Optimal Spatial Policies, Geography, and Sorting by Pablo Fajgelbaum and Cecile Gaubert

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Research objective

- Characterize (theoretically and quantitatively) optimal (labor market taxes/subsidies and consumption transfers) policies across cities - when the economic environment has both production and consumption externalities.

Plan of this presentation

1. Example (with representative agent and no trade across cities) which gives it away.
2. General model - detailed notation - no formal discussion of results.
3. Data and quantitative exercise.

Example that gives it away

- $j \in J$ cities with homogeneous agents,
- Utility with amenity externality, e.g., congestion:

$$u_j = a_j c_j, \;\; a_j = A_j L_j^{\gamma_A};$$

- Per-worker production with production externality, e.g., spillovers, returns to scale:

$$z_j = Z_j L_j^{\gamma_P}$$

- Aggregate labor L given.

Example that gives it away

- Eq'm allocation with free mobility of labor across cities $i, j \in J$: $u_j = u_i$ - but then by feasibility $c_j = z_j$, and hence

$$a_j z_j = a_i z_i$$

- Optimal allocation (identical weights) of L between $i, j \in J$:
  - with no consumption transfers (Kline and Moretti, 2014), i.e., $c_j = z_j$:

$$a_j z_j = a_i z_i;$$

  - with consumption transfers $t_j = c_j - z_j$:

$$z_i = z_j, c_i = c_j.$$

Example that gives it away

- Formally, at the eq'm allocation:

$$\frac{du}{u} = (\gamma^P + \gamma^A)(z_i - z_j)\frac{dL}{Y}$$

  where du is change in utility in i (keeping j's constant) and dL is labor movement from j to i.

- Intuitively, at the eq'm allocation:
  - if $z_i > z_j$, then $a_i < a_j$ (so that $u_i = u_j$ at $c_j = z_j$) ;
  - if $(\gamma^P + \gamma^A)$ (positive production externality stronger than negative congestion externality);
  - then moving labor to more productive city i ($dL > 0$) with transfer $t_i > 0$ (compensating for congestion) is Pareto improving.

The general model

- $j \in J$ cities, and $\theta \in \Theta$ labor types (high/low skills); with $L^\theta = \sum_j L_j^\theta$, given;
- Utility:
$$u_j^\theta = a_j^\theta(L_j^1, \ldots, L_j^\Theta) U(c_j^\theta, h_j^\theta);$$
- Production:
$$Y_j = Y_j(N_j^Y, I_j^Y), H_j = H_j(N_j^H, I_j^H)$$
with
$$N_j^Y + N_j^H = N(z_j^1 L_j^1, \ldots, z_j^\Theta L_j^\Theta), \quad z_j^\theta = z_j^\theta(L_j^1, \ldots, L_j^\Theta);$$
- Feasibility:
$$H_j(N_j^H, I_j^H) = \sum_\theta L_j^\theta h_j^\theta,$$
and
$$Y_j(N_j^Y, I_j^Y) = \sum_i d_{ji} Q_{ji}, \quad Q(Q_{1i}, \ldots, Q_{Ji}) = \sum_\theta L_i^\theta c_i^\theta + I_i^Y + I_i^H$$

The general model: Commodity space/Prices

- Consumption, P_j;
- Rental housing , R_j;
- Domestic tradable commodity, p_j, such that $P_i \frac{\partial Q(Q_{1i},\ldots,Q_{Ji})}{\partial Q_{ji}} = d_{ji} p_j$;
- Wage, $w_j^\theta = W_j \frac{\partial N(z_j^1 L_j^1,\ldots,z_j^\Theta L_j^\Theta)}{\partial L_j^\theta}$, where W_j is wage per efficiency unit.

The general model: Implementation result

- Let production and amenities cross-spillover elasticities be defined by:

$$\gamma^{P,j}_{\theta,\theta'} = \frac{L^\theta_j}{z^{\theta'}_j}\frac{\partial z^{\theta'}_j}{\partial L^\theta_j}, \quad \gamma^{A,j}_{\theta,\theta'} = \frac{L^\theta_j}{a^{\theta'}_j}\frac{\partial a^{\theta'}_j}{\partial L^\theta_j}.$$

