Decade-Long Changes in Spatial Mismatch in Beijing, China: Are Disadvantaged Workers Better Off or Worse?

Yunlei Qi\textsuperscript{1}, Yingling Fan\textsuperscript{1,*}, Tieshan Sun\textsuperscript{2}, Lingqian Hu\textsuperscript{3}

\textsuperscript{*}Corresponding author

\textsuperscript{1}University of Minnesota; \textsuperscript{2}Peking University; \textsuperscript{3}University of Wisconsin–Milwaukee
Introduction

Spatial Mismatch in the US
Disadvantaged groups: African-Americans, Latinos, low-income single mothers, welfare recipients and immigrants.

Spatial Mismatch in Chinese Cities
Disadvantaged groups: low-wage workers, unskilled workers, migrant workers without local Hukou (registered permanent residence).

Evolution of Spatial Mismatch in Chinese Cities

Starting: The erosion of the danwei system and the emergence of private market housing in the 1990s.

Changes: land policy and municipal-level fiscal behaviors

Urbanization: The arrival of massive wave of rural migrants

Inflated Housing Market and Residential Suburbanization
Concentrated in the periphery of urban areas

Spatial Mismatch in Chinese Cities
Introduction

Unskilled Workers

Migrant Workers

Jobs Accessible by Public Transit

Innovation
II Study Area and Data Sources

- Study Area – Beijing Metropolitan Area

Study Area Characterisites

Area unit: Jiedao

# of area units: 246

Area size: 9,116 square kilometers (sqkms)


Total Jobs: 8,907,983 (2001); 10,005,171 (2013)

Two City Centers:

- (1) The site of the Forbidden City and bounded by the Second Ring Road;
- (2) The geometric center of the official CBD boundary in 1992 Beijing Master Plan.
III Analysis and Findings

1. Identifying Disadvantaged Workers and Unskilled Jobs

Workers
- **Migrant Workers**: Permanent population whose *Hukou* is not in Beijing or undetermined. (corresponding to Local Workers, who has local *Hukou*.)
- **Unskilled Workers**: Permanent population (aged 6 & older) who haven’t accepted college education (大专以下学历人口).

Jobs
- **Unskilled Jobs** (Industry-based classification): All Beijing workers in industries whose proportion of college workers is lower than 48.88% (the overall proportion of college workers in Beijing based on the Economic Census in 2008) are considered as unskilled workers. (There are 32 skilled industries and 55 unskilled industries).
III Analysis and Findings

• 1. Identifying Disadvantaged Workers and Unskilled Jobs

Changes in Population and Employment Composition, 2000-2010

- Total Population
  - 2000: Local, 80%; Migrant, 20%
  - 2010: Local, 62%; Migrant, 38%

- Population aged 6 & older
  - 2000: Unskilled, 81%; Skilled, 19%
  - 2010: Unskilled, 41%; Skilled, 59%

- Total Jobs
  - 2000: Unskilled Local, 37%; Skilled Local, 25%
  - 2013: Unskilled Local, 37%; Skilled, 59%
Analysis and Findings

- 2. Examining the geography of spatial mismatch
  - (1) Spatial distribution of total jobs and migrant workers

  (1) Concentrated near the fringe

  (2) Suburbanization
Analysis and Findings

2. Examining the geography of spatial mismatch
   - (1) Spatial distribution of jobs accessible by public transit and migrant workers

Definition: the amount of jobs reachable by public transit from each *jiedao* centroid within a predetermined transit travel time (60 min in this paper).

