Location Choices and the Role of Marriage Market
Evidence from US Young Workers

Sitian Liu

October 6, 2018
Sex Ratio Among Singles (25-44) in the SF Bay Area
Surplus of Singles in the US

Singles, 18-64

Los Angeles, CA
83,788 more single men than women

New York, NY
146,466 more single women than men

Research Questions

▶ Do marriage market conditions affect young workers’ location choices?
▶ If so, what are the implications for the labor market?
  ▸ Young workers’ responses to wage shock
  ▸ Equilibrium wages across cities
Research Questions

- Do marriage market conditions affect young workers’ location choices?
- If so, what are the implications for the labor market?
  - Young workers’ responses to wage shock
  - Equilibrium wages across cities
- Motivation
  - Gender difference in location choices: throughout the industrialized world, rural areas are lacking young women (Edlund, 2005).
  - Spatial wage gaps: unexploited opportunities for higher productivity, migration costs, and endogenous differences (amenity).
Source: American Community Survey (ACS) 2010-2014 5-Year Sample, restricted to individuals who are single or who were married during the past year (for the first time). Weighted by sample population in each MSA. 4 MSAs with sex ratios greater than 2 are excluded.
Source: Census 2000 5% Sample and ACS 2010-2014 5-Year Sample, restricted to individuals who are single. Y-axis is the average wage of single male (female) full-time workers in each MSA, excluding year FE, MSA FE, gender-specific industry FE, and the effects of age and education. Plots only include wages and sex ratios in 2010-2014 pool.
ROADMAP

1. Two-City Spatial Equilibrium Model
2. Data & Descriptive Facts
3. Empirical Strategy
4. Preliminary Results
5. Next Steps
A Two-City Spatial Equilibrium Model Model without Marriage Market

- **Labor Demand**
  - Two cities: New York (NY) & Milwaukee (MW)
  - Two types of labor: male labor \( (L^m) \) & female labor \( (L^f) \)
  - Two industries → two types of products: agricultural products \( (Y_a) \) and manufacturing products \( (Y_m) \)

\[
Y_a = A_a (L^m)^{\alpha_1}, \quad 0 < \alpha_1 < 1 \\
Y_m = A_m (L^f)^{\alpha_2}, \quad 0 < \alpha_2 < 1
\]

- A representative firm in each city combines the products into a homogenous final consumption good \( (Y) \) (price normalized to 1):
  - NY manufacture-dominated & MW agriculture-dominated

\[
Y_{NY} = \beta_1 Y_a + (1 - \beta_1) Y_m, \quad 0 < \beta_1 < 1 \\
Y_{MW} = \beta_2 Y_a + (1 - \beta_2) Y_m, \quad \beta_1 < \beta_2 < 1
\]
MODEL WITHOUT MARRIAGE MARKET

- Labor Supply
  - A unit mass of men and a unit mass women.
  - Utility max (men): \( \max_C \ln(C_i^m) \text{ s.t. } C_i^m \leq W_i^m, i \in \{NY, MW\} \)
  - Indirect utility functions for men & women in city \( i \):
    \[
    V^m(W_i^m) = \ln(W_i^m) \\
    V^f(W_i^f) = \ln(W_i^f)
    \]

- Spatial Equilibrium
  - No migration cost. Decreasing MP & no migration:
    \[
    W_{NY}^m = W_{MW}^m \\
    W_{NY}^f = W_{MW}^f.
    \]
  - Equilibrium sex ratios:
    \[
    \frac{L_{NY}^m}{L_{MW}^m} < 1 \text{ & } \frac{L_{NY}^f}{L_{MW}^f} > 1
    \]
    \( \iff \) Sex ratio < 1 in NY & sex ratio > 1 in MW.
**Model without Marriage Market**

- **Effect of a Local Labor Demand Shock**
  - There is localized technological shock that increases the productivity of manufacturing industry only in NY ($A_m \rightarrow A'_m$):

\[
\frac{L_{NY}^f}{L_{MW}^f} \uparrow
\]

\[
\frac{L_{NY}^m}{L_{MW}^m}
\]

remains the same

- More women are attracted to NY to take the earning opportunity.
- Men are not affected since the productivity of men is independent of that of women.
Leaving all the other assumptions unchanged, now I assume that people choose a city for both higher wages and more opportunities of meeting a marriage partner.

