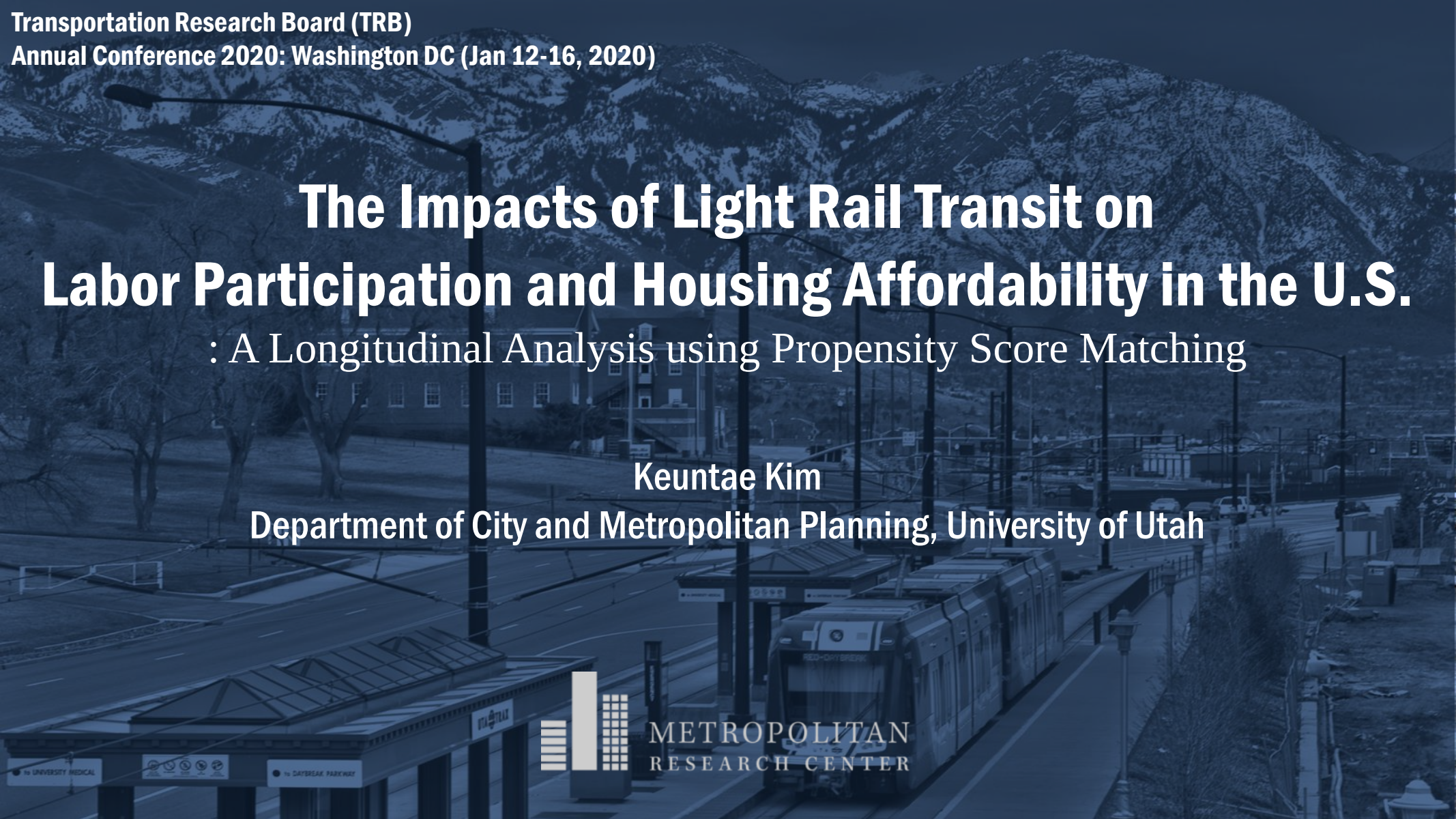
Transportation Research Board (TRB)
Annual Conference 2020: Washington DC (Jan 12-16, 2020)



The Impacts of Light Rail Transit on Labor Participation and Housing Affordability in the U.S.

