Navigating the Geography of Regional Disparities: Market Access and the Core-Periphery Divide

Gabrielle Gambuli
CY Cergy Paris Université, THEMA
ESSEC Business School

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Introduction

Does proximity to markets explain regional development disparities within countries?

- What is known?
  - Yes, it has an impact
  - Theory : *international trade wage equation*
    - wages related to market access/potential
    - Fujita, Krugman and Venables (1999), Redding and Venables (2004), Head and Mayer (2011)
  - Empirical verification
    - at the country level, to explain between country variation (Redding and Venables, 2004; Head and Mayer, 2011)
    - at the regional level, to explain within country variation (Hanson, 2005; Brakman, Garretsen and Marrewijk, 2009)

Introduction

Does proximity to markets explain regional development disparities within countries?

- Goal : provide a falsification test at the regional level within countries worldwide
  - use extensive regional dataset with geographic and education controls
  - provide a market access index where distance is considering geographic typologies (land & water surfaces), as well as cultural and economic proximity
    - ⋆ recognize important role of maritime transportation into international trade
    - ⋆ "around 80% of global trade by volume and over 70% of global trade by value are carried by sea and are handled by ports worldwide" (The Review of Maritime Transport 2018, UNCTAD)
  - investigate heterogenous effects : the core VS the periphery, developed VS developing countries

Motivation : Why do we care about regional disparities?

- Economic and social inequality
  - unequal access to ressources (education, healthcare), employment opportunities
- Hurt social cohesion
  - rise protest movements and voting decisions cleavage - Brexit (Loss, McCann, Springford and Thissen, 2017), election of Trump in the US (Rodriguez-Pose, Lee & Lipp, 2020), far-right and -left political parties ascendance in European countries (Dijsktra, Poelman and Rodriguez-Pose, 2020)

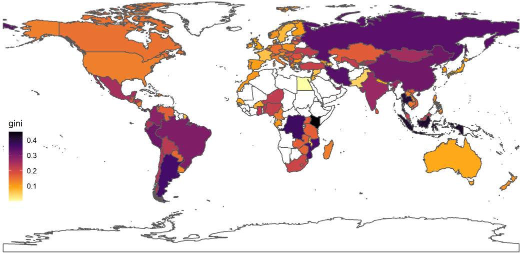

Figure 1: Gini index in the regional income per capita in 2005

Theoretical fundations

1. The International Trade Wage Equation
   - Fujita, Krugman and Venables (1999)
     - ★ general equilibrium model with international trade (economies of scale) and monopolistic competition (differentiated goods, large number of firms, profit maximization)
     - ★ low transportation costs to demand → attract firms → competition for labor → higher wages
   - Redding and Venables (2004), Head and Mayer (2011): gravity-based
2. Agglomeration economies and growth
   - Baldwin and Martin (2004)
     - ★ technology/knowledge spillovers
3. The Lucas-Lucas Model
   - Gennaioli, LaPorta, Lopez-de-Silvanez and Shleifer (2013)
     - ★ emphasize the role of human capital and human capital externalities in wage disparities
     - ★ higher human capital → higher marginal productivity → higher wages

- Key assumption: (1) immobile labor - (2) and (3) mobile labor

Data

- Gennaioli, LaPorta, Lopez-de-Silvanez and Shleifer (2013) extensive regional dataset
  - covers 70% of the world surface and 90% of the world GDP as of 2005
  - variables : GDP, education, population size, temperature, proximity to the ocean, natural resources, culture, institutions quality

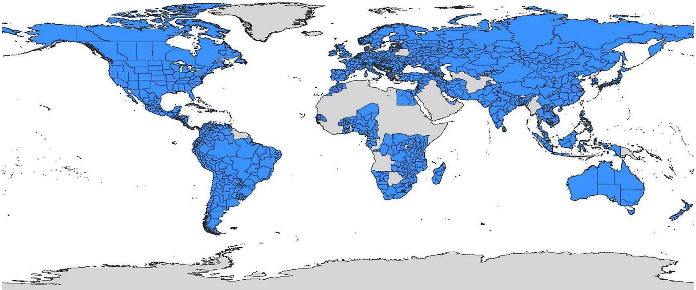

Figure 2: Gennaioli et al. (2013) regional dataset

Regional Market Potential

- The intensity of potential trade interactions between regions is proportional to their market size weighted by their proximity

$$\text{MP}_i = \sum_{j \neq i} y_j \frac{\tilde{y}_j}{\tilde{y}_{\max,c_j}} \tau_{ij} + b \times y_i \frac{\tilde{y}_i}{\tilde{y}_{\max,c_i}} \tau_{ii} \tag{1}$$