- **Utility functions for men and women in city $i \in \{NY, MW\}$:**
  
  $U^m_i = \ln(C^m_i) - \lambda^m \ln(r_i)$
  
  $U^f_i = \ln(C^f_i) + \lambda^f \ln(r_i)$

  where $r_i$ is the sex ratio in city $i$: $r_i \equiv \frac{L^m_i}{L^f_i}$.

- **The indirect utility functions for men and women in city $i$:**
  
  $V^m(W^m_i, r_i) = \ln(W^m_i) - \lambda^m \ln(r_i)$  \hspace{1cm} (1)

  $V^f(W^f_i, r_i) = \ln(W^f_i) + \lambda^f \ln(r_i)$.  \hspace{1cm} (2)
**Model With Marriage Market**

- **Spatial Equilibrium**
  - No migration:

\[
\frac{W^m_{NY}}{W^m_{MW}} = \left( \frac{r_{NY}}{r_{MW}} \right)^{\lambda^m},
\]
\[
\frac{W^f_{NY}}{W^f_{MW}} = \left( \frac{r_{MW}}{r_{NY}} \right)^{\lambda^f}.
\]

- **Equilibrium sex ratios:**

\[
\frac{L^m_{NY}}{L^m_{MW}} \uparrow \quad \text{&} \quad \frac{L^f_{NY}}{L^f_{MW}} \downarrow
\]

\[\iff \text{Sex ratio} \uparrow \text{in NY & sex ratio} \downarrow \text{in MW compared to the case in which marriage market conditions are not taken into account.}\]
Model With Marriage Market

- Effect of a Local Labor Demand Shock
  - There is localized technological shock that increases the productivity of manufacturing industry only in NY:
    \[
    \frac{L_{NY}^f}{L_{MW}^f} \uparrow \quad \& \quad \frac{L_{NY}^m}{L_{MW}^m} \uparrow
    \]
  - More women are attracted to NY to take the earning opportunity.
  - Men also go to NY now because migration of women to NY increases the marriage market condition for men in NY.
Roadmap

1. Two-City Spatial Equilibrium Model
2. Data & Descriptive Facts
3. Empirical Strategy
4. Preliminary Results
5. Next Steps
Data

- Integrated Public Use Microdata Series (IPUMS)
  - Census 2000 5% Sample
  - American Community Survey (ACS) 2010-2014 5-Year Sample
- Individual level observations: age, gender, marital status, education attainment, industry, wages, housing costs, geographic location (state of birth, residence one year ago, current residence).
- 18-50 year-old unmarried people.
- Geographical unit: metropolitan statistical area (MSA).
## Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>All MSAs</th>
<th>Men-Biased MSAs</th>
<th>Women-Biased MSAs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>Age</td>
<td>30.04</td>
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<tr>
<td>Population</td>
<td>51094.8</td>
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<td>Sex Ratio</td>
<td>1.07</td>
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<tr>
<td>Sex Ratio (College)</td>
<td>0.81</td>
<td>0.08</td>
<td>0.86</td>
</tr>
<tr>
<td>Sex Ratio (Non-College)</td>
<td>1.16</td>
<td>0.12</td>
<td>1.38</td>
</tr>
<tr>
<td>Rent</td>
<td>402.51</td>
<td>602.1</td>
<td>382.84</td>
</tr>
<tr>
<td>Share of College Workers</td>
<td>0.36</td>
<td>0.48</td>
<td>0.27</td>
</tr>
<tr>
<td>Men’s Wage</td>
<td>44481.67</td>
<td>44206.13</td>
<td>40104.08</td>
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<tr>
<td>Women’s Wage</td>
<td>41953.33</td>
<td>36892.14</td>
<td>38305.83</td>
</tr>
<tr>
<td>Number of People</td>
<td>2,467,165</td>
<td>2,467,165</td>
<td>272,250</td>
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<tr>
<td>Number of Workers</td>
<td>1,068,169</td>
<td>1,068,169</td>
<td>108,300</td>
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<tr>
<td>Number of MSAs</td>
<td>290</td>
<td>290</td>
<td>74</td>
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</table>

