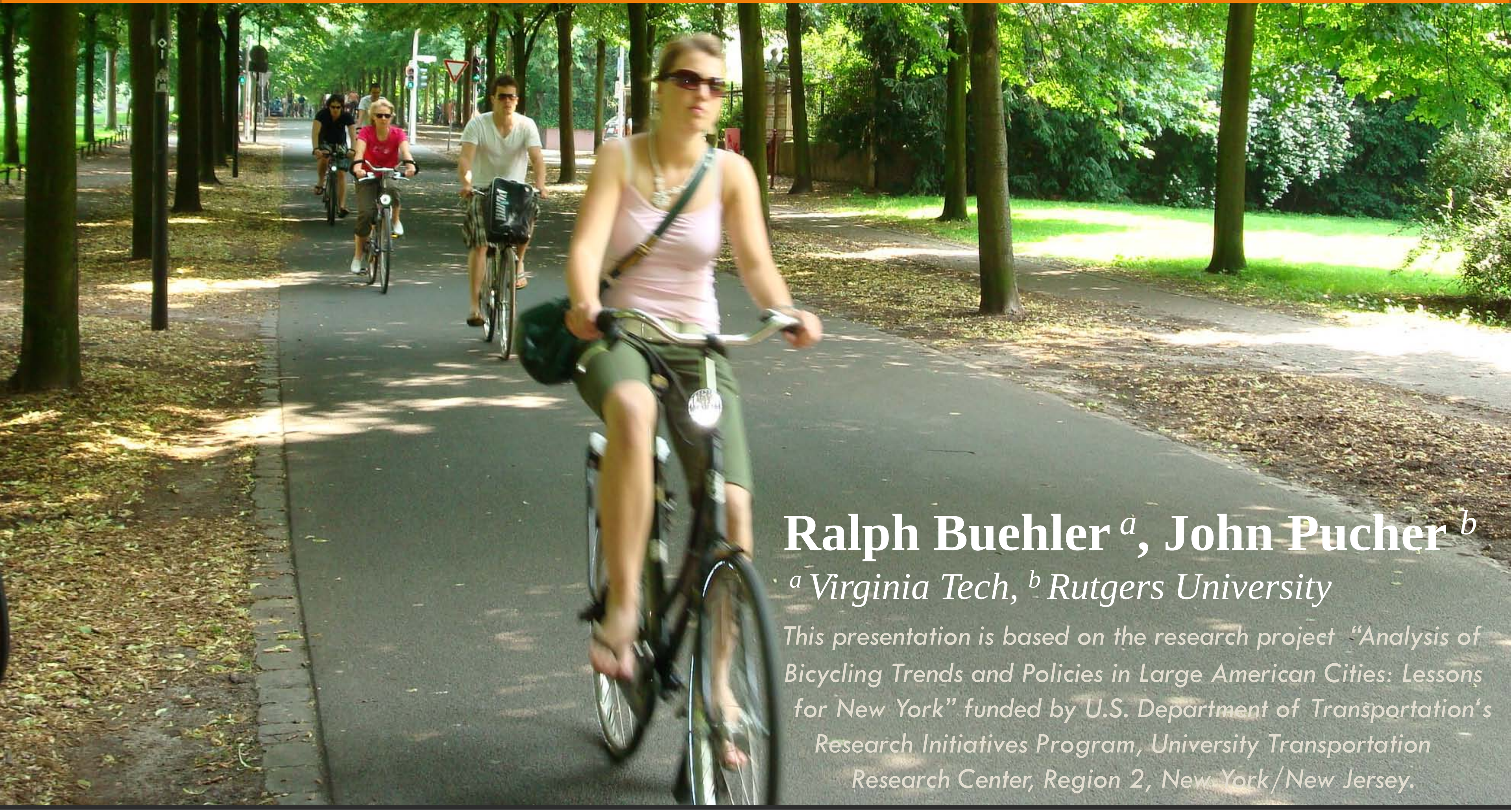
Impacts of Bike Paths and Lanes on Cycling in Large American Cities



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4:30PM- 6:00PM

Session 750: Decisions on Whether and Where to Bicycle: Role of Facilities and Social Environment; sponsored by Bicycle Transportation Committee (ANF20)

Promoting Cycling in the USA

- Many American cities are trying to increase cycling.
- The main approach is the provision of off-street bike paths and on-street bike lanes.