: A Longitudinal Analysis using Propensity Score Matching

Keuntae Kim
Department of City and Metropolitan Planning, University of Utah

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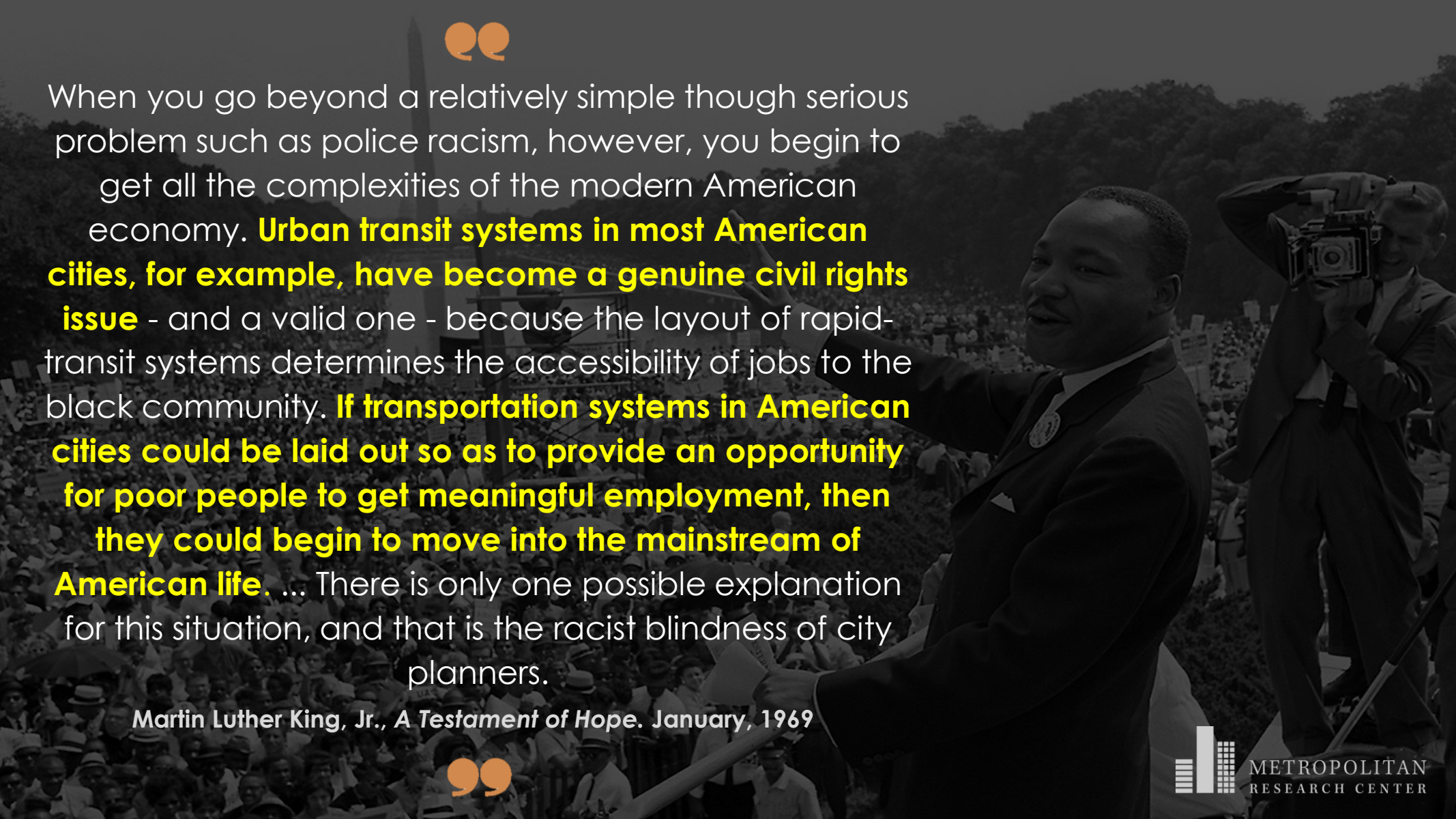

When you go beyond a relatively simple though serious problem such as police racism, however, you begin to get all the complexities of the modern American economy. **Urban transit systems in most American cities, for example, have become a genuine civil rights issue** - and a valid one - because the 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

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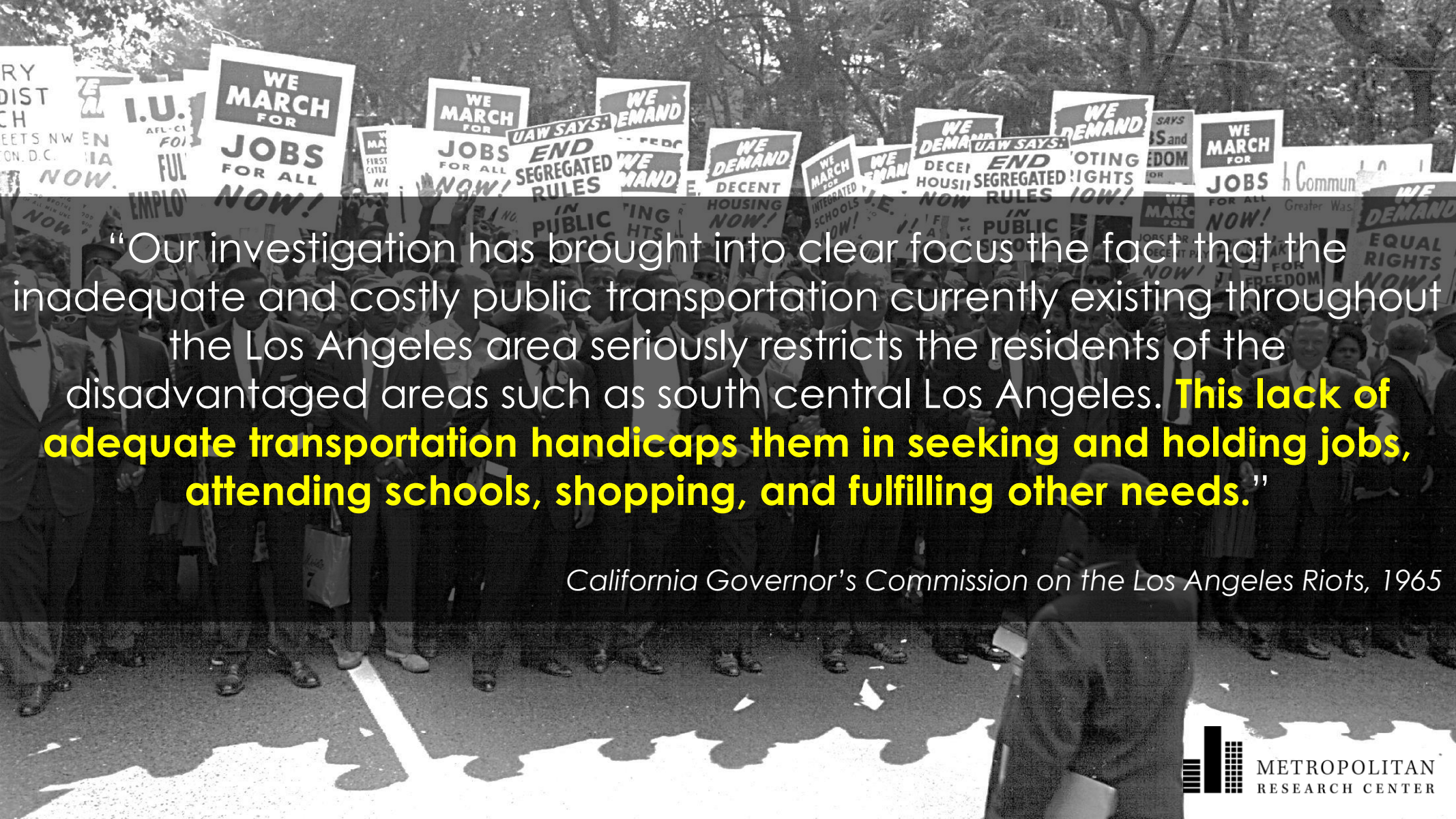

