Riding the Monsoon

Geography and Iron Age Trade in the Indian Ocean

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Introduction

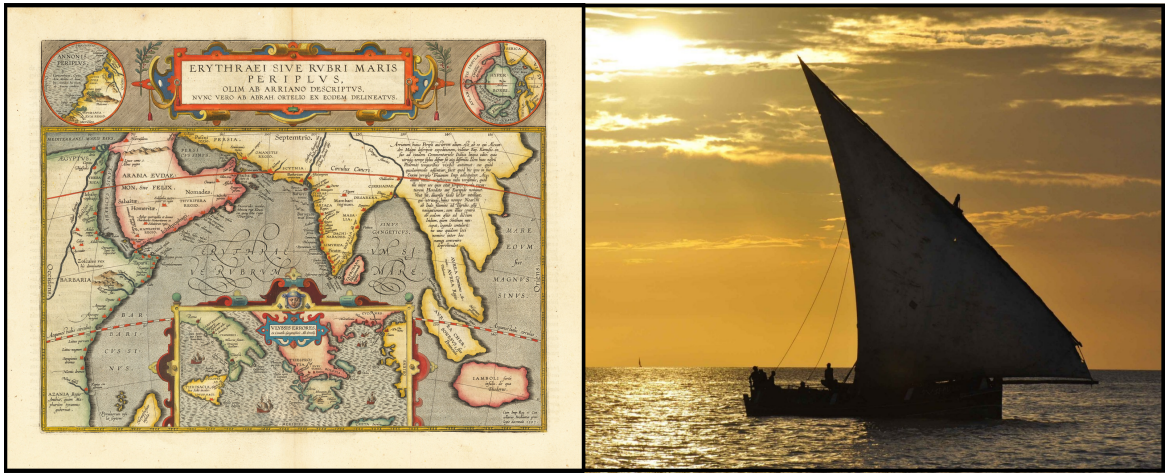
Motivation

Research Question:

How did the unique geography of the Indian Ocean influence trade and development in the late Iron Age?

- Trade in the ancient world was hindered by high trade costs and technological limitations
  - This reduced the attractiveness and profitability of long-distance, trans-oceanic trade
- The unique geography and climatic conditions of the Indian Ocean made this region an exception to this
  - Orientation of land masses around the Indian Ocean
  - Regularity of monsoon winds
- Climate and geography can overcome technological barriers and reduce trade costs to help sustain complex trade networks

This Paper



- Construct a new dataset of ancient Indian Ocean trade from **textual sources**
- Calculate **wind-dependent** transportation costs and routes
- Develop a modified **Ricardian gravity model** to estimate trade
- Estimate the relationship between ancient **trade flows and development**

Key Results

- Wind speed-dependent distance costs matter: monsoon winds facilitated sophisticated long-distance trade.
- The relationship between distance and trade volume is non-linear: this is linked to both a proximity effect and an endowment effect.
- Diversity of exports is linked to higher levels of development: heavy reliance on imports seems to be connected to lower levels of development.
- Evidence for an ancient resource curse: cities that are more dependent on cash crops are under-developed.

Related Literature

This paper is the first to use ancient textual sources to model trade in the Indian Ocean and provide insight into potential trade-driven determinants of growth in the region at the time.

- Pre-modern Trade
  - Barjamovic et al. (2019)
  - Bakker et al. (2018)
  - Pascali (2017)
- Ancient Trade Data
  - Fluckiger et al. (2019)
  - Broodbank (2006)
  - Temin (2006; 2013)
- Trade Costs
  - Maurer and Rauch (2019)
  - Juhasz (2018)
  - Liu and Meissner (2015)
- Trade and Development
  - Redding and Venables (2004)
  - Wacziarg and Welch (2008)
  - Feyrer (2019)

Outline

1) Data and Ancient Trade

2) Gravity Estimation

3) Trade Network Results

4) Trade and Development

5) Conclusion

Data and Ancient Trade

Trade Data

- Data from the Periplus of the Erythraean Sea (mid-first century)
- 150 individual products; 37 product types
- 47 identified cities: three levels of record
  - goods listed with partner city
  - goods listed with partner region
  - goods listed without any partner
- Data Issues:
  - Quality indicators
  - Quantity indicators
  - Omitted data

City Map | Product Data | City Data

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8. After Avalites there is another market-town, better than this, called Malao, distant a sail of about eight hundred stadia. The anchorage is an open roadstead, sheltered by a spit running out from the east. Here the natives are more peaceable. There are imported into this place the things already mentioned, and many tunics, cloaks from Arsinoe, dressed and dyed; drinking-cups, sheets of soft copper in small quantity, iron, and gold and silver coin, not much. There are exported from these places myrrh, a little frankincense, (that known as far-side), the harder cinnamon, *duaca*, Indian copal and *macir*, which are imported into Arabia; and slaves, but rarely.

36. Sailing through the mouth of the Gulf, after a six-days' course there is another market-town of Persia called Ommana. To both of these market-towns large vessels are regularly sent from Barygaza, loaded with copper and sandalwood and timbers of teakwood and logs of blackwood and ebony. To Ommana frankincense is also brought from Cana, and from Ommana to Arabia boats sewed together after the fashion of the place; these are known as *madarata*. From each of these market-towns, there are exported to Barygaza and also to Arabia, many pearls, but inferior to those of India; purple, clothing after the fashion of the place, wine, a great quantity of dates, gold and slaves.

Text from PME (Schoff, 1912)

▸ City Map ▸ Product Data ▸ City Data

Export Shares by City

Trade Variables

Bilateral Trade Flows:

$$X_{ij} = \sum_g x_{ijg}$$

$$\text{with } x_{ijg} = \begin{cases} 1 & \text{if good } g \text{ is traded between cities } i \text{ and } j; \\ 0 & \text{otherwise.} \end{cases}$$

Trade Basket Diversity:

$$h_i = 1 - \sum_n \left(\frac{\lambda_{in}}{L_i} \right)^2$$

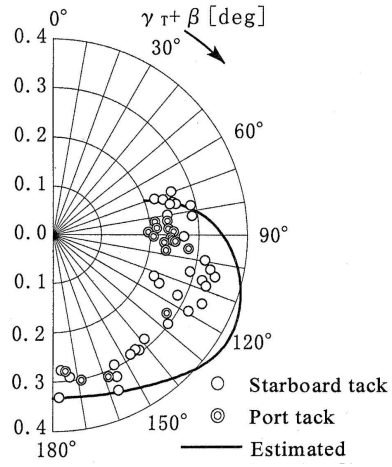
where λ_{in} is the number of products in category n and L_i is the total number of products.