Past Research on Paths/Lanes

- Past research suggests that separate cycling facilities are associated with higher cycling levels.
- Contradictory evidence on the impacts of different kinds of facilities:
  - Some studies find that bike paths are associated with higher cycling levels, but that lanes are not.
  - Other studies find that lanes are related to more cycling, but paths are not.

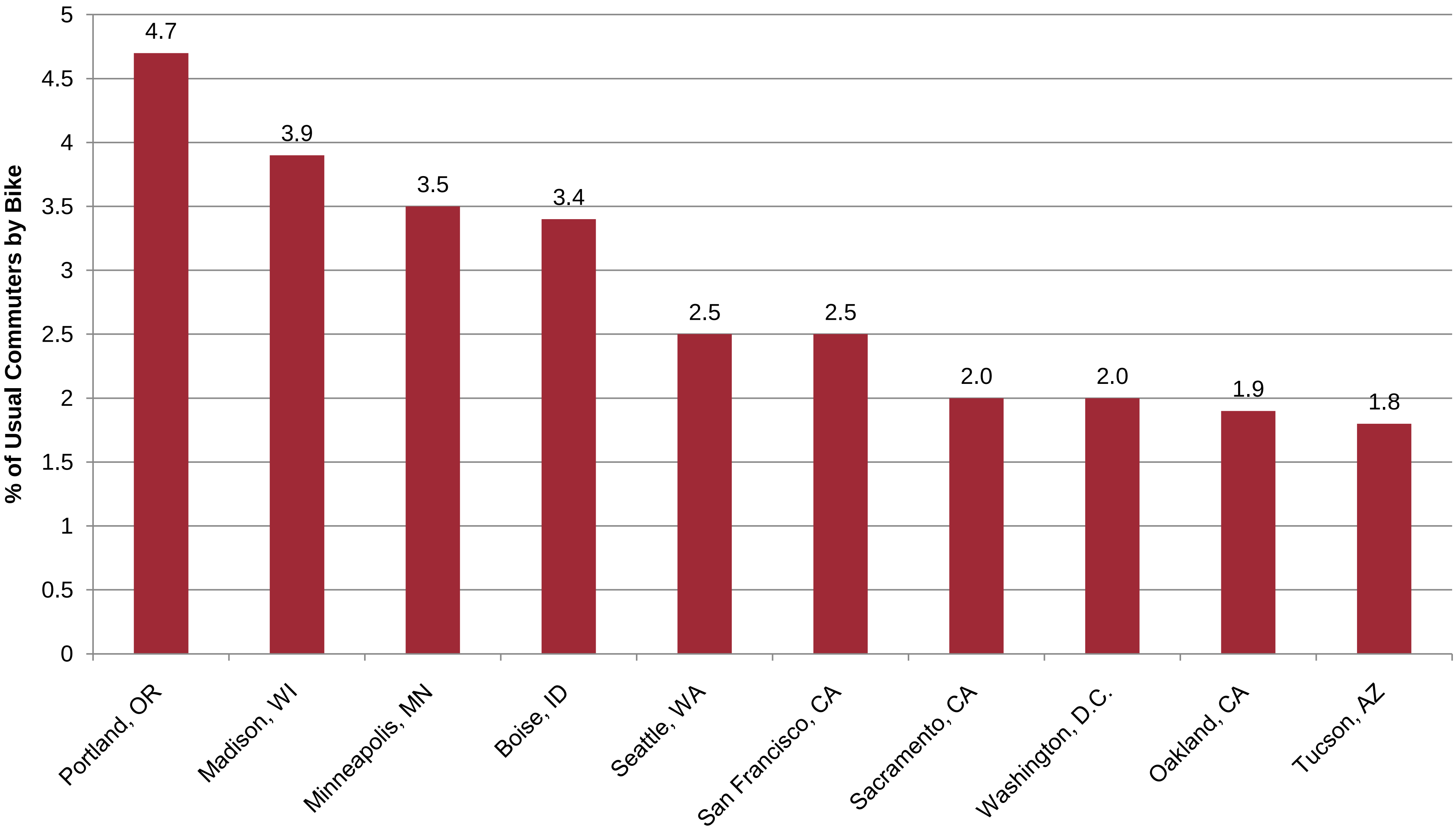
Limitations of Past Research

- Most prior research that distinguishes between paths and lanes focuses on only one city per study.
- Most comparative analysis of different cities is hampered by small sample size—usually fewer than 50 cities.

