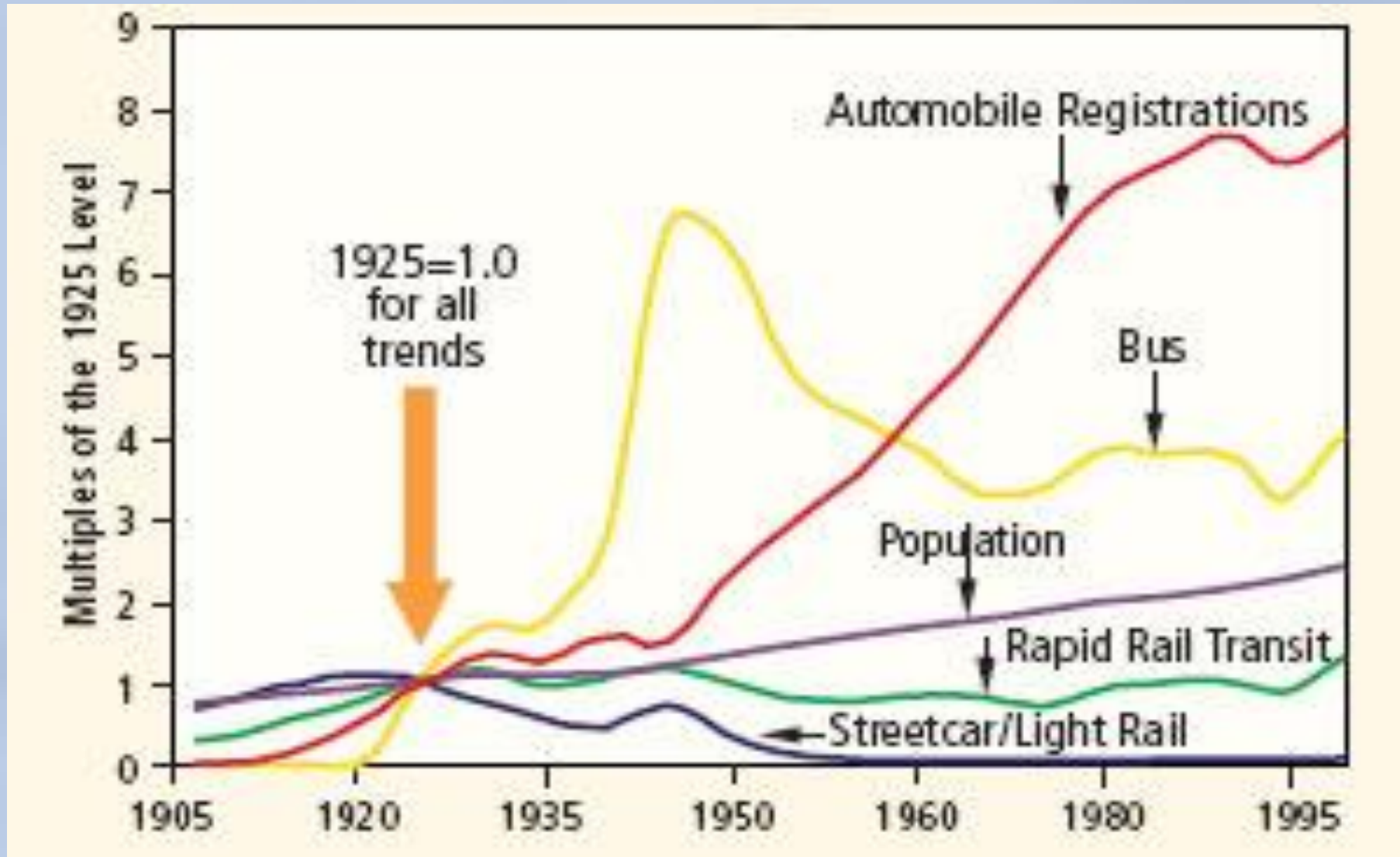


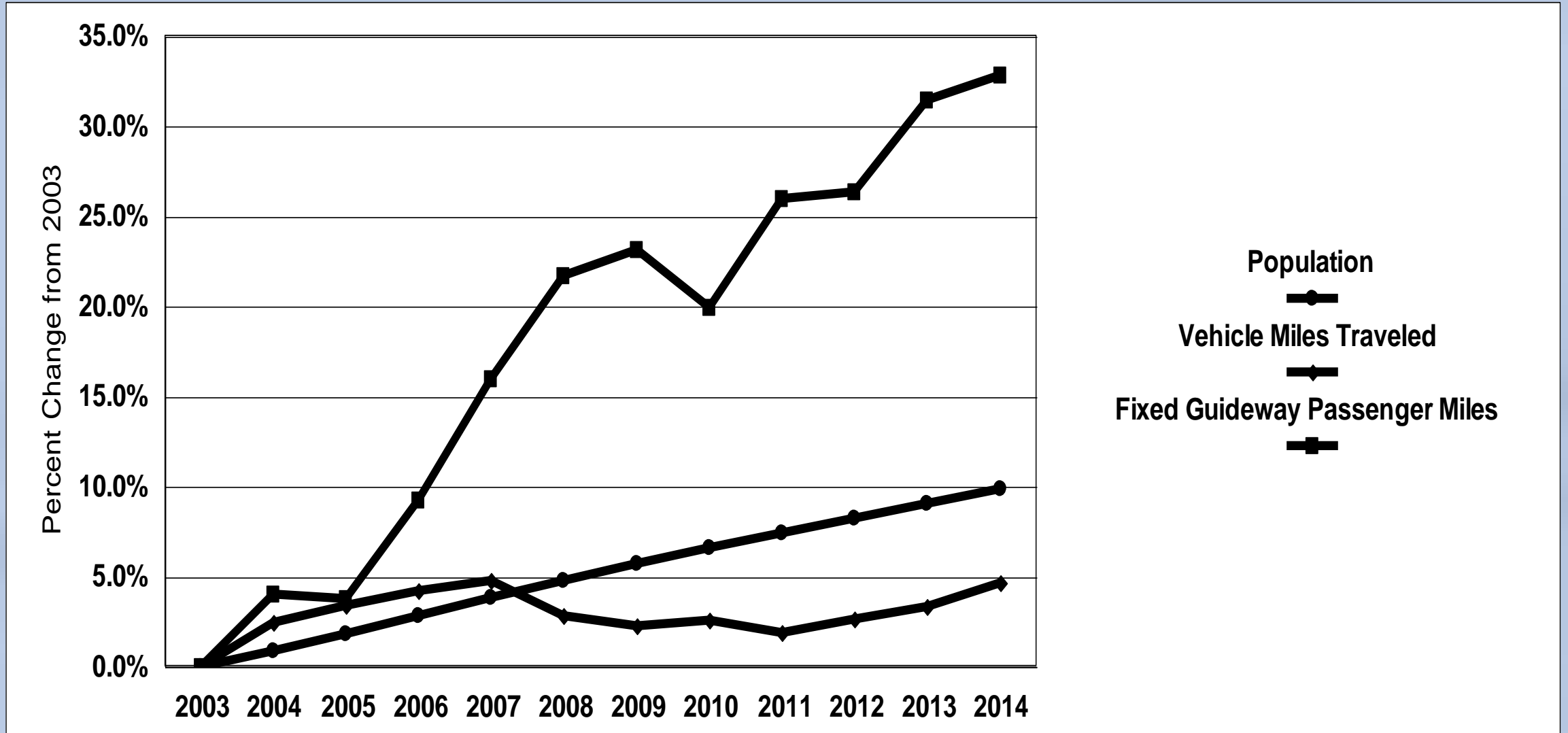
Fixed Guideway Transit Outcomes on Rents, Jobs, and People and Housing

**Arthur C. Nelson, Ph.D., ASCE, FAICP
Professor of Planning and Real Estate Development
University of Arizona**

Changing Transportation Modes in 20th Century



Percent change 2003 to 2014 in population, vehicle miles traveled and FGT passenger miles annually



Theory

Transportation systems **improve accessibility** thereby reducing the **friction of distance** and **increasing economic exchange**.

But **transportation systems (i.e. highways)** can reduce **economic development** such as when beltways disperse to densities lower than their **economic thresholds**.

Adding **new transportation modes** in built-up urban areas can **increase aggregate economic activity** by making congested areas less congested.

Public transit should **reduce production costs, increase income, raise property values, increase jobs, and raise the overall rate of return** to real estate investments.

Scant research: We will **help close this gap**.

DART Rail System Map



Denver, Colorado
RTD Light Rail

- Denver Union Station – Littleton – Mineral
- 30th – Downing – Littleton – Mineral
- Denver Union Station – Lincoln
- Downtown Denver – Lincoln
- Downtown Denver – Nine Mile
- Denver Union Station – Jefferson County Government Center



Denver RTD Light Rail (not an official diagram / not to scale) as of January 2014
Diagram by Robert McConnell "The Port of Authority" for Wikimedia Commons
CC-BY-SA 3.0 (creativecommons.org/licenses/by-sa/3.0/deed.en)
Created with Inkscape (inkscape.org)



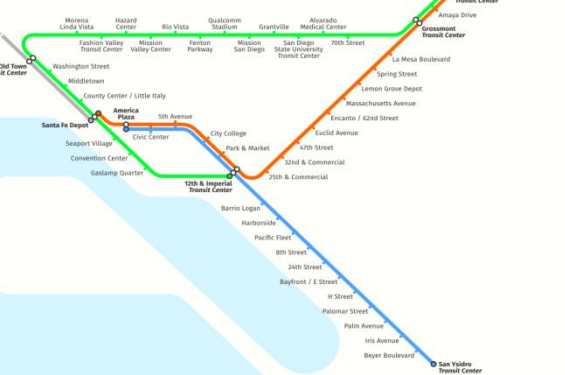
San Diego Trolley

Service as of January 2014

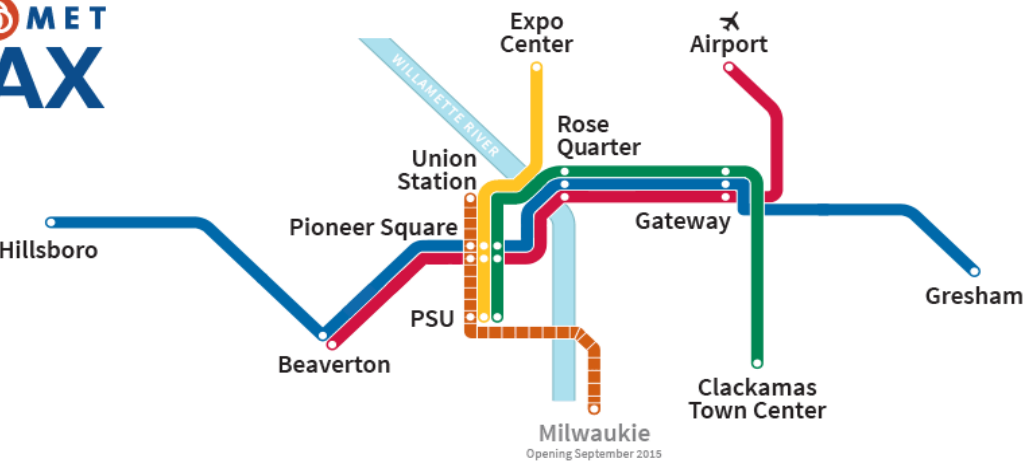
- Blue Line: America Plaza – San Ysidro
- Orange Line: Santa Fe Depot – El Cajon
- Green Line: 125th St Imperial – San Marcos Transit Center
- Coaster connecting service: San Diego – Oceanside