Follow the monocentric patterns
2. Examining the geography of spatial mismatch
   - (1) Spatial distribution of unskilled jobs and unskilled workers

Widely Scattered
Analysis and Findings

• 2. Examining the geography of spatial mismatch
  – (1) Spatial distribution of unskilled jobs accessible by public transit and unskilled workers

Better served by public transit
Analysis and Findings

2. Examining the geography of spatial mismatch
   - (1) Spatial distribution of unskilled jobs and migrant unskilled workers in 2010
     
     ![Map of unskilled jobs and workers in 2010](image)
     
     Both concentrated but mismatched

     ![Map of skilled jobs and workers in 2010](image)
     
     More dispersed
2. Examining the geography of spatial mismatch
   - (1) Spatial distribution of unskilled jobs accessible by public transit and migrant unskilled workers

```
Better served by public transit
Unskilled Jobs Accessible by Public Transit (2013) and Unskilled Workers (Migrant) (2010)
Unskilled Jobs Accessible by Public Transit (2013) and Unskilled Workers (Local) (2010)
Skilled Jobs Accessible by Public Transit (2013) and Skilled Workers (Migrant) (2010)
Skilled Jobs Accessible by Public Transit (2013) and Skilled Workers (Local) (2010)
Jobs (accessible by public transit) concentrated more than the workers
```
Analysis and Findings

2. Examining the geography of spatial mismatch
   - (2) Percentage distributions by distance to the nearest city centers in Beijing

- Public transit system’s substantial progress in central areas;
- More dispersed jobs;
- Disadvantaged migrant population (concentration band is moving out);
Analysis and Findings

2. Examining the geography of spatial mismatch
   - (2) Percentage distributions by distance to the nearest city centers in Beijing
III Analysis and Findings

- 3. Quantifying the magnitude of spatial mismatch
  - The Dissimilarity Indexes (D)
    \[ D = \frac{1}{2} \times \sum_{i=1}^{n} \left| \frac{w_i}{\sum_{i=1}^{n} w_i} - \frac{e_i}{\sum_{i=1}^{n} e_i} \right| \]

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010</th>
<th>Total (% of Change)</th>
<th>Due to jobs shift</th>
<th>Due to workers shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>0.2704</td>
<td>0.3141</td>
<td>0.0437 (16.2%)</td>
<td>0.0288</td>
<td>0.0149</td>
</tr>
<tr>
<td>Local population</td>
<td>0.2767</td>
<td>0.3101</td>
<td>0.0334 (12.1%)</td>
<td>0.0362</td>
<td>-0.0028</td>
</tr>
<tr>
<td>Migrant population</td>
<td>0.3246</td>
<td>0.3763</td>
<td>0.0517 (15.9%)</td>
<td>0.0014</td>
<td>0.0503</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>0.2829</td>
<td>0.3018</td>
<td>0.0189 (6.7%)</td>
<td>0.0175</td>
<td>0.0014</td>
</tr>
<tr>
<td>Unskilled workers (Local)</td>
<td></td>
<td>0.3298</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled workers (Migrant)</td>
<td></td>
<td>0.3372</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers</td>
<td>0.2855</td>
<td>0.3096</td>
<td>0.0241 (8.4%)</td>
<td>0.0407</td>
<td>-0.0166</td>
</tr>
<tr>
<td>Skilled workers (Local)</td>
<td></td>
<td>0.3012</td>
<td>0.0437 (16.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers (Migrant)</td>
<td></td>
<td>0.4100</td>
<td>0.0334 (12.1%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analysis and Findings

3. Quantifying the magnitude of spatial mismatch

- The General Dissimilarity Index (GD)

\[ GD = \frac{1}{2} \times \sum_{i=1}^{n} \left| \frac{cw_i}{\sum_{i=1}^{n} cw_i} - \frac{ce_i}{\sum_{i=1}^{n} ce_i} \right| \]

\[ cw_i = \sum_{j=1}^{n} \frac{w_j}{d_{ij}^2 + 1} \quad ce_i = \sum_{j=1}^{n} \frac{e_j}{d_{ij}^2 + 1} \]