"Our investigation has brought into clear focus the fact that the inadequate and costly public transportation currently existing throughout the Los Angeles area seriously restricts the residents of the disadvantaged areas such as south central Los Angeles. **This lack of adequate transportation handicaps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

California Governor's Commission on the Los Angeles Riots, 1965

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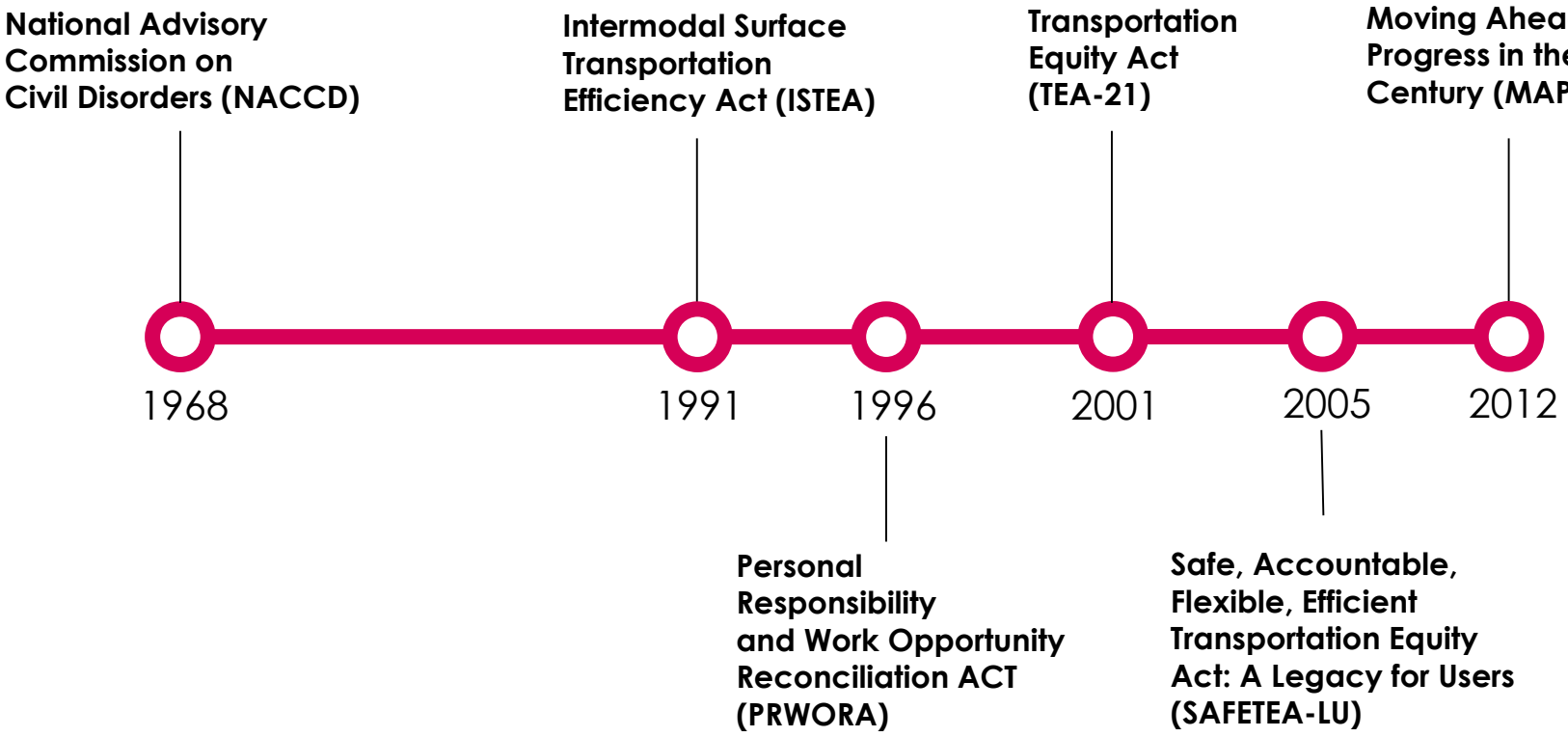
Empirical Reports and Policies
: Transportation and Employment Equity



