Firm Sorting and Agglomeration
Cecile Gaubert, 2018

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Contents

The author develops a theory of location choice of heterogeneous firms in a variety of sectors across cities

Effects on aggregate TFP and welfare

Research question

How much of the productivity advantage of a region is shaped by efficiency of the firms it attracts?

- Aggregate impact of altering location choice of heterogeneous firms

Framework

Decompose productivity advantage into:

1. Advantages by density
2. Endogenous sorting of more productive firms

-> Evaluate the general equilibrium effect of spatial policies

Findings

Policies that subsidize smaller cities can have negative aggregate effects, and do not necessarily reduce spatial disparities

- Firms have higher revenues in larger cities, but not necessarily higher employment
- Labor intensive sectors locate in small cities, where wages are lower
- Differences in productivity induce sorting across city sizes
- Heterogeneous firms in large cities benefit from stronger agglomeration forces

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Literature review

1 Henderson (1974)

General theory of mobile heterogeneous firms

2 Behrens et al. (2014)

Spatial sorting of entrepreneurs who produce non-tradable intermediates

3 Eeckhout (2014), Davis and Dingel (2012)

Spatial sorting of workers who differ in skill level -> wage inequality

4 Combes (2012)

Productivity advantage of firms in larger cities driven by selection of larger cities

5 Duranton and Pugna (2001)

Lifecycle model of firm location -> urban diversity

6 Desmet et al (2013)

Welfare implications of spatial equilibrium -> measures agglomeration externalities

7 Rosenthal et al (2004)

Impact of sorting across space on wage distribution

8 Kline and Moretti (2014)

Methodology to estimate aggregate effects

9 Glaeser et al (2008)

Economic impact of place-based policies

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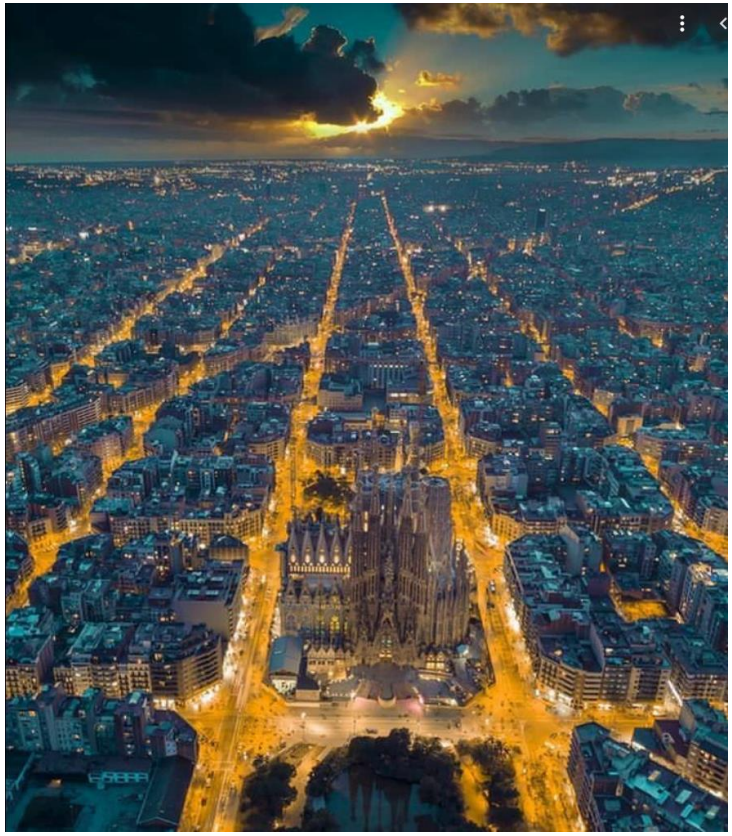
A model of the location of choice of heterogeneous firms