Transportation Cost Data

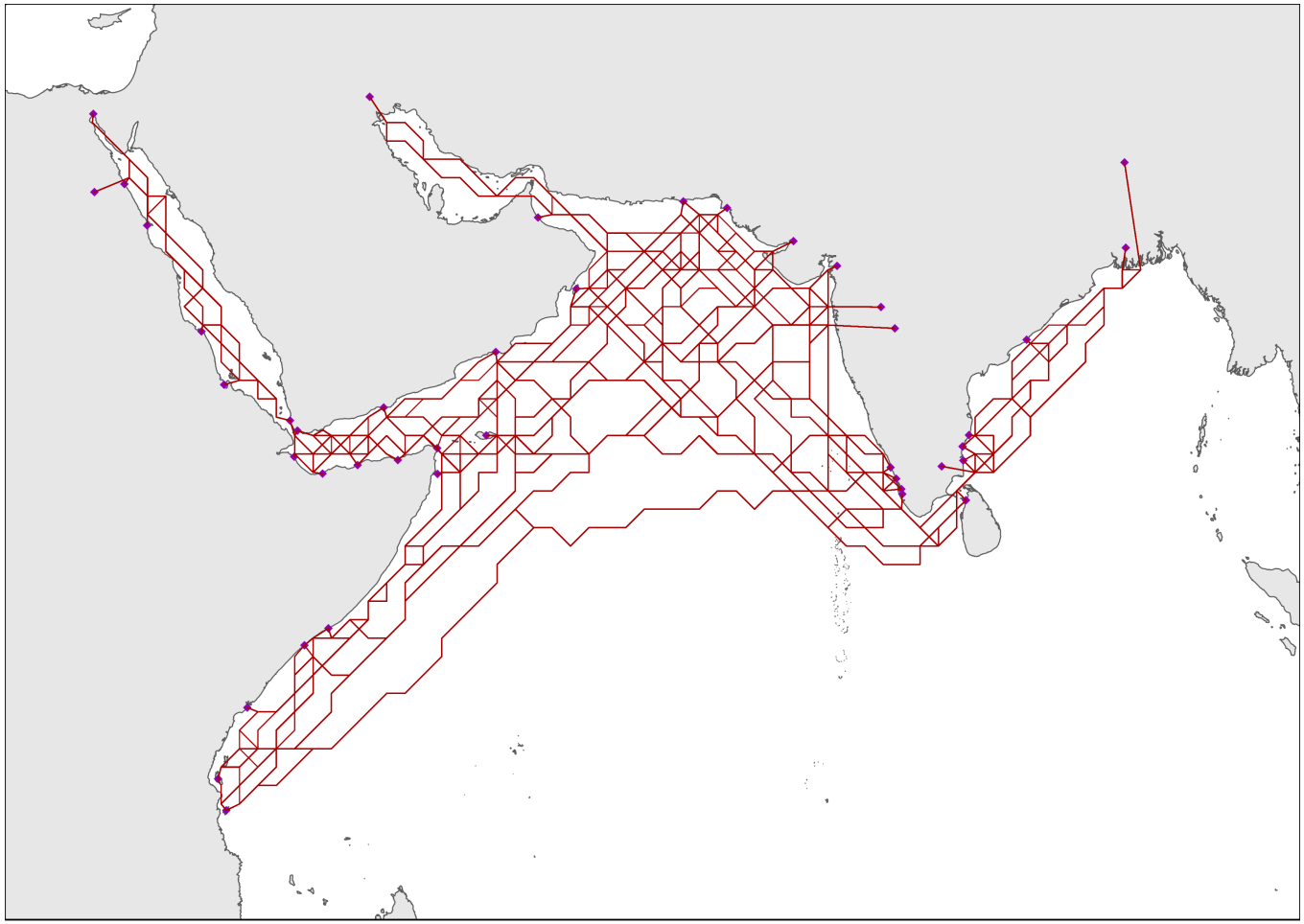
- Seasonal Monsoon Wind Data
  - CERSAT/Laboratoire D'Océanographie Spatiale
    - ERS-1/ERS-2/NSCAT satellite data
  - 1992-1995
    - June to July: Summer (SW) Monsoon
    - January to February: Winter (NE) Monsoon

▸ Summer Monsoon ▸ Winter Monsoon

- Calculating Sailing Speed
  - Nomoto, Masuyama, and Sakurai (2000)
    - Naniwa-maru sea trials in 1999
    - Square-rigged cargo ship from Edo period



Sea Routes (Summer Monsoon)



▸ Winter Routes

Sailing Times

Origin	Destination	Travel Time	
		Attested	Calculated
Berenike	Malao	1 Month	36.03 Days
Myos Hormos	Muza	1 Month	30.84 Days
Myos Hormos	Barygaza	>2 Months	64.70 Days
Tabae	Rhapta	<1 Month	17.99 Days

Note: Travel times are calculated according to monsoon wind data in the ideal sailing season for the direction of travel. Attested travel times come from Cobb (2018).

- Transportation costs are calculated as the length of time needed for a return trip between two cities in the correct season

