Second Nature Geography and Regional Income Disparities in Colombia

JESUS LOPEZ-RODRIGUEZ and MARIA CECILIA ACEVEDO-VILLALOBOS
HARVARD UNIVERSITY AND KENEDY SCHOOL OF GOVERNMENT

Structure of the Presentation

- 1. Introduction
- 2. The model
- 3. Model implementation and market access measure
- 4. Empirical results
- 5. Concluding remarks

1. Introduction

•New Economic Geography (Spatial Economics, Economic Agglomeration, General Equilibrium Framework)

•Different levels of Agglomeration

1. At global scale (see Map 1)
    1. NAFTA, EU and East Asia (83% world GDP in the year 2000, 70% in 1980)

2. In big market areas (see Map 2)
    1. *European Blue Banana* concentrates (20% area, 40% GDP and 50% population)
    2. US manufacturing belt

3. At Country Level
    1. In France (Ille de France) (2,2% area, 18,9 % population, 30% GDP)
    2. São Paulo (over 18 million people in its metropolitan area,15% of Brazilian GDP)

4. At Industrial district Level
    1. Toyota city in Japan, Detroit in US
    2. Sillicon Valley (see Map 4)

5. In large commercial districts
    1. Montparnasse in Paris
    2. Ginzo in Tokio
    3. Soho in London

6. At the lowest level
    1. Clothing Shops in Oxford Street (UK) (see Map 5)
    2. 5 Avenue in NY

What are the driving forces of agglomeration?

- Marshall (1890) identified three sources of agglomeration

    1. Knowledge spillovers
    2. Thick labour market in localized industries
    3. Forward and backward linkages associated with large markets

- NEG falls in the 3rd type of Marshallian externalities
- An economic model of agglomeration should explain both concentration (Centripetal Forces) and dispersion (Centrifugal Forces)

- Building blocks in NEG
    1. Increasing returns to scale
    2. Imperfect competition
    3. Transport costs
    4. Locational movement of productive factors and consumers

- Core-periphery model of NEG (Krugman 1991)
- Basic features of this model
  - 2x2x2 model (2 regions, 2 productions sectors, 2 types of labour-workers and farmers)
  - Manufacturing sector (horizontally differentiated product, IRS, workers)
  - Agricultural sector (homogeneous good, CRS, farmers)
  - Workers are mobile, farmers are immobile
  - Trade of manufactures involves a Transport Cost
  - Centrifugal force (immobile farmers)
  - Centripetal force
    1. larger number of firms locate in a region….more varieties….workers … ….better access to a greater number of varieties….. ……. get a higher real income….. more workers to migrate towards this region
    2. The increase in the number of workers….larger market in the region…. **scale economies**…..incentive to concentrate the production of each variety in only one region…**transport cost**…. production in the region that offers a larger market….
    3. **Circular causation of** forward and backward linkages
  - If forward and backward linkages are higher than centrifugal forces the economy will end up with a core-periphery pattern

Can New Economic Geography explain Regional Disparities in Colombia?

1. Stilized facts in Colombia?

a) Income disparities in Colombia are quite large
b) PC GDR in Bogota is more than twice as high as the national average
c)The spatial distribution of pc GDR in Colombia shows a strong core-periphery gradient (see Map 6)

2. Economic Growth theory gives explanations but are a-geografical in nature

3. NEG provides a conceptual framework within which the geographical structure of production and income levels can be analysed explicitly

- Our paper provides an explanation of regional disparities in the Colombian Departamentos using a NEG framework

- Why this investigation is important?