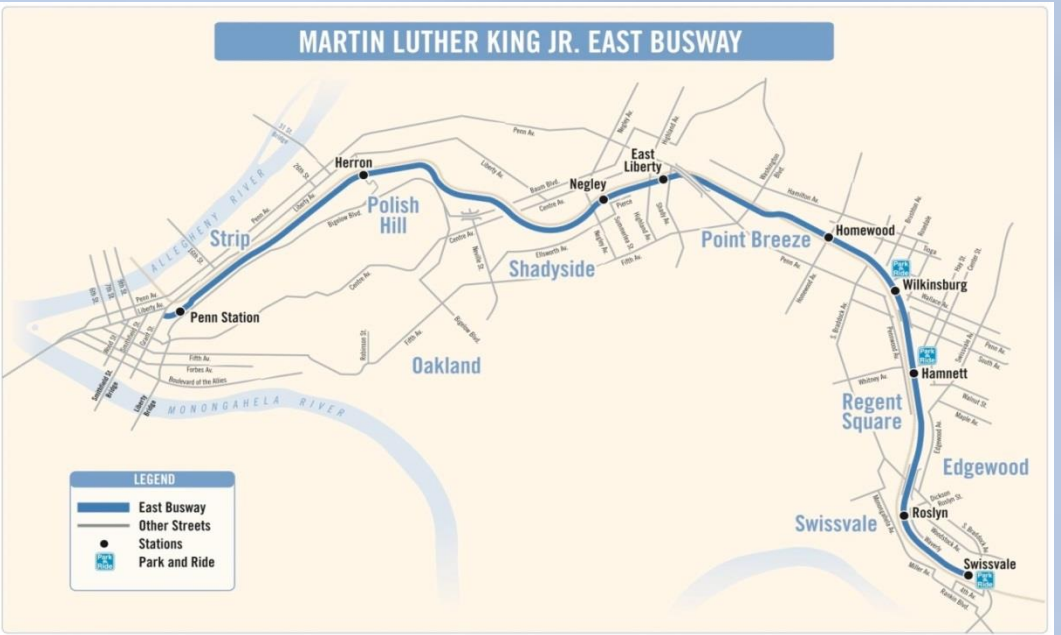
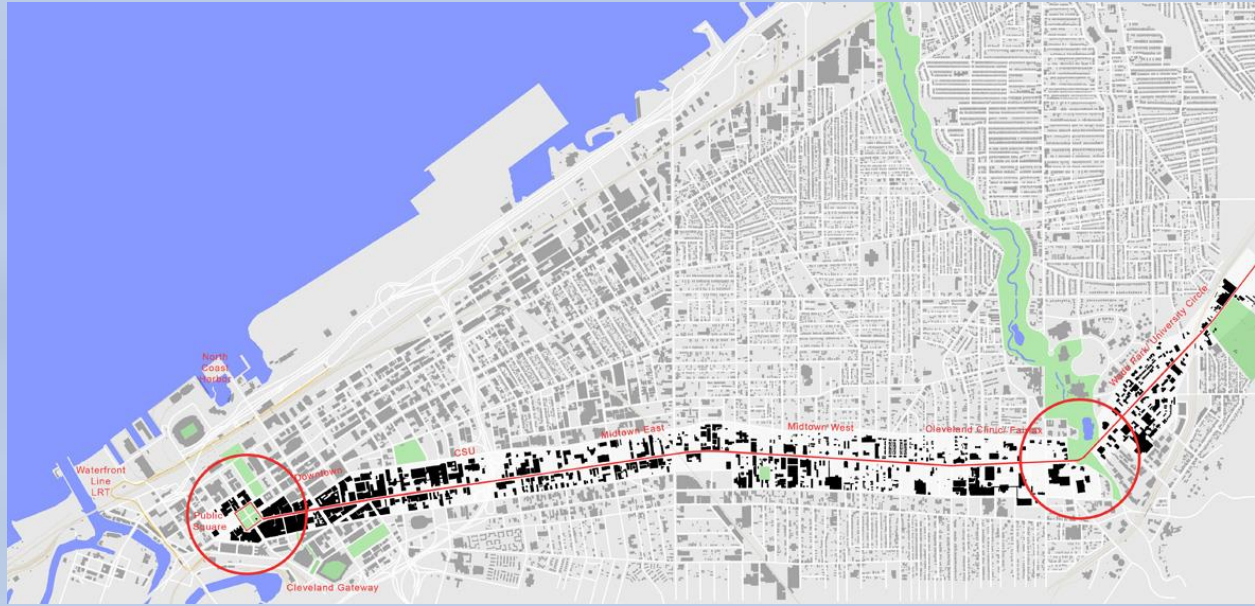
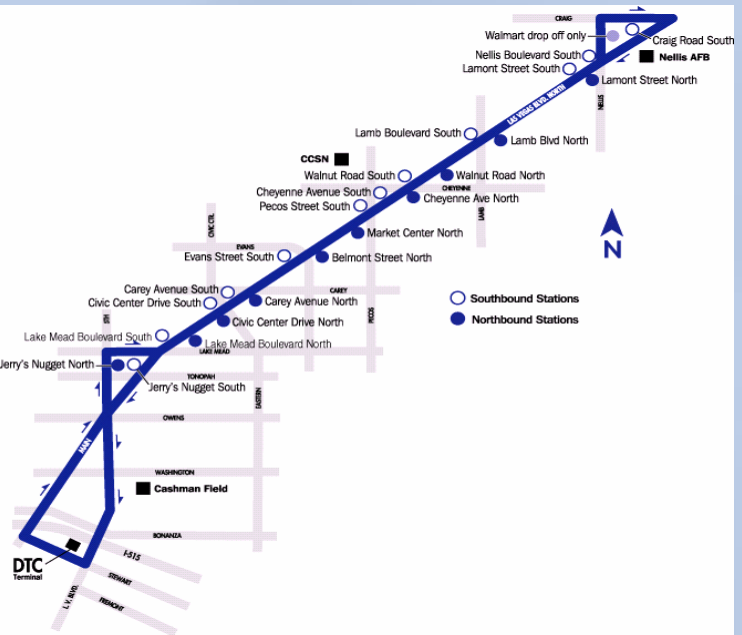
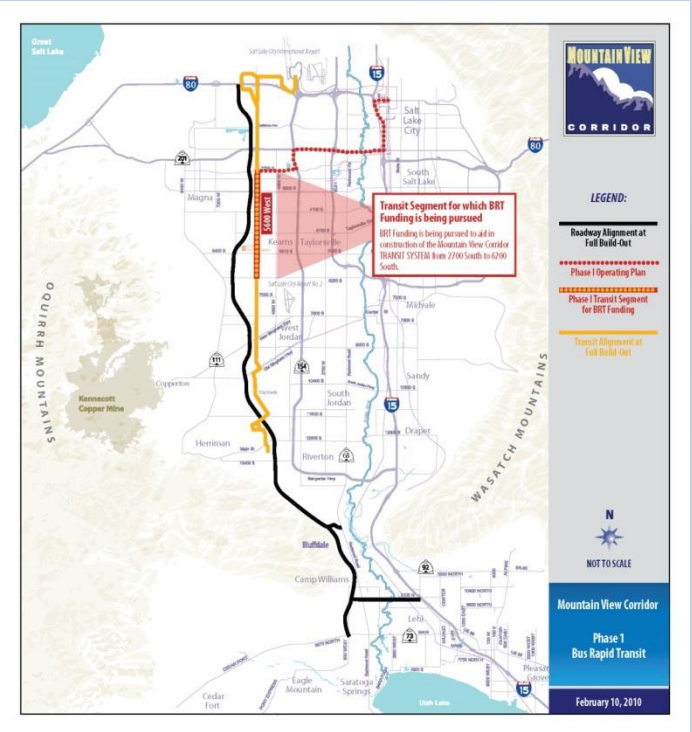
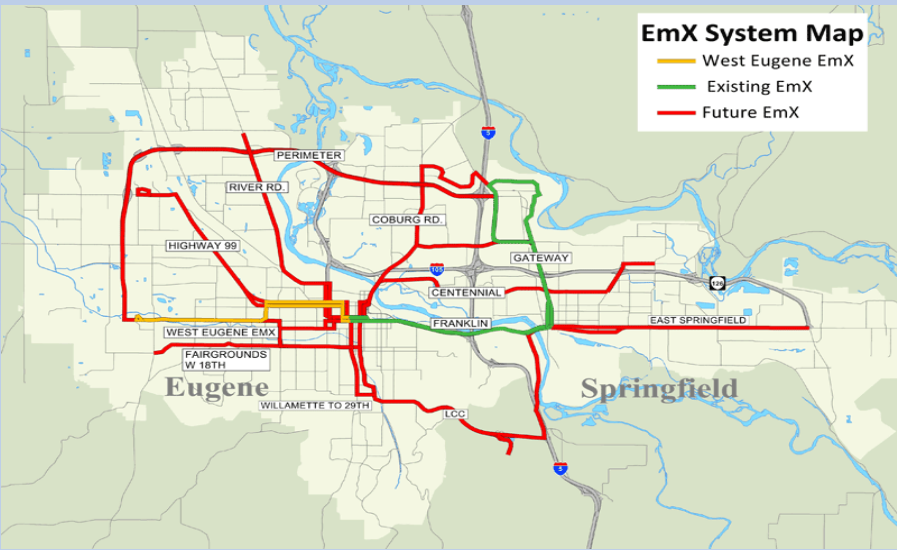
Key to symbols

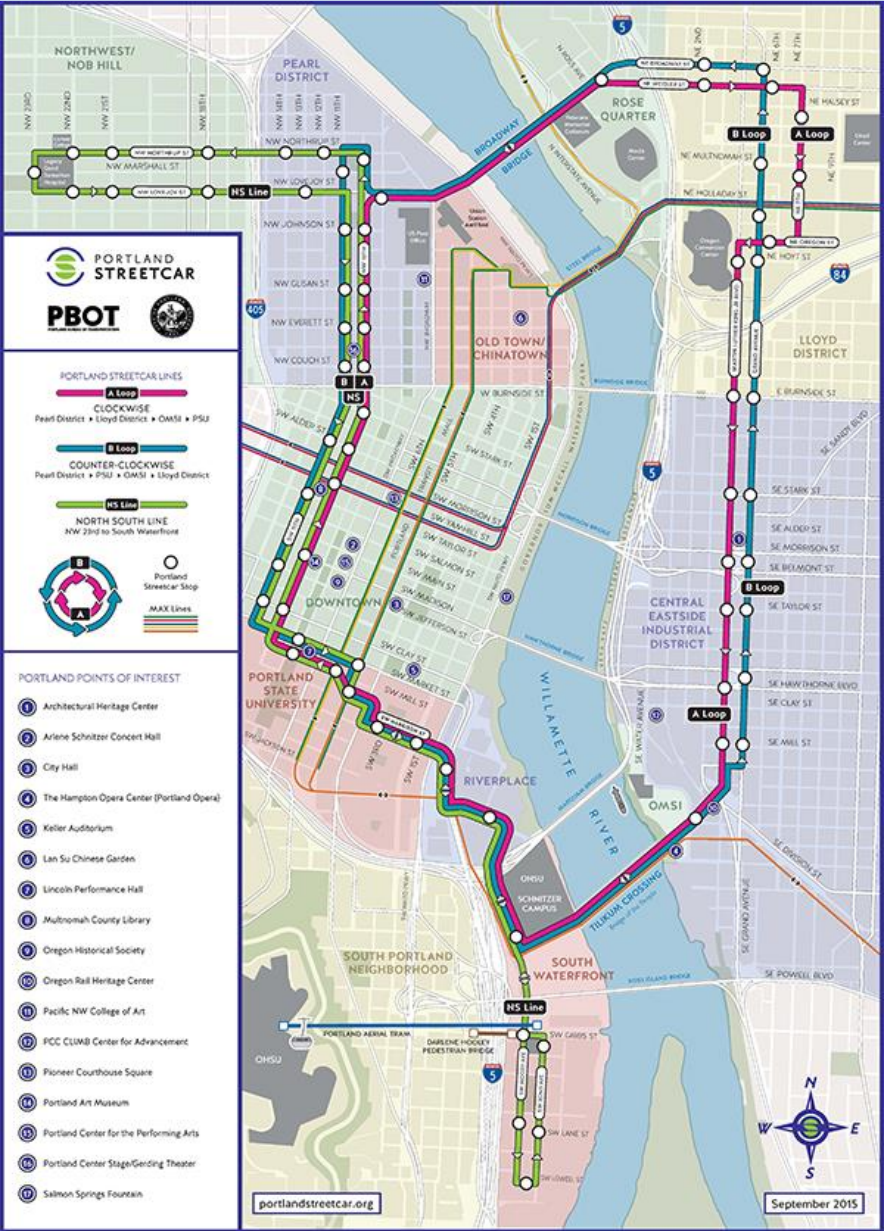
- Normal station
- Transfer station
- Terminal station