Historical Development

- 0.5 degree by 0.5 degree grid
- Sample:
  - 500 km radius around cities

▸ Hinterland Variations

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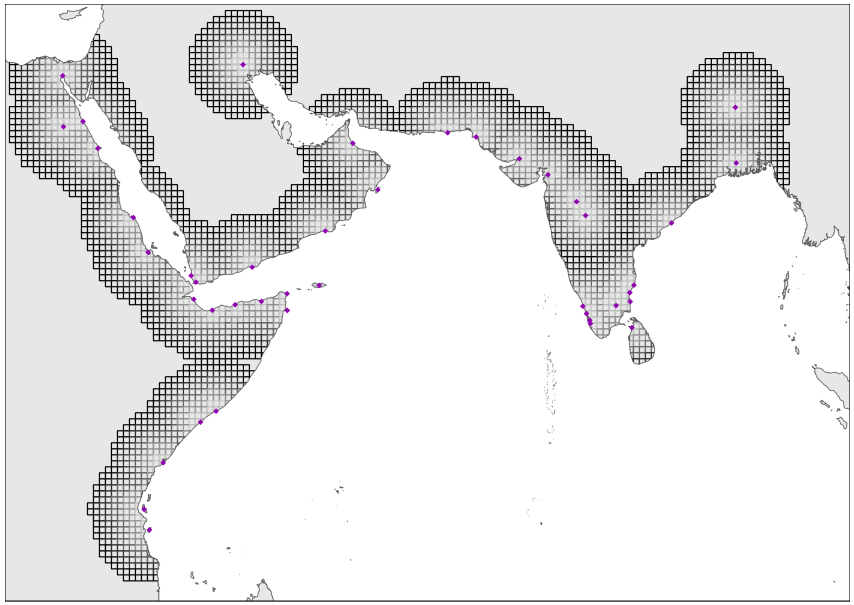
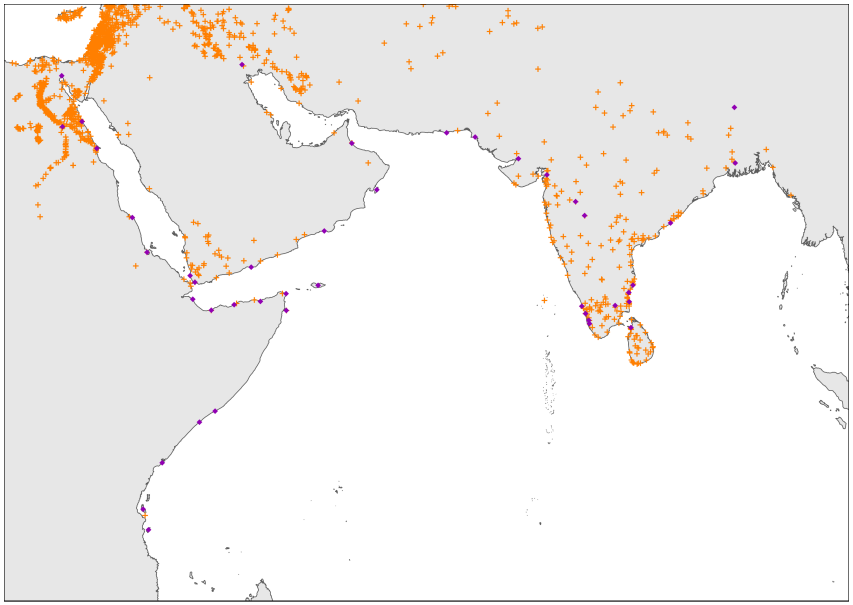
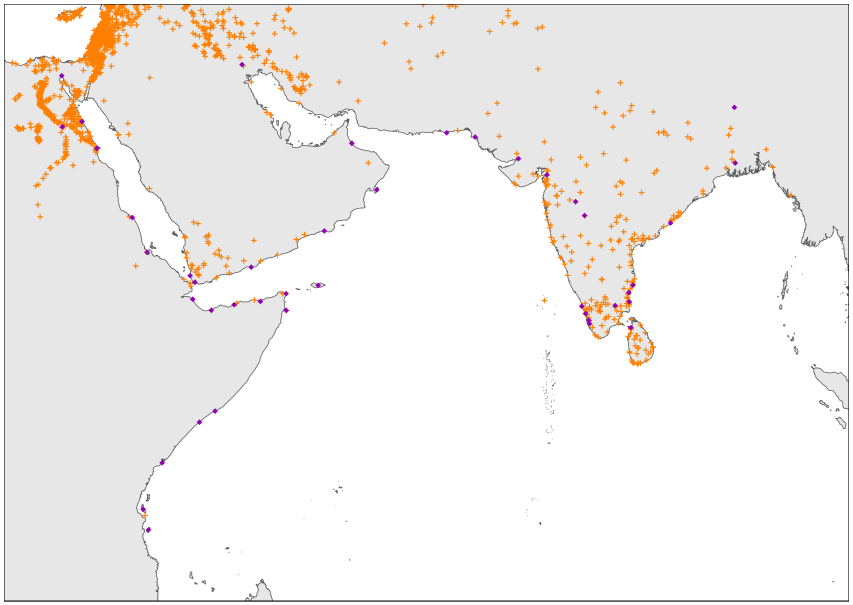


Historical Development



Historical Development



- 37000 ancient sites
  - pre-Bronze Age to Late Medieval
- Four broad categories:
  - Settlements; Buildings; Geography; Polities
  - 24400 settlements and buildings
- 6600 sites of the right type within the right location and date range

Historical Development

Growth Variable:

- Difference in the number of sites in a grid cell before and after the cut-off date
- Cut-off date: 30 BCE
- Maximum date: 640 CE

$$y_c = \sigma_c^{post} - \sigma_c^{pre}$$

Site Distribution

Region	Sites	Standard Deviation
Egypt	290.200	378.342
Horn of Africa	1.571	1.988
East Africa	0.200	0.447
Arabia	8.500	11.149
Persia	94.333	151.296
Scythia	7.500	3.536
India	13.667	9.076
All Regions	46.907	152.495

Note: Sites is the average number of sites within 500 km of cities in the given region.

- Summing of different site types: lack of non-Mediterranean data
- Selection bias: Roman infrastructure & archaeological focus

Gravity Estimation

Gravity Model

- Ricardian gravity model Model
  - Eaton and Kortum (2002)
  - Anderson and van Wincoop (2003)
  - Barjamovic et al (2019)
- Cities choose import baskets based on price distributions
  - Technology, input prices (labour), transportation distance
- More competitive cities will trade more varieties (not just more goods)
  - City size (labour)
  - Transport costs (distance)

Gravity Model

Gravity estimation equation:

$$E[X_{ij}] = exp\{\beta_0 + \beta_1 ln(d_{ij}) + \mu_i + \mu_j + \epsilon_{ij}\}$$

- Unique features of the Indian Ocean reduce trade costs
  - Seasonal regularity of the monsoon
  - Orientation of landmasses around the Indian Ocean

Gravity Results

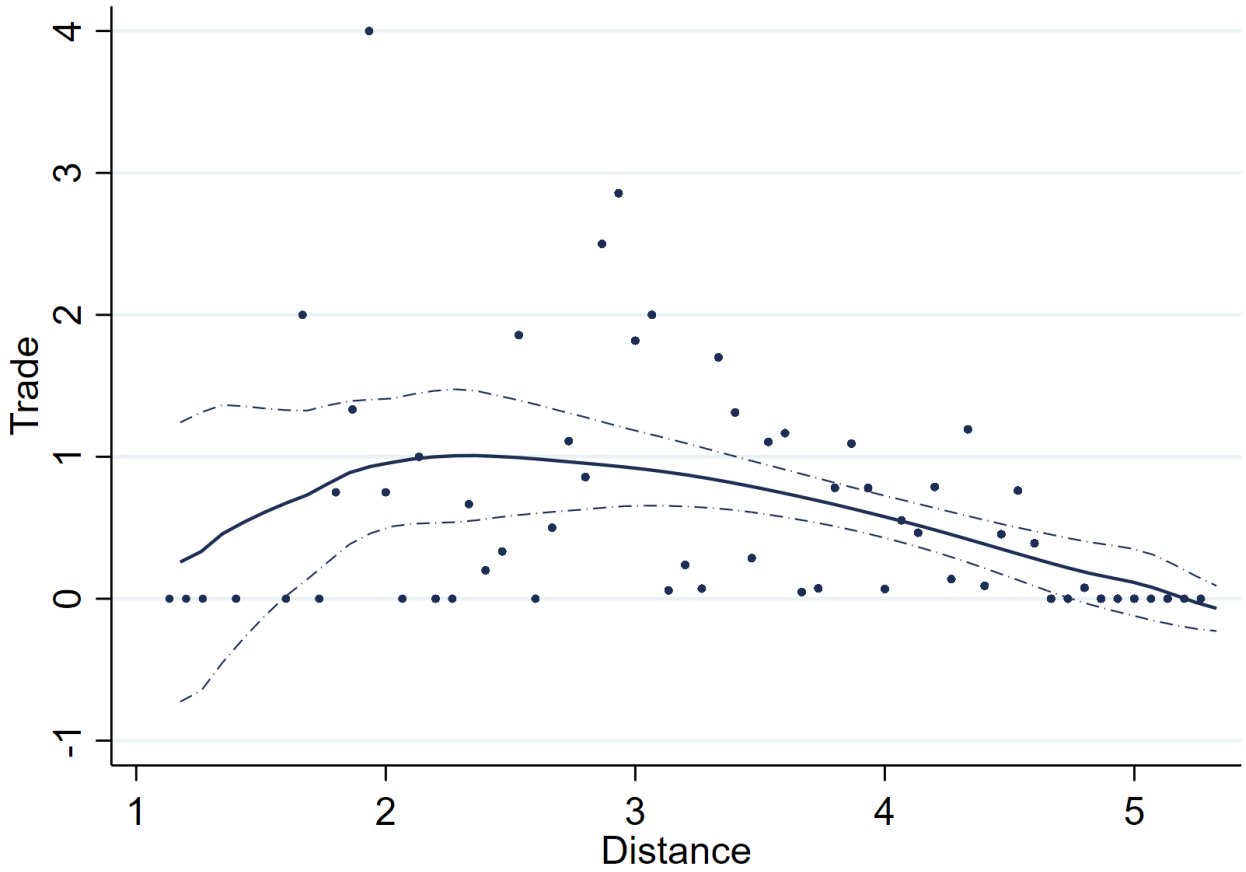
	(1)	(2)	(3)
ln(SailDist)	-0.273**	0.334	-8.534**
	(0.114)	(0.241)	(3.156)
sqrt(ln(SailDist))			30.029**
			(10.563)
City FE	Yes	Yes	Yes
N	107	556	556
R^2	0.856	0.225	0.257