  - Contributes to the empirical literature in NEG testing one of the predictions of the model (wage equation)

  - Emphasizes the role of remoteness (market access) in avoiding regional wage differences to be bid away and so in acting as a penalty for economic convergence of income levels

- Main Contributions

  - Confirm the theoretical predictions of the model
  - Emphasizes de role of SNG in the explanation of per capita differences among the Colombian departamentos

2. The model

ü Reduced version of an Economic geography
- R localizations
- Manufacturing sector
  1. Increasing returns to scale
  2. Diferentiated goods
  3. Manufacturing goods are use only in consumption

ü Demand
- Final demand in localization j:

$$\max_{x_{i,j}} U_j = \left[\sum_{i=1}^{R} n_i x_{i,j}^{\frac{s-1}{s}} \right]^{s/s-1} \quad s.t. \quad \sum_{i=1}^{R} n_i x_{i,j} p_{i,j} = Y_j$$

- n_i Number of firms in localization i
- $x_{i,j}$ consumption in j of variety produced i
- s Elasticity of substitution among varieties
- $P_{i,j}$ Price of varieties produced in i and sold in j $P_{i,j} = p_i T_{i,j}$
- Y_j Total income in localization j

– Final demand facing a firm in i from localization j

$$x_{i,j} = p_{ij}^{-s} \left[\sum_{n=1}^{R} n_n p_{nj}^{1-s} \right]^{-1} Y_j$$

– Price index for manufacturing goods and rewriting consumption expenditure

$$P_j = \left[\sum_{n=1}^{R} n_n p_{nj}^{1-s} \right]^{\frac{1}{1-s}} \qquad E_j = Y_j$$

– Final demand in localization j:

$$x_{ij}^{cons} = p_{ij}^{-s} P_j^{s-1} E_j$$

– To x_{ij}^{cons} arrive to j, $T_{i,j} x_{ij}^{cons}$ must be shipped
– Effective demand facing a firm in i from j is:

$$x_{ij} = T_{ij} p_{ij}^{-s} P_j^{s-1} E_j = p_i^{-s} T_{ij}^{1-s} P_j^{s-1} E_j$$

Supply side:

A representative country i firm maximizes the following profit function

$$\prod_i = \sum_{j=1}^{R} \frac{P_{i,j} X_{i,j}}{T_{i,j}} - w_i^a u_i^{1-a} (F + x_i)$$

- F fixed input requirement
- w_i Salary
- u_i Other primary factors
- $T_{i,j}$ iceberg transport costs
- $P_{i,j}$ Price of goods produced in i and sold in j
- $x_i \equiv \sum_j x_{i,j}$ total output of the firm

The first order conditions for profit maximization

$$P_i = \frac{s}{s-1} w_i^a u_i^{1-a}$$

Substituting this pricing rule into the profit function we obtain the following expression for the equilibrium profit function

$$\Pi_i = \left(\frac{P_i}{s} \right) [x_i - (s-1)F]$$

In order to break the firm's output must equal $\bar{X} = (s-1).F$

The price needed to sell this many units satisfies $P_i^s = \frac{1}{\bar{x}} \sum_{j=1}^{R} E_j G_j^{s-1} T_{i,j}^{1-s}$

Combining the expression in last equation with the fact that, in equilibrium prices are a constant mark-up over marginal costs we obtain the following zero-profit condition

$$\left[\left(\frac{s}{s-1}\right)w_i^a u_i^{1-a}\right]^s = \sum_{j=1}^{R} E_j G_j^{s-1} T_{i,j}^{1-s} \qquad \textit{wage equation}$$

The wage equation can be rewritten as

$$w_i = A(MA_i)^{\frac{1}{as}} u_i^{\frac{-b}{a}}$$

$$A = \left(\frac{s}{s-1}\right)^{\frac{-1}{a}}$$

$$MA_i = \sum_{j=1}^{R} E_j G_j^{s-1} T_{i,j}^{1-s}$$

meaning of the equation: “high market access locations have relatively high wages”

3. Econometric specification and Regional System

The results that are obtained from the theoretical model can be tested by using the following regression equation

$$\log(w_i) = q + s^{-1}\log\left[MA_i\right] + h_i$$

This equation allows us to check if there is a spatial wage structure in the EU, i.e. whether there is a positive correlation between manufacturing wages and distance from large consumer markets

In order to control for the potential existence of other shocks to the dependent variable that are correlated with measures of economic geography

$$Lnw_i = q + s^{-1}\ln MA_i + \sum_{n=1}^{N} g_n X_{i,n} + h_i$$

3.1 Data and Regional System

Dependent variable:

Independent variables:
Market Access (MA): proxy for access to sources of expenditure.
We compute market access as a distance weighted sum of regional GDPs:

$$MA_i = \sum_{j=i}^{n} \frac{GDR_j}{d_{i,j}}$$

GDRj Gross Departamental Revenue of region j
dij Distance between i and j
n Measures the number of regions considered

Methodology:
GIS
Colombian Departamentos
Data .....

