

Microeconomic Impacts of Public Transit Evidence from Lahore, Pakistan

Hadia Majid¹ Ammar A. Malik² Kate Vyborny³

¹Lahore University of Management Sciences

²Urban Institute

³Duke University

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Motivation

- **Urban growth:** of the total expected population increase of 1.4 billion people in developing countries by 2030; 96% will live in urban areas (World Bank 2013)
- **Rapid increase in cars:** e.g. in Beijing, from 2 to 5 million from 2004-2010
- But poor have **limited access to cars or public transport:** in SS Africa, 5% of urban trips are on public transport (Pojani and Stead 2015)
- Governments **investing in public transit:** 205 BRTs in operation including 117 in Asia, Africa and Latin America, and even more are planned (www.brtdata.org)

Research Question

- How do urban **public transit investments** affect:
 - Travel decisions
 - Labor markets
 - Firm activity
 - Land prices
 - Urban form and density
- What can be learnt from past experiences to improve designs of future projects?

Lahore Metrobus



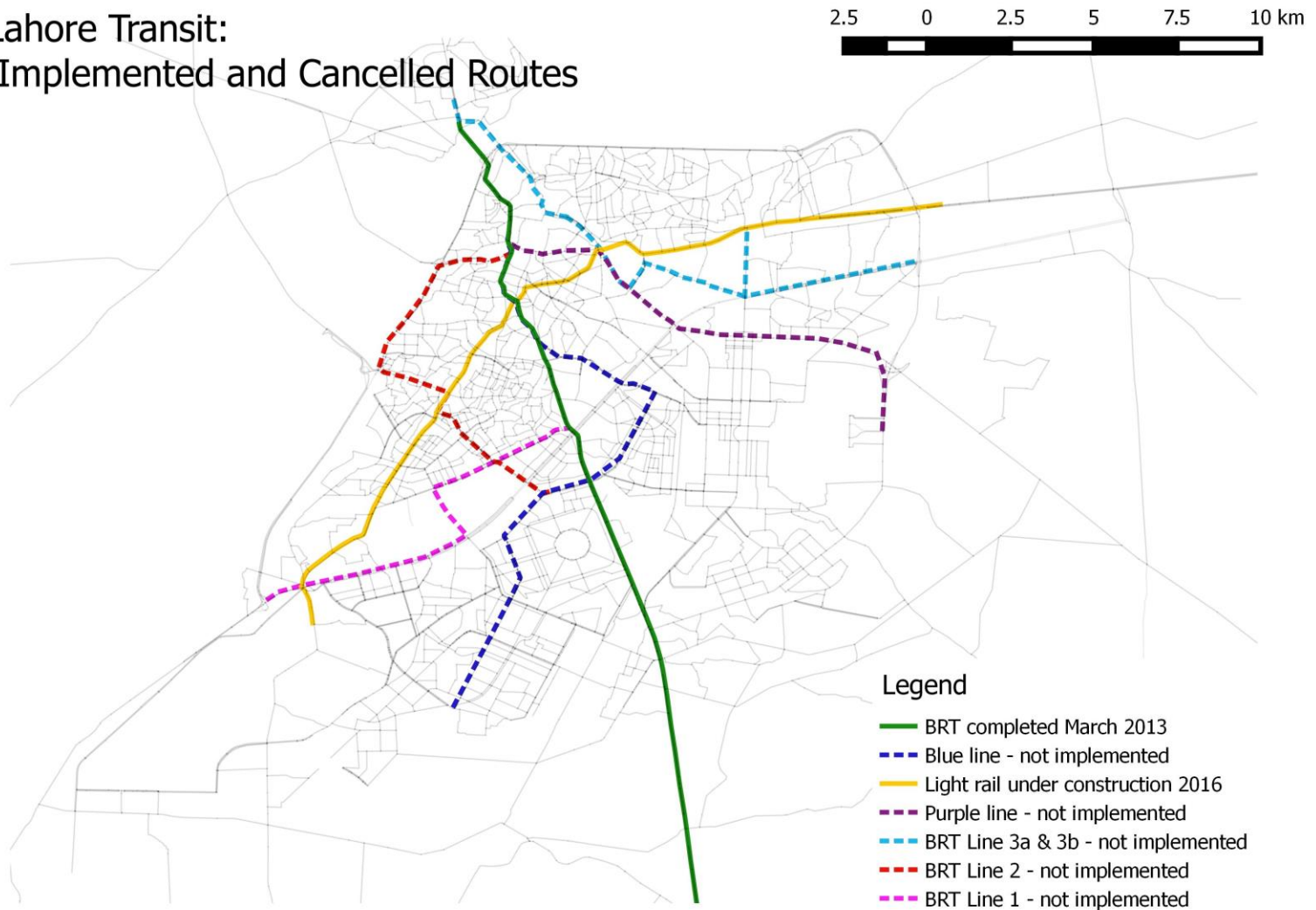
- City of 10 million (estm.)
- Major BRT line (27 km) introduced in 2013
- 20 cents flat fare after subsidy!
- 200,000 daily trips, well above planned capacity
- Decision to replicate in 5 other cities, 2 already in operation
- Political controversy!

