Cities
○○○○

Motivation and Background
○○○○○

Proposed Approach
○○○○○○

Preliminary Results
○○○

To Do List
○○

City Location Choice and Houehold Productivity

Tan Sein Jone

University of British Columbia

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Table of contents

Table of Contents

Agglomoration

- 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 benifits cities offer.
  - Households, better work oppotunities and better amenities.
  - Businesses, better access to services and a larger market.

Trivial Solution

- If cities are identical and size determines the magnitude of agglomoration benifits, 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.

Table of Contents

Eaton and Kortum (2002)

- Ricardian Model of Trade
  - Countries should perfectly specialize in the production of goods they have a comparative advantage in.

- Probabalistic 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)

- Quatitative Spacial 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 preferencces 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.

Table of Contents

Setup

- N cities indexed by c.

- K occupations indexed by k.

- A continuim 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 housheold maximizes utility by choosing the city that maximizes their wage.

Productivity

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

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

- T_{ck} is the city occupation specific productivity scale parameter.
    - This represents a city's absolute advantage in that occupation.
- $H_k(\nu)$ is the household type occupation specific productivity scale parameter.
- θ is the Frechet shape parameter.
- ρ_k is the occupation correlation parameter.

Correlation Function

- These productivities have a correlation structure.

$$G(Z_1^{-\theta}, \ldots, Z_N^{-\theta}) = \sum_k [\sum_c^N (T_{ck}^\star Z_c^{-\theta})^{\frac{1}{1-\rho_k}}]^{1-\rho_k} \qquad (2)$$

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

Choice Shares

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

$$\pi_c = \frac{T_c^{\star} Z_c^{-\theta}}{\sum_c^N T_c^{\star} Z_c^{-\theta}} \tag{4}$$

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

Table of Contents

Setup

- 2 occupations
  - Trades and services with corresponding hosuehold types.

- 3 cities
  - Chicago, Detriot and New York.
  - Chicago and Detriot specialise in trades with Chicago having an absolute advantage.
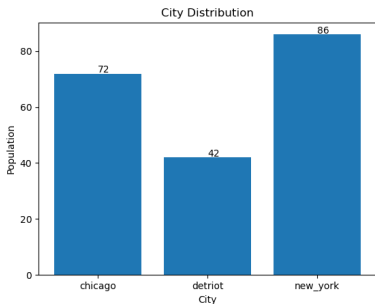 - New York specialises in services.

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○○○○

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○○○○○

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○○○○○○

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○○●

To Do List
○○

Simulation Results

Figure: Initial Distribution of Populations
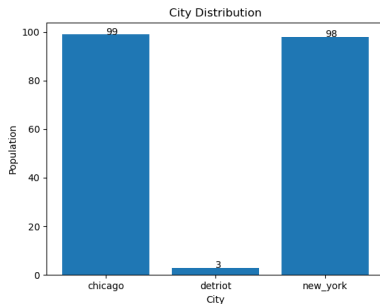
Figure: Post Detriot Shock

Table of Contents

Cities
○○○○

Motivation and Background
○○○○○

Proposed Approach
○○○○○○

Preliminary Results
○○○

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○●

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- Estimation equation for parameters.

- Obtain wage and emplyment for American cities.

- Run counterfacutals.
  - China shock.