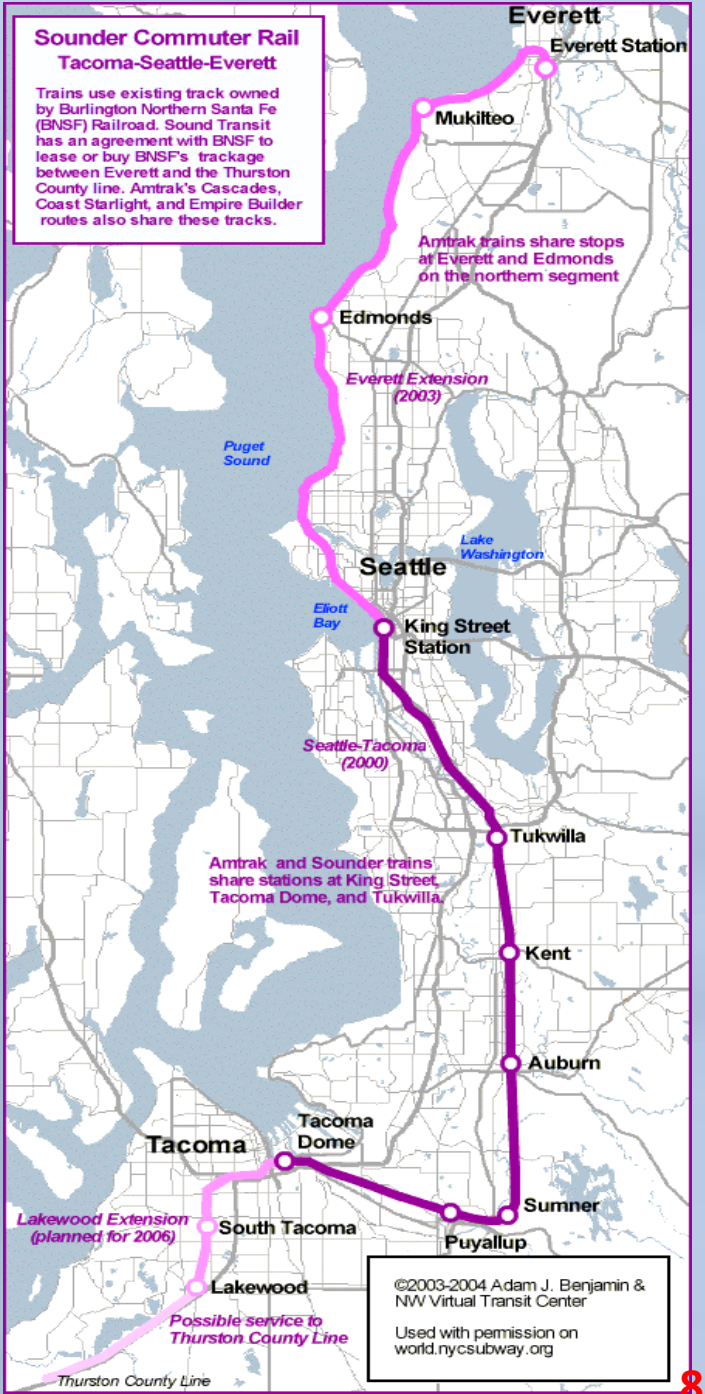
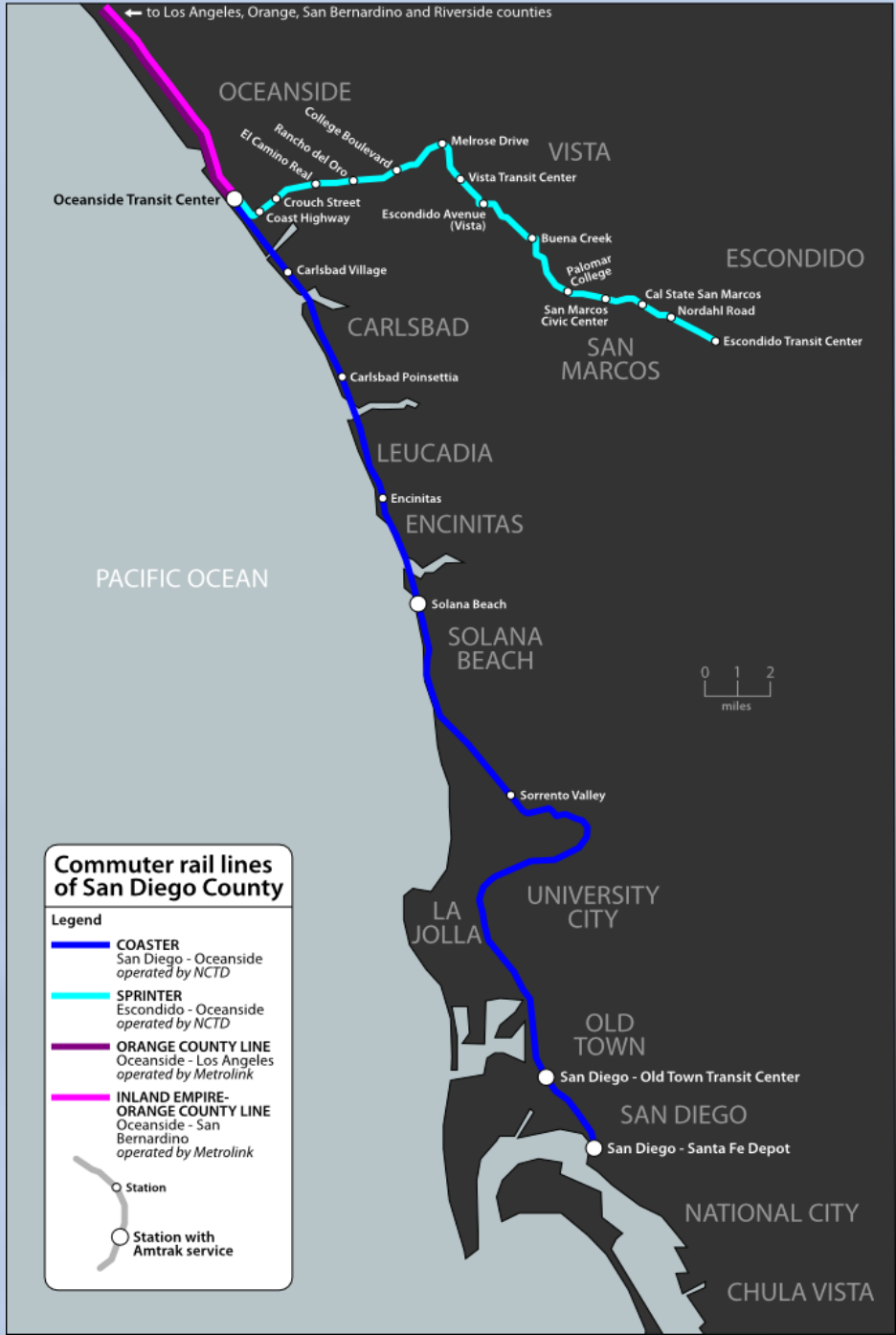
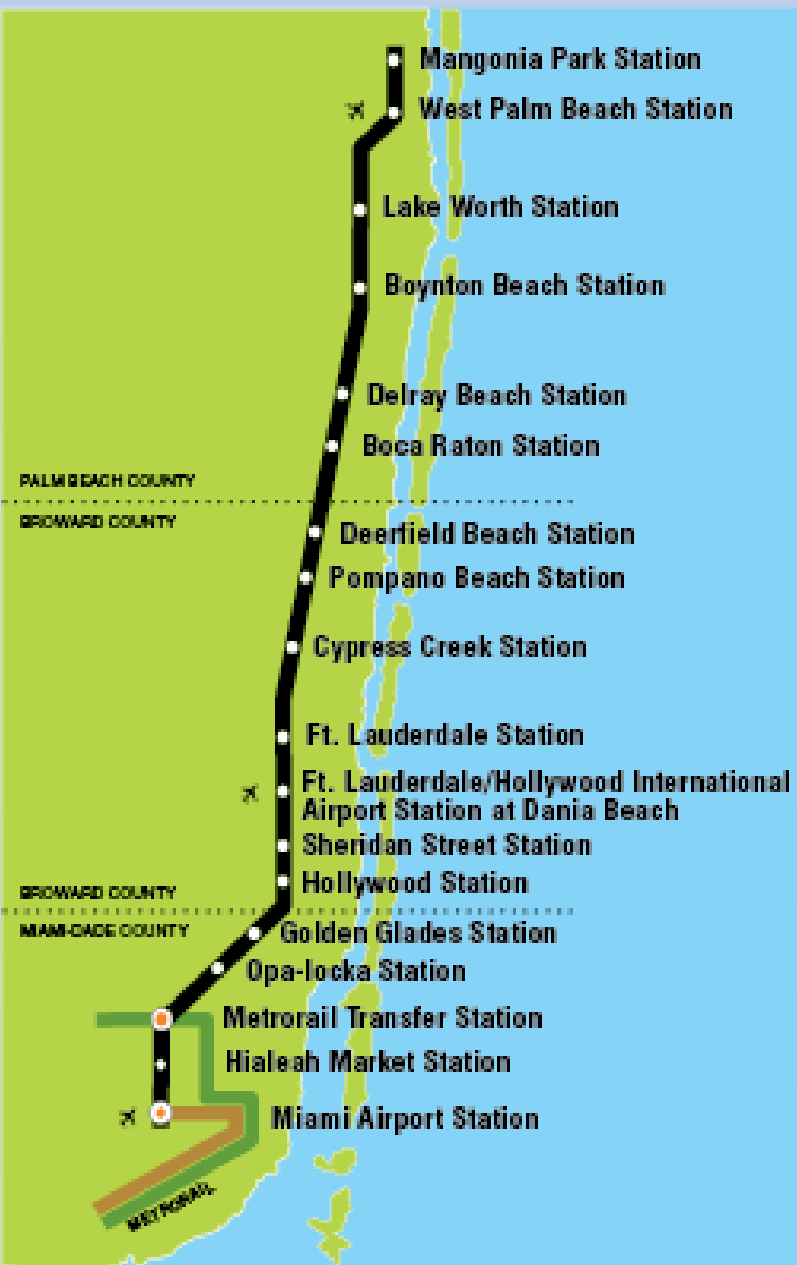


TRIMET
MAX









TRANSIT STATIONS AND REAL ESTATE RENT VALUE-ADDED

Association between Location in 1/2 mile and 1/2 to 1.0 mile Transit Corridors and Asking Rents for Office, Retail and Apartment Square Foot

THEORY

The real estate market values proximity to transit systems. This will be **revealed as a rent premium per square foot** for office, retail and apartment real estate with respect to location within the first one-half mile of a transit corridor and less so within the next one-half mile.

HYPOTHESES

H_1 : There is no statistically significant association between rents per square foot of office, retail and apartment space with respect to location within one-half mile and between one-half and one mile of transit stations.

H_2 : If H_1 is rejected, there is no difference in the magnitudes of coefficients between the distance bands.