This Project

- Quasi-experimental design using **planned and cancelled lines as comparison groups**
- Detailed **microdata**: income, jobs, transport modes, residential and work locations, housing and rents etc.
 - 2010: 18,000 HH survey covering the entire city by JICA
 - 2016: 13,000 HH survey in subsample of areas, real estate agents surveys, rider surveys, field observations, satellite data
- Partial equilibrium: effects are a combination of net **changes in activity and reorganization** across space

Lahore Transport Masterplan

Lahore Transit: Implemented and Cancelled Routes



Plan spans most employment



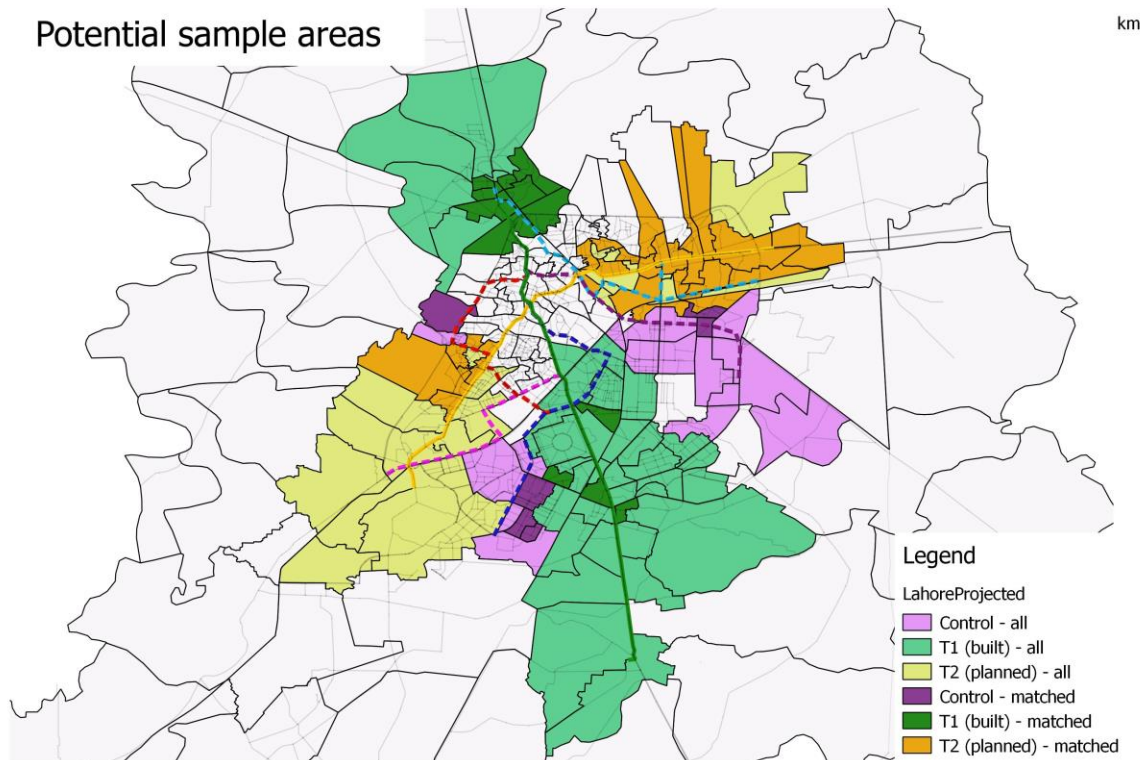
