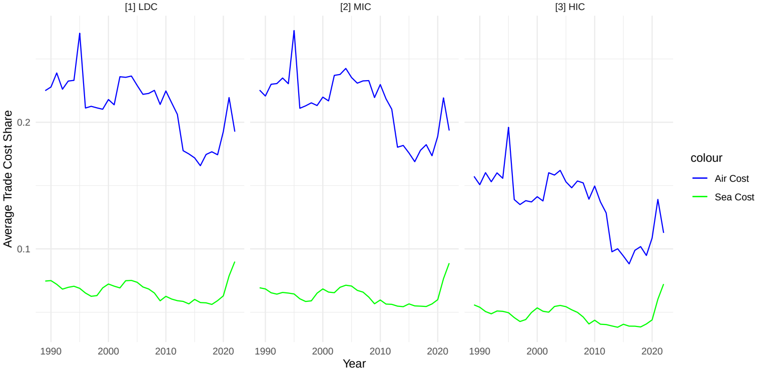


- LDCs send a greater share of goods to the US by sea

Ad-Valorem Trade Costs Differ by Transport Mode

- LDCs have the highest values for (air transport cost)/(air transport value)

Costs Gaps Not Driven by Country or Product



- Controlling for country and HS4 product categories

Summary Statistics

variable	[1] LDC	[2] MIC	[3] HIC
Distance	11,342.760	8,969.753	8,147.470
Air Centrality	0.019	0.043	0.104
Sea Centrality	12.336	28.937	38.165
Air Value/weight	474.690	200.462	229.056
Sea Value/weight	5.450	6.844	3.054
Air CIF	0.092	0.108	0.029
Sea CIF	0.096	0.058	0.042
Air cif FE	0.106	0.074	0.010
Sea cif FE	0.094	0.076	0.059

How Do Transport Networks Affect Trade Costs?

Regress the CIF shares (or, predicted CIF shares) for transport mode m on centrality, value-weight ratio, distance and group:

$$\log(CIF_{it}^{m}) = \alpha_0 + \alpha^m port\_centrality_{it}^{m} + \beta^m value\_weight_{it}^{m} + \gamma^m log(distance_i) + \tau_g^m + \varepsilon_{it}^{m}$$

- $\alpha, \ \beta, \ \gamma$ - Coefficients
- τ_g - Country-group dummies (HIC baseline)
- ε_{it} - error term
- $CIF_{it}^{m} = \frac{\sum Charges_{it}}{\sum Value_{it}}$ OR $\frac{\sum \hat{CIF}_{it} * Value_{it}}{\sum Value_{it}}$
- where $\hat{CIF}_{it}$ is predicted value from $CIF_{ijt} = a + factor(cgroup) + factor(year) + HS4 - CountryFE$

Network Centrality Affects Transport Costs

	Dependent variable:			
	air_CIF	sea_CIF	FE_air	FE_sea
log(Air Centrality)	−0.006***		−0.005***	
	(0.001)		(0.001)	
log(value_weightratio$_{air}$)	−0.041***		−0.043***	
	(0.002)		(0.002)	
log(Sea Centrality)		−0.007**		−0.007**
		(0.003)		(0.003)
log(value_weightratio$_{sea}$)		−0.007**		−0.006**
		(0.003)		(0.003)
LDC	0.033***	0.059***	0.042***	0.050***
	(0.007)	(0.010)	(0.007)	(0.010)
MIC	0.016***	0.011	0.021***	0.011*
	(0.005)	(0.007)	(0.005)	(0.006)
log(distance)	0.028***	0.014**	0.036***	0.018***
	(0.005)	(0.007)	(0.004)	(0.006)
Constant	−0.007	−0.001	−0.060	−0.042
	(0.043)	(0.062)	(0.042)	(0.058)
Observations	2,436	2,480	2,436	2,480
R^2	0.236	0.024	0.272	0.023
Note:				*p<0.1; **p<0.05; ***p<0.01

Conclusions

1. Network centrality matters for trade costs
2. Countries with more central ports (nodes) face lower transport costs
3. ... and can therefore enjoy more gains from trade
4. Transport mode matters":
    - sea centrality effects are (slightly) greater than air centrality
    - cost gaps between poor and high income countries more stat. significant for air transport
    - distance drives costs more for air travel.

Thank You!

Questions or comments:

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