Key assumptions



01 Production takes place in cities

02 Cities are constrained in land supply

03 Economy is composed of a variety of sectors

04 Heterogeneous firms in productivity

05 Local labor and traded capital

06 Non-market interactions within cities results in positive agglomeration externalities

Set-up of the problem and agent's problem

		Problem	Objective
01	Cities	$h^S = \gamma^b \left(\frac{\ell}{1-b}\right)^{1-b}.$	Housing construction explained by land and local labor
02	Workers	$U = \left(\frac{c}{\eta}\right)^{\eta} \left(\frac{h}{1-\eta}\right)^{1-\eta},$	Max utility by consuming housing and a bundle of goods
03	Firms	$y_j(z,L) \;=\; \psi(z,L,s_j)\; k^{\alpha_j}\; \ell^{1-\alpha_j},$	Production for each heterogeneous firm (z) by using labor and capital input factors, and capital intensity
04	Firm sorting	$\frac{\psi_2(z,L,s_j)\,L}{\psi(z,L,s_j)} = (1-\alpha_j)\,b\,\frac{1-\eta}{\eta}$	Firm choose city size choosing the elasticity of productivity to city size equal to the elasticity of labor cost relative to city size
05	City developers	$\max_{\{T_j(L)\}_{j\in 1,\ldots,S}} \Pi_L = b(1-\eta)w(L)L - \sum_{j=1}^{S} \int_z T_j(L)\pi_j(z,L)\,\mathbb{1}_j(z,L)dF_j(z),$ such that $\mathbb{1}_j(z,L)=1$ if firm z chooses their city, $\mathbb{1}_j(z,L)=0$ otherwise.	Max subsidies for landowner profits given aggregate firm's efficiencies
06	Welfare properties in equilibrium	$\frac{\psi_2(z,L,s)L}{\psi(z,L,s)} = b\frac{1-\eta}{\eta}(1-\alpha)\chi(z),$	Location choice of firm to maximize welfare given firm's location, firm's employment, firm's production and consumption and location of workers

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Estimation of the model

01 **Data**: Firm-level data set of French firms: balance sheets for all firms with revenues over 730K euros. Contains geographic location at postal code level which are mapped to 314 French commuting zones.

03 **Structural estimation - Specification:** Econometric specification where a_j measure the strength of agglomeration externalities

$$\log(\psi_j(z_i, L; s_j, a_j)) = a_j \log L + \log(z_i)(1 + \log \frac{L}{L_o})^{s_j} + \epsilon_{i,L} \quad for\ \log(z_i) \geq 0\ and\ L \geq L_o$$

$$\log(\psi_j(z_i, L; s_j, a_j)) = 0 \quad for\ L < L_o$$

More details in next slide

02 **Descriptive evidence on sorting**:

- Elasticity of firm revenues to city size: **positive**
- Elasticity of firm employment to city size: **lower, it could be negative**

$$share_j = \beta_0 + \beta_1 \alpha_j^K + \beta_2 X_j + \epsilon_j,$$

- Industries that use more tradable capital are more likely to be located in larger cities
- Firms that locate in large cities benefit disproportionally from agglomeration externalities

$$\Delta_t \text{City Size}_i = \alpha + \beta \omega_{ijt} + X_{it} + \epsilon_{it}$$

- Firms initially larger tend to move into larger cities

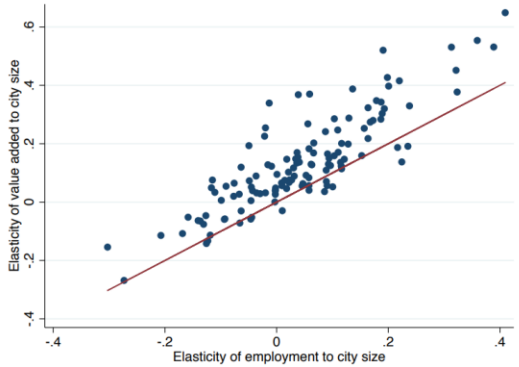
04 **Structural estimation - Procedure:** Estimation done through two stages:

1. Calibrate for each industry its capital intensity and elasticity of substitution
2. Use a simulated method of moments to estimate the firm's choice of city size

The author tests three sets of non-parametric moments and model fit. Results are consistent.