TRANSIT STATIONS AND REAL ESTATE RENT VALUE-ADDED

Association between Location in 1/2 mile and 1/2 to 1.0 mile Transit Corridors and Asking Rents for Office, Retail and Apartment Square Foot

METHOD

The theory can be tested through cross-section analysis such as hedonic regression. It establishes associative relationships, not causal ones. The “treatment” variables are whether a property is located within one-half mile (1.0) or between one-half mile and one mile (1,0) of a transit corridor. Control variables include building structure features and metropolitan area location.

DATA

Rent data and building characteristic data for early 2015 are provided by permission from CoStar.

TRANSIT STATIONS AND REAL ESTATE RENT VALUE-ADDED

Association between Location in 1/2 mile and 1/2 to 1.0 mile Transit Corridors and Asking Rents for Office, Retail and Apartment Square Foot

BRT = Bus rapid transit
LRT = Light rail transit
SCT =- Streetcar transit
CRT = Commuter rail transit

Only coefficients
 $p < 0.05$ reported

Corridor Width	Office	Retail	Apartment
BRT <1/2 mile		-2.5%	3.0%
BRT 1/2-1.0 mile			1.7%
LRT <1/2 mile		2.5%	4.5%
LRT 1/2-1.0 mile	2.3%	2.1%	2.5%
SCT <1/2 mile	5.0%	6.3%	10.8%
SCT 1/2-1.0 mile	3.9%		9.0%
CRT <1/2 mile	-2.2%	-3.5%	
CRT 1/2-1.0 mile		-2.3%	

TRANSIT STATIONS AND REAL ESTATE RENT VALUE-ADDED

Association between Location in 1/2 mile and 1/2 to 1.0 mile Transit Corridors and Asking Rents for Office, Retail and Apartment Square Foot

FINDINGS

Light Rail Transit and ***Streetcar Transit*** systems have positive associations with respect to office, retail and apartment rents. **Rents are highest in the closest corridor to transit lines. Residential has the highest percent association followed by retail and the office.**

Bus Rapid Transit systems have no association with respect to office rents, a negative one with respect to retail rents in the closest corridor, but positive ones with respect to apartment location in both.

Commuter Rail Transit systems have negative associations with respect to office and retail land uses, and ambiguous associations with respect to apartments.

IMPLICATIONS

Light Rail Transit and ***Streetcar Transit*** systems have the **most robust associations** between transit corridor location and all land uses with the strongest influences on residential land uses.

Bus Rapid Transit systems **do not appear** to have strong influences on office rents, a minor and perhaps negative influence on retail rents, but positive though small influences on apartment rents.

Commuter Rail Systems are a **disaster** ... but no or bad planning may be the culprit.

Transit and land use planning may be guided by these market-based findings.

TRANSIT AND WAGES

The Association between Transit and Jobs by Wage Categories over Time within 1/2 Mile of Transit Stations

THEORY

Despite wishful thinking that transit will expand the supply of lower-wage jobs near transit stations, **economic theory posits that transit will increase real estate values requiring investors to increase returns resulting in higher-wage jobs** even to the extent of displacing lower-wage ones.

HYPOTHESIS

H_1 : There is no statistically significant association between the shift in the share of regional jobs by wage category between time periods with respect to location within a one-half mile distance band from the nearest transit station.

TRANSIT AND WAGES

The Association between Transit and Jobs by Wage Categories over Time within 1/2 Mile of Transit Stations

METHOD

Shift-share analysis can detect shifts in the share of jobs by wage category over time

- Regional shift = changes attributable to regional change
- Industry shift = changes attributable to sector change
- Station Area shift = changes attributable to location within 1/2 mile of transit stations (Station Area shift results are reported)

DATA

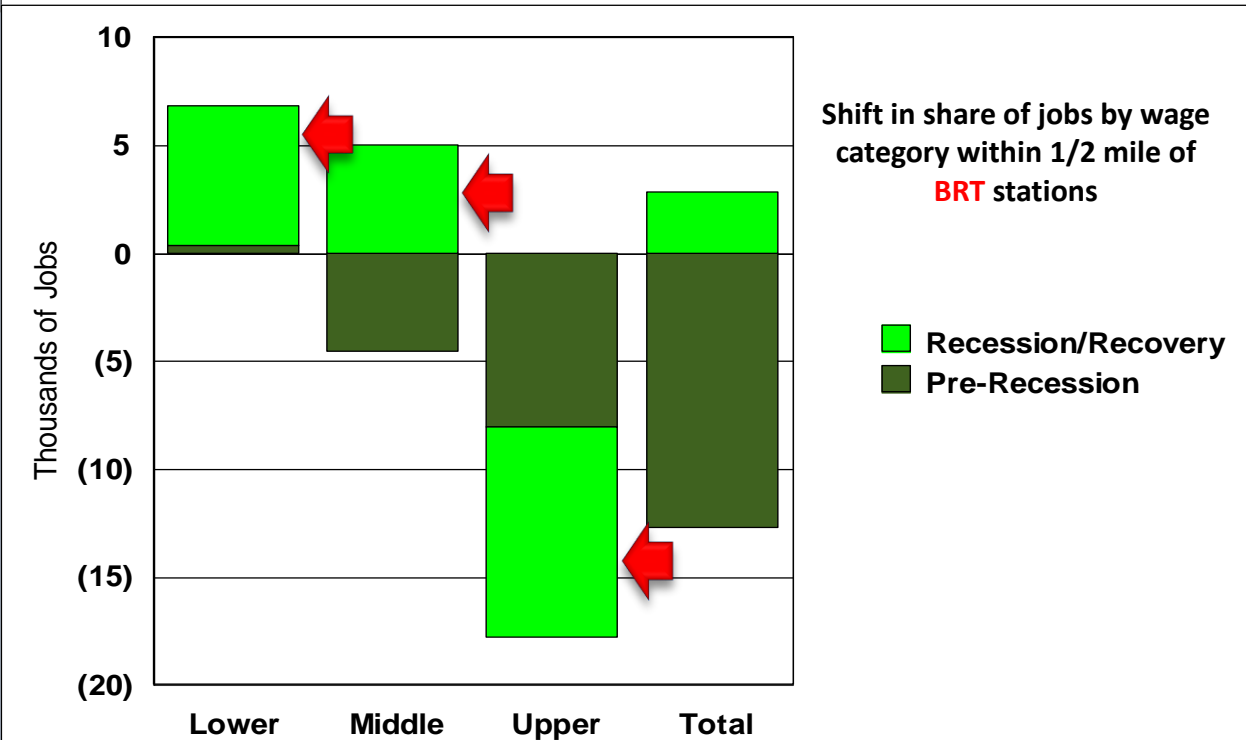
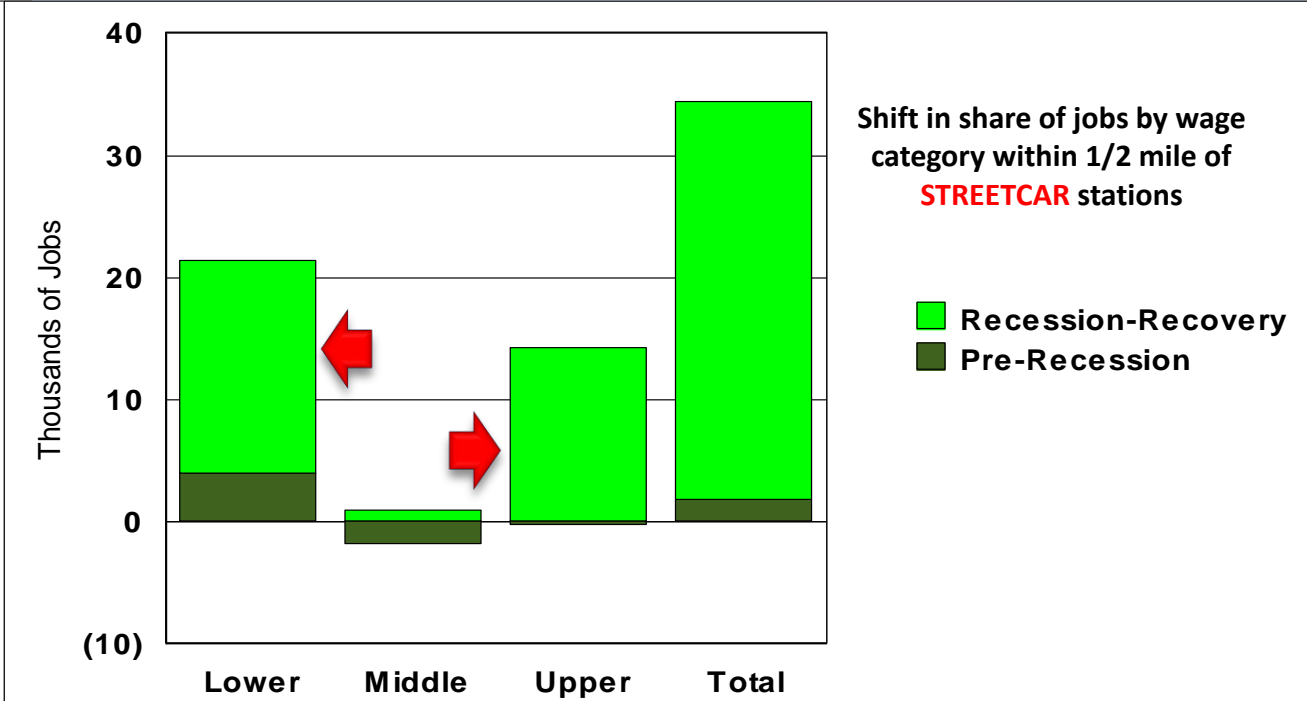
The Longitudinal Employment-Household Dynamics (LEHD) database is used for the period 2002 through 2011:

- Pre-Recession = 2002 (2004 in AZ) - 2007
- Recession/Recovery = 2007 - 2011

Wage Categories Defined

[Analysis does not use the LEHD wage categories]

NAICS	Description	Mean Annual Wages	Category
44	Retail Trade	\$25,779	Lower
71	Arts, Entertainment, and Recreation	\$32,188	Lower
72	Accommodation and Food Services	\$17,453	Lower
81	Other Services (except Public Administration)	\$29,021	Lower
	<i>Weighted Mean Wages and National Share of Jobs</i>	<i>\$23,696</i>	31%
48	Transportation and Warehousing	\$45,171	Middle
53	Real Estate and Rental and Leasing	\$46,813	Middle
56	Administrative, Support, Waste Mgmt., Remediation	\$35,931	Middle
61	Educational Services	\$35,427	Middle
62	Health Care and Social Assistance	\$44,751	Middle
	<i>Weighted Mean Wages and National Share of Jobs</i>	<i>\$41,723</i>	35%
22	Utilities	\$94,239	Upper
31	Manufacturing	\$54,258	Upper
42	Wholesale Trade	\$65,385	Upper
51	Information	\$83,677	Upper
52	Finance and Insurance	\$88,677	Upper
54	Professional, Scientific, and Technical Services	\$75,890	Upper
55	Management of Companies and Enterprises	\$105,138	Upper
	<i>Weighted Mean Wages and National Share of Jobs</i>	<i>\$70,490</i>	34%



TRANSIT AND WAGES

The Association between Transit and Jobs by Wage Categories over Time within 1/2 Mile of Transit Stations

IMPLICATIONS

Serving downtowns/near-downtowns, **Streetcar Transit** systems experienced substantial gains in share of lower- and upper-wage jobs. These are in the retail, lodging and food service sectors that locate along downtown streetcar routes.

Light Rail Transit and **Streetcar Transit** systems attract upper-wage firms. Those stations command rent premiums than can be afforded only through more productive labor and thus higher paying jobs.