One built line: crossing entire N-S



Second line under-construction



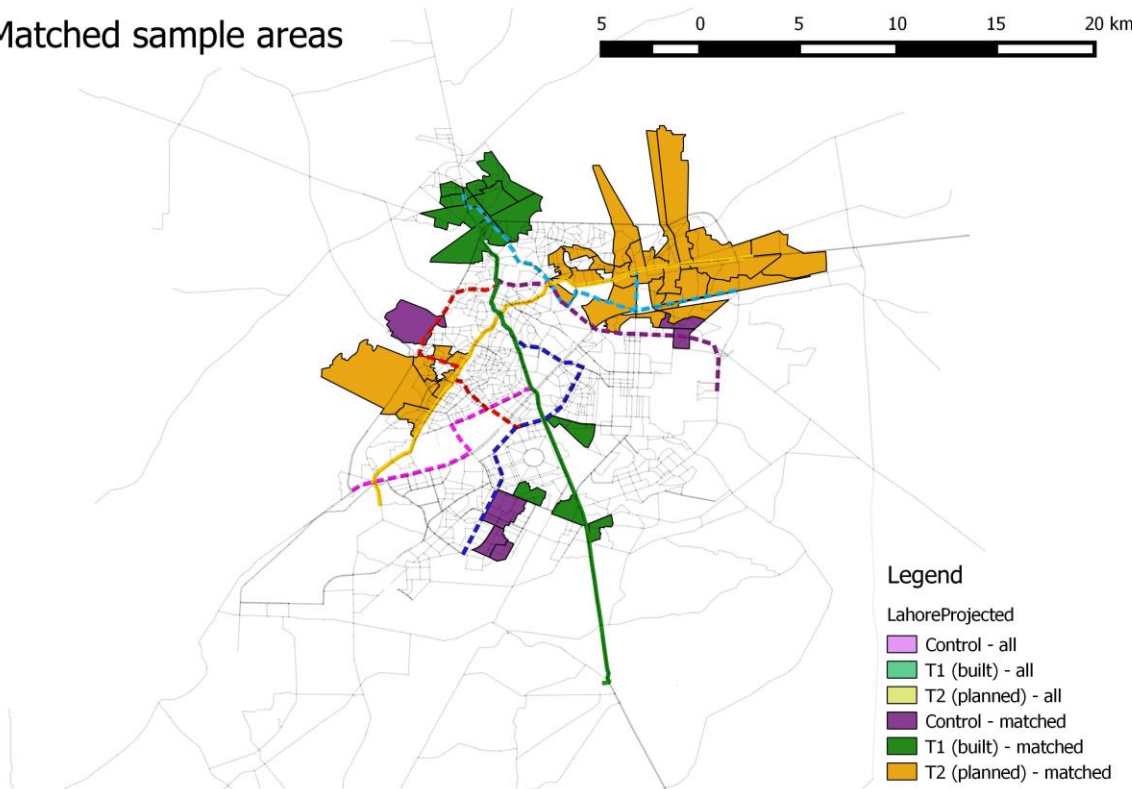
Quasi-experiment plus matching



- Planned (under construction) and cancelled lines form comparison groups
- Major arteries – prioritization of green (built 2013) and orange line (under construction)
- Avoid spillovers: C zones at minimum distance from T1/T2 stops

Matched sub-sample

Matched sample areas



- Selected “zones” similar on observables at baseline
- Matched on 2010 data (labor, income, commute, demographics), 1998 census (pre-trends) characteristics of surrounding zones
- Well-balanced after matching