Sorting evidence shows that it accounts for half of the productivity gains

Figure 1: Elasticity of mean value added and employment with city size.



Note: This figure plots for β in the regression: $\log \text{mean va}(L_i) = \alpha + \beta \log L_i + \epsilon_i$ against β in the regression β: $\log \text{mean empl}(L_i) = \alpha + \beta \log L_i + \epsilon_i$, ran sector by sector at the NAF600 level for industries with more than 200 mono-establishment firms.

Effects of sorting into agglomeration forces:

- Literature shows **Elasticity of observed firm productivity to city size** ranges from 3-8%
- Using French data author finds elasticity value of 4.2%. While the counterfactual data is 2.3%

-> Firm **sorting** accounts for almost **half of the productivity gains** measured in equilibrium between cities and different sizes.

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Evaluation of the general equilibrium impact of a set of placed-based policies

1. Tax incentives

Hypothesis: In presence of agglomeration externalities, attracting more economic activity can locally create more agglomeration externalities enhancing local TFP and attracting even more firms.

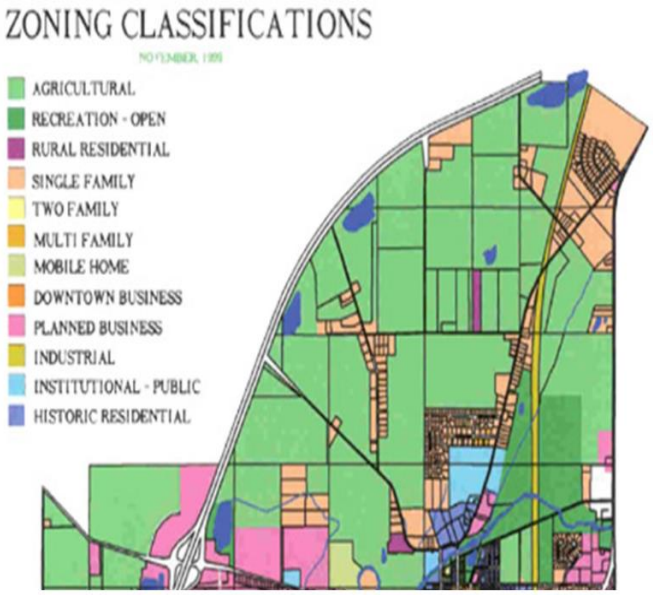
Effect -> Ambiguous. Depends shape of agglomeration externalities:

- Smaller cities benefit from policies

- Larger cities may marginally lose resources

- **Local effects:** Large effects of subsidizing small cities on targeted areas. *Results*: Growth of number of establishments by 19%.
- **Aggregate effects:** Negative long-run effects on: **TFP** and **welfare**. Mid-size cities become less attractive than larger cities. Equilibrium:
    i. Growth in the size of smaller cities
    ii. Decrease population of mid-size cities

Evaluation of the general equilibrium impact of a set of placed-based policies



2. Land regulation

Hypothesis: Literature argue against zoning regulation.

Rationale: They may increase the quality of life for existing residents (commercial zones, building height)

Effect: They dampen the agglomeration effects on the economy. Effects on welfare:

i. Housing sector becomes more productive and housing supply increases

ii. Increase in housing supply flattens out the wage growth

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The way firms sort across cities of different sizes is relevant for understanding aggregate outcomes

The model built is helpful to conduct policy analysis. Main conclusions:

- A policy that targets firms locating in the least productive cities tends to hamper productivity of economy as a whole.
- Policies that encourage the growth of all cities can enhance equilibrium productivity and welfare.