Light Rail Transit systems outside downtowns are dispersed and there may not be the critical mass of economic activity that justifies lower-wage firms to move close to them

Bus Rapid Transit systems are in heavily-trafficked corridors. BRT stations may attract firms that pay lower- and middle-wages categories

Firms are not attracted to **Commuter Rail Transit** stations. Little proactive planning/investment to make CRT stations attractive to development.

TRANSIT STATION DISTANCE-RELATED JOB SHARE CHANGE

Change in Share of Jobs over Time with Respect to Light Rail, Streetcar and Bus Rapid Transit Station Distance Band

THEORY

Fixed-guideway transit investments should change the regional distribution of jobs over time favoring station proximity.

HYPOTHESIS

H_1 : There is no statistically significant association between the change in regional share of jobs over time with respect to distance band from the nearest transit station.

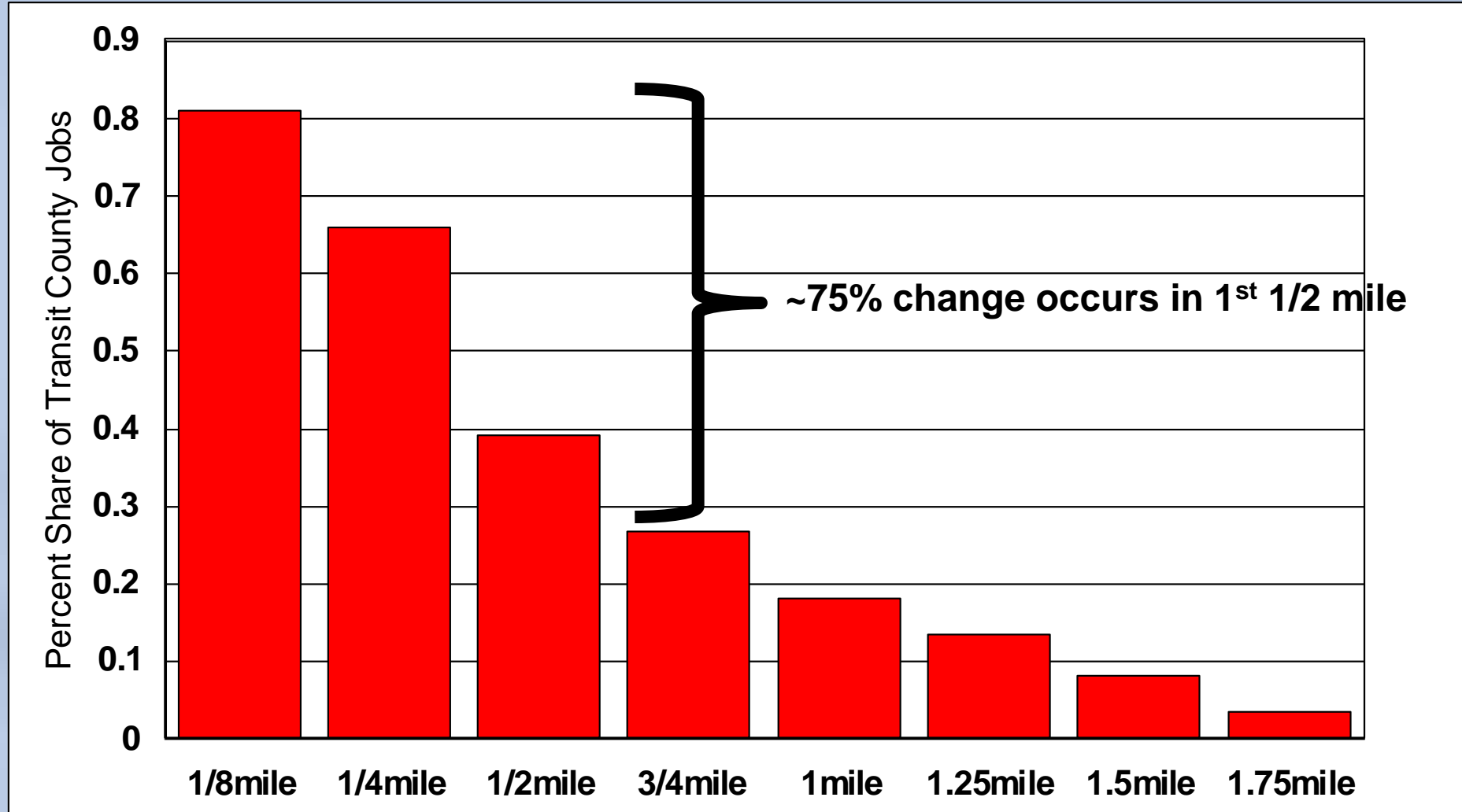
METHOD

Semi-log regression is used to test the association between transit accessibility and jobs by distance band from transit stations from 2004 through 2011. Independent variables are transit station distance band and metropolitan area binaries.

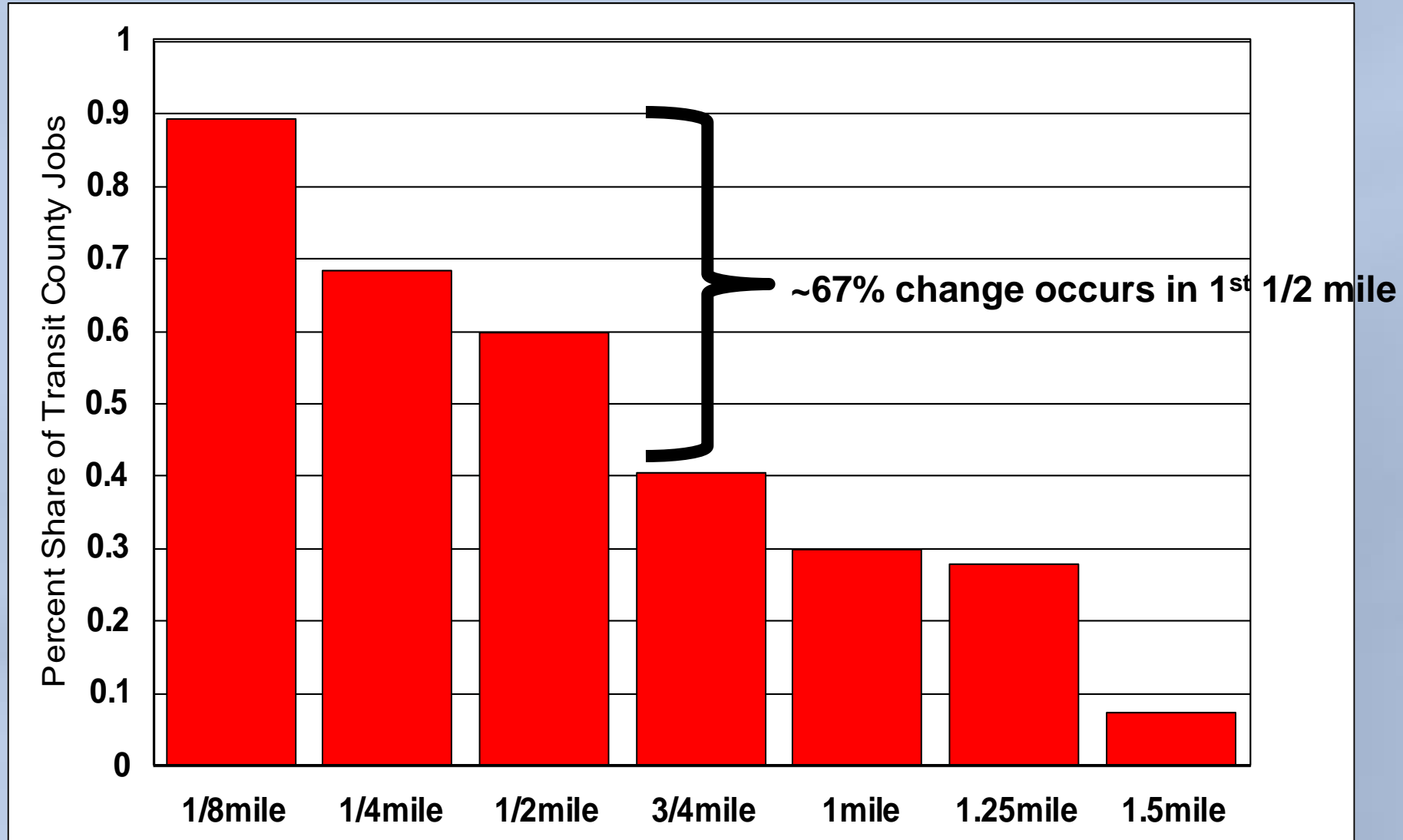
DATA

The Longitudinal Employment-Household Dynamics (LEHD) database is used for the period 2002 through 2011.

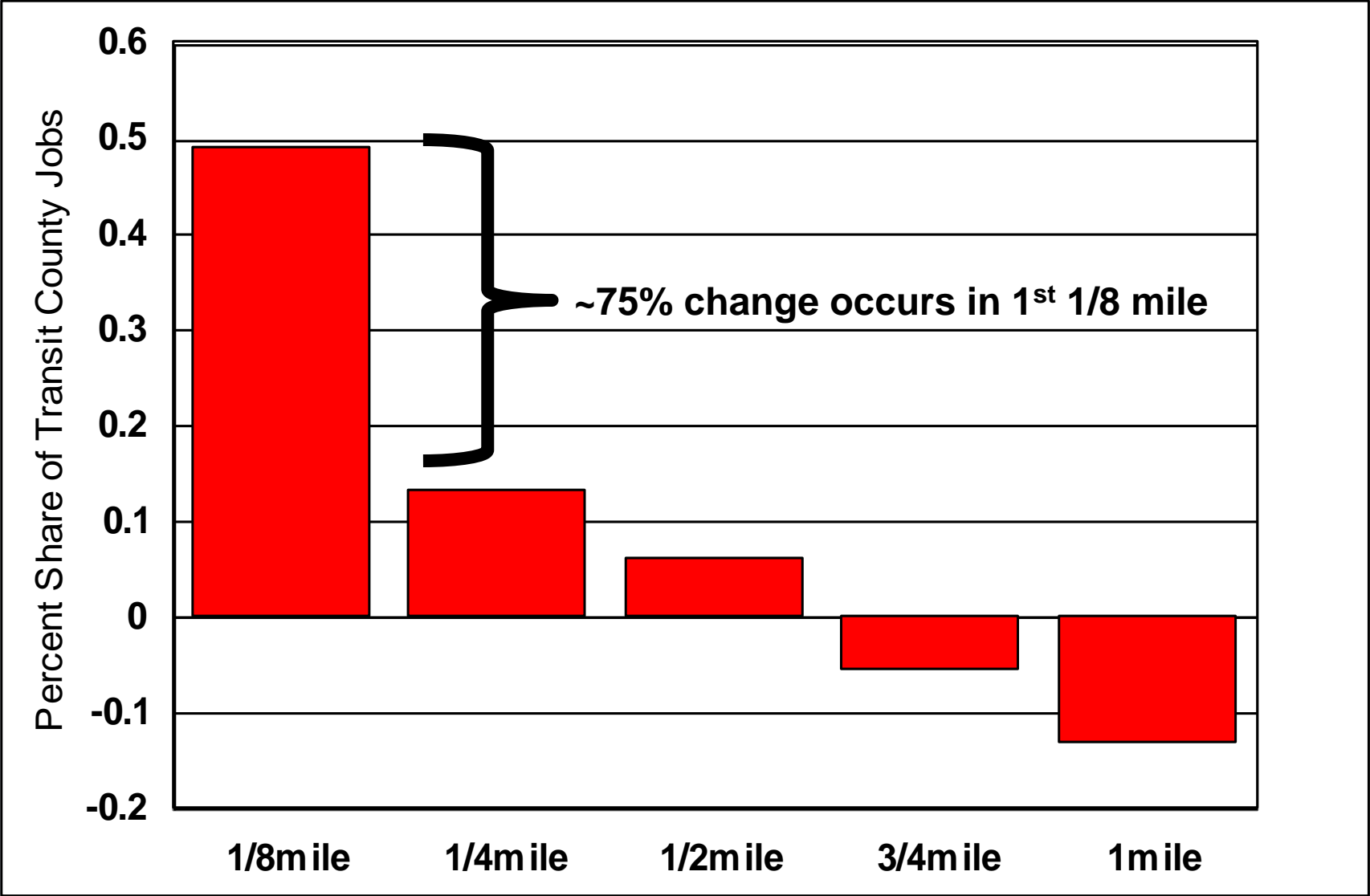
Percent of transit county job share change with respect to distance band from **LIGHT RAIL** transit stations, 2004-2011



Percent of transit county job share change with respect to distance band from STREETCAR transit stations, 2004-2011



Percent of transit county job share change with respect to distance band from **BUS RAPID TRANSIT** stations, 2004-2011



TRANSIT STATION DISTANCE-RELATED JOB SHARE CHANGE

Change in Share of Jobs over Time with Respect to Light Rail, Streetcar and Bus Rapid Transit Station Distance Band

IMPLICATIONS

Light Rail Transit TOD planning focus on the first 1/2 mile but there is non trivial attractiveness to 1.25 miles.