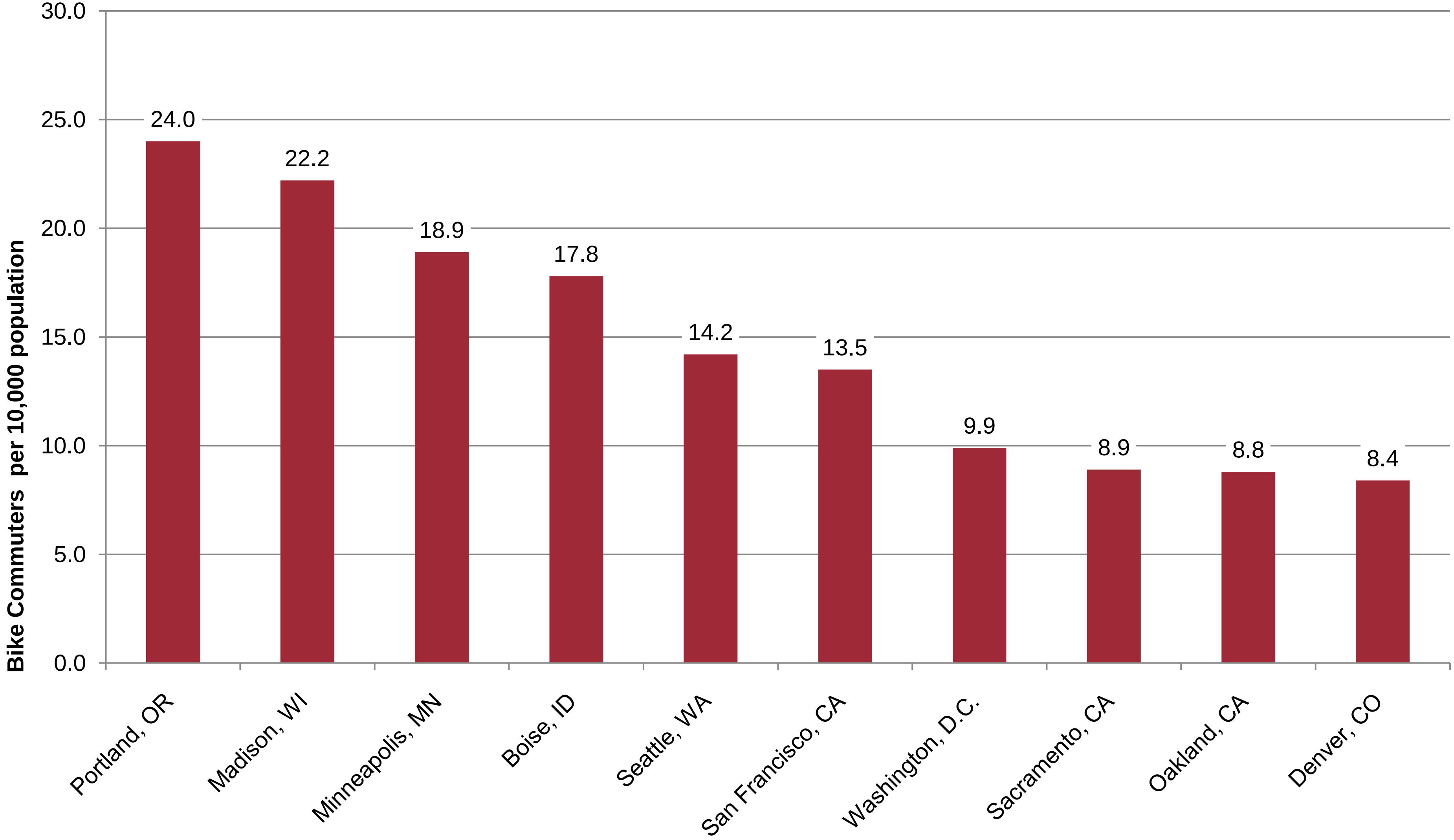
Data and Methods of Our Study

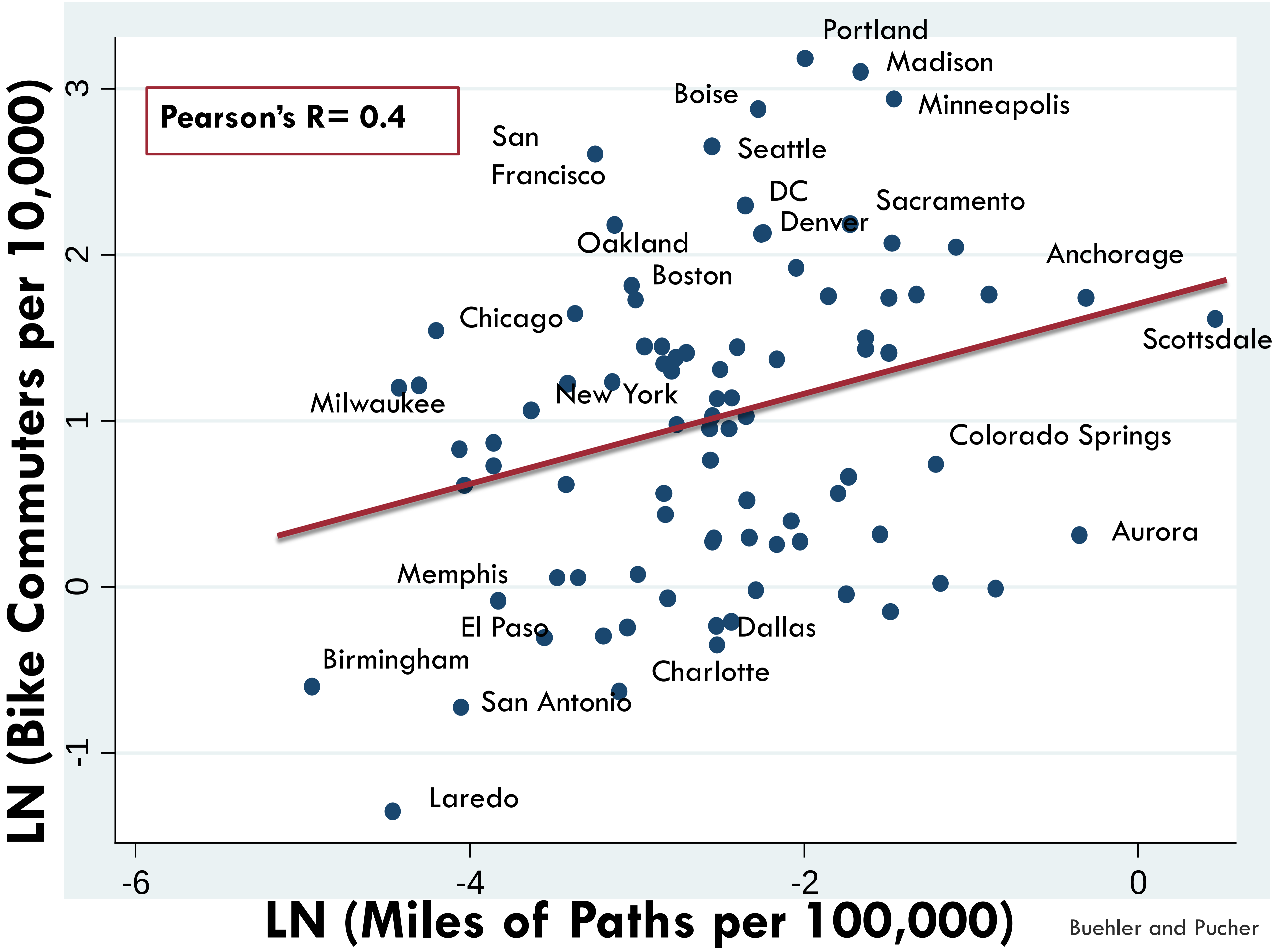
- New data on supply of lanes and paths in the 100 largest U.S. cities (2008).
  - Collected directly from planners, transportation experts, and government officials in each city.
- Bi-variate correlations, quartile analysis, and multiple regression analysis.