4. Empirical Results

A.1 Cross-section regressions – MA based on (log) Gross Department Product

	Gross Department Revenue (in logs)			
	1985	**1990**	**1995**	**2000**
	(1)	**(2)**	**(3)**	**(4)**
Constant	5.33	5.79	6.22	6.20
	(2.21)**	(2.38)**	(2.67)**	(2.67)**
Market Access based on the Gross Department Product (log)	0.63	0.62	0.62	0.63
	(0.22)***	(0.20)***	(0.21)***	(0.20)***
N	24	24	24	24
R^2	0.27	0.28	0.27	0.29

Note: Standard error robust to heteroskedasticity in parentheses

*: Statistically significant at the 10% level

**: Statistically significant at the 5% level

***: Statistically significant at the 1% level

A.2 Cross-section regressions – MA based on (log) Gross Department Revenue

	Gross Department Revenue per capita (in logs)			
	1985	**1990**	**1995**	**2000**
	(1)	**(2)**	**(3)**	**(4)**
Constant	5.61	6.48	6.48	7.51
	(1.45)***	(1.70)***	(1.70)***	(1.87)***
Market Access based on the Gross Department Revenue (log)	0.60	0.56	0.55	0.54
	(0.15)***	(0.15)***	(0.16)***	(0.14)***
N	24	24	24	24
R^2	0.27	0.28	0.26	0.29

Note: Standard error robust to heteroskedasticity in parentheses
*: Statistically significant at the 10% level
**: Statistically significant at the 5% level
***: Statistically significant at the 1% level

B. Pooled OLS

	Gross Department Revenue per capita (in logs)			
	(1)	**(2)**	**(3)**	**(4)**
Constant	2.65	2.84	3.52	3.82
	(0.084)***	(0.085)***	(0.30)***	(0.30)***
Market Access based on the Gross Department Product (log)	0.90		0.84	
	(0.007)***		(0.022)***	
Market Access based on the Gross Department Revenue (log)		0.89		0.82
		(0.008)***		(0.021)***
Roads (log)			0.11	0.11
			(0.021)***	(0.021)***
Secondary education (log)			0.19	0.20
			(0.075)**	(0.077)***
N	624	624	384	384
R^2	0.95	0.95	0.90	0.90

Note: Standard error robust to heteroskedasticity in parentheses
*: Statistically significant at the 10% level
**: Statistically significant at the 5% level
***: Statistically significant at the 1% level

C. Fixed effects regressions

Estimating equation: $$Lnw_{idt} = q + s^{-1} \ln MA_{idt} + \sum_{t=1975}^{2000} b_t + h_i + e_{idt}$$

	Gross Department Revenue per Capita (logs)			
	(1)	**(2)**	**(3)**	**(4)**
Market Access based on the Gross Department Product (log)	0.91 (0.006)***	1.49 (0.60)**		
Market Access based on the Gross Department Revenue (log)			0.90 (0.006)***	1.63 (0.53)***
Time fixed effects	no	yes	no	yes
Department fixed effects	yes	yes	yes	yes
F calc under H_0 that time fixed effects are all equal to zero (p-value)		0.000		0.000
N	624	624	624	624
R^2	0.95	0.92	0.95	0.91

Note: Standard error robust to heteroskedasticity in parentheses
*: Statistically significant at the 10% level
**: Statistically significant at the 5% level
***: Statistically significant at the 1% level