Streetcar Transit stations TOD planning focus up to 1/2 mile → Streetcars are in highly dense urban environments more conducive to walking. But there is non-trivial attractiveness to 1.25 miles.

Bus Rapid Transit TOD planning may focus on the first 1/8 mile and less-so between 1/8 mile and 1/4 mile. Similar to prior research.

THE EFFECT OF TRANSIT STATION PROXIMITY ON CHANGE IN JOBS BY ECONOMIC SECTOR, 2008-2011

THEORY

The Great Recession has helped restructure the economy favoring transit station proximity for many economic sectors.

HYPOTHESIS

H_1 : There is no statistically significant association between the change in regional share of jobs by economic sector over time with respect to several distance bands from the nearest transit station.

METHOD

Shift-share analysis can detect shifts in the share of jobs by wage category over time

Regional shift = changes attributable to regional change

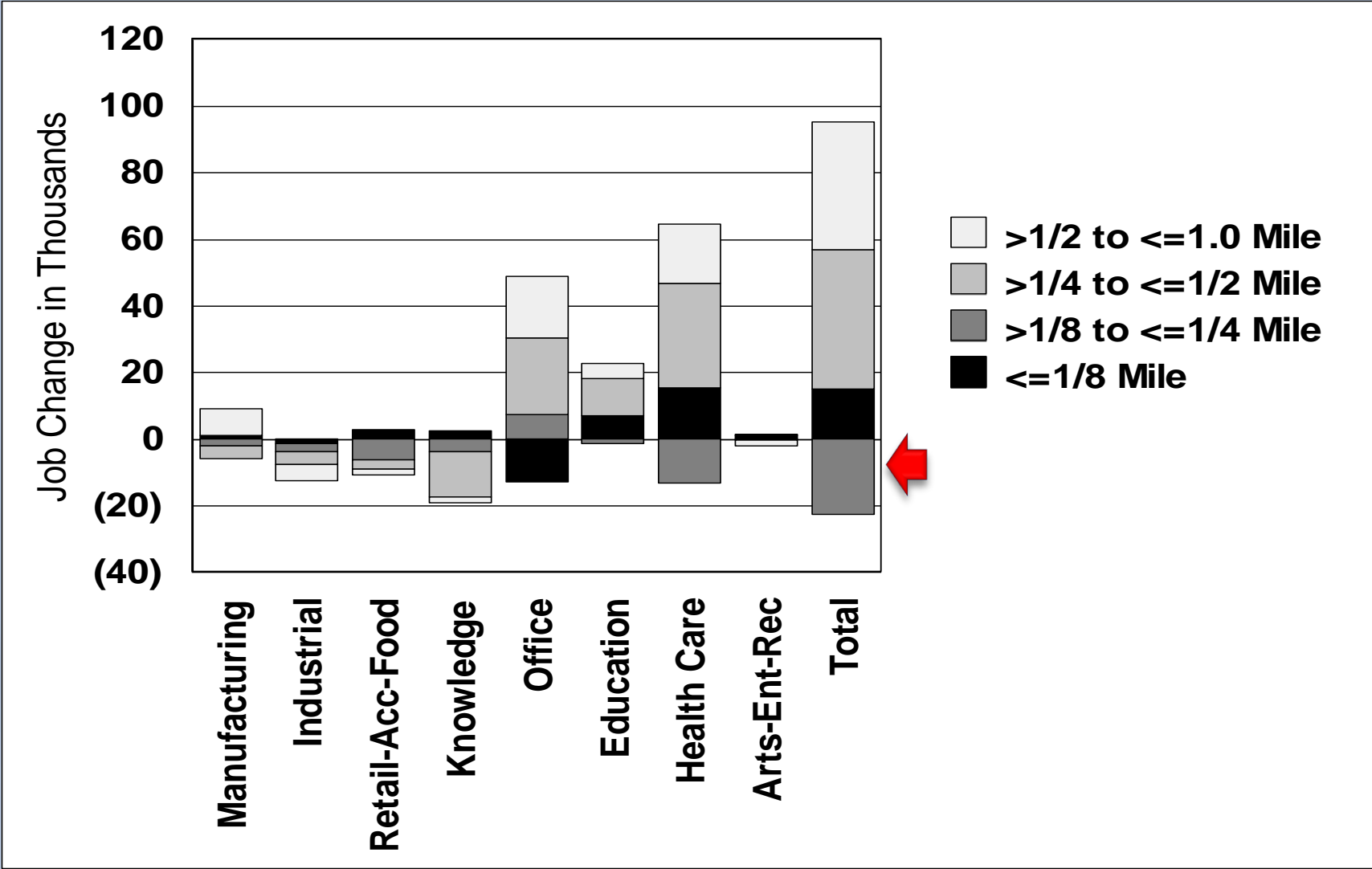
Industry shift = changes attributable to sector change

Station Area shift = changes attributable to location within 1/2 mile of transit stations (Station Area shift results are reported)

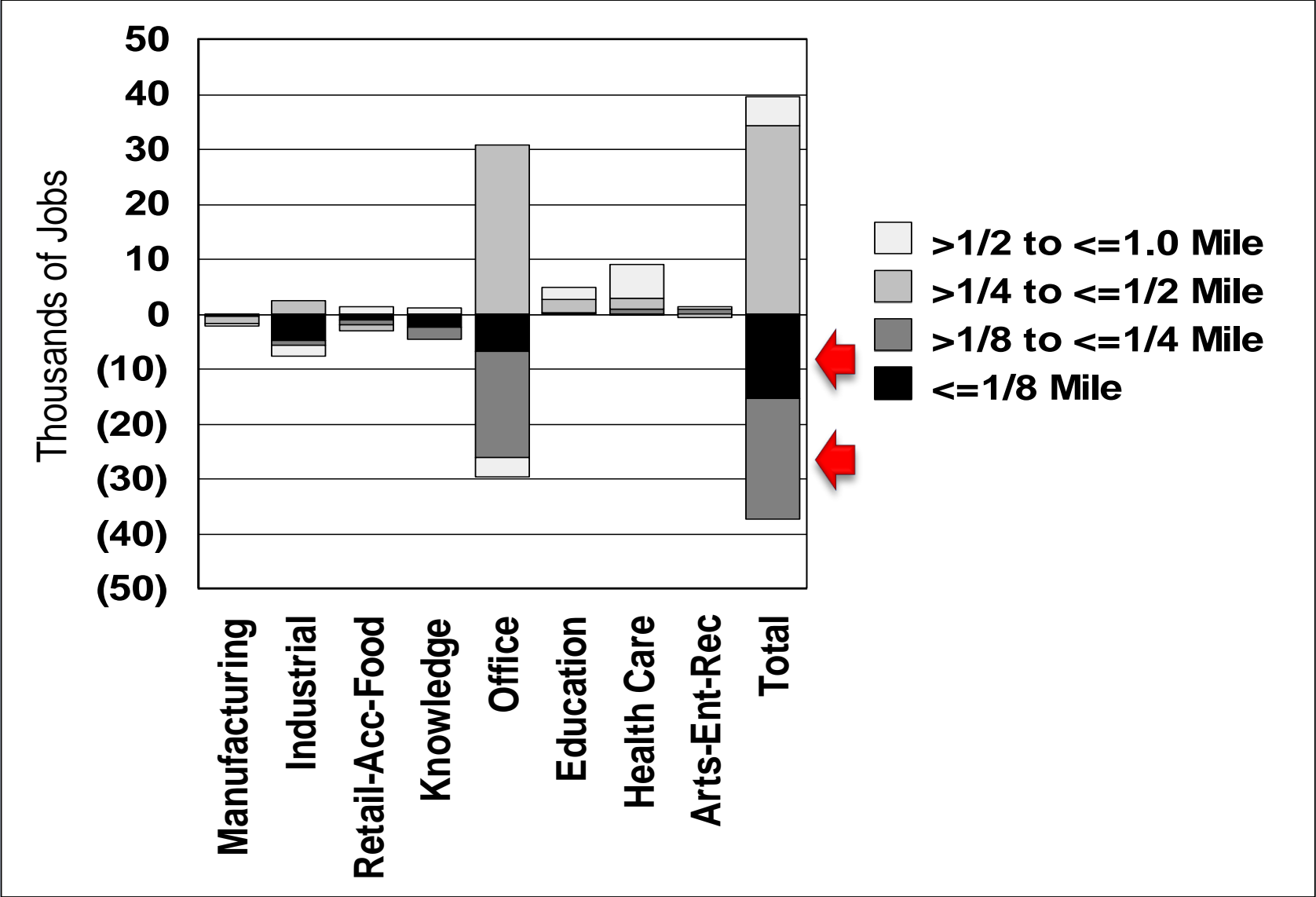
DATA

The Longitudinal Employment-Household Dynamics (LEHD) database is used for the period 2008 through 2011.