Note: Summary statistics are calculated from ACS 2010-2014 5-year sample, restricted to 18-50 year-old unmarried people living in MSAs (i.e. rural areas are excluded). Men-biased MSAs are defined as the MSAs whose sex ratios are above 90th percentile (1.17) and women-biased MSAs are defined as the MSAs whose sex ratios are below 10th percentile (0.99). College workers are defined as workers who have completed at least 4 years of college and non-college workers are all other workers. Sex ratios are calculated among all single people and wages are calculated among single full-time workers.
## Largest and Smallest Sex Ratios and Largest Changes in Sex Ratios

<table>
<thead>
<tr>
<th>Lowest Sex Ratios in 2000</th>
<th>Highest Sex Ratios in 2000</th>
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</thead>
<tbody>
<tr>
<td>MSA</td>
<td>Sex Ratio</td>
</tr>
<tr>
<td>Midland, TX</td>
<td>0.667</td>
</tr>
<tr>
<td>Monroe, LA</td>
<td>0.762</td>
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<tr>
<td>Hammond, LA</td>
<td>0.813</td>
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<tr>
<td>Greenville, NC</td>
<td>0.835</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lowest Sex Ratios in 2014</th>
<th>Highest Sex Ratios in 2014</th>
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</thead>
<tbody>
<tr>
<td>MSA</td>
<td>Sex Ratio</td>
</tr>
<tr>
<td>Madera, CA</td>
<td>0.690</td>
</tr>
<tr>
<td>La Crosse-Onalaska, WI-MN</td>
<td>0.824</td>
</tr>
<tr>
<td>Harrisonburg, VA</td>
<td>0.830</td>
</tr>
<tr>
<td>Greenville, NC</td>
<td>0.835</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Largest Decreases in Sex Ratios</th>
<th>Largest Increases in Sex Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSA</td>
<td>ΔSex Ratio</td>
</tr>
<tr>
<td>Gainesville, FL</td>
<td>-0.249</td>
</tr>
<tr>
<td>Fayetteville, NC</td>
<td>-0.402</td>
</tr>
<tr>
<td>Killeen-Temple, TX</td>
<td>-0.494</td>
</tr>
<tr>
<td>Jacksonville, NC</td>
<td>-0.806</td>
</tr>
</tbody>
</table>
Industry and City

Industry Composition (2010-2014)

Percentage of Workers

Men-Biased Cities  Women-Biased Cities

Men (Women)-biased cities include MSAs whose sex ratios are above (below) 90th (10th) percentile.
Gender and Industry

Gender Composition Across Industries

![Bar chart showing gender composition across industries. The chart compares the ratio of men across different industries for the years 2000 and 2010-2015. The industries include Agri, Mining, Const, Manu-Nondur, Transp/Commu/Utility, Retail, Fin/Insu, Business/Repair, Personal/Serv, Prof, Pubic, and Military. The bars are color-coded with blue for 2000 and red for 2010-2015.]
Roadmap