5. Concluding Remarks

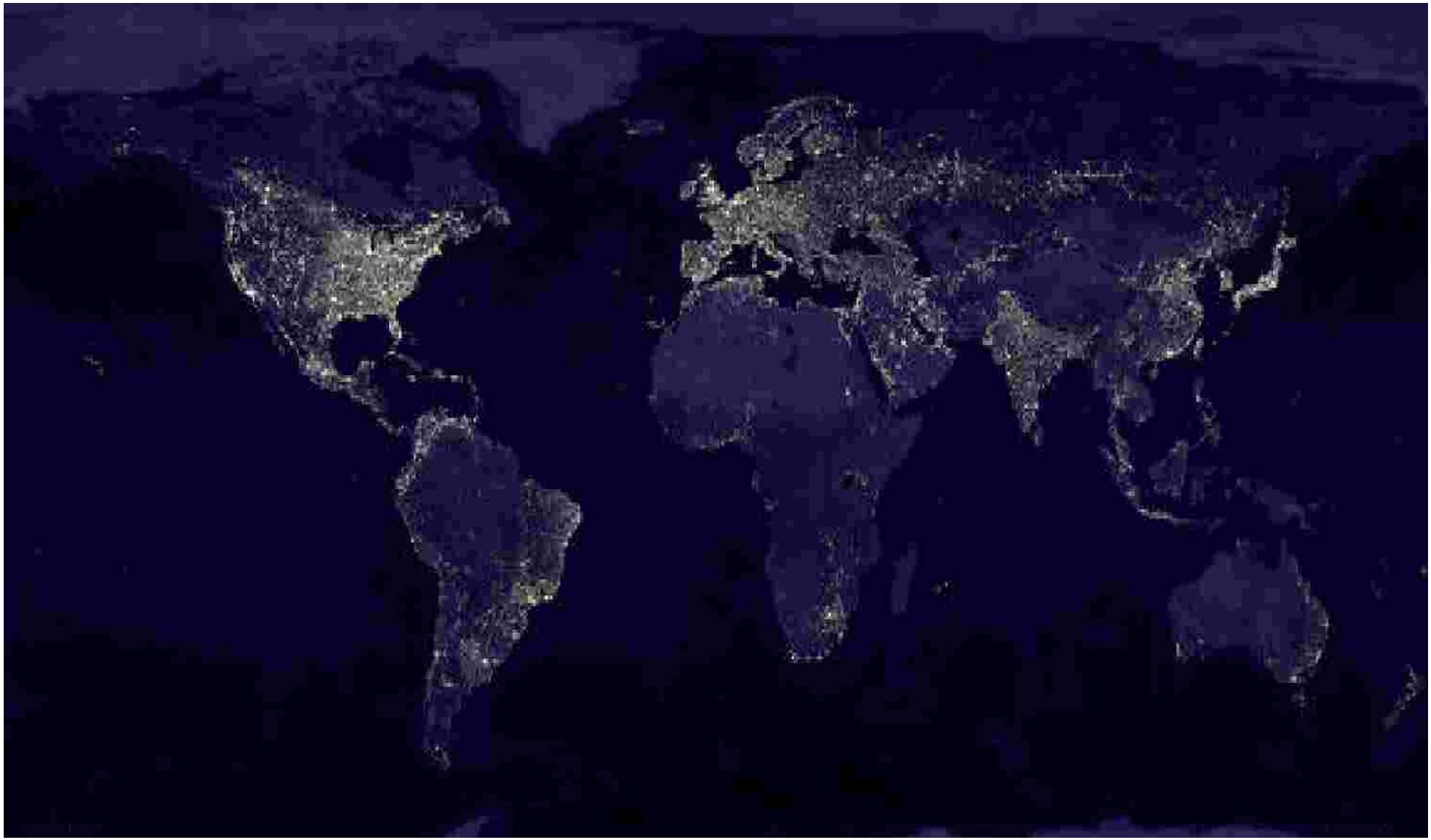
- The results suggest the importance of the geography of access to markets in determining the spatial distribution of income across Colombian departamentos

- From our estimations, it is possible to conclude that an increase in market access by 1%, is associated with an improvement of between 0.90% and 1.60% in nominal wages, depending on the assumptions
- Economic geography may not be the only cause that explains why Departments located in the periphery have not converged to the central Departments in terms of economic outcomes. History, political decisions, and the lack of a true State policy should also explain the poor economic performance of these regions (Meisel, 2007).