  - where y the GDP, $\tilde{y}$ the GDP per capita, τ_{ij} the trade costs, τ_{ii} the internal transport costs, b the border effect

$$\tau_{ii} = \left[\frac{2}{3} \sqrt{\frac{\text{area}_i}{\pi}} \right]^{-1} \tag{2}$$

Regional Market Potential

- Two candidates for trade costs τ_{ij} :

$$\tau_{ij}^{(1)} = \text{haversine distance}_{ij}^{\hat{\beta}_1} \times \left[\mathbb{1}_{\{c_i \neq c_j\}} e^{\hat{\beta}_2 \mathbb{1}_{\text{language}_{ij}} + \hat{\beta}_3 \mathbb{1}_{\text{contig}_{ij}} + \hat{\beta}_4 \mathbb{1}_{\text{colony}_{ij}} + \hat{\beta}_5 \mathbb{1}_{\text{RTA}_{ij}} + \hat{\beta}_6 \mathbb{1}_{\text{currency}_{ij}}} + \mathbb{1}_{\{c_i = c_j\}} e^{\hat{\beta}_7} \right] \quad (3)$$

$$\tau_{ij}^{(2)} = \text{shipment distance}_{ij} \times \left[\mathbb{1}_{\{c_i \neq c_j\}} e^{\hat{\beta}_2 \mathbb{1}_{\text{language}_{ij}} + \hat{\beta}_3 \mathbb{1}_{\text{contig}_{ij}} + \hat{\beta}_4 \mathbb{1}_{\text{colony}_{ij}} + \hat{\beta}_5 \mathbb{1}_{\text{RTA}_{ij}} + \hat{\beta}_6 \mathbb{1}_{\text{currency}_{ij}}} + \mathbb{1}_{\{c_i = c_j\}} e^{\hat{\beta}_7} \right] \quad (4)$$

Regional Market Potential

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$$\tau_{ij}^{(2)} = \left[\kappa_{io}^{\hat{\gamma}_1} \kappa_{od}^{\hat{\gamma}_2} \kappa_{dj}^{\hat{\gamma}_3} \mathbb{1}_{\text{maritime route}} + \kappa_{ij}^{\hat{\gamma}_4} \left(1 - \mathbb{1}_{\text{maritime route}}\right)\right] \times \left[\mathbb{1}_{\{c_i \neq c_j\}} e^{\hat{\beta}_2 \mathbb{1}_{\text{language}_{ij}} + \hat{\beta}_3 \mathbb{1}_{\text{contig}_{ij}} + \hat{\beta}_4 \mathbb{1}_{\text{colony}_{ij}} + \hat{\beta}_5 \mathbb{1}_{\text{RTA}_{ij}} + \hat{\beta}_6 \mathbb{1}_{\text{currency}_{ij}}} + \mathbb{1}_{\{c_i = c_j\}} e^{\hat{\beta}_7}\right] \quad (4)$$

  - where κ is a fine scale grid shortest path example
  - o and d are the origin and destination ports - *data: World Port Index*
  - $\mathbb{1}_{\text{maritime route}} = 1$ if i and j are not accessible via land transportation alone, zero otherwise
  - all coefficients are estimated using CEPII gravity database gravity equation

Empirical Model

- Gennaioli et al. (2013) model:

$$\ln \text{GDPpc}_i = \alpha_1 \text{ inv. dist. coast}_i + \alpha_2 \text{ education}_i + \alpha_3 \ln \text{population size}_i + \alpha_4 \text{ temperature}_i + \alpha_5 \ln \text{oil pc}_i + \zeta_{c(i)} + u_i \quad (5)$$