Standard errors in parentheses

* Significant at 0.10; ** Significant at 0.05

Note: Dependent variable is the total number of good varieties traded; ln(SailDist) is the log of the total round-trip sailing time for the fastest calculated route accounting for wind speed.

Non-linear Distance



Non-linear Distance

Proximity Variable:

$$Neighbour_{ij} = \begin{cases} 1 & \text{if } d_{ij} \leq 14 \text{ days;} \\ 0 & \text{otherwise.} \end{cases}$$

Endowment Index:

$$EI_{ij} = 1 - \sum_{n} \frac{|\lambda_{in} - \lambda_{jn}|}{L_i + L_j}$$

Where λ_{in} is the number of products within the product category n exported by city i and L_i is the total number of products exported by city i

Non-linear Distance

	(1)	(2)
ln(SailDist)	-1.151**	-1.098**
	(0.465)	(0.473)
Neighbour	-2.858**	-1.912**
	(0.734)	(0.797)
Endowment Index		-10.316**
		(1.562)
City FE	Yes	Yes
N	556	556
R^2	0.293	0.430

Standard errors in parentheses

* Significant at 0.10; ** Significant at 0.05

Note: Dependent variable is the total number of good varieties traded; ln(SailDist) is the log of the total round-trip sailing time for the fastest calculated route accounting for wind speed; Neighbour is a dummy variable for cities in close proximity; Endowment Index is an index of similarity of endowments.

Trade and Development

Export-led Growth

Distance to Periplus ports:

$$y_c = \beta_1 ln(d_c) + \nu_c + \epsilon_c$$

Export and Import basket diversity:

$$y_c = \beta_1 \omega_c h_c^x + \beta_2 \omega_c h_c^m + \nu_c + \epsilon_c$$

ω_c is a distance weight term given by $\frac{1}{d_c}$ (where d_c is the distance to the nearest port in the Periplus.

Ancient Resource Curse

Sectoral shares:

$$S(r)_i = \frac{\lambda_{ir}}{L_i}$$

The share $S(r)_i$ of sector r for city i is the number of products λ_{ir} in sector r exported or imported by city i divided by the total number of products exported by city i, L_i

Estimation equation:

$$y_c = \beta_1 \omega_c S(mfg)_c^x + \beta_2 \omega_c S(spc)_c^x + \beta_3 \omega_c S(bul)_c^m + \nu_c + \epsilon_c$$

▶ Product Sectors

Trade and Development

	(1)	(2)	(3)
ln(Dist)	-0.094*		
	(0.054)		
Export Diversity		31.273**	
		(11.199)	
Import Diversity		-15.278**	
		(6.691)	
Manufactures			3.115**
			(1.462)
Spices & Aromatics			-22.187*
			(13.262)
Bullion			638.741**
			(315.511)
Rome	0.388**	0.467**	0.465**
	(0.192)	(0.187)	(0.187)
Cell FE	Yes	Yes	Yes
N	3172	3172	3172
R^2	0.065	0.069	0.067

Standard errors in parentheses

* Significant at 0.10; ** Significant at 0.05

Note: Dependent variable is the standardised change in ancient place records within a grid cell; ln(Dist) is the distance from the nearest Periplus port; Export and Import Diversity are distance-weighted Herfindahl-style indices of export/import product concentration; Manufactures and Spices & Aromatics are distance-weighted measures of export shares for the given sector; Bullion is the distance-weighted measure of import share of bullion products; Rome is a dummy for the grid cell being a part of the Roman Empire.

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Robustness Checks

Robustness Checks

- Product Shares

$$X_{ij} = \frac{\sum_g x_{ijg}}{Z_i + Z_j}$$

$$\text{with } x_{ijg} = \begin{cases} 1 & \text{if good } g \text{ is traded between cities } i \text{ and } j; \\ 0 & \text{otherwise.} \end{cases}$$

- Third Century Decline
  - Adjusted maximum cut-off date: 300 CE
- Variations in Hinterland Size
  - Reduce sample grid radius size around cities
  - 350 km and 150 km

Robustness: Product Shares

	(1)	(2)
ln(SailDist)	-0.260**	-1.407**
	(0.104)	(0.533)
Neighbour		-2.371**
		(0.799)
Endowment Index		-12.690**
		(1.897)
City FE	Yes	Yes
N	107	446
R^2	0.850	0.980

Standard errors in parentheses

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Note: Dependent variable is the share of total good varieties traded; ln(SailDist) is the log of the total round-trip sailing time for the fastest calculated route accounting for wind speed; Neighbour is a dummy variable for cities in close proximity; Endowment Index is an index of similarity of endowments.

Robustness: Third Century Decline

	(1)	(2)	(3)
ln(Dist)	-0.091*		
	(0.054)		
Export Diversity		31.640**	
		(11.193)	
Import Diversity		-15.517**	
		(6.688)	
Manufactures			3.082**
			(1.461)
Spices & Aromatics			-22.260*
			(13.255)
Bullion			641.890**
			(315.347)
Rome	0.381**	0.458**	0.456**
	(0.192)	(0.187)	(0.187)
Cell FE	Yes	Yes	Yes
N	3172	3172	3172
R^2	0.065	0.068	0.067

Standard errors in parentheses

* Significant at 0.10; ** Significant at 0.05

Note: Dependent variable is the standardised change in ancient place records within a grid cell with a date limit of 300 CE imposed; ln(Dist) is the distance from the nearest Periplus port; Export and Import Diversity are distance-weighted Herfindahl-style indices of export/import product concentration; Manufactures and Spices & Aromatics are distance-weighted measures of export shares for the given sector; Bullion is the distance-weighted measure of import share of bullion products; Rome is a dummy for the grid cell being a part of the Roman Empire.