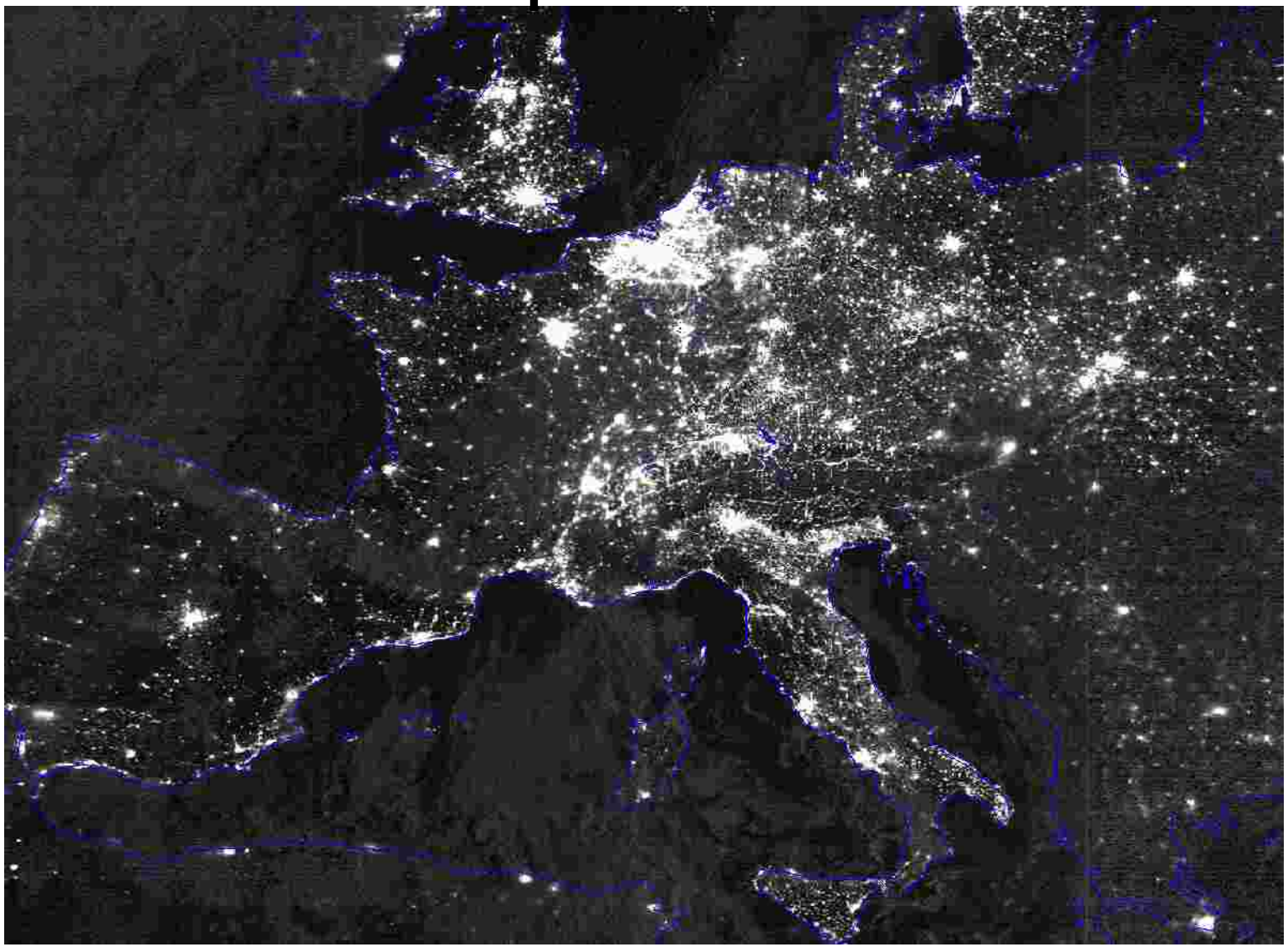
Thank you.....

Questions, comments.....