- This paper's model:

$$\ln \text{GDPpc}_i = \alpha_0 \ln \text{MP}_i^{(h,s)} + \alpha_1 \text{ inv. dist. port}_i + \alpha_2 \text{ education}_i + \alpha_3 \ln \text{population density}_i + \alpha_4 \text{ temperature}_i + \alpha_5 \ln \text{oil pc}_i + \zeta_{c(i)} + u_i \quad (6)$$

- Country fixed effects $\zeta_{c(i)}$ allows within-country investigation and controlling for all countries' unobservable characteristics
- To avoid endogeneity: use the non-local and the foreign market potential indexes as proxy variables

Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
market potential	0.11^{***}	0.09^{***}	0.06^{**}	0.05^{*}	0.07	0.00
	(0.03)	(0.03)	(0.02)	(0.03)	(0.07)	(0.09)
inv. dist. port	0.14^{**}	0.13^{**}	0.14^{**}	0.13^{**}	0.14^{**}	0.13^{**}
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
years education	0.28^{***}	0.28^{***}	0.28^{***}	0.28^{***}	0.28^{***}	0.28^{***}
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
population density	−0.00	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
temperature	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
oil per cap.	0.19^{***}	0.19^{***}	0.19^{***}	0.19^{***}	0.19^{***}	0.19^{***}
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Num. obs.	1464	1464	1464	1464	1464	1464
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Num. groups: code	103	103	103	103	103	103
Adj. R^2 (proj model)	0.43	0.42	0.42	0.42	0.42	0.42
Regressor	$MP^{(h)}$	$MP^{(s)}$	$NLMP^{(h)}$	$NLMP^{(s)}$	$FMP^{(h)}$	$FMP^{(s)}$

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Robust standard errors adjusted for clustering on each country are in parentheses.

Table 1: Regional Development and Market Potential (2005) education endogeneity

Baseline Results: Main Take-Away

- Falsification test: elasticity coefficient, $\alpha_0 = [0.05; 0.1]$, is consistent with theory and empirical literature
  - Theory: should be equal to $\frac{1}{\beta\sigma}$, with β the income labor share and σ the elasticity of substitution between varieties.
    - ★ Reshef & Santoni (2023): $\beta_{2007} = [0.3; 0.7]$
    - ★ Fontagné, Guimbard & Orefice (2020): $\sigma = [5; 20]$
  - Expected $\alpha_0 = [0.07; 0.7]$

The Core-Periphery Divide

- Clustering algorithm to identify core, semi-periphery and periphery regions within countries, with respect to their GDP

$$\ln \text{GDPpc}_i = \delta_1 \ln \text{MP}_i^{(h,s)} + \delta_2 \ln \text{MP}_i^{(h,s)} \times \mathbb{1}_{\text{semi-periphery}} + \delta_3 \ln \text{MP}_i^{(h,s)} \times \mathbb{1}_{\text{periphery}} + \sum_{k=1}^{5} \alpha_k X_i^{(k)} + \zeta_{c(i)} + u_i \quad (7)$$

  - δ_1 elasticity coefficients for core regions
  - δ_3 the difference in the elasticity coefficients between core and periphery regions

Stylized facts

On average, within countries, periphery regions have a 62% lower GDPpc than core regions, and a 30% lower market potential.

The Core-Periphery Divide Results

	(1)	(2)	(3)	(4)	(5)	(6)
market potential	0.12^{***}	0.10^{***}	0.08^{***}	0.07^{***}	0.09	-0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.08)
market potential $\times \mathbb{1}_{\text{semi-periphery}}$	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
market potential $\times \mathbb{1}_{\text{periphery}}$	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Num. obs.	1460	1460	1460	1460	1460	1460
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Num. groups: code	101	101	101	101	101	101
Adj. R^2 (proj model)	0.47	0.47	0.47	0.47	0.46	0.46
Regressor	$MP^{(h)}$	$MP^{(s)}$	$NLMP^{(h)}$	$NLMP^{(s)}$	$FMP^{(h)}$	$FMP^{(s)}$

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Robust standard errors adjusted for clustering on each country are in parentheses.