Robustness: Hinterland Variations

	350 km			150 km		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Dist)	-0.158**			-0.306**		
	(0.074)			(0.144)		
Export Diversity		42.234**			55.579**	
		(12.678)			(17.047)	
Import Diversity		-21.947**			-30.188**	
		(7.574)			(10.151)	
Manufactures			3.024*			2.876*
			(1.577)			(1.572)
Spices & Aromatics			-32.943**			-45.012**
			(15.394)			(21.056)
Bullion			724.274**			1108.955**
			(367.894)			(539.840)
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2042	2042	2042	601	601	601
R^2	0.109	0.114	0.111	0.397	0.410	0.404

Standard errors in parentheses

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Note: Dependent variable is standardised change in ancient place records within a grid cell; ln(Dist) is the distance from the nearest Periplus port; Export and Import Diversity are distance-weighted Herfindahl-style indices of export/import product concentration; Manufactures and Spices & Aromatics are distance-weighted measures of export shares for the given sector; Bullion is the distance-weighted measure of import share of bullion products; Controls for the grid cell being a part of the Roman Empire are included.

Conclusion

Discussion

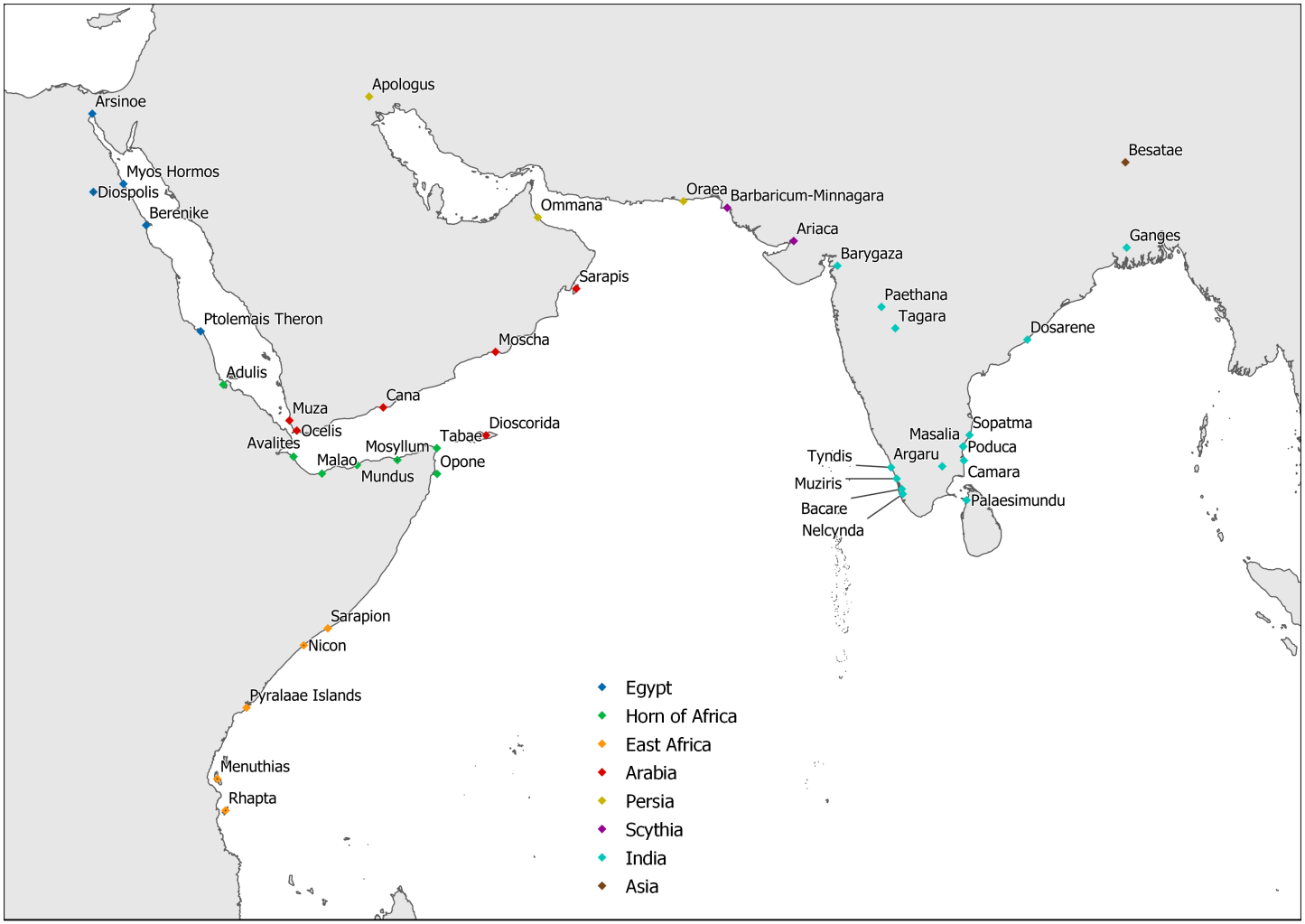
- Distance has an impact on trade in the Indian Ocean
  - Sailing time was an important factor in trade
  - Distance reduced a city's comparative advantage in markets (in a Ricardian sense)
- Non-linear effects of distance
  - Cities that are too close together appear to trade less
    - Similarities in endowment
    - Missing data: bias in data collection in the Periplus

Discussion

- Ancient export-oriented growth
  - Diversity of exports matters
  - More variety is linked to higher later development
- Under-development and the resource curse
  - Reliance on ancient 'cash crops' (spice, incense, resin, etc.) is linked to lower development levels
  - Pliny and the 100 million sesterces per year
    - Bullion imports are linked to significantly higher development

