The Impacts of Light Rail Transit on Labor Participation and Housing Affordability in the U.S.: A Longitudinal Analysis using Propensity Score Matching

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When you go beyond a relatively simple though serious problem such as police racism, however, you begin to get all the complexities of the modern American economy. Urban transit systems in most American cities, for example, have become a genuine civil rights issue - and a valid one - because the layout of rapid-transit systems determines the accessibility of jobs to the black community. If transportation systems in American cities could be laid out so as to provide an opportunity for poor people to get meaningful employment, then they could begin to move into the mainstream of American life. ... There is only one possible explanation for this situation, and that is the racist blindness of city planners.

Martin Luther King, Jr., A Testament of Hope. January, 1969
Our investigation has brought into clear focus the fact that the inadequate and costly public transportation currently existing throughout the Los Angeles area seriously restricts the residents of the disadvantaged areas such as south central Los Angeles. This lack of adequate transportation handicaps them in seeking and holding jobs, attending schools, shopping, and fulfilling other needs.

California Governor’s Commission on the Los Angeles Riots, 1965
Empirical Reports and Policies: Transportation and Employment Equity

- National Advisory Commission on Civil Disorders (NACCD)
- Intermodal Surface Transportation Efficiency Act (ISTEA)
- Transportation Equity Act (TEA-21)
- Moving Ahead for Progress in the 21st Century (MAP-21)

- 1968
- 1991
- 1996
- 2001
- 2005
- 2012

Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA)
Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)
Academic Studies

• **Spatial Mismatch** (Kain 1968 and 1992; Yi 2006; Ihlanfeldt and Sjoquist 1998; Sanchez et al 2004)
  - The dispersion of jobs from the central urban core and the isolation of employment opportunities from low-income people

• **Private vs. Public Mobility**
  - Public transit increases probability of being employed and getting out public assistance program (Cervero et al 2002)
  - Difference in job accessibility among racial groups and
  - Still debatable (Sanchez 1999; Ong 2002; Taylor and Ong 1995; Cervero et al 2002)
Academic Studies

- **Transit & Employment** (Sanchez 1999a, 1999b; Holzer and Quigley 2003; Yi 2006; Minocha et. al 2008; Kolko 2011; Chatman and Noland 2014; Canales et. al 2019)

  ✓ two-stage regression: proximity to transit affects increase in the average rates of labor participation (Sanchez 1999), but racial employment effects may exist (Holzer and Quigley 2003).

  ✓ Transit quality service and employment accessibility: housing policies for bringing more affordable housing closer to employment-generating areas led by quality transit service (Minocha et. al 2008)

  ✓ Disaggregate analysis (Yi 2006; Sanchez 1999b)

    : good access to transit / jobs by transit significantly affects employment levels, but questionable about improving economic equity.

    : The likelihood of welfare recipients being employed increases with good access to transit
Academic Studies

**Transit & Employment** (Sanchez 1999a, 1999b; Holzer and Quigley 2003; Yi 2006; Minocha et. al 2008; Chatman and Noland 2014; Canales et. al 2019)

- Analyzing transit service on agglomeration economies (Chatman and Noland 2014)
  - Transit-Agglomeration / Agglomeration-Productivity / Transit-agglomeration-Productivity Models
  - Analysis of 319-354 MSA in the U.S. → **Significant indirect effects** of transit service on productivity

- Light-rail transit investment → increase in the level of employment in nearby neighborhoods (Canales et. al 2019)
  - questionable about increase in employment opportunities for transit-dependent, low-wage workers.

- Cross-sectional / single-wave survey data analysis
Academic Studies

• **Transit & Community Empowerment** (Litman 2017; Wellman 2012)
  
  ✓ Community empowerment is multidimensional, but achieving transportation equity is a key factor for socioeconomic stability, which in turn leads to community empowerment.

  ✓ Transit Development & Gentrification:
Academic Studies

• **Transit & Housing Affordability** *(Renne et. al 2016)*

  ✓ Analysis of housing and transportation cost (H+T) in 4,399 fixed-route transit stations areas / Classified as TOD, TAD, and hybrids

  : Premium effects on housing price in TOD areas, but **the overall H+T costs may be more affordable than TAD and hybrids.**

  ✓ Cross-sectional data analysis
Effects of fixed guideway transit on both labor participation and housing affordability in terms of neighborhood change has remained unexplored so far.
Data and Variables

• Dependent variables
  ✓ % change in the average weeks worked
  ✓ Difference in a share of “stable workers” (worked more than 40 weeks in the previous year)
  ✓ Difference in a share of “unstable workers” (worked less than 14 weeks)
  ✓ % change in the median gross rent

• Independent variables
  ✓ LRT access dummy (within 0.5 mile)
  ✓ Total jobs
  ✓ Total population
  ✓ Median household income
  ✓ Non-white population
  ✓ Total housing units
  ✓ Workers driving to work
  ✓ Population (age 25+) with BA degree
  ✓ Employment access index
  ✓ Block group size
  ✓ Unemployment rate
  ✓ 5-tier employment mix score
  ✓ Average commuting time
  ✓ Host county categorical variables
Data and Variables

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  - Difference in a share of “stable workers” (worked more than 40 weeks in the previous year)
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  - % change in the median gross rent
  - % change in the selected monthly owner-occupied cost (SMOC)

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  - Unemployment rate
  - 5-tier employment mix score
  - Average commuting time
  - Host county categorical variables
Method: Propensity Score Matching (PSM)
PSM Diagram