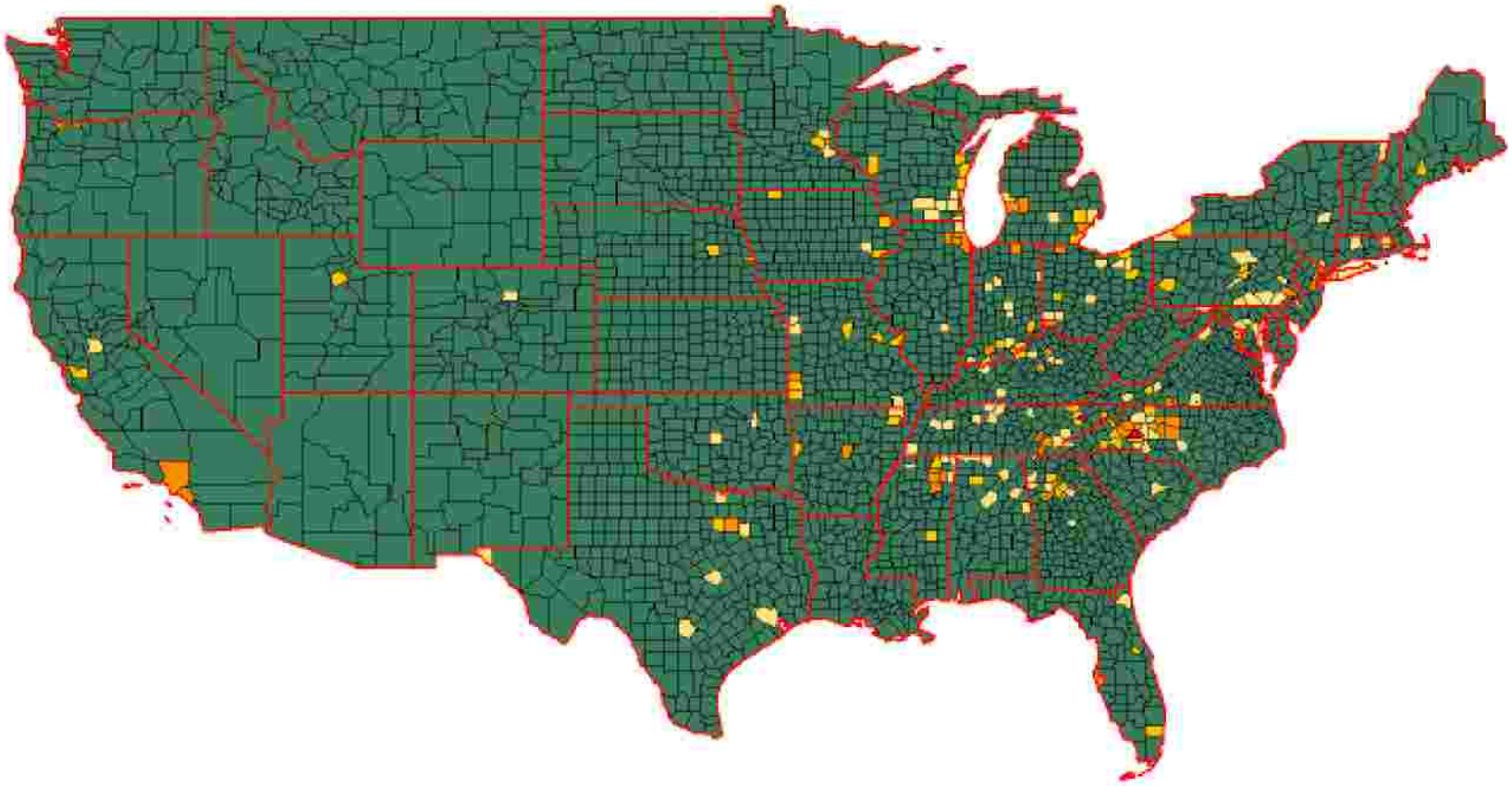
Map 1: Core-Periphery Pattern at Global Scale