Thank You

Periplus City Map



Product Data Table

Product	Product Category	X	M
Clarified Butter	Animal Products	6	2
Horses	Animal Products	1	2
Mountain Tortoise	Ivory & Shell	1	1
Tortoise Shell	Ivory & Shell	12	9
Ivory	Ivory & Shell	9	6
Elephant Ivory	Ivory & Shell	1	1
Rhino Ivory	Ivory & Shell	6	2
Rice	Grain	7	7
Wheat	Grain	14	9
Indian Copal	Plant Products	2	1
Aloes	Plant Products	1	12
Macir	Plant Products	2	1
Palm Oil	Plant Products	5	1
Sesame Oil	Plant Products	7	6
Dates	Plant Products	2	2
Sour Grape Juice	Plant Products	6	1
Sugarcane Juice	Plant Products	6	2
Blackwood	Timber	2	1
Ebony	Timber	2	1
Sandalwood	Timber	2	1
Teakwood	Timber	2	1
Coloured Lac	Dye	1	1
Purple	Dye	2	2
Wine	Wine	8	6
Duaca	Incense & Spices	2	1
Fragrant Ointments	Incense & Spices	1	2
Frankincense	Incense & Spices	4	13
Myrrh	Incense & Spices	3	3
Spikenard	Incense & Spices	3	4
Storax	Incense & Spices	1	2
Cinnamon	Incense & Spices	2	3
Malabathrum	Incense & Spices	4	8
Pepper	Incense & Spices	3	4
Spices	Incense & Spices	1	2
Awls	Finished Products	5	1
Daggers	Finished Products	5	1
Hatchets	Finished Products	5	1
Images	Finished Products	1	2
Lances	Finished Products	5	1
Sewn Boats	Finished Products	1	1
Native Produce	Finished Products	1	12
Arabian Clothing	Textiles	1	2
Blankets	Textiles	1	2
Cloaks	Textiles	6	3
Coloured Sashes	Textiles	1	2
Girdles	Textiles	7	2
Local Clothing	Textiles	2	3
Robes	Textiles	1	1
Skin Coats	Textiles	1	1
Thin Clothing	Textiles	1	2
Tunics	Textiles	5	1
Indian Cloth	Textiles	1	6
Cloth	Textiles	2	5
Cotton Cloth	Textiles	7	2
Mallow Cloth	Textiles	2	2
Monache Cloth	Textiles	7	2
Muslins	Textiles	3	4
Purple Cloth	Textiles	1	2
Raw Silk	Textiles	1	5
Sagmatogene Cloth	Textiles	7	2
Silk Cloth	Textiles	4	5
Silk Yarn	Textiles	1	5
Carnelian	Gems & Glass	1	1
Coral	Gems & Glass	1	2
Diamonds	Gems & Glass	3	4
Pearls	Gems & Glass	5	6
Sapphires	Gems & Glass	3	4
Transparent Stones	Gems & Glass	3	4
Flint Glass	Gems & Glass	1	1
Glass	Gems & Glass	5	1
Murrhine Glass	Gems & Glass	1	1
Copper	Metals & Minerals	3	3
Iron	Metals & Minerals	1	1
Steel	Metals & Minerals	1	1
Tin	Metals & Minerals	1	2
Enslaved Persons	Humans	6	11
Coin/Gold	Bullion	2	2
Gold Plate	Plateware	1	2
Silver Plate	Plateware	1	2

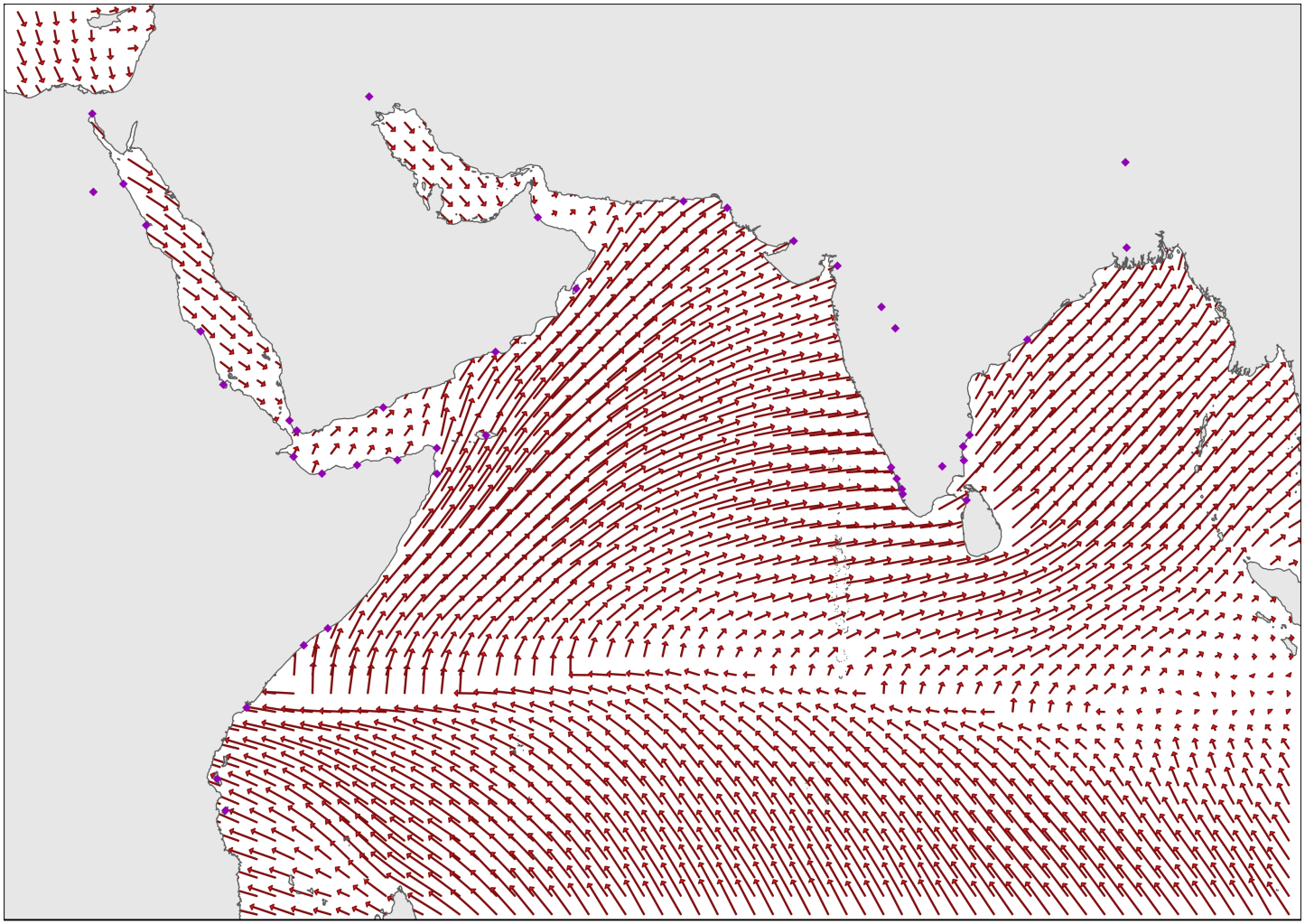
Note: This table includes all individual products listed in the text of [**?**] with origins and destinations identified. X indicates the number of cities exporting the product; M indicates the number of cities importing it.