Table 2: Regional Development and Market Potential (2005) - Core and Periphery

Core-Periphery Divide Results: Main Take-Away

- The periphery is less sensitive than the core
  - suggests higher β and/or higher σ
- Policy implication
  - would require substantial investments in transport infrastructure to foster regional development in the periphery and narrow the gap with the core.

Conclusion: Main Take-Aways

- Falsification test:
  - elasticity coefficient, $\alpha_0 = [0.05; 0.1]$, is consistent with theory and empirical literature
- New result:
  - heterogenous elasticity within countries: the periphery is less sensitive than the core
- Results are robust to panel data (1995, 2000, 2005)
- Other results:
  - results led by middle-income countries than in high- and low-income countries.
  - centrality/proximity to foreign cores hurts the national periphery results
    - ★ Is it capturing import competition? Is the periphery a consistent loser from trade?
    - ★ Effect significant for centrality to foreign cores with no FTA $\rightarrow$ Is it depicting the border shadow?

Thank you for your attention

Gabrielle Gambuli
gabrielle.gambuli@cyu.fr
gambuligabrielle.github.io

Shipment distance example

- i = Guildford, o = Portsmouth, d = Le Havre, j = Cergy

Figure 3: Guildford to Cergy back

Maritime distance examples back

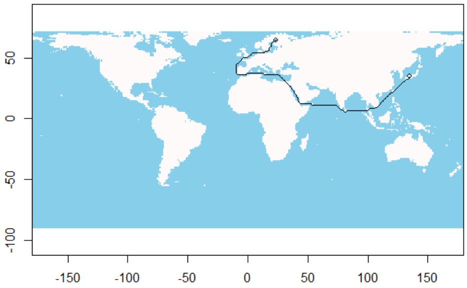

Figure 4: Finland to Japan

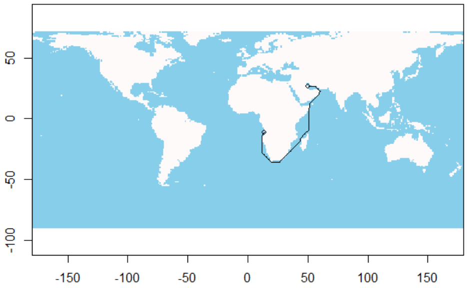

Figure 5: Saudi Arabia to Angola

Gravity Equation

- The gravity equation is estimated in cross-section (2005) as follows:

$$\begin{aligned} \ln \tilde{\text{TF}}_{ij} &= \beta_1 \ln \text{dist}_{ij}^{(\text{haversine})} + \beta_2 \mathbb{1}_{\text{lang}_{ij}} + \beta_3 \mathbb{1}_{\text{contig}_{ij}} + \beta_4 \mathbb{1}_{\text{colony}_{ij}} \\ &\quad + \beta_5 \mathbb{1}_{\text{RTA}_{ij}} + \beta_6 \mathbb{1}_{\text{curr}_{ij}} + \delta_i + \delta_j + \epsilon_{ij} \end{aligned} \tag{8}$$

$$\begin{aligned} \ln \tilde{\text{TF}}_{ij} &= \gamma_1 \ln \text{dist}_{io}^{(\text{land, from exporter to origin port})} \mathbb{1}_{\text{maritime route}} \\ &\quad + \gamma_2 \ln \text{dist}_{od}^{(\text{sea, between ports})} \mathbb{1}_{\text{maritime route}} \\ &\quad + \gamma_3 \ln \text{dist}_{dj}^{(\text{land, from destination port to importer})} \mathbb{1}_{\text{maritime route}} \\ &\quad + \gamma_4 \ln \text{dist}_{ij}^{(\text{land})} (1 - \mathbb{1}_{\text{maritime route}}) \\ &\quad + \beta_2 \mathbb{1}_{\text{lang}_{ij}} + \beta_3 \mathbb{1}_{\text{contig}_{ij}} + \beta_4 \mathbb{1}_{\text{colony}_{ij}} + \beta_5 \mathbb{1}_{\text{RTA}_{ij}} + \beta_6 \mathbb{1}_{\text{curr}_{ij}} + \delta_i + \delta_j + \epsilon_{ij} \end{aligned} \tag{9}$$