Empirical Specification

- Variable of interest: **Measure of public transport access to city center** – travel times reported by community respondent
 - “How long does it take to get from here to Kalma Chowk using only walking, bus, wagon or metrobus?”
- Use **distance to bus stop** as an **instrument for travel time** from community to central point in city
- Identifying assumption: **Conditional on distance to any planned stop, distance to build stop is exogenous**
 - An area 1km from a planned stop and another 1km from a built stop with similar observables in 2010 have the same time trend in Y

Descriptive Statistics – 2016 Survey

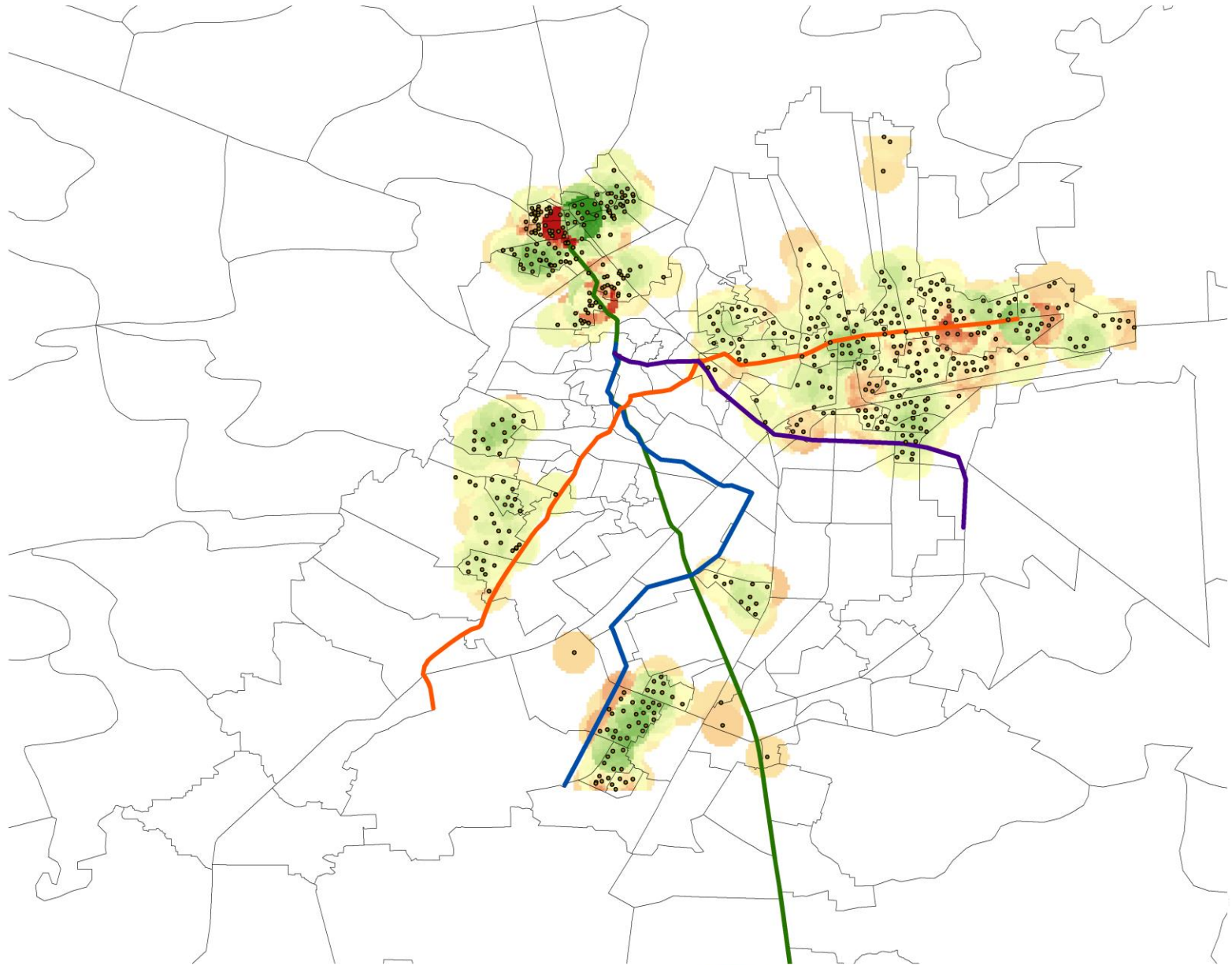
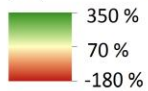
	mean
Female	0.486
Age	34.932
Years education	7.675
Commute time (minutes)	4.931
Commute time - conditional	23.435
Public transport commute	0.024
Public transport commute - conditional	0.068
Work outside home	0.335
Work outside home (women)	0.036
Ln distance to work (km)	2.693
HH member joined	0.018
HH moved to area	0.181
HH owns dwelling	0.793
New workplace	0.048