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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)

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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

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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

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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:

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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

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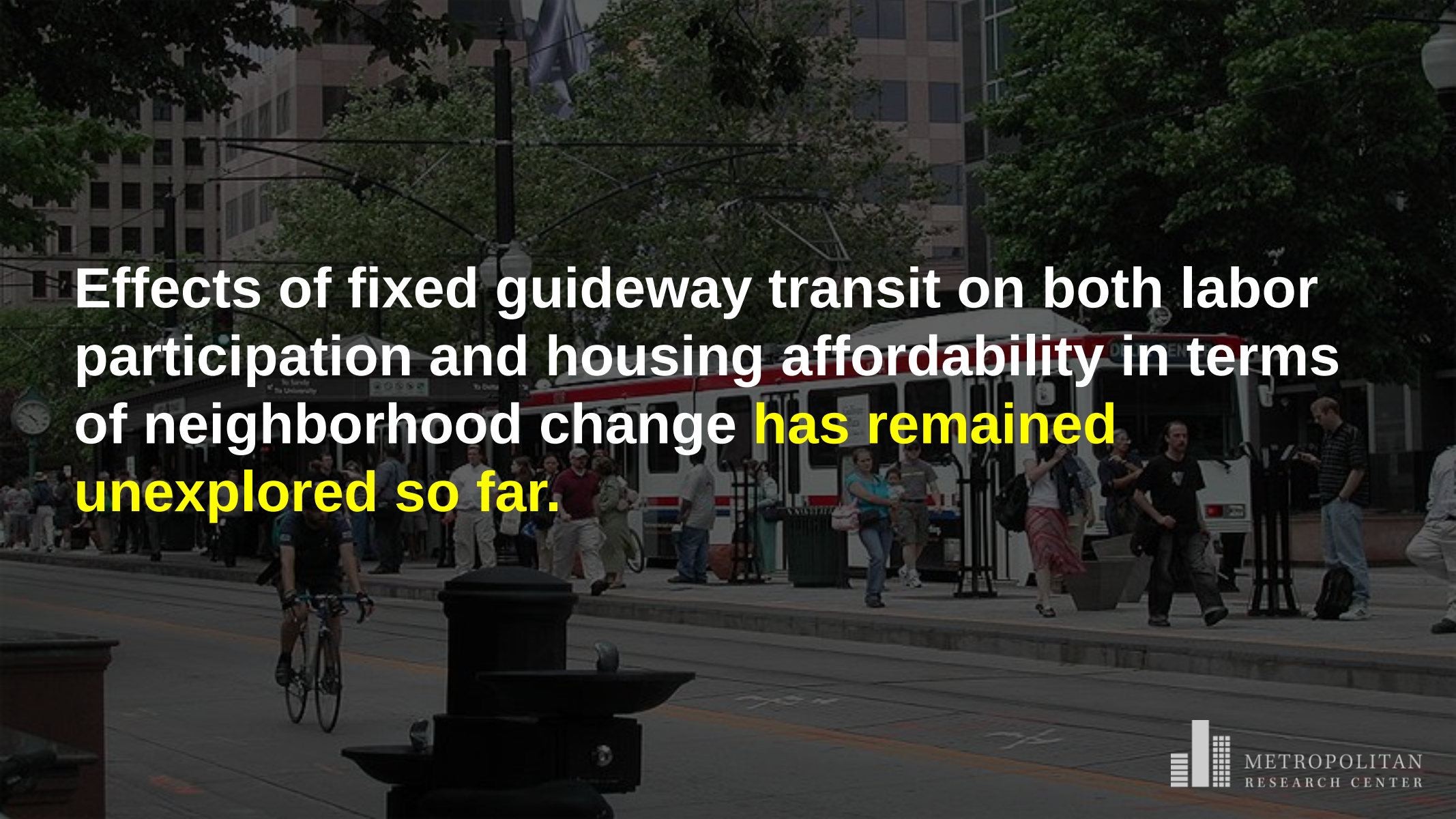
Effects of fixed guideway transit on both labor participation and housing affordability in terms of neighborhood change has remained unexplored so far.
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Data and Variables

- **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 then 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

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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)
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  - ✓ % change in the median gross rent
  - ✓ % change in the selected monthly owner-occupied cost (SMOC)

- **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**

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LYNX Blue Line, Charlotte, NC