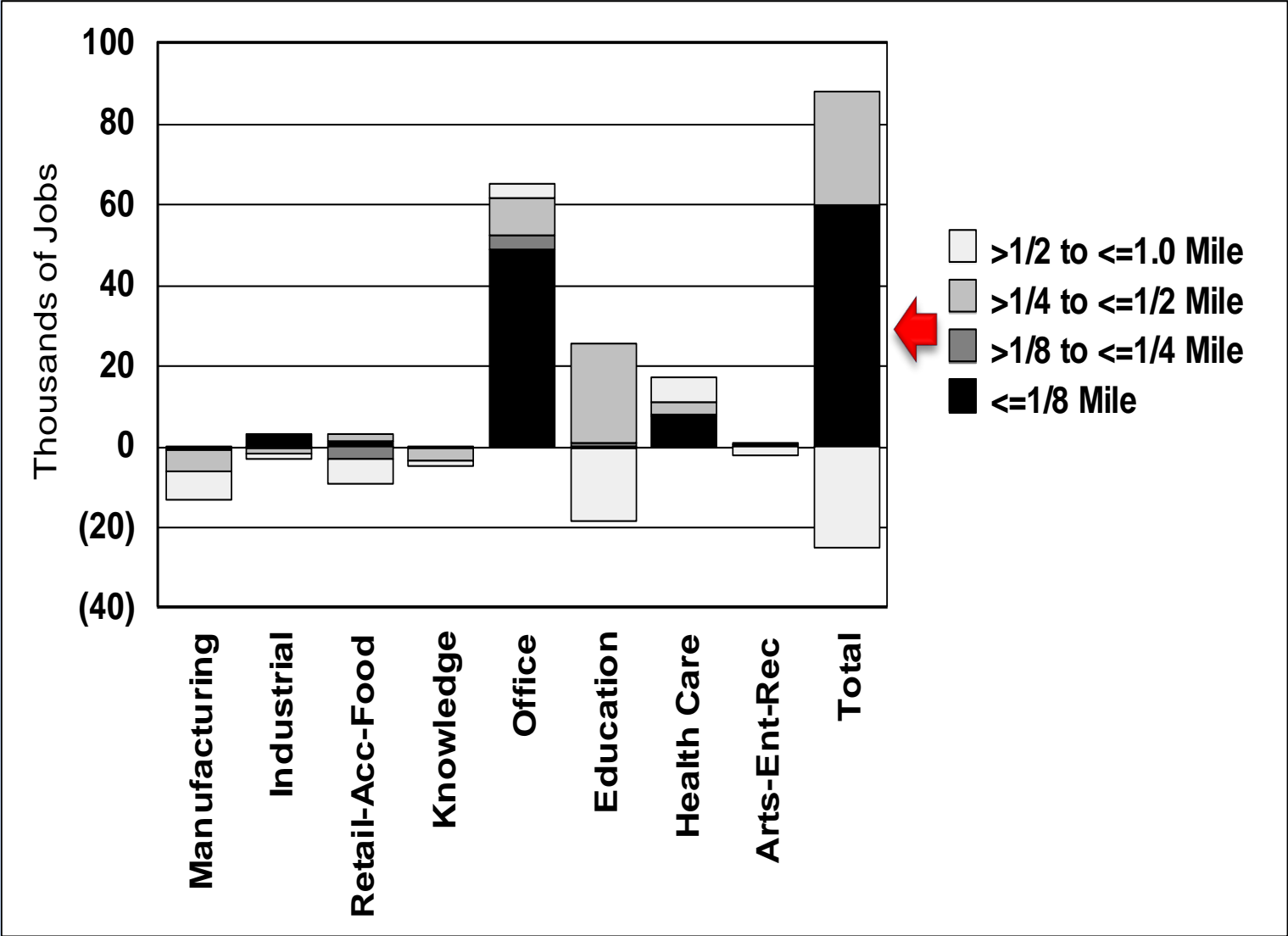
Comparisons of Economic Group Job Change by LIGHT RAIL Transit Station Distance Band, 2008-2011



Comparisons of Economic Group Job Change by STREETCAR Transit Station Distance Band, 2008-2011



Comparisons of Economic Group Job Change by BRT Station Distance Band, 2008-2011



THE EFFECT OF TRANSIT STATION PROXIMITY ON CHANGE IN JOBS BY ECONOMIC SECTOR, 2008-2011

IMPLICATIONS

- First:** Land-extensive industrial group firms in warehousing, wholesaling and utilities may be outbid for transit-accessible locations by more land-intensive economic groups.
- Second:** Considering only the economic groups that lost jobs, nearly all of them lost jobs at a faster pace ***within one mile*** of transit stations than the transit county as a whole. They may be outbid by other firms.
- Third:** For a given transit mode and within a given distance from a transit station, economic development planners may consider attracting firms in target economic groups.
- Caveat →** Another analysis found ***BRT attractive to manufacturing*** but closer examination showed micro-brewery attraction with synergistic/co-location restaurant outcomes.
- Fourth:** The distribution of change in jobs for any given economic group may be influenced by residential development that is attracted to transit stations.
- In downtowns with streetcars, residential development may be outbidding nonresidential development for locations up to one-quarter mile away from SCT stations.

TRANSIT'S INFLUENCE ON DEMOGRAPHIC AND HOUSING CHANGE, 2000-2010

THEORY

Transit will influence demographic and housing patterns leading to population and housing growth near transit stations. As the benefits of transit may confer a premium on station proximity, higher income and by implication mostly White households may be attracted. As stations are associated with non-family externalities, mostly younger households without children will be attracted to locations near stations. To the extent the market capitalizes on location efficiencies, housing supply should increase.

COMPOSITE HYPOTHESIS

H_1 : There is no statistically significant difference over the period 2000 to 2010 between change in the selected demographic features and housing within several distance bands from transit stations compared to the central county as a whole in terms of: (1) population; (2) White population; (3) minority population; (4) households; (5) households by type; (6) householders by age; (7) median household income; (8) housing units; and (9) housing tenure.

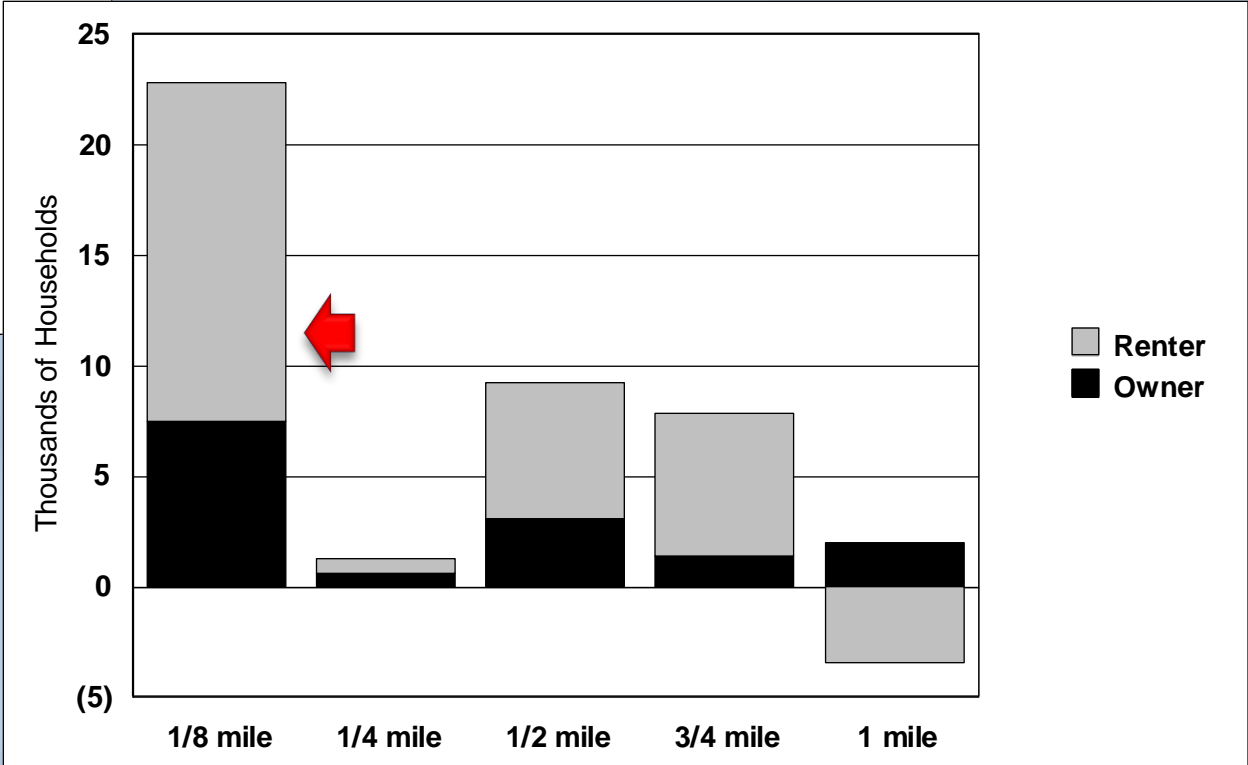
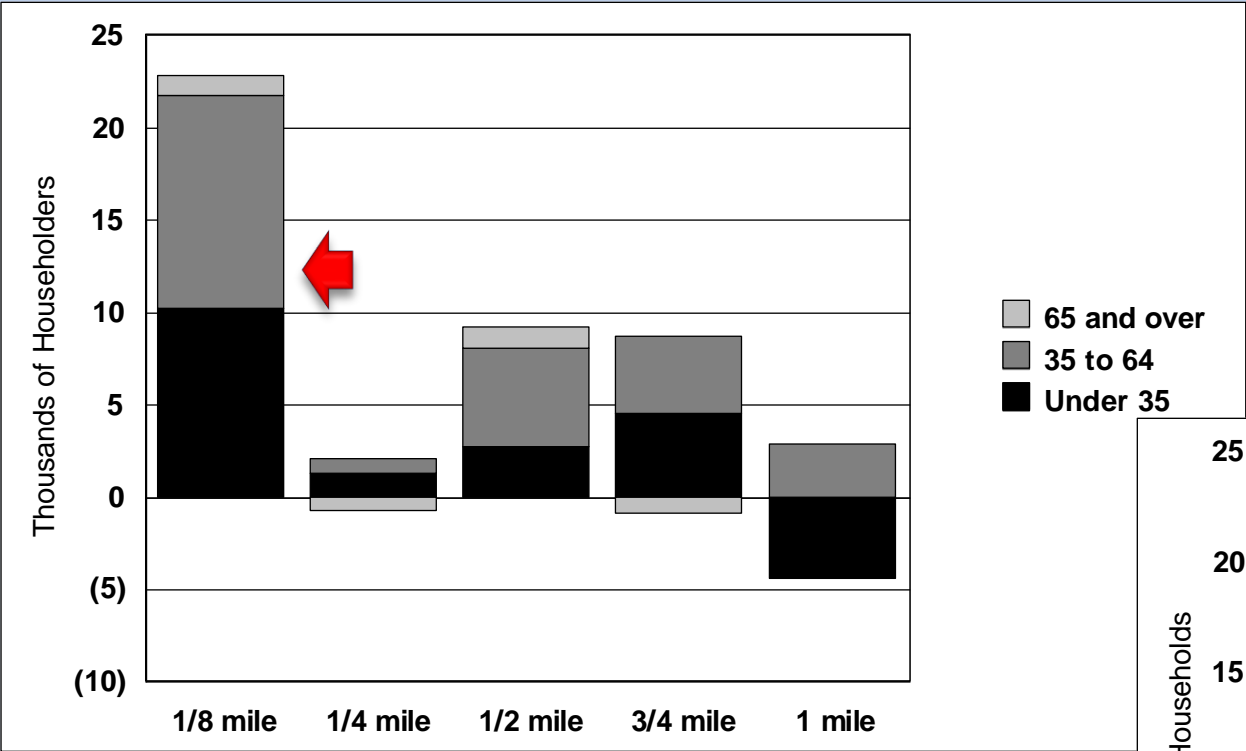
METHOD

This is a pre-post difference test using Z-scores at $p < 0.01$ to assess whether there are significant differences in demographic and housing outcomes between 2000 and 2010.

