

# City Location Choice and Household Productivity

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June 14, 2024

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# Agglomeration

- According to the world bank, 56% of the world's population live in cities.
  - This is expected to increase to 70% by 2050.
- People choose to live in cities in spite of problems such as congestion and high rents.
- This is because of the benefits cities offer.
  - Households, better work opportunities and better amenities.
  - Businesses, better access to services and a larger market.

# Trivial Solution

- If cities are identical and size determines the magnitude of agglomeration benefits, then all households would choose to live in the same city.
- Cities are obviously not homogenous.
  - Toronto is not the same as Vancouver.
- Why do people choose to live in the cities they do?

# Research Question

- What will happen to city populations when there's a shock to the economy?
  - What will the migration patterns look like?
- How substitutable are cities?
  - How do households choose between cities?
- With city heterogeneity, can we break the independence of irrelevant alternatives (IIA) assumption in spacial econ?
  - Cities are not directly substitutable for each other.

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# Eaton and Kortum (2002)

- Ricardian Model of Trade
  - Countries should perfectly specialize in the production of goods they have a comparative advantage in.
- Probabilistic draws of Productivity
  - Draw from a Frechet distribution.
  - For a variety of goods, what is the probability you can produce below a certain price?
- Result
  - Non zero production of all goods in all countries.



# Redding (2016)

- Quantitative Spatial Model
- Take EK and applied to to an urban/spacial setting.
- Wages are determined by productivities.
- Wages and amenities determine location choice shares.

# Lind and Ramondo (2023)

- Trade with Correlation
- Preferences
  - EK has CES preferences where goods are perfectly substitutable.
  - Lind and Ramondo proposed a cross nested CES structure in order to break IIA.
  - A Lamborghini is not the same as a Toyota.
- Better suited substitution patterns in trade.

# This Paper

- Apply this new framework that allows for correlation to Redding's QSM.
- QSM currently loads city heterogeneity entirely onto amenities.
- This paper will attempt to explain some of that variation.

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# Setup

- $N$  cities indexed by  $c$ .
- $K$  occupations indexed by  $k$ .
- A continuum of household types  $\nu \in [0, 1]$ .

# Setup

- Output is entirely determined by productivity.
- Wages are determined by productivity and a city specific price index.
  - The price index will be set to 1 in the baseline model.
- Utility is entirely determined by wages.
  - A household maximizes utility by choosing the city that maximizes their wage.

# Productivity

- Every household in every city occupation pair draws a productivity from this Frechet distribution.

$$P[Z_{ck} < z] = \exp[-(T_{ck}^* z^{-\theta})^{\frac{1}{1-\rho_k}}] \quad (1)$$

- $T_{ck}^*$  is the city occupation specific productivity scale parameter.
  - This represents a city's absolute advantage in that occupation.
- $\theta$  is the Frechet shape parameter.
- $\rho_k$  is the occupation correlation parameter.

# Correlation Function

- These productivities have a correlation structure.

$$G(Z_1^{-\theta}, \dots, Z_N^{-\theta}) = \sum_k \left[ \sum_c^N (T_{ck}^* Z_c^{-\theta})^{\frac{1}{1-\rho_k}} \right]^{1-\rho_k} \quad (2)$$

- Cities have correlated draws based on occupations.
- $T_{ck}^*$  is what we get when we intergrate over all household types.



# Choice Shares

$$\pi_c = \frac{Z_c^{-\theta} G_c(Z_1^{-\theta}, \dots, Z_N^{-\theta})}{G(Z_1^{-\theta}, \dots, Z_N^{-\theta})} \quad (3)$$

$$\pi_c = \frac{T_c^* Z_c^{-\theta}}{\sum_c^N T_c^* Z_c^{-\theta}} \quad (4)$$

- Choice shares are dependent on productivity shares and city specific shifters.

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# Setup

- 3 cities
  - Chicago, Detroit and New York.
  - Chicago and Detroit specialise in trades.
  - New York specialises in services.

# Simulation Results

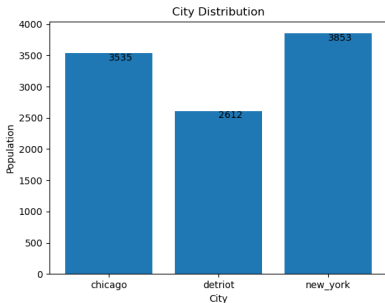


Figure: Initial Distribution of Populations

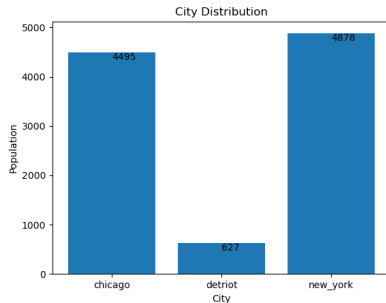


Figure: Post Detroit Shock

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# To Do List

- Estimation equation for parameters.
- Obtain wage and employment for American cities.
- Run counterfactuals.
  - China shock.