Dallas Area Rapid Transit, Dallas, TX

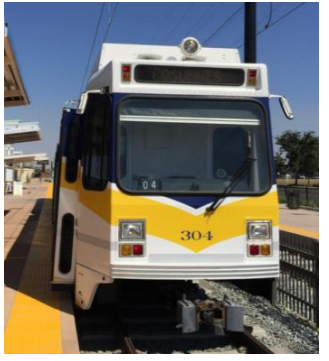
Denver RTD, Denver, CO

METRORail, Houston, TX

Metro Blue Line, Minneapolis, MN

Valley Metro, Phoenix, AZ

MAX LRT, Portland, OR



RTD, Sacramento, CA

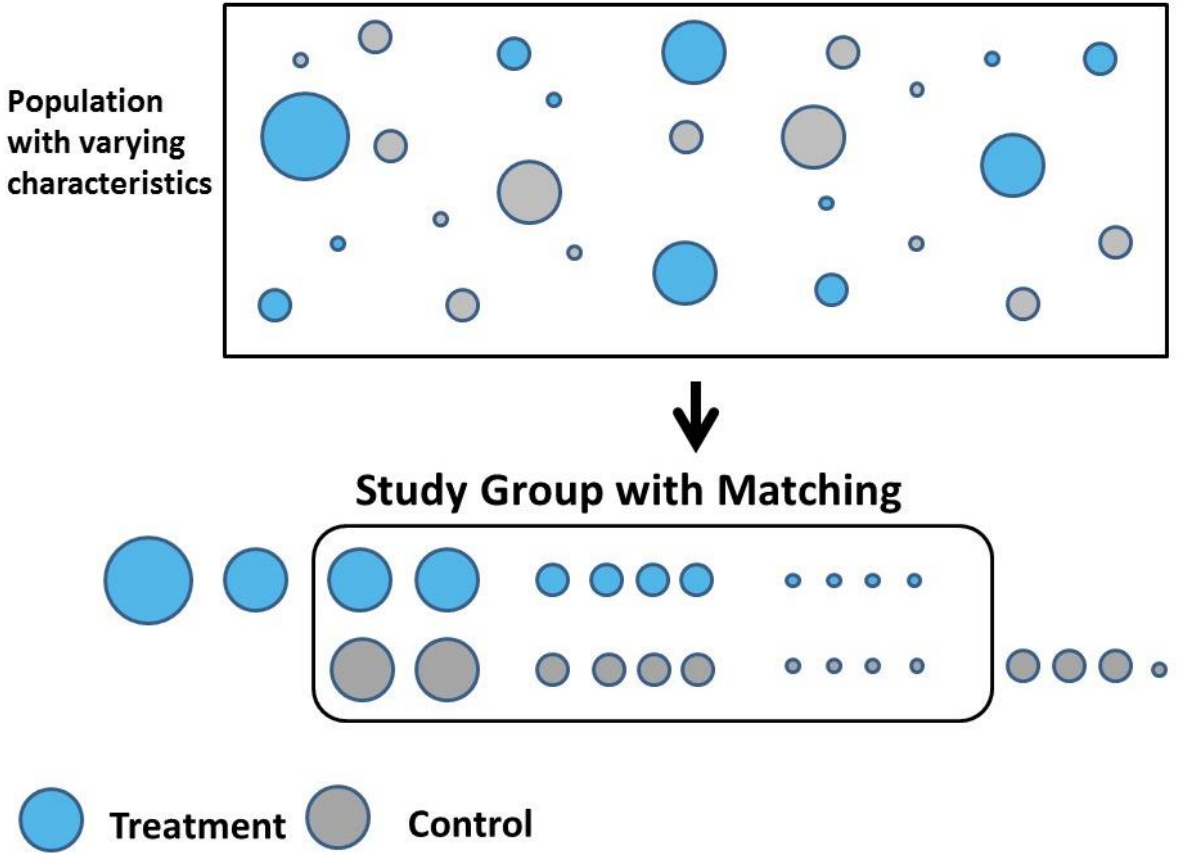
TRAX, Salt Lake City, UT

SRPINTER, San Diego, CA

Link LRT, Seattle, WA

RiverLine LRT, Camden, NJ

Method: Propensity Score Matching (PSM)



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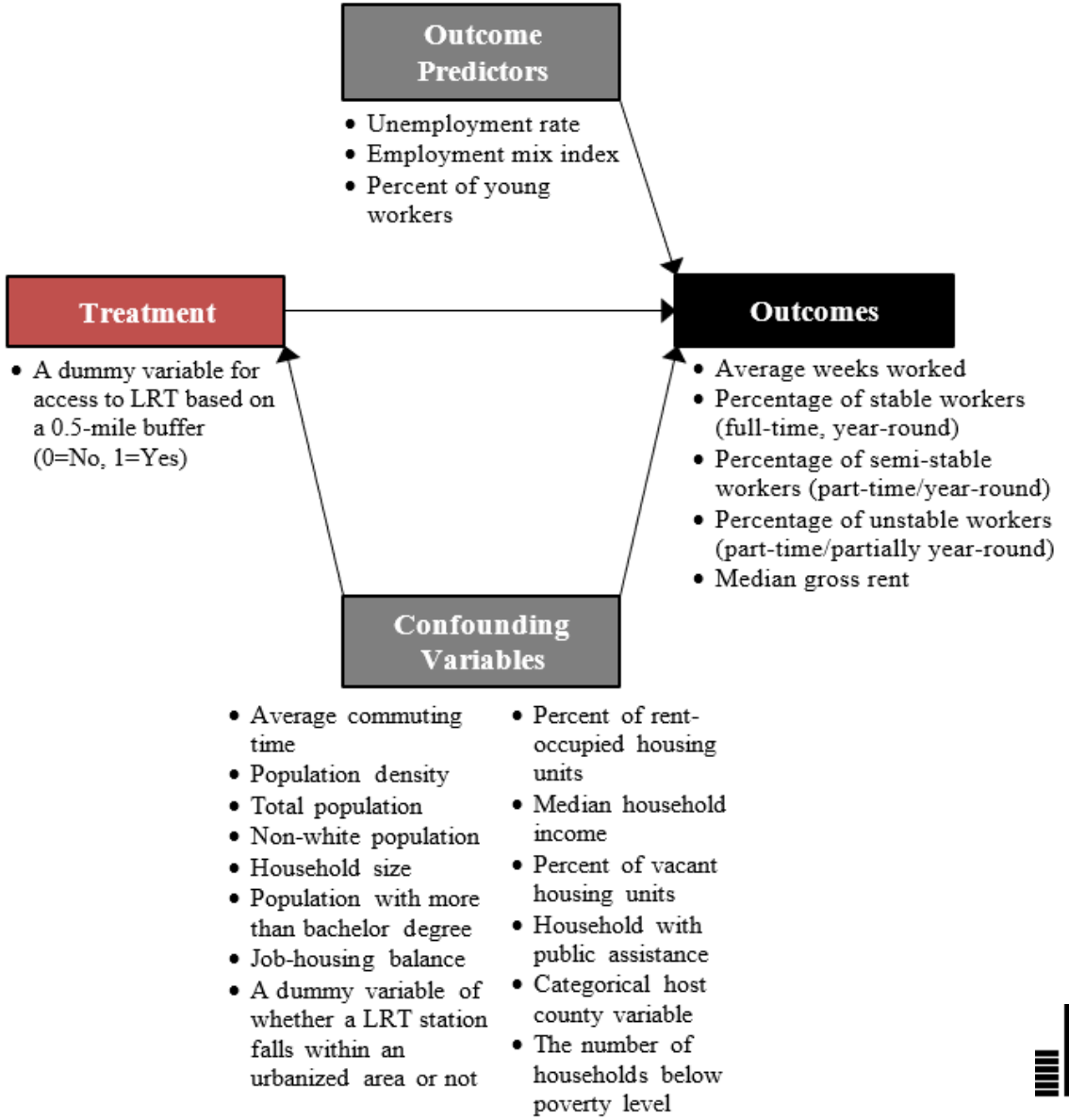
PSM Diagram