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Empirical Strategy

- Estimate the indirect utility functions for high-skill men, high-skill women, low-skill men, and low-skill women.
- Two-Step Procedure (Diamond, 2016; Berry et al., 1995).
- Indirect utility function for a high-skill \((H)\) male \((m)\) worker \(i\) of city \(j\) at time \(t \in \{2000, 2014\}\):

\[
V_{ijt}^{m,H} = \beta_{1}^{m,H} \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \ln(r_{jt}) + \gamma_{t}^{m,H} sameState_{ij} + \epsilon_{ijt},
\]

where

- \(w_{jt}^{m,H}\): average wage of high-skill men in city \(j\) at time \(t\).
- \(m_{jt}^{m,H}\): ratio of high-skill women to high-skill men in city \(j\) at time \(t\).
- \(r_{jt}\): average housing rent in city \(j\) at time \(t\).
- \(sameState_{ij}\): indicator that city \(j\) belongs to individual \(i\)'s state of birth.
- \(\epsilon_{ijt}\): an idiosyncratic taste for city \(j\) at time \(t\), drawn from Type I Extreme Value distribution.
Empirical Strategy

- Estimate the indirect utility functions for high-skill men, high-skill women, low-skill men, and low-skill women.
- Two-Step Procedure (Diamond, 2016; Berry et al., 1995).
- Indirect utility function for a high-skill ($H$) male ($m$) worker $i$ of city $j$ at time $t \in \{2000, 2014\}$:

$$V_{ijt}^{m,H} = \beta_{1}^{m,H} \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \ln(r_{jt})$$

$$+ \gamma_{t}^{m,H} sameState_{ij} + \epsilon_{ijt},$$

where

- $w_{jt}^{m,H}$: average wage of high-skill men in city $j$ at time $t$.
- $m_{jt}^{m,H}$: ratio of high-skill women to high-skill men in city $j$ at time $t$.
- $r_{jt}$: average housing rent in city $j$ at time $t$.
- $sameState_{ij}$: indicator that city $j$ belongs to individual $i$’s state of birth.
- $\epsilon_{ijt}$: an idiosyncratic taste for city $j$ at time $t$, drawn from Type I Extreme Value distribution.
Mean utility value for high-skill men of city $j$ at time $t$: the component of $V_{ij}^{m,H}$ that only depends on the characteristics of the destination city:

$$
\delta_{jt}^{m,H} \equiv \beta_{1}^{m,H} \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \ln(r_{jt})
$$

$$
\Rightarrow V_{ij}^{m,H} = \delta_{jt}^{m,H} + \gamma_{t}^{m,H} \text{sameState}_{ij} + \epsilon_{ijt}.
$$
First Step

- **Mean utility value** for high-skill men of city \( j \) at time \( t \): the component of \( V_{ijt}^{m,H} \) that only depends on the characteristics of the destination city:

\[
\delta_{jt}^{m,H} \equiv \beta_{1}^{m,H} \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \ln(r_{jt})
\]

\[
\Rightarrow V_{ijt}^{m,H} = \delta_{jt}^{m,H} + \gamma_{t}^{m,H} \text{sameState}_{ij} + \epsilon_{ijt}.
\]

- **Conditional logit model**: high-skill male population of city \( j \) at time \( t \)

\[
HM_{jt} = \sum_{i \in HM} \frac{\exp(\delta_{jt}^{m,H} + \gamma_{t}^{m,H} \text{sameState}_{ij})}{\sum_{k=1}^{J} \exp(\delta_{kt}^{m,H} + \gamma_{t}^{m,H} \text{sameState}_{ik})}
\]

Parameters to estimate: value of being in hometown state(\( \gamma_{t}^{m,H} \)) and mean utility for city \( j \) at time \( t \) (\( \delta_{jt}^{m,H}, j = 1, ..., J \)).
**Second Step**

- Decompose mean utility value $\delta_{jt}^{m,H}$ into values of wage, marriage market, rent, and some unobservable characteristics of the city:

  $$\delta_{jt}^{m,H} = \beta_{1}^{m,H} \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \ln(r_{jt}) + v_{jt}^{m,H}$$

- Differencing mean utilities for a city in two years:

  $$\Delta \delta_{jt}^{m,H} = \beta_{1}^{m,H} \Delta \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \Delta \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \Delta \ln(r_{jt}) + \Delta v_{jt}^{m,H}$$
Second Step