- Then, if functional forms are (Cobb-Douglas and CES where appropriate) such that $\gamma^{P,j}_{\theta,\theta'} = \gamma^{P}_{\theta,\theta'}$, $\gamma^{A}_{\theta,\theta'} = \gamma^{A}_{\theta,\theta'}$ (constant elasticities) , optimal transfers of the form $t^\theta_j = s^\theta_j w^\theta_j - T^\theta$ satisfy:

$$s^\theta_j = \frac{\gamma^P_{\theta,\theta} + \gamma^A_{\theta,\theta}}{1-\gamma^A_{\theta,\theta}} + \sum_{\theta'\neq\theta} \frac{\gamma^P_{\theta,\theta'} w^{\theta'}_j + \gamma^A_{\theta,\theta'} x^{\theta'}_j}{1-\gamma^A_{\theta,\theta}} \frac{L^{\theta'}_j}{w^\theta L^\theta_j}$$

  implement an optimal allocation with $w^\theta_j, x^\theta_j, L^\theta_j$,, for any $\theta \in \Theta$, $j \in J$.
- Subsidy for group θ increases with $\gamma^P_{\theta,\theta} + \gamma^A_{\theta,\theta}$, $\gamma^P_{\theta,\theta'}$, $\gamma^A_{\theta,\theta'}$, $L^{\theta'}_j$, ...

Quantitative exercise: Data and calibration

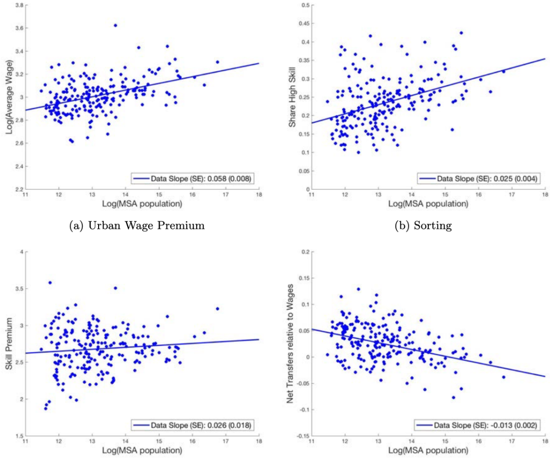
- Model with Cobb-Douglas and CES where appropriate - hence with constant production and amenities cross-spillover elasticities; two groups of workers (high/low skills)
- Data: Bureau Economic Analysis, Regional Accounts; American Community Survey; Commodity Flow Survey - observed income etc net of variation in socio-demographic composition within groups across MSA's
- Calibration: Diamond (2016) for utility and production function (for each MSA) parameters; Diamond (2016) and Kline and Moretti (2014) for production cross-spillover elasticities; Diamond (2016) for amenities cross-spillover elasticities;

Quantitative exercise: Data and calibration

- Exercise:
  - given wages, employment, expenditures, across high/low skilled and SMA's;
  - given calibrated parameters;
  - assuming data is generated at eq'm (for some gov't transfers);
  - can solve for optimal allocations.

Quantitative exercise: Stylized eq'm relationships

Figure 1: Urban Premia



(a) Urban Wage Premium

(b) Sorting

(c) Urban Skill Premium

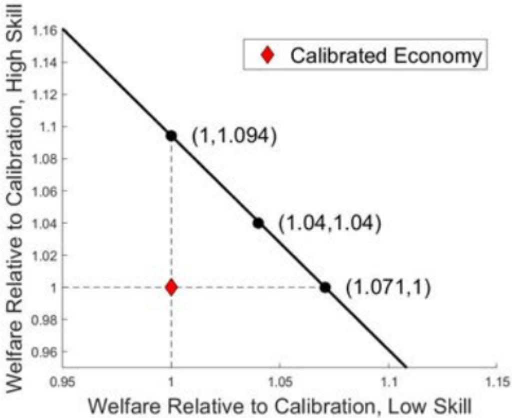
(d) Net Transfers

Note: each figure shows data across MSAs. All the city level outcomes reported on the vertical axes of panels (a) to (c) are adjusted by socio-demographic characteristics of each city, as detailed in Online Appendix B.1.

Quantitative exercise: Pareto frontier

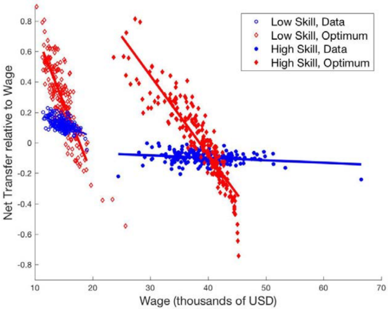
Figure 2: Utility Frontier of the U.S.

(a) Benchmark



Quantitative exercise: Optimal transfers

Figure 3: Per Capita Transfers by Skill Level and MSA, Data and Optimal Allocation



Note: each point in the figure corresponds to an MSA-skill group combination. The vertical axis shows the difference between the average transfer relative to wage and the horizontal axis shows the average wage. For details of how the data is constructed see Online Appendix B. The slopes of each linear fit (with SE) are: Low Skill, Data: -0.02 (0.001); Low Skill, Optimum: -0.095 (0.004); High Skill, Data: -0.002 (0.001); High Skill, Optimum: -0.05 (0.002). The figure corresponds to planner's weights such that both types of workers experience the same welfare gain in Figure 2.