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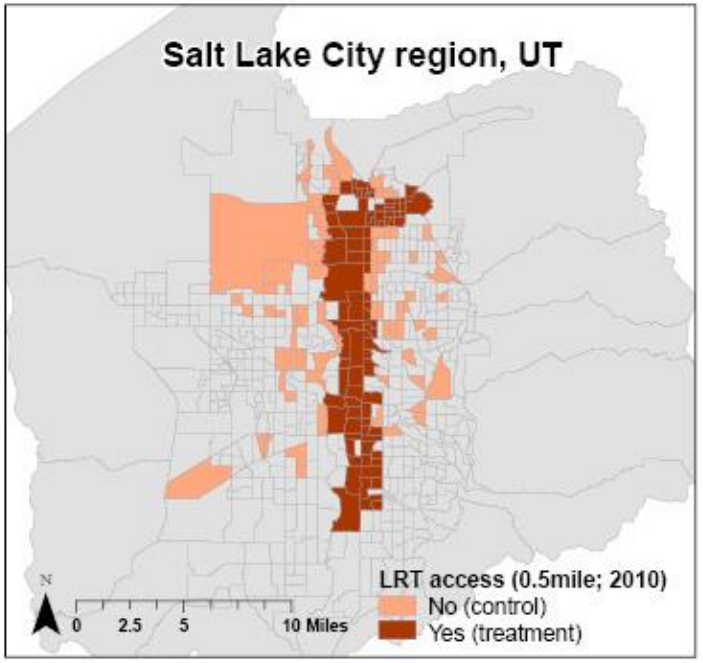
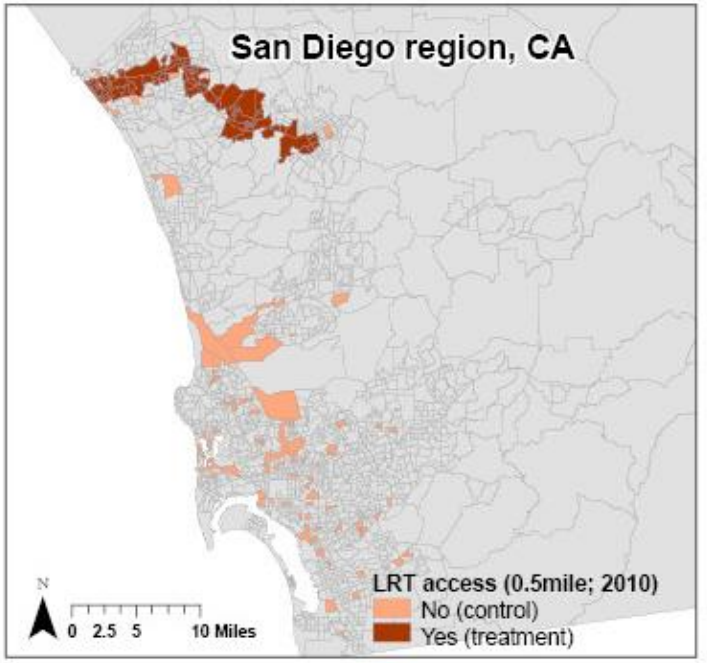
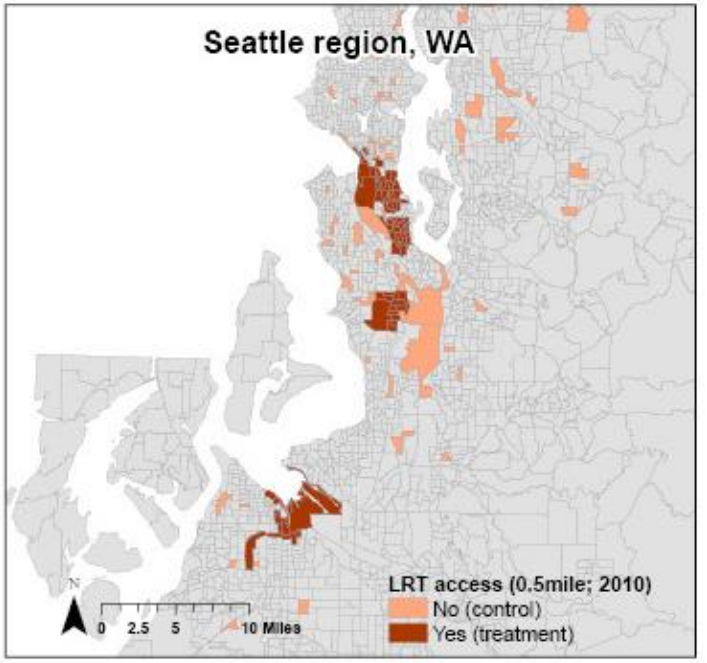
Matched Samples After PSM