Changes in Residential Rents

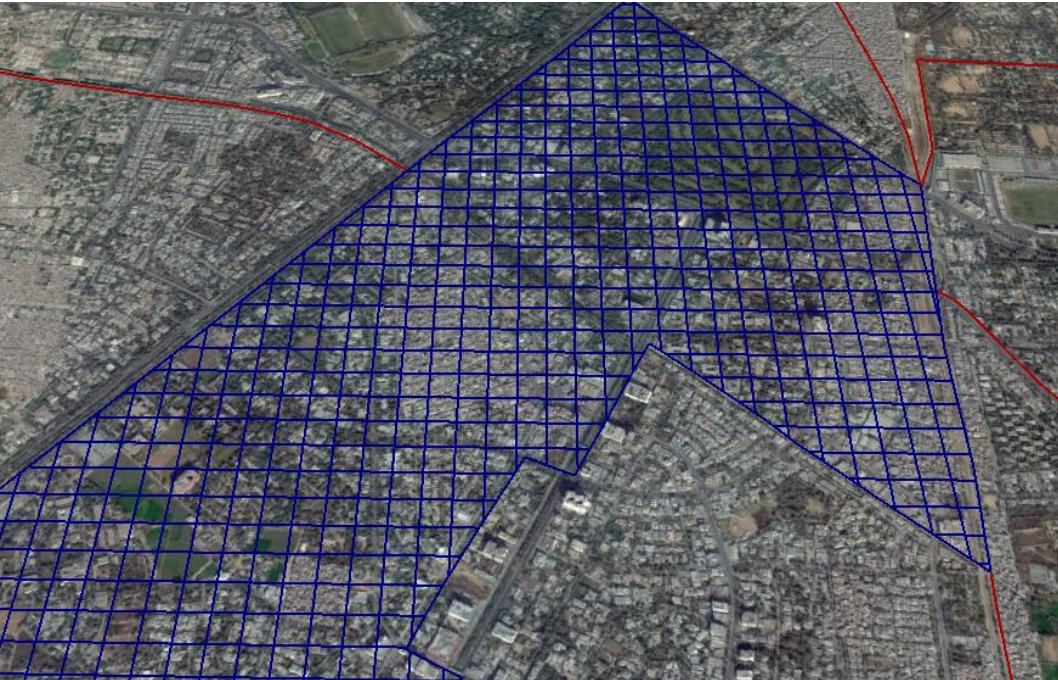
Legend

- Purple Line
- Orange Line
- Blue Line
- Metrobus Line

Change in Rent per m²
(Adjusted for Inflation)



Satellite Imagery



- Experimentation with measuring pre- (2010) and post-BRT (2016) built area density in C and T zones
- 100 x 100 meter grid cells layered onto free Google Earth imagery
- Likert scale: 0 → not at all built-up; 5 → fully built-up