Top Ten of 100 Largest U.S. Cities by Bike Share of Regular Commuters, 2006/08



Top Ten of 100 Largest U.S. Cities by Bike Commuters per 10,000 population, 2006/08




Pearson's R= 0.4
LN (Bike Commuters per 10,000)
LN (Miles of Paths per 100,000)
-1
0
1
2
3
-6
-4
-2
0
Portland
Madison
Minneapolis
Boise
Seattle
San Francisco
DC
Sacramento
Denver
Oakland
Boston
Anchorage
Chicago
Scottsdale
New York
Milwaukee
Colorado Springs
Aurora
Memphis
El Paso
Dallas
Birmingham
Charlotte
San Antonio
Laredo
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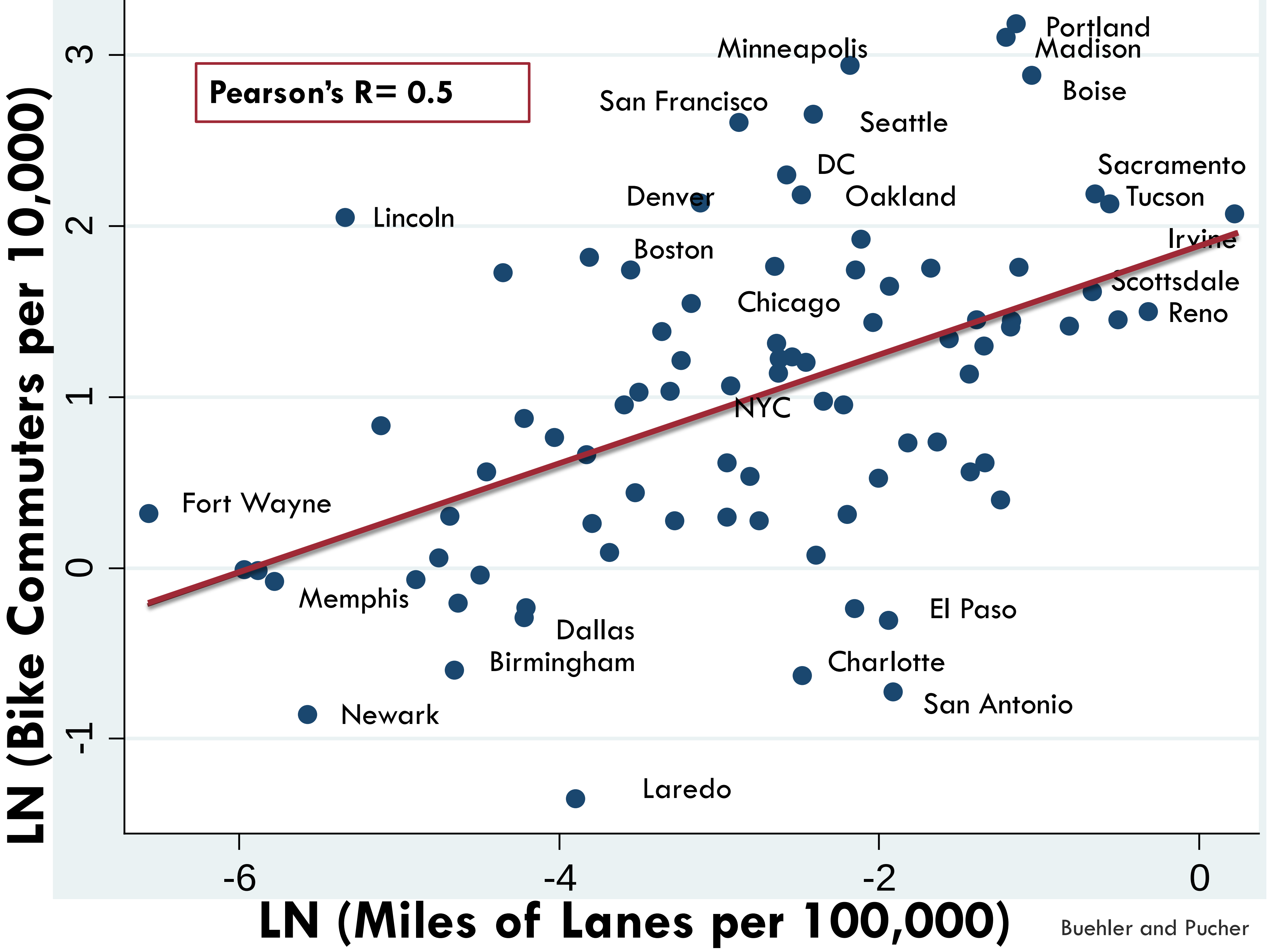

