Can Public Transport Infrastructure Relieve Spatial Mismatch?
Evidence from Recent Light Rail Extensions

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Motivation

- Paradox: Even though public transportation plays a small role for commuting patterns in the US, cities have invested in light rail systems.
- Few people take public transit to work. Only in older cities like New York and Boston does transit have a high share. In newer cities, this share is tiny (nationwide only 2.8% of all trips to work are made by urban rail).
- In recent years, many cities have extended their networks or introduced new light rail systems at high cost (e.g. Phoenix: $1.7bn, Dallas: $860mn, Houston: $324mn). Per mile construction costs average around $70mn.
- Fare revenues only cover about 30% of operating costs.
- Why do cities (and the federal government through subsidies) spend so much on light rail even though people barely use it?
Spatial Mismatch

- One reason is to relieve spatial mismatch: Suburbanization of people and jobs leads to physical isolation of the inner city poor from job opportunities.
- Lack of transport means to reverse commute could be a main driver of spatial mismatch and urban poverty.
- Potential channels: inability to commute to work, high cost of job search, unpredictable arrival times.
- Goal of light rail investment: increase accessibility to employment.
Evidence for the Transportation Theory

- Studies have repeatedly found correlation between poverty and low transit provision: Blumenberg and Ong (2001) show that many welfare recipients in Los Angeles live in job-poor areas. Sanchez (2002) finds that higher public transportation provision is correlated with lower income inequality.

- Baum (2009) uses differences in welfare vehicle asset rules between states as instruments for car ownership and finds that vehicle ownership increases the probability of exiting welfare for single mothers and to be employed.

- Holzer et al (2003) study expansion of the San Francisco BART system and show that increased ability to reverse commute can improve hiring of ethnic minorities (positive effect for Hispanics, but not for blacks)

- Andersson et al (2014) find that better job accessibility decreases unemployment duration of workers affected by mass layoffs
Literature
Previous studies

- Glaeser et al (2008) use time-series variation in the extent of rail transit provision for 16 cities from 1980 to 2000 and regress census tract poverty levels on the presence of light rail stations within a one-mile distance. They find that increased access to transit lines is associated with 0.004 percentage point higher poverty rates.

- Problematic measure: Distance to light rail station does not take into account the destinations one can reach

- Most new stations are built in suburbs, but most poor people live in city center with existing transit access (no variation in distance)

- My contribution: new geospatial method to measure public transport job accessibility
Data

- Decennial Census and ACS: Income, poverty rates, employment, and race at census tract level (2000, 2010-now)
- LEHD: Job counts (by wage, age, and education brackets) at census block level (2002-2011)
- Geospatial data on roads, buses, and light rail lines (for now, only for Los Angeles-Long Beach MSA)
Legend

- Light Rail Expansion
- Existing Light Rail
- Bus Routes

Los Angeles Multimodal Network

Date: 4/18/2015

Source: Los Angeles County MTA
Methodology

- Using a multimodal transportation network, calculate a cost distance matrix for all census tracts (in time)
- For every census tract, count all the jobs in the census tracts that can be reached within a specific time (e.g. 2 hours) using public transportation
- Regress changes in wages, poverty, and employment on changes in job accessibility between light rail expansion
Endogeneity Issues

▶ Non-random assignment of light rail lines (restrict sample to poor, racially homogeneous areas away from construction)
▶ Residential sorting: Poor/rich people move closer to light rail (check for changes in racial makeup, housing prices)
▶ Employer sorting: Jobs move towards/away from light rail (check for job growth around new transit stations)
Los Angeles Changes in Job Accessibility 2002-2010

Legend
- Light Rail Expansion
- Existing Light Rail
- Poor Census Tracts

Changes in Accessible Jobs
-10,082 - 0
1 - 232,752
232,753 - 345,782
345,783 - 451,070
451,071 - 622,649
622,650 - 968,825

Date: 4/20/2015

Data Source: Decennial Census 2000
## Summary Statistics

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Job Access</td>
<td>3177</td>
<td>2,291,159</td>
<td>1,028,950</td>
<td>12</td>
<td>3,576,708</td>
<td>2,125,912</td>
<td>2,456,301</td>
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<tr>
<td>Mean Income</td>
<td>3173</td>
<td>67,760</td>
<td>39,939</td>
<td>10,083</td>
<td>422,269</td>
<td>58,755</td>
<td>76,781</td>
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<tr>
<td>Poverty</td>
<td>3175</td>
<td>17.25%</td>
<td>12.62%</td>
<td>0%</td>
<td>82.8%</td>
<td>18.36%</td>
<td>16.13%</td>
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<tr>
<td>Unemployed</td>
<td>3176</td>
<td>6.91%</td>
<td>3.92%</td>
<td>0%</td>
<td>42.4%</td>
<td>5.03%</td>
<td>8.79%</td>
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<td>Population $\geq$ 16yo</td>
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<td>3,370</td>
<td>1,080</td>
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<td>10,886</td>
<td>3,293</td>
<td>3,447</td>
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<tr>
<td>Black</td>
<td>3177</td>
<td>9.30%</td>
<td>15.69%</td>
<td>0%</td>
<td>91.8%</td>
<td>9.88%</td>
<td>8.72%</td>
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<tr>
<td>Latino</td>
<td>3177</td>
<td>47.17%</td>
<td>30.08%</td>
<td>2.3%</td>
<td>99%</td>
<td>45.69%</td>
<td>48.66%</td>
</tr>
</tbody>
</table>
### Elasticities: Whole Sample