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PSM Balance Check

Variables	Before Matching			After Matching		
	No LRT (n=14582)	LRT (n=1048)	Mean Difference[2)]	No LRT (n=1048)	LRT (n=1048)	Mean difference[1)]
Population density	8.7	10.9	2.2***	10.6	10.9	0.3
Total population	1361.1	1282.1	-79.0***	1282.3	1282.1	-0.2
Median household income	53127.7	39931.6	-13196.2***	40147.2	39931.6	-215.7
Non-white population	399.4	466.5	67.1***	478.7	466.5	-12.2
% vacant housing units	5.5	7.3	1.8***	7.4	7.3	-0.1
Household size	2.7	2.4	-0.3***	2.5	2.4	-0.0
% households with public assistance	3.0	5.0	2.0***	5.1	5.0	-0.1
% families below the poverty level	8.3	12.9	4.6***	12.9	12.9	0.0
Job-housing balance	1.8	13.0	11.2***	7.2	13.0	5.8
Population with bachelor's degree or higher	29.9	28.0	-1.9***	27.3	28.0	0.6
% renter-occupied housing units	33.0	50.1	17.1***	48.7	50.1	1.3
% young workers	29.8	28.6	-1.1***	28.3	28.6	0.3
Unemployment rate	6.0%	7.9%	1.9%***	8.2%	7.9%	-0.2%
Employment mix index (2002)	0.7	0.7	0.0**	0.7	0.7	0.0
Average commuting time (min.)	28.3	25.1	-3.2***	25.0	25.1	0.1

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

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The "True Effect" of LRT

Outcomes		Observed difference (original sample)[2)]	ATE (difference after matching)	Mean of Control Group	ATE/ control ratio
Labor Participation	Average weeks worked (% change)	1.32%***	1.03%**	2.40%	0.43
	Full-time, year-round workers (over 35 hrs/wk & 50-52 wks/yr; %p difference)	1.22%***	1.62%***	4.17%	0.39
	Part-time, year-round workers (less 35 hrs/wk & 50-52 wks/yr; %p difference)	-1.65%***	-0.62%	-8.94%	0.07
	Part-time & part-year workers (less 35 hrs/wk & less 50 wks/yr; %p difference)	-0.34%	-0.78%**	0.69%	-1.13
Housing cost	Median gross rent (% change)	11.13%***	3.87%	43.00%	0.09

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

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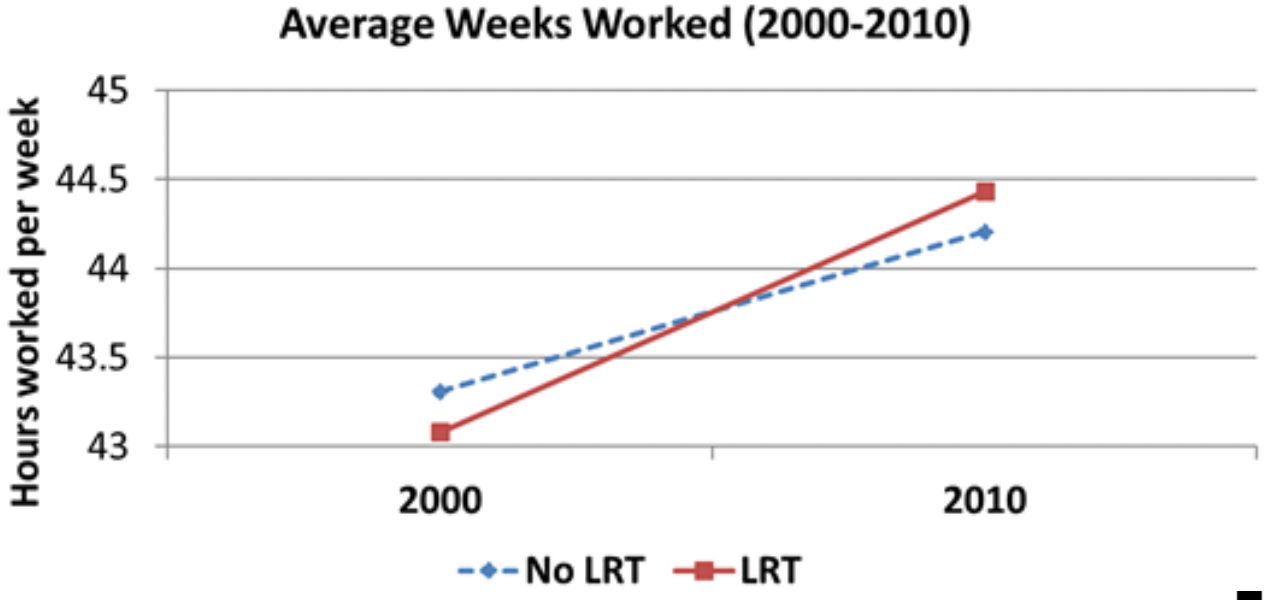
Visualizing Change (I)