Quantitative exercise: Optimal transfers

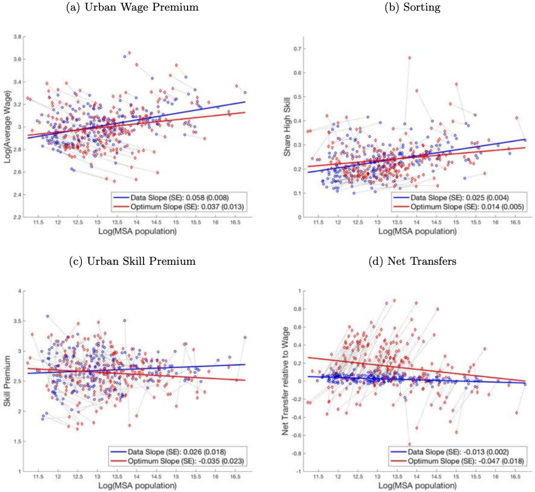
- To understand what drives these optimal transfers, return to the expression for optimal subsidies

$$s_j^{\theta} = \frac{\gamma_{\theta,\theta}^{P} + \gamma_{\theta,\theta}^{A}}{1 - \gamma_{\theta,\theta}^{A}} + \sum_{\theta' \neq \theta} \frac{\gamma_{\theta,\theta'}^{P} w_j^{\theta'} + \gamma_{\theta,\theta'}^{A} x_j^{\theta'}}{1 - \gamma_{\theta,\theta}^{A}} \frac{L_j^{\theta'}}{w^{\theta} L_j^{\theta}}$$

The first term is driven by own spillovers, while the second term is shaped by cross spillovers. [...] for low skill workers, both of these terms are negative. The negative cross-spillovers through amenities lead to the higher tax of low skill workers in large, high-wage cities where a larger share of expenditures accrues to high skill workers. [...] high skill workers generate [instead] positive own spillovers. According to the first term, these positive spillovers would call for a labor income subsidy. However, this force is more than offset by strong positive cross spillovers onto low skill workers, which calls for more mixing of high-skill workers with low-skill workers. A higher tax in high-wage cities directs skilled workers into small, low-wage cities that are relatively abundant in low skill workers.

Quantitative exercise: Eq'm vs. Optimal relationships

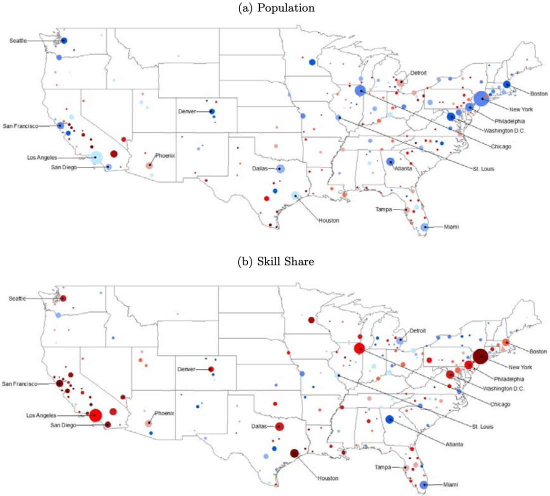
Figure 5: Urban Premia, Data and Optimal Allocation



Note: each panel reports outcomes across MSAs in the data and in the optimal allocation. Each linked pair of observations corresponds to the same MSA.

Quantitative exercise: Population and skill optimal reallocations

Figure 6: Optimal Population Reallocation and Change in Skill Share



The maps show the growth in population (top panel) and share of college workers (bottom panel) from the observed to the optimal allocation. Cities are weighted by initial population. Red means positive growth and blue is negative growth.

Leaving New York never easy .. I ain't moving to Detroit

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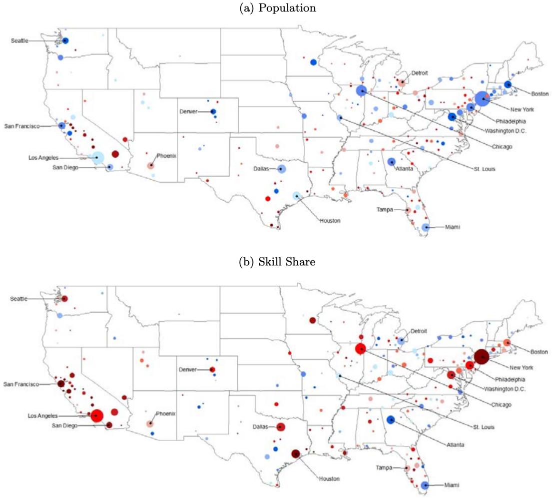

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