<table>
<thead>
<tr>
<th></th>
<th>(1) log Income</th>
<th>(2) log Poverty</th>
<th>(3) log Unemployed</th>
<th>(4) log Population</th>
<th>(5) log Black</th>
<th>(6) log Latino</th>
</tr>
</thead>
<tbody>
<tr>
<td>log Job Access</td>
<td>1.151***</td>
<td>-0.749***</td>
<td>2.656***</td>
<td>0.215***</td>
<td>0.0967*</td>
<td>0.573***</td>
</tr>
<tr>
<td></td>
<td>(0.0311)</td>
<td>(0.0715)</td>
<td>(0.0921)</td>
<td>(0.0185)</td>
<td>(0.0574)</td>
<td>(0.0275)</td>
</tr>
<tr>
<td>Constant</td>
<td>-5.472***</td>
<td>13.26***</td>
<td>-36.24***</td>
<td>4.993***</td>
<td>-0.0986</td>
<td>-4.651***</td>
</tr>
<tr>
<td></td>
<td>(0.445)</td>
<td>(1.023)</td>
<td>(1.319)</td>
<td>(0.265)</td>
<td>(0.822)</td>
<td>(0.394)</td>
</tr>
<tr>
<td>$N$</td>
<td>3173</td>
<td>3170</td>
<td>3169</td>
<td>3178</td>
<td>3175</td>
<td>3178</td>
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<tr>
<td>adj. $R^2$</td>
<td>0.888</td>
<td>0.827</td>
<td>0.415</td>
<td>0.927</td>
<td>0.955</td>
<td>0.976</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
## Elasticities: Whole Sample vs Poor Tracts

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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</thead>
<tbody>
<tr>
<td>log Household</td>
<td><strong>1.151</strong>*</td>
<td><strong>1.310</strong>*</td>
<td>-0.749***</td>
<td>-1.419***</td>
<td><strong>2.656</strong>*</td>
<td><strong>2.576</strong>*</td>
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<tr>
<td>Income</td>
<td>(0.0311)</td>
<td>(0.0761)</td>
<td>(0.0715)</td>
<td>(0.108)</td>
<td>(0.0921)</td>
<td>(0.175)</td>
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<tr>
<td>log Poverty</td>
<td></td>
<td></td>
<td><strong>13.26</strong>*</td>
<td><strong>24.49</strong>*</td>
<td><strong>-36.24</strong>*</td>
<td><strong>-36.10</strong>*</td>
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<td></td>
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<td></td>
<td>(1.023)</td>
<td>(1.607)</td>
<td>(1.319)</td>
<td>(2.589)</td>
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<tr>
<td>log Unemployed</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td><strong>-5.472</strong>*</td>
<td><strong>-8.885</strong>*</td>
<td>13.26***</td>
<td><strong>24.49</strong>*</td>
<td><strong>-36.24</strong>*</td>
<td><strong>-36.10</strong>*</td>
</tr>
<tr>
<td></td>
<td>(0.445)</td>
<td>(1.130)</td>
<td>(1.023)</td>
<td>(1.607)</td>
<td>(1.319)</td>
<td>(2.589)</td>
</tr>
<tr>
<td>Sample</td>
<td>all</td>
<td>poor</td>
<td>all</td>
<td>poor</td>
<td>all</td>
<td>poor</td>
</tr>
<tr>
<td>N</td>
<td>3173</td>
<td>886</td>
<td>3170</td>
<td>888</td>
<td>3169</td>
<td>887</td>
</tr>
<tr>
<td>adj. $R^2$</td>
<td>0.888</td>
<td>0.551</td>
<td>0.827</td>
<td>0.513</td>
<td>0.415</td>
<td>0.278</td>
</tr>
</tbody>
</table>

Poor sample restricted to census tracts with poverty rate higher than 25%

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
## Elasticities: Whole Sample vs Poor Tracts

<table>
<thead>
<tr>
<th></th>
<th>(1) log Population</th>
<th>(2) log Population</th>
<th>(3) log Black</th>
<th>(4) log Black</th>
<th>(5) log Latino</th>
<th>(6) log Latino</th>
</tr>
</thead>
<tbody>
<tr>
<td>log Job Access</td>
<td>0.215***</td>
<td>0.210***</td>
<td>0.0967*</td>
<td>-0.254</td>
<td>0.573***</td>
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<td>(0.0185)</td>
<td>(0.0509)</td>
<td>(0.0574)</td>
<td>(0.165)</td>
<td>(0.0275)</td>
<td>(0.0478)</td>
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<td>Constant</td>
<td>4.993***</td>
<td>4.859***</td>
<td>-0.0986</td>
<td>5.423**</td>
<td>-4.651***</td>
<td>1.935***</td>
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<tr>
<td></td>
<td>(0.265)</td>
<td>(0.755)</td>
<td>(0.822)</td>
<td>(2.448)</td>
<td>(0.394)</td>
<td>(0.709)</td>
</tr>
</tbody>
</table>

Sample:
- All
- Poor

N:
- 3178
- 890
- 3175
- 888
- 3178
- 890

adj. $R^2$:
- 0.927
- 0.888
- 0.955
- 0.947
- 0.976
- 0.937

Poor sample restricted to census tracts with poverty rate higher than 25%

Standard errors in parentheses

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Findings

- Wages and population increase while poverty decreases with more access to jobs
- Unemployment increases with better job accessibility
- Slight evidence for migration of Latinos towards areas with better access
- Jobs counts seem to increase closer to light rail stations
- Next step: Compare to a counterfactual scenario with better bus access
Thank you