- Bartik Labor Demand Shock (Bartik, 1991): for high-skill men

\[
\Delta B_{jt}^{m,H} := \sum_{ind} \Delta w_{ind, -j,t}^H \cdot \theta_{ind,0}^m \cdot \frac{H_{ind,j,0}}{H_{j,0}}
\]

where

- \( \Delta w_{ind, -j,t}^H \): change of average wage of high-skill workers in industry \( ind \), excluding workers in city \( j \), between base year 2000 and time \( t \) (2014).
- \( \theta_{ind,0}^m \): ratio of male workers to all workers in industry \( ind \) in base year 2000.
- \( H_{ind,j,0} \): number of high-skill workers in industry \( ind \) in city \( j \) in base year 2000.
- \( H_{j,0} \): number of high-skill workers in city \( j \) in base year 2000.
SECOND STEP

GMM estimates of high-skill men’s preferences for cities’ wages, marriage markets, and rents:

$$\Delta \delta_{jt}^{m,H} = \beta_{1}^{m,H} \Delta \ln(w_{jt}^{m,H}) + \beta_{2}^{m,H} \Delta \ln(m_{jt}^{m,H}) + \beta_{3}^{m,H} \Delta \ln(r_{jt}) + \Delta v_{jt}^{m,H}$$

Instruments:

- $\Delta B_{jt}^{m,H}$
- $\Delta B_{jt}^{w,H}$
- $\Delta B_{jt}^{m,H}$
- $\Delta B_{jt}^{g,edu} x_{j}^{reg}$
- $\Delta B_{jt}^{g,edu} x_{j}^{geo}$

where $g \in \{m, f\}$, $edu \in \{H, L\}$, and $x_{j}^{reg}$ measures land use regulation and $x_{j}^{geo}$ measures the geographic characteristics of a city that make land less developable (Diamond, 2016).
Roadmap

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### Table: Relationships between Utility, Wages and Sex Ratios

<table>
<thead>
<tr>
<th></th>
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<tr>
<td><strong>College Men</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Wage</td>
<td>6.881***</td>
<td>6.607***</td>
<td>7.716***</td>
<td>7.381***(0.401)</td>
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<td><em>No. Men [Single]</em></td>
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<td>Observations</td>
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<tr>
<td>R-squared</td>
<td>0.493</td>
<td>0.078</td>
<td>0.506</td>
<td>0.499</td>
<td>0.115</td>
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<td><strong>Non-College Men</strong></td>
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<tr>
<td>Wage</td>
<td>4.695***</td>
<td>4.780***</td>
<td>3.906***</td>
<td>3.819***(0.723)</td>
<td>3.819***</td>
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<td><em>No. Men [Single]</em></td>
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<tr>
<td>Wage</td>
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<td>7.644***</td>
<td>6.553***</td>
<td>6.131***(0.529)</td>
<td>6.131***</td>
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<td>No. Men</td>
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<tr>
<td><em>No. Women [Single]</em></td>
<td>-6.155***</td>
<td>-1.279</td>
<td>-6.605***</td>
<td>-1.720***(1.324)</td>
<td>-1.720**</td>
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<td>R-squared</td>
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<td><strong>Non-College Women</strong></td>
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<tr>
<td>Wage</td>
<td>2.786***</td>
<td>3.188***</td>
<td>7.674***</td>
<td>7.158***(0.479)</td>
<td>7.158***</td>
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<tr>
<td>No. Men</td>
<td></td>
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</tr>
<tr>
<td><em>No. Women [Single]</em></td>
<td>0.967</td>
<td>2.566***</td>
<td>-4.873***</td>
<td>-2.260***(0.902)</td>
<td>-2.260**</td>
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<tr>
<td>Observations</td>
<td>304</td>
<td>304</td>
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<tr>
<td>R-squared</td>
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<td>0.224</td>
<td>0.056</td>
<td>0.235</td>
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</table>