- **Change in the Avg. Number of Weeks Worked**
  - ✓ Crossover pattern: **lower** labor participation in the LRT group in 2000 → **higher** labor participation in 2010



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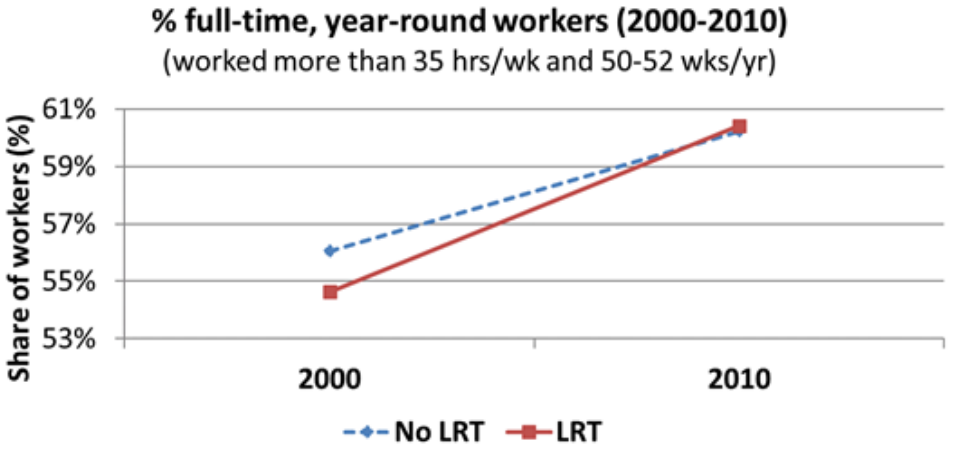
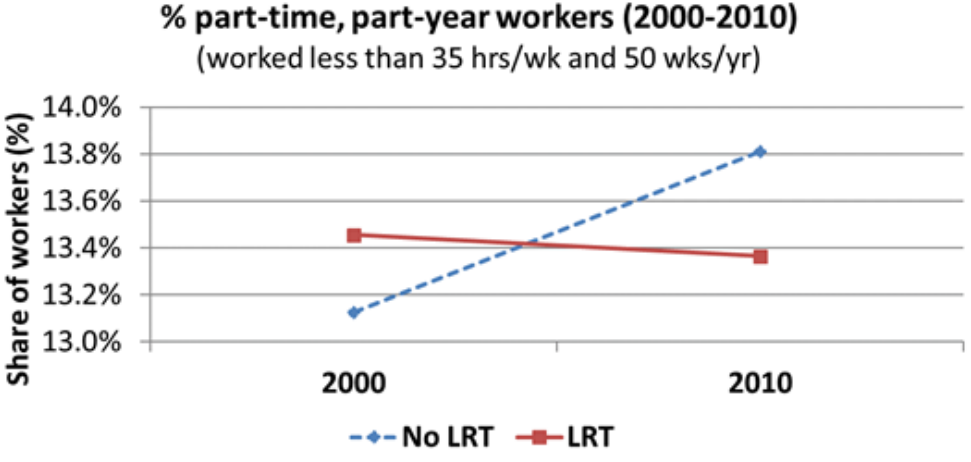
Visualizing Change (II)

- **% 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





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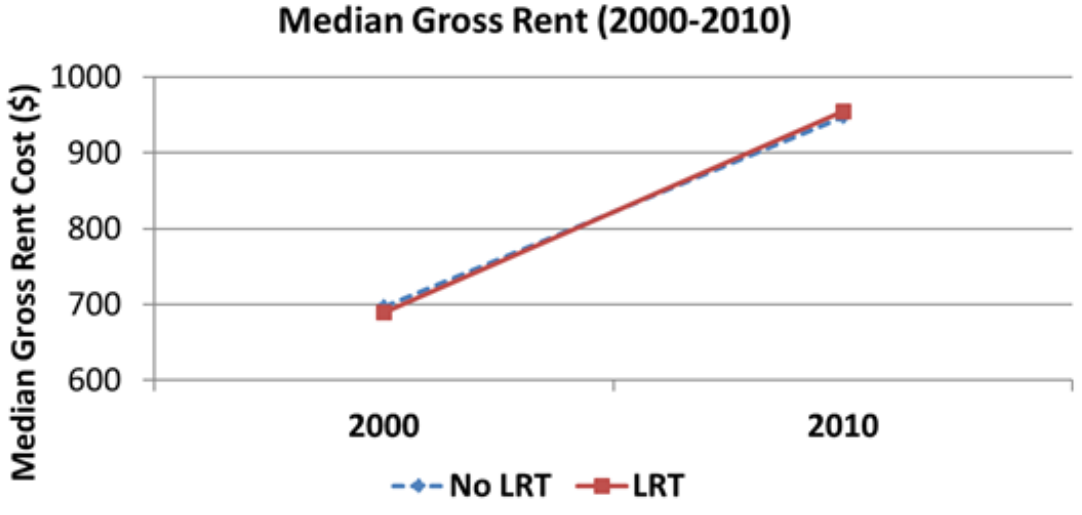
Visualizing Change (III)

- **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.**



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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

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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.

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