- $\tilde{\text{TF}}_{ij} = \text{TF}_{c_i c_j} \times \frac{y_i}{y_{c_i}} \times \frac{y_j}{y_{c_j}}$
- $\hat{\beta}_1 = -1.18$; $\hat{\beta}_2 = 0.66$; $\hat{\beta}_3 = 1.12$; $\hat{\beta}_4 = 1.37$; $\hat{\beta}_5 = 0.47$; $\hat{\beta}_6 = 0.79$; $\hat{\beta}_7 = 1.96$; $\hat{\gamma}_1 = -0.07$; $\hat{\gamma}_2 = -0.96$; $\hat{\gamma}_3 = -0.06$; $\hat{\gamma}_4 = -1.00$. back

Education proxy: average eduction of old (+65 years old)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
market potential	0.16^{**}	0.16^{**}	0.11^{**}	0.11^{**}	0.03	-0.02
	(0.06)	(0.07)	(0.05)	(0.06)	(0.12)	(0.10)
education +65 years old	0.22^{***}	0.22^{***}	0.22^{***}	0.22^{***}	0.22^{***}	0.22^{***}
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
Num. obs.	607	607	607	607	607	607
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Num. groups: code	39	39	39	39	39	39
Adj. R^2 (proj model)	0.38	0.37	0.37	0.37	0.36	0.36
Regressor	$MP^{(h)}$	$MP^{(s)}$	$NLMP^{(h)}$	$NLMP^{(s)}$	$FMP^{(h)}$	$FMP^{(s)}$

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Robust standard errors adjusted for clustering on each country are in parentheses.

Table 3: Regional development and Market Potential - Education of old back

Centrality to cores

	(1)	(2)
$\text{centrality}^{\text{domestic cores}} \times \mathbb{1}(\gamma_g = \text{core})$	0.31^{***}	0.31^{**}
	(0.11)	(0.15)
$\text{centrality}^{\text{domestic cores}} \times \mathbb{1}(\gamma_g = \text{semi-periphery})$	0.02	0.02
	(0.02)	(0.02)
$\text{centrality}^{\text{domestic cores}} \times \mathbb{1}(\gamma_g = \text{periphery})$	0.05^{**}	0.06^{*}
	(0.02)	(0.03)
$\text{centrality}^{\text{foreign cores}} \times \mathbb{1}(\gamma_g = \text{core})$	-0.18	
	(0.13)	
$\text{centrality}^{\text{foreign cores}} \times \mathbb{1}(\gamma_g = \text{semi-periphery})$	-0.32^{**}	
	(0.14)	
$\text{centrality}^{\text{foreign cores}} \times \mathbb{1}(\gamma_g = \text{periphery})$	-0.33^{**}	
	(0.15)	
$\text{centrality}^{\text{foreign cores, no FTA}} \times \mathbb{1}(\gamma_g = \text{core})$		-0.23
		(0.25)
$\text{centrality}^{\text{foreign cores, no FTA}} \times \mathbb{1}(\gamma_g = \text{semi-periphery})$		-0.30
		(0.19)
$\text{centrality}^{\text{foreign cores, no FTA}} \times \mathbb{1}(\gamma_g = \text{periphery})$		-0.30^{**}
		(0.15)
$\text{centrality}^{\text{foreign cores, FTA}} \times \mathbb{1}(\gamma_g = \text{core})$		-0.06
		(0.12)
$\text{centrality}^{\text{foreign cores, FTA}} \times \mathbb{1}(\gamma_g = \text{semi-periphery})$		-0.11
		(0.11)
$\text{centrality}^{\text{foreign cores, FTA}} \times \mathbb{1}(\gamma_g = \text{periphery})$		-0.12
		(0.12)
Num. obs.	1460	1392
Num. groups: code	101	97
Adj. R^2 (proj model)	0.32	0.33

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. Robust standard errors adjusted for clustering on each country are in parentheses.

Table 4: Regional Development, the Core and Periphery, and Centrality to cores back