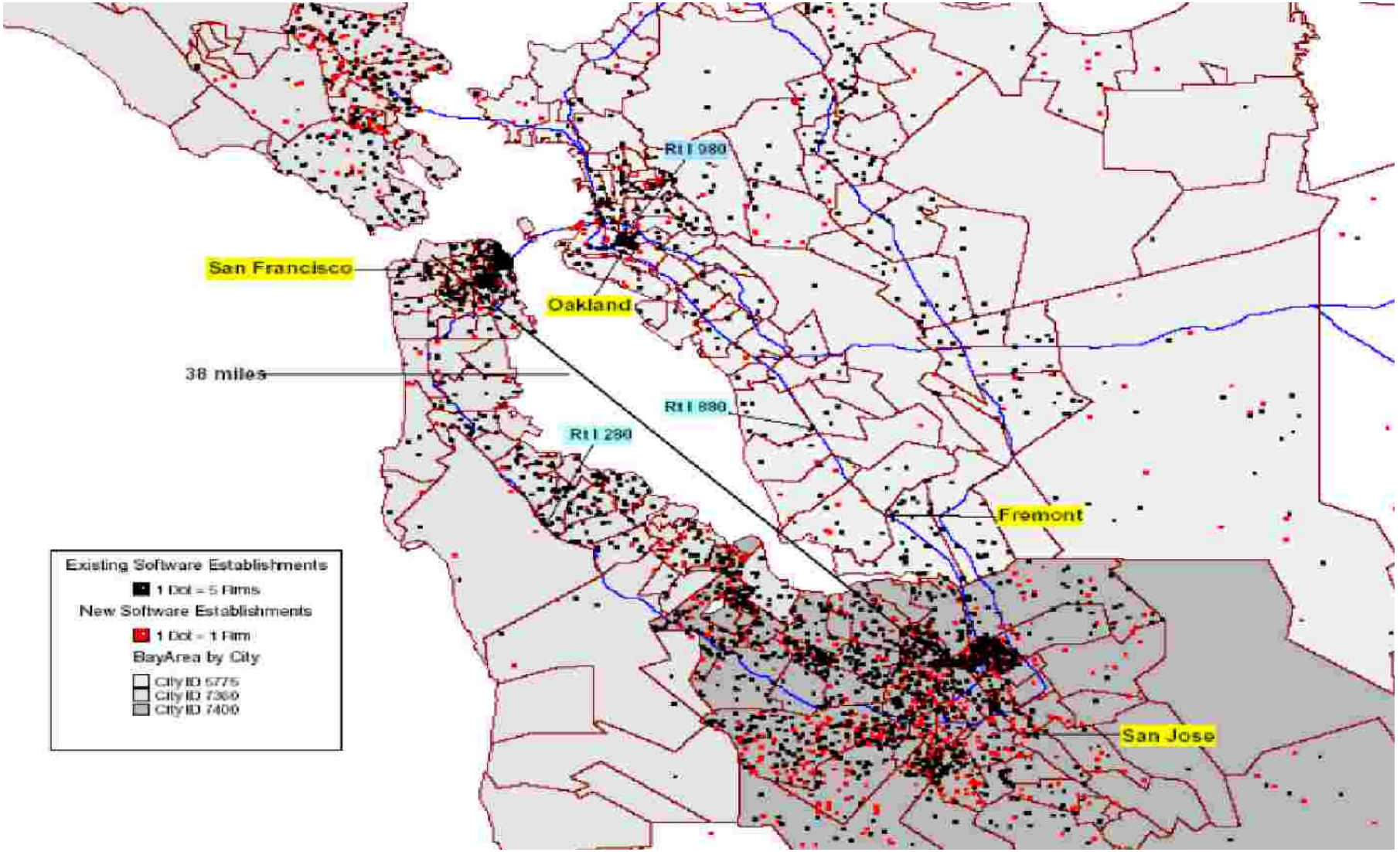
Map 2: Core-Periphery Pattern at European level



Map 3: Employment in Furniture Industry in US



Map 4: Software Stablishments in San Francisco



Map 5: Clothing Shops

Map 6:Per Capita GDR and distance from Colombia