City Data Table

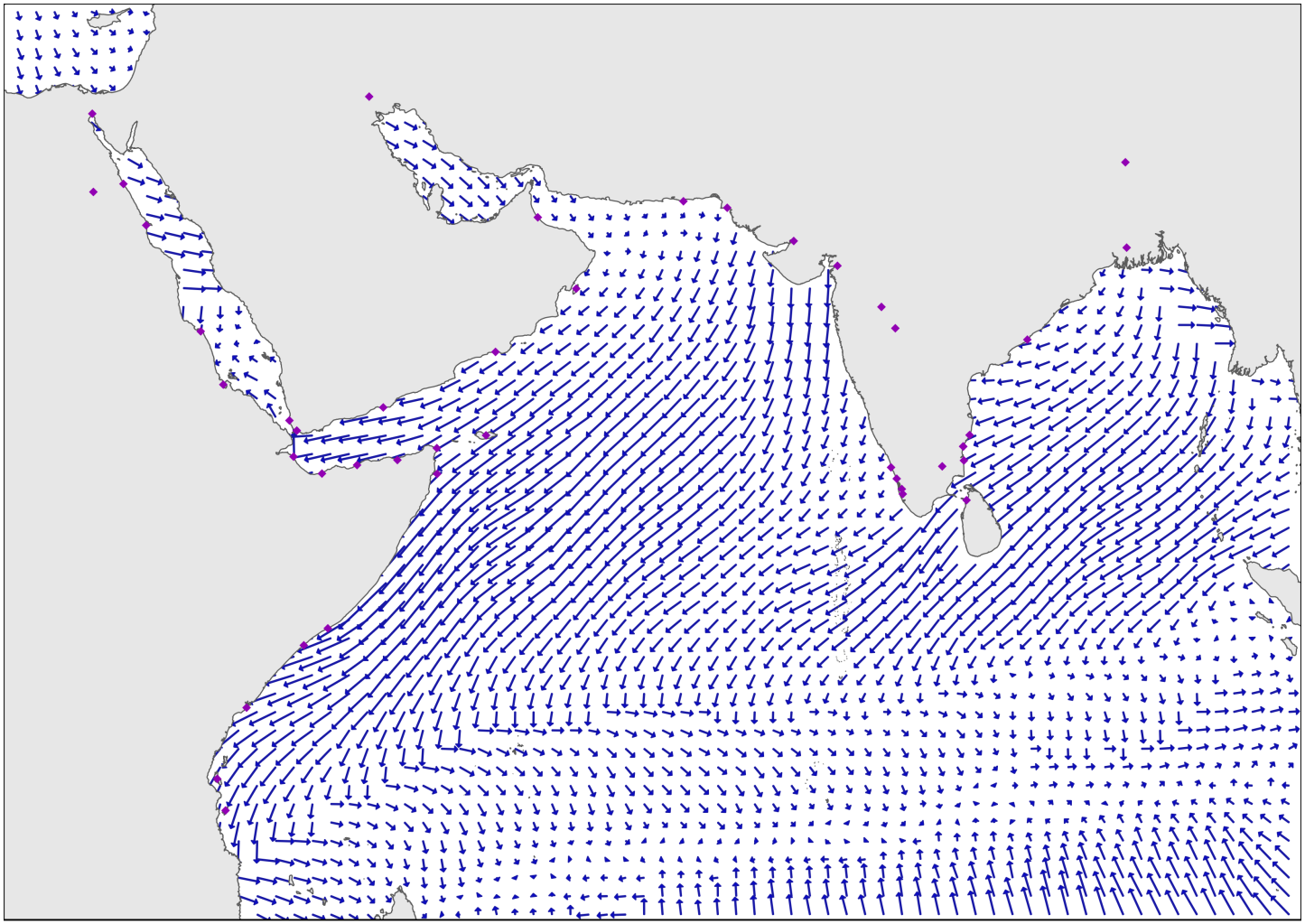
City	Region	Coordinates	Goods	Partners
Arsinoe	Egypt	29.97, 32.55	3	7
Berenike	Egypt	23.91, 35.48	22	3
Diospolis	Egypt	25.72, 32.61	3	7
Myos Hormos	Egypt	26.16, 34.24	22	3
Adulis	Horn of Africa	15.26, 39.66	32	3
Avalites	Horn of Africa	11.35, 43.47	22	6
Malao	Horn of Africa	10.44, 45.02	30	9
Mosyllum	Horn of Africa	11.17, 49.11	34	5
Mundus	Horn of Africa	10.9, 46.92	31	9
Tabae	Horn of Africa	11.82, 51.25	32	5
Opone	Horn of Africa	10.42, 51.27	30	7
Menuthias	East Africa	-6.13, 39.33	13	1
Nicon	East Africa	-1.22, 41.84	11	1
Pyralaae Islands	East Africa	-2.27, 40.9	11	1
Rhapta	East Africa	-7.85, 39.78	11	1
Sarapion	East Africa	2.03, 45.33	11	1
Cana	Arabia	14.03, 48.34	36	16
Dioscorida	Arabia	12.51, 53.92	11	10
Moscha	Arabia	17.04, 54.43	5	8
Muza	Arabia	13.32, 43.25	47	11
Ocelis	Arabia	12.77, 43.65	14	3
Sarapis	Arabia	20.47, 58.82	1	1
Apologus	Persia	30.89, 47.58	12	4
Ommana	Persia	24.34, 56.73	16	6
Oraea	Persia	25.21, 64.63	8	1
Ariaca	Scythia	23.06, 70.62	19	7
Barbaricum-Minnagara	Scythia	24.86, 67.01	22	1
Bacare	India	9.59, 76.49	34	6
Barygaza	India	21.71, 72.99	64	15
Camara	India	11.14, 79.86	13	5
Muziris	India	10.16, 76.21	34	7
Nelcynda	India	9.32, 76.54	34	6
Paethana	India	19.48, 75.38	1	1
Poduca	India	11.9, 79.82	13	5
Sopatma	India	12.53, 80.16	13	5
Tagara	India	18.32, 76.13	4	1
Tyndis	India	10.77, 75.9	34	6
Besatae	East Asia	27.33, 88.62	1	5

Note: This table only includes cities that have both goods and partners listed in the text of [**?**]. Coordinates are in (Lat, Lon) format; Goods indicates the number of unique products the city trades (both imports and exports); Partners indicates the number of other cities a given city trades with.