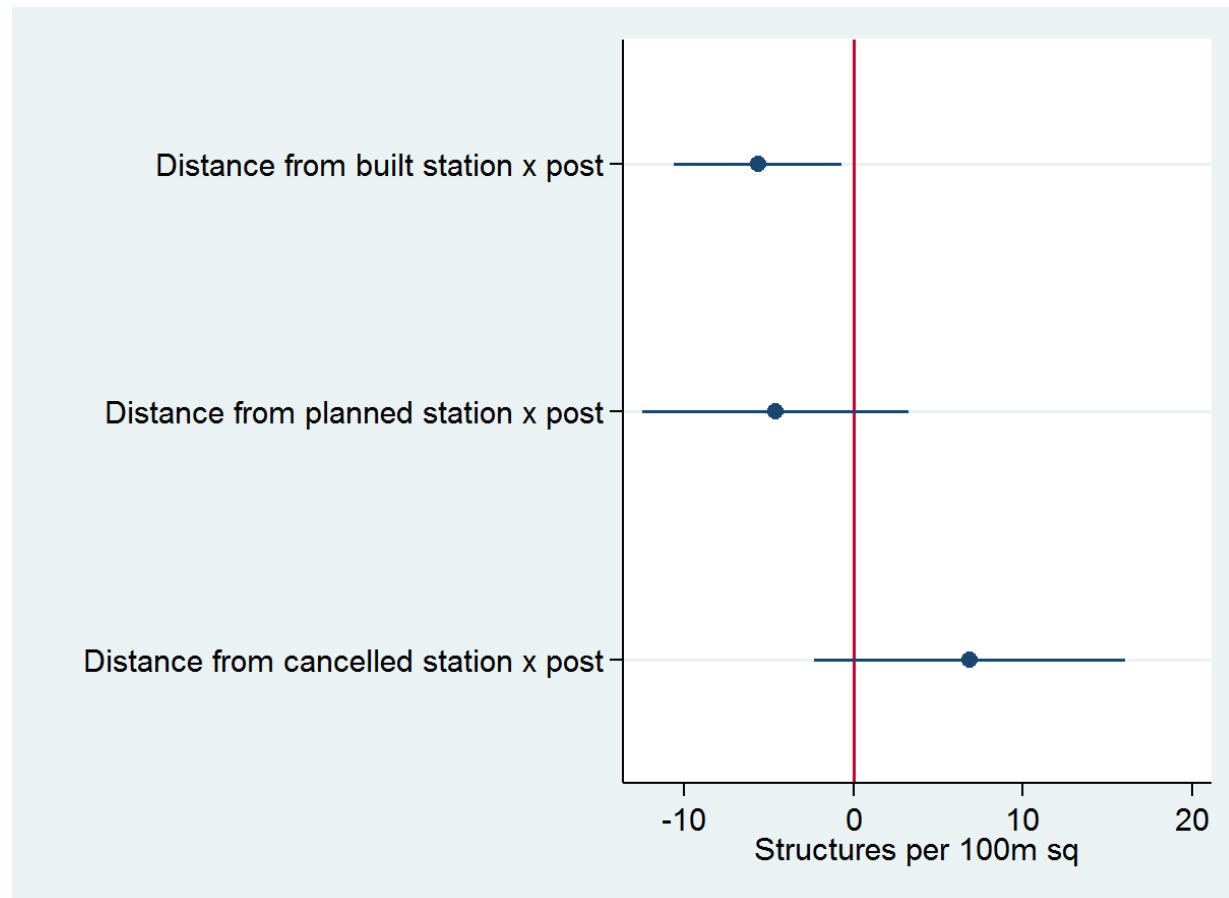
Results

- Impact of greater accessibility – ten minute decrease in public transport travel time to center

Outcome	Estimate	% change
Commute time (users and non-users)	-1.1 min.***	5%
Commutes by public transport	0.8 p.p.***	11%
Labor force participation	0.00 (N.S.)	-
Distance to work (km)	0.00 (N.S.)	-
Local businesses per HH	0.13***	8%