**Outcome Predictors**
- Unemployment rate
- Employment mix index
- Percent of young workers

**Treatment**
- A dummy variable for access to LRT based on a 0.5-mile buffer (0=No, 1=Yes)

**Outcomes**
- Average weeks worked
- Percentage of stable workers (full-time, year-round)
- Percentage of semi-stable workers (part-time/year-round)
- Percentage of unstable workers (part-time/partially year-round)
- Median gross rent

**Confounding Variables**
- Average commuting time
- Population density
- Total population
- Non-white population
- Household size
- Population with more than bachelor degree
- Job-housing balance
- A dummy variable of whether a LRT station falls within an urbanized area or not
- Percent of rent-occupied housing units
- Median household income
- Percent of vacant housing units
- Household with public assistance
- Categorical host county variable
- The number of households below poverty level
Matched Samples After PSM
## PSM Balance Check

<table>
<thead>
<tr>
<th>Variables</th>
<th>Before Matching</th>
<th>After Matching</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No LRT (n=14582)</td>
<td>LRT (n=1048)</td>
</tr>
<tr>
<td>Population density</td>
<td>8.7</td>
<td>10.9</td>
</tr>
<tr>
<td>Total population</td>
<td>1361.1</td>
<td>1282.1</td>
</tr>
<tr>
<td>Median household income</td>
<td>53127.7</td>
<td>39931.6</td>
</tr>
<tr>
<td>Non-white population</td>
<td>399.4</td>
<td>466.5</td>
</tr>
<tr>
<td>% vacant housing units</td>
<td>5.5</td>
<td>7.3</td>
</tr>
<tr>
<td>Household size</td>
<td>2.7</td>
<td>2.4</td>
</tr>
<tr>
<td>% households with public assistance</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>% families below the poverty level</td>
<td>8.3</td>
<td>12.9</td>
</tr>
<tr>
<td>Job-housing balance</td>
<td>1.8</td>
<td>13.0</td>
</tr>
<tr>
<td>Population with bachelor’s degree or higher</td>
<td>29.9</td>
<td>28.0</td>
</tr>
<tr>
<td>% renter-occupied housing units</td>
<td>33.0</td>
<td>50.1</td>
</tr>
<tr>
<td>% young workers</td>
<td>29.8</td>
<td>28.6</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>6.0%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Employment mix index (2002)</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Average commuting time (min.)</td>
<td>28.3</td>
<td>25.1</td>
</tr>
</tbody>
</table>

1) The t-test results in the table are drawn from the independent t-test. 2) ***: \(p < .01\), **: \(p < .05\), *: \(p < .1\)
### The “True Effect” of LRT

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Observed difference (original sample)</th>
<th>ATE (difference after matching)</th>
<th>Mean of Control Group</th>
<th>ATE/ control ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labor Participation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average weeks worked (change)</td>
<td>1.32%***</td>
<td>1.03%**</td>
<td>2.40%</td>
<td>0.43</td>
</tr>
<tr>
<td>Full-time, year-round workers (over 35 hrs/wk &amp; 50-52 wks/yr; %p difference)</td>
<td>1.22%***</td>
<td>1.62%***</td>
<td>4.17%</td>
<td>0.39</td>
</tr>
<tr>
<td>Part-time, year-round workers (less 35 hrs/wk &amp; 50-52 wks/yr; %p difference)</td>
<td>-1.65%***</td>
<td>-0.62%</td>
<td>-8.94%</td>
<td>0.07</td>
</tr>
<tr>
<td>Part-time &amp; part-year workers (less 35 hrs/wk &amp; less 50 wks/yr; %p difference)</td>
<td>-0.34%</td>
<td>-0.78%**</td>
<td>0.69%</td>
<td>-1.13</td>
</tr>
<tr>
<td><strong>Housing cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median gross rent (change)</td>
<td>11.13%***</td>
<td>3.87%</td>
<td>43.00%</td>
<td>0.09</td>
</tr>
</tbody>
</table>

1) The t-test results in the table are drawn from the independent t-test. 2) ***: p < .01, **: p < .05, *: p < .1
Visualizing Change (I)

• Change in the Avg. Number of Weeks Worked

  ✓ Crossover pattern: lower labor participation in the LRT group in 2000 → higher labor participation in 2010
Visualizing Change (II)

• **% of Full-time/Year-round workers**
  - LRT group: increased by 5.8% (higher % growth than non-LRT group)

• **% of part-time/part-year workers**
  - LRT group: decreased / Non-LRT group: increased
Visualizing Change (III)

• **Change in the Med. Gross Rent**
  
  ✓ LRT group: *lower* in 2000 → *higher* in 2010 than non-LRT group
  ✓ Seems to confirm the premium pricing effects on residential properties, but difference in rent is *not significant*.
Conclusion

• Light rail transit does affect improvement in level of employment status and housing affordability.
  ✓ “Cross-over” patterns in the average weeks worked and median gross rent

• Improved labor participation & housing affordability
  → Economic stability
  → Providing the built-environmental conditions for strong community empowerment
Limitations / Further Research

• Using aggregated data
  ✓ Constraints to interpret the role of public transit on employment and housing affordability
  ✓ Time-series disaggregate data required to get a comprehensive picture of proximity to transit / quality of employment / housing affordability (e.g., ReferenceUSA, Zillow, etc.)

• Adding more dependent variables
  ✓ Additional variables that measures community empowerment should be required

• PSM: Methodological Constraints
  ✓ Impossible to include all relevant variables into the matching process: Selection bias may exist.