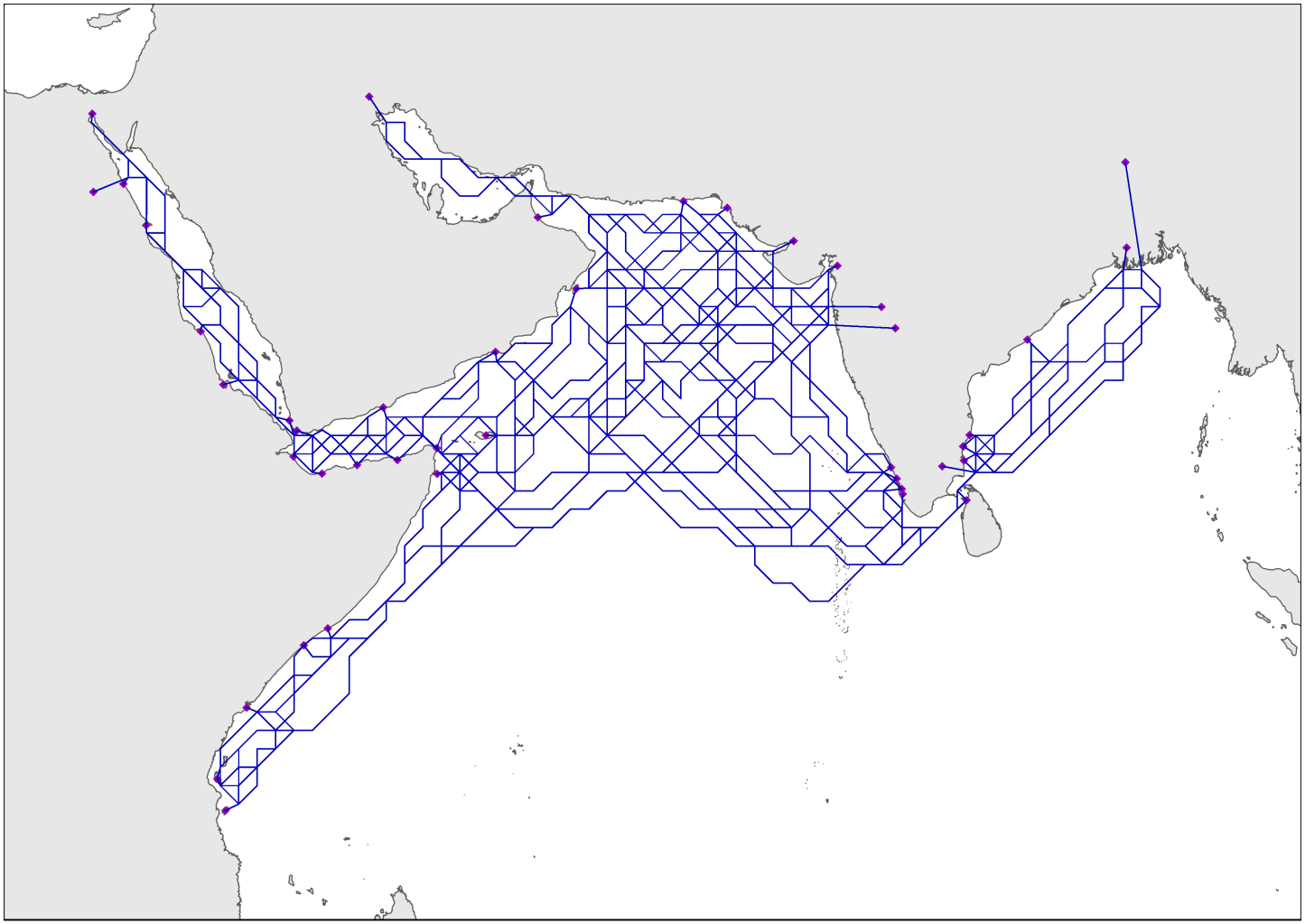
Summer Monsoon Winds



Winter Monsoon Winds



Winter Monsoon Routes



Ricardian Gravity Model

Following Eaton and Kortum (2002):

$z_j(g)$ is city j's efficiency of producing good g

City-specific probability distribution $F_j(z) = Pr[Z_j \leq z]$
Fréchet Type II distribution:

$$F_j(z) = e^{-T_j z^{-\theta}}$$

$T_j > 0$ is a city specific parameter
$\theta > 1$ is a parameter for the variation in the distribution

Ricardian Gravity Model

Cost of delivering a unit of good g produced in city j to city i is

$$p_{ij}(g) = \left(\frac{c_j}{z_j(g)} \right) d_{ij}$$

c_j is the cost of all inputs, including labour
d_{ij} is an iceberg transport cost

Consumers choose goods from destinations that minimise price

The price of good g in i will be the lowest across all N sources:

$$p_i(g) = \min\{p_{ik}(g); k = 1, ..., N\}$$

Ricardian Gravity Model

The price distribution for what city n actually buys is:

$$G_i(p) = Pr[P_i \leq p] = 1 - \prod_{j=1}^{N}[1 - G_{ij}(p)]$$

inserting the price distribution function collapses the function into something resembling $G_{ij}(p)$:

$$G_i(p) = 1 - e^{-\Phi_i p^{\theta}}$$

where

$$\Phi_i = \sum_{j=1}^{N} T_j(c_j d_{ij})^{-\theta}$$

Ricardian Gravity Model

The probability that city j provides a good at the lowest price in destination i is

$$\pi_i = \frac{T_j(c_j d_{ij})^{-\theta}}{\Phi_i}$$

which is equivalent to the contribution of city j to city i's price parameter

Average expenditure of city i on each good does not vary by source, so the proportion of goods city i buys from city j is the proportion of its expenditure on goods from city j:

$$\pi_{ij} = \frac{X_{ij}}{X_i} = \frac{T_j(c_j d_{ij})^{-\theta}}{\Phi_i} = \frac{T_j(c_j d_{ij})^{-\theta}}{\sum_{j=1}^{N} T_j(c_j d_{ij})^{-\theta}}$$

Ricardian Gravity Model

This expression can be rearranged into a equation resembling a basic gravity function:

$$X_{ij} = \frac{T_j(c_j d_{ij})^{-\theta} X_i}{\sum_{j=1}^{N} T_j(c_j d_{ij})^{-\theta}}$$

using market clearing conditions, this can be turned into a standard gravity equation in the normal way:

$$X_{ij} = \frac{X_i X_j}{X_w} \left(\frac{d_{ij}}{\Phi_j \Phi_i} \right)^{-\theta}$$

where $X_w = \sum_k X_k$ is total output and Φ_j and Φ_i serve as multi-lateral resistance terms.

Sector Data Table

Manufactures:

Product	Product Category	Product	Product Category
Palm Oil	Plant Products	Robes	Textiles
Sesame Oil	Plant Products	Skin Coats	Textiles
Coloured Lac	Dye	Thin Clothing	Textiles
Purple	Dye	Tunics	Textiles
Wine	Wine	Indian Cloth	Textiles
Awls	Finished Products	Cloth	Textiles
Daggers	Finished Products	Cotton Cloth	Textiles
Hatchets	Finished Products	Mallow Cloth	Textiles
Images	Finished Products	Monache Cloth	Textiles
Lances	Finished Products	Muslins	Textiles
Sewn Boats	Finished Products	Purple Cloth	Textiles
Native Produce	Finished Products	Raw Silk	Textiles
Arabian Clothing	Textiles	Sagmatogene Cloth	Textiles
Blankets	Textiles	Silk Cloth	Textiles
Cloaks	Textiles	Silk Yarn	Textiles
Coloured Sashes	Textiles	Flint Glass	Gems & Glass
Girdles	Textiles	Glass	Gems & Glass
Local Clothing	Textiles	Murrhine Glass	Gems & Glass

Spices & Aromatics:

Product	Product Category	Product	Product Category
Indian Copal	Plant Products	Spikenard	Incense & Spices
Aloes	Plant Products	Storax	Incense & Spices
Macir	Plant Products	Cinnamon	Incense & Spices
Duaca	Incense & Spices	Malabathrum	Incense & Spices
Fragrant Ointments	Incense & Spices	Pepper	Incense & Spices
Frankincense	Incense & Spices	Spices	Incense & Spices
Myrrh	Incense & Spices		

Bullion:

Product	Product Category
Coin/Gold	Bullion

Note: This table groups individual products from Table **??** into the sectoral categories that are included in the development analysis.