Note: Weighted by sample population of each type of people in each MSA in each year. Standard errors in brackets. Standard errors clustered by MSA. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Dependent variable is the mean utility for a city in a year, distinct for 4 types of people.
## Preliminary Results

**Table:** Estimates of Location Preferences

<table>
<thead>
<tr>
<th></th>
<th>High-Skill Men</th>
<th>High-Skill Women</th>
<th>Low-Skill Men</th>
<th>Low-Skill Women</th>
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<tbody>
<tr>
<td><strong>Step 1: Clogit Model</strong></td>
<td></td>
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</tr>
<tr>
<td>Year</td>
<td>2000</td>
<td>2014</td>
<td>2000</td>
<td>2014</td>
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<tr>
<td>Value of Living in Birth State</td>
<td>3.596***</td>
<td>3.936***</td>
<td>3.83***</td>
<td>3.981***</td>
</tr>
<tr>
<td></td>
<td>4.32***</td>
<td>4.43***</td>
<td>4.104***</td>
<td>4.896***</td>
</tr>
<tr>
<td><strong>Step 2: Decomposition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>4.673</td>
<td>5.957</td>
<td>6.771</td>
<td>7.921</td>
</tr>
<tr>
<td></td>
<td>(3.645)</td>
<td>(3.995)</td>
<td>(5.127)</td>
<td>(6.646)</td>
</tr>
<tr>
<td>Marriage Mkt - Same Type</td>
<td>-0.543</td>
<td>4.934</td>
<td>3.393</td>
<td>16.40</td>
</tr>
<tr>
<td></td>
<td>(3.925)</td>
<td>(7.231)</td>
<td>(4.830)</td>
<td>(11.25)</td>
</tr>
<tr>
<td>Marriage Mkt - Different Type</td>
<td>-5.855</td>
<td>-17.24</td>
<td>-5.545</td>
<td>-9.616</td>
</tr>
<tr>
<td></td>
<td>(6.640)</td>
<td>(12.38)</td>
<td>(8.148)</td>
<td>(14.28)</td>
</tr>
<tr>
<td>Rent</td>
<td>1.618</td>
<td>1.799</td>
<td>-9.429***</td>
<td>-10.18***</td>
</tr>
<tr>
<td></td>
<td>(1.532)</td>
<td>(1.605)</td>
<td>(2.211)</td>
<td>(2.902)</td>
</tr>
<tr>
<td></td>
<td>-10.18***</td>
<td>-10.18***</td>
<td>-7.353***</td>
<td>-8.102***</td>
</tr>
<tr>
<td></td>
<td>(8.481)</td>
<td>(9.674)</td>
<td>(6.376)</td>
<td>(16.02)</td>
</tr>
<tr>
<td></td>
<td>-7.353***</td>
<td>-7.353***</td>
<td>-8.102***</td>
<td>0.274</td>
</tr>
<tr>
<td></td>
<td>(4.879)</td>
<td>(4.879)</td>
<td>(4.369)</td>
<td>(4.879)</td>
</tr>
</tbody>
</table>

Note: First step estimates are from conditional logit model of city choice, weighted by population of a unique birth state and destination pair of each type of people, restricted to 18-50 year-old unmarried full-time workers. Second step estimates are from 2SLS, weighted by population of a city for each type of people in 2000. Data include 189 observations, i.e. 189 MSAs.
ROADMAP

1. Two-City Spatial Equilibrium Model
2. Data & Descriptive Facts
3. Empirical Strategy
4. Preliminary Results
5. Next Steps
Next Steps

- Better estimates of location preferences.
  - Tabular data: National Historical Geographic Information System (NHGIS).
  - Better instruments of sex ratio (e.g. gender-specific laws, such as abortion laws and maternity benefits).
- Marriage decisions together with location choices.
  - Panel data: Panel Study of Income Dynamics (PSID), National Longitudinal Survey of Youth (NLSY).