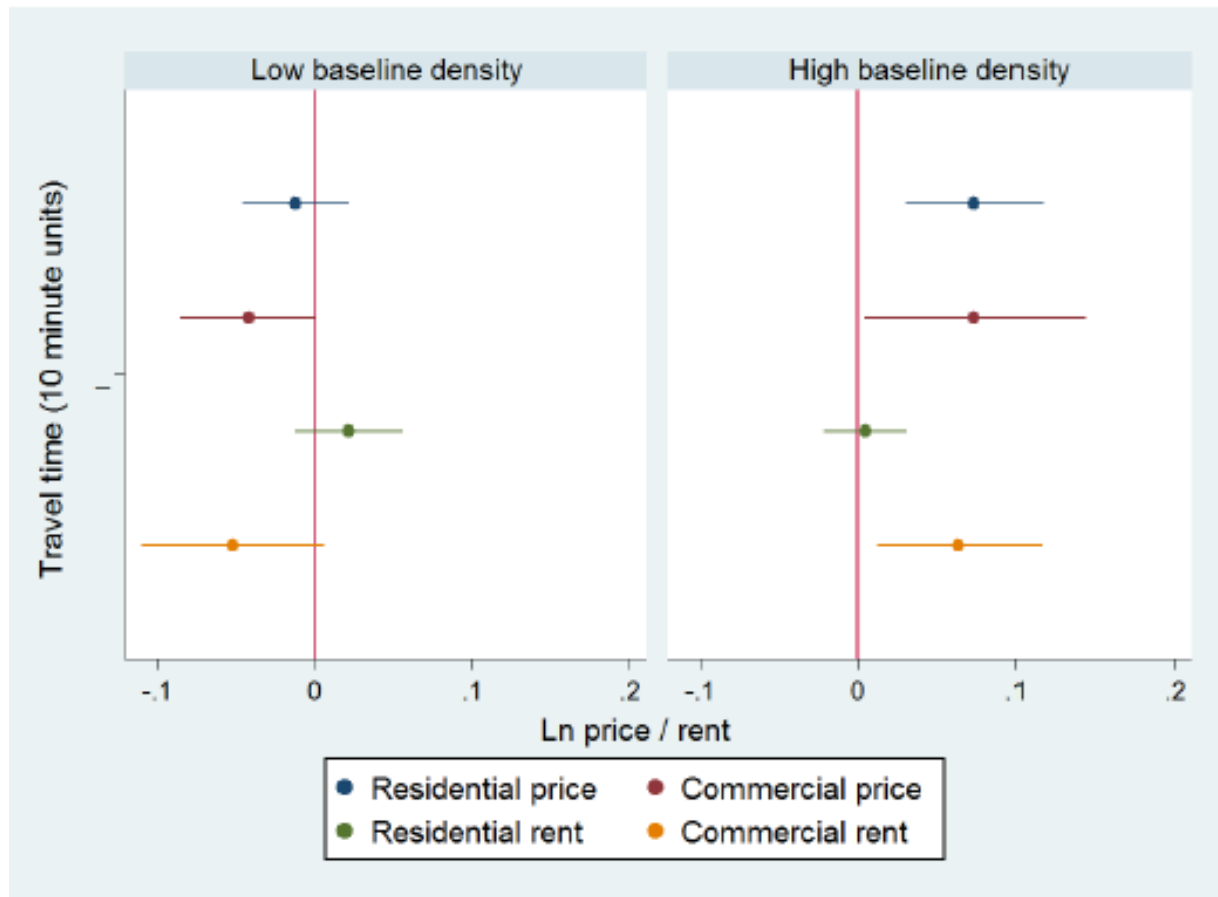
Results

- Built density appears to have increased around treated stations



Results

- Real estate prices increased in high density areas



Conclusions

- As of 2.5 years after first line opened:
 - Time savings for commuters
 - Switch to public transport commute
 - No evidence of labor market adjustments
 - Increase in local business activity
 - Increase in density
 - Prices increased where baseline density high
- Next steps
 - Use of firm locations in analysis, # firms in X commute time
 - Firm surveys, impacts on larger more formal firms
 - Systematic Analysis of satellite data
 - Potential future survey rounds after Orange line is launched

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