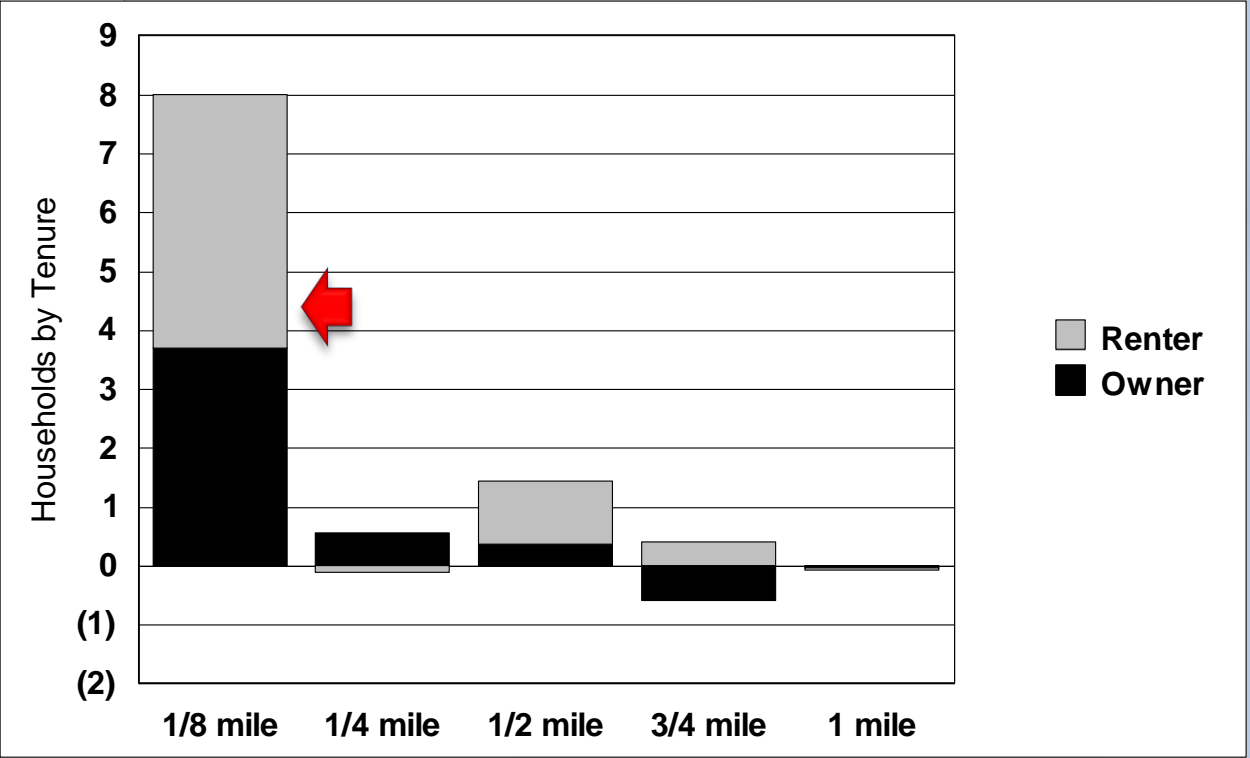
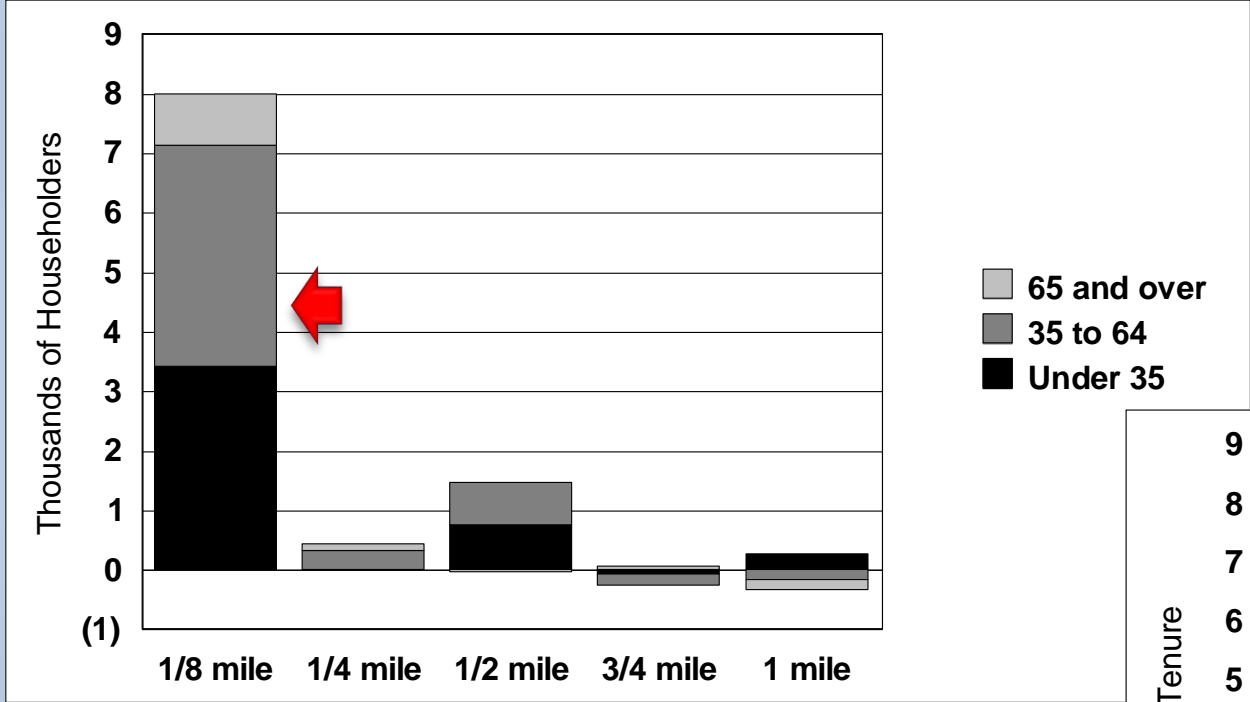
DATA

Decennial census for 2000 and mostly for 2010, and the ACS 5-year data for household income for 2010. The analysis is applied to all Light Rail Transit, Streetcar Transit and Bus Rapid Transit systems operating no later than 2005.

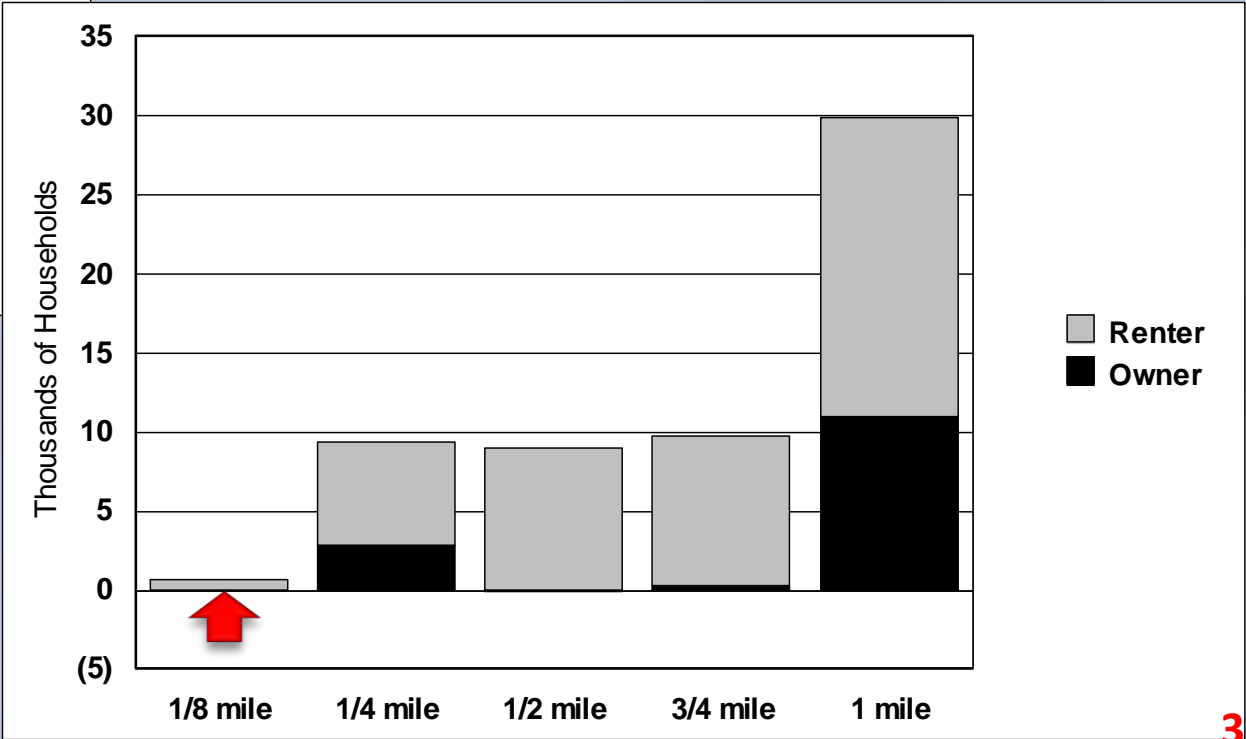
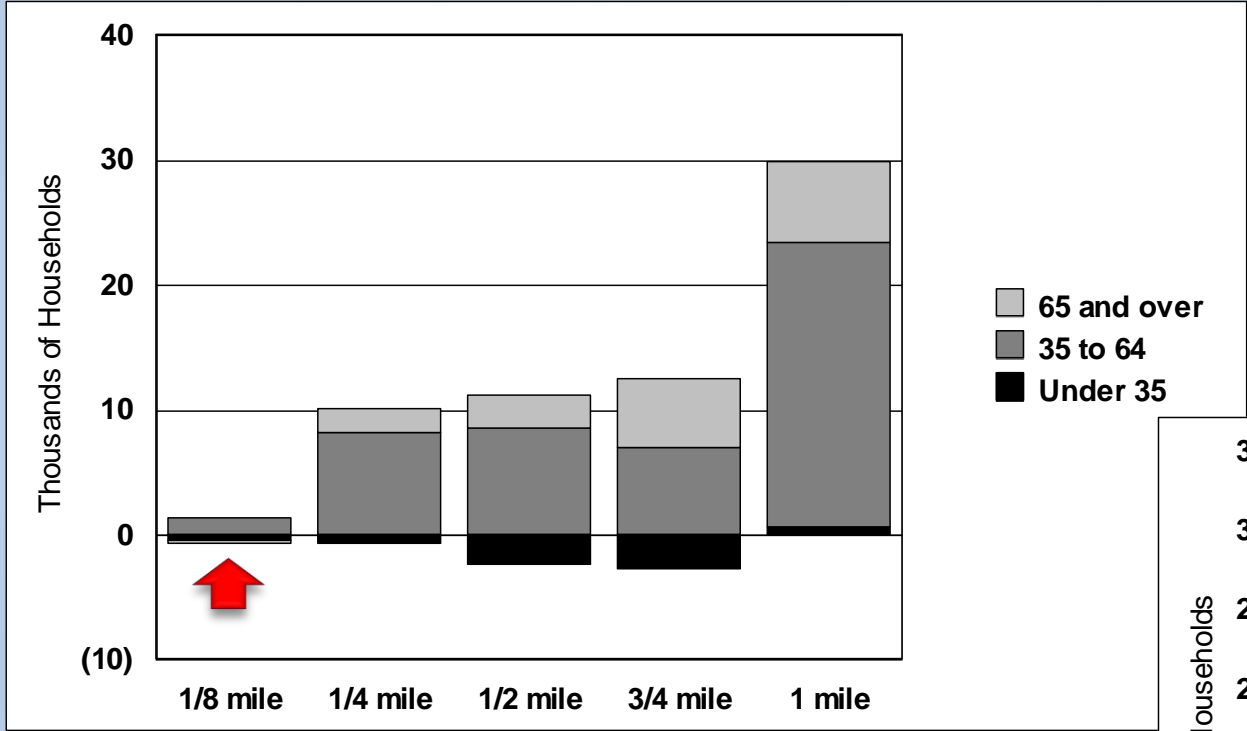
Householder age and tenure change within distance bands from LIGHT RAIL transit stations



Householder age and tenure change within distance bands from STREETCAR transit stations



Householder age and tenure change within distance bands from BRT stations



TRANSIT'S INFLUENCE ON DEMOGRAPHIC AND HOUSING CHANGE, 2000-2010

IMPLICATIONS

Light Rail Transit and **Streetcar Transit** systems are associated with considerable demographic and housing change changes within the first 1/8 mile of transit stations and then from 1/4 to 1/2 mile.

- There appears to be a ***hollowing-out effect*** between 1/8 and 1/4 mile. **Why?**

Bus Rapid Transit systems have little effect on demographic and housing or tenure change in the first 1/8 mile but have important effects from 1/8 to 3/4 mile.

- Jobs clearly attracted to first 1/8 mile and may be displacing residential demand to the next bands.

Next Steps

- Update LEHD data to 2014, input into our analytic templates, and be able to assess true recovery outcomes.
- Expand rent analysis to include socioeconomic variables and submarkets of individual systems to generate local market outcomes.
- Drill down to station area or small area analysis → our work has been at the 10k foot level but we have the data and tools to undertake small area analysis.