<table>
<thead>
<tr>
<th></th>
<th>GD</th>
<th>2000</th>
<th>2010</th>
<th>Total (% of Change)</th>
<th>Due to jobs shift</th>
<th>Due to workers shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>0.1254</td>
<td>0.1698</td>
<td>0.0444 (35.4%)</td>
<td>0.0052</td>
<td>0.0392</td>
<td></td>
</tr>
<tr>
<td>Local population</td>
<td>0.1207</td>
<td>0.1500</td>
<td>0.0093 (24.3%)</td>
<td>0.0164</td>
<td>0.0129</td>
<td></td>
</tr>
<tr>
<td>Migrant population</td>
<td>0.1877</td>
<td>0.2275</td>
<td>0.0398 (21.2%)</td>
<td>-0.0237</td>
<td>0.0635</td>
<td></td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>0.1264</td>
<td>0.1577</td>
<td>0.0313 (24.8%)</td>
<td>0.0063</td>
<td>0.0250</td>
<td></td>
</tr>
<tr>
<td>Skilled workers</td>
<td>0.1287</td>
<td>0.1509</td>
<td>0.0222 (17.2%)</td>
<td>0</td>
<td>0.0222</td>
<td></td>
</tr>
<tr>
<td>Unskilled workers (Local)</td>
<td>0.1603</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled workers (Migrant)</td>
<td>0.1899</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers (Local)</td>
<td>0.1380</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers (Migrant)</td>
<td>0.2255</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### III Analysis and Findings

- **3. Quantifying the magnitude of spatial mismatch**
  - The Dissimilarity Index based upon Job Access by Transit (DTransit)

\[
D\text{Transit} = \frac{1}{2} \times \sum_{i=1}^{n} \left| \frac{w_i}{\sum_{i=1}^{n} w_i} - \frac{ca_i}{\sum_{i=1}^{n} ca_i} \right|
\]

\[
ca_i = \sum_{j=1}^{n} e_{ij} f(t_{ij})
\]

\[
f(t_{ij}) = \begin{cases} 1; & \text{if } t_{ij} \leq 60 \\ 0; & \text{if } t_{ij} > 60 \end{cases}
\]

<table>
<thead>
<tr>
<th></th>
<th>DTransit</th>
<th>Total (% of Change)</th>
<th>Change</th>
<th>Due to Transit shift</th>
<th>Due to jobs shift</th>
<th>Due to workers shift</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population</td>
<td>0.4289</td>
<td>0.4940</td>
<td>0.0651 (15.2%)</td>
<td>-0.0056</td>
<td>-0.0104</td>
<td>0.0811</td>
</tr>
<tr>
<td>Local population</td>
<td>0.4223</td>
<td>0.4536</td>
<td>0.0313 (7.4%)</td>
<td>-0.0060</td>
<td>-0.0089</td>
<td>0.0462</td>
</tr>
<tr>
<td>Migrant population</td>
<td>0.5060</td>
<td>0.5786</td>
<td>0.0726 (14.3%)</td>
<td>-0.0042</td>
<td>-0.0161</td>
<td>0.0929</td>
</tr>
<tr>
<td>Unskilled workers</td>
<td>0.4620</td>
<td>0.5326</td>
<td>0.0706 (15.3%)</td>
<td>-0.0050</td>
<td>-0.0204</td>
<td>0.0960</td>
</tr>
<tr>
<td>Unskilled workers (Local)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled workers (Migrant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers</td>
<td>0.3639</td>
<td>0.4213</td>
<td>0.0574 (15.8%)</td>
<td>-0.0080</td>
<td>-0.0103</td>
<td>0.0757</td>
</tr>
<tr>
<td>Skilled workers (Local)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled workers (Migrant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

• The disadvantaged workers’ spatial mismatch problem:
  – Migrant workers: Mismatched concentration of jobs and housing.
  – Unskilled workers: Dispersed housing and suburbanization of jobs, yet public transit exacerbate mismatch between worker residences and accessible jobs.
  – Exacerbation: Improvement of public transit system in central areas and the boom of housing price (accelerated residential suburbanization) both resulted in the greater extent of mismatch experienced by migrant and unskilled workers.

• Policy implications
  – Public transit system: Orientation towards disadvantaged workers.
  – New affordable housing projects: Located with better access to job opportunities and included migrant workers.
Thank you!