Pearson's R= 0.5
Portland
Madison
Minneapolis
Boise
San Francisco
Seattle
DC
Sacramento
Denver
Oakland
Tucson
Lincoln
Irvine
Boston
Scottsdale
Chicago
Reno
NYC
Fort Wayne
Memphis
El Paso
Dallas
Birmingham
Charlotte
San Antonio
Newark
Laredo
LN (Bike Commuters per 10,000)
LN (Miles of Lanes per 100,000)
3
2
1
0
-1
-6
-4
-2
0
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Control Variables

- Population density
- Age of housing stock
- Share of students in population
- Share of households without cars
- Cycling safety
- Extreme climate
- Regional differences

Descriptive Statistics and Data Sources of Variables in the Analysis

Variable	Mean	Median	SD	Cases	Description & Measurement	Source
Bike Share Commuters	0.8	0.6	0.80	100	Percent of workers regularly commuting by bike	ACS, 3 year averages 2006-2008
Bike Commuters per Population	3.9	2.6	4.40	100	Daily total number of workers regularly commuting by bike per 10,000 population	
Bike Lane Supply	13.40	7.10	19.3	90	Miles of bike lanes in city per 100,000 population	Data collected from each city individually; Population data from ACS, 2006-2008
Bike Path Supply	13.10	7.90	19.9	90	Miles of bike and shared-use paths in city per 100,000 population	
Population Density	4,768	3,600	3,900	100	City population divided by land area in square miles	Population from ACS 2006-2008; Land Area from U.S. Census, 2000
Age of housing Stock/Road Network Proxy	23.9	15.2	21.50	100	Percent of housing stock built before 1950	U.S. Census, 2000
College Students	9.3	7.7	2.90	100	Percent of total population enrolled in college or university	ACS, 2006-2008
Car Access	12.7	9.7	9.40	100	Percent of households without a motorized vehicle	ACS, 2006-2008
Extreme Weather	54.4	35.5	46.8	100	30 year average of annual number of days above 90 °F	National Climatic Data Center (NCDC), 2009 and 2010
Bike Safety	6.7	5.8	4.10	100	State level data: three year average of bicyclist fatality rate per 10,000 cyclists	NHTS, ACS 2006-2008
Geography	0.4	0	n.a.	100	Dummy variable flagging cities in "West" Census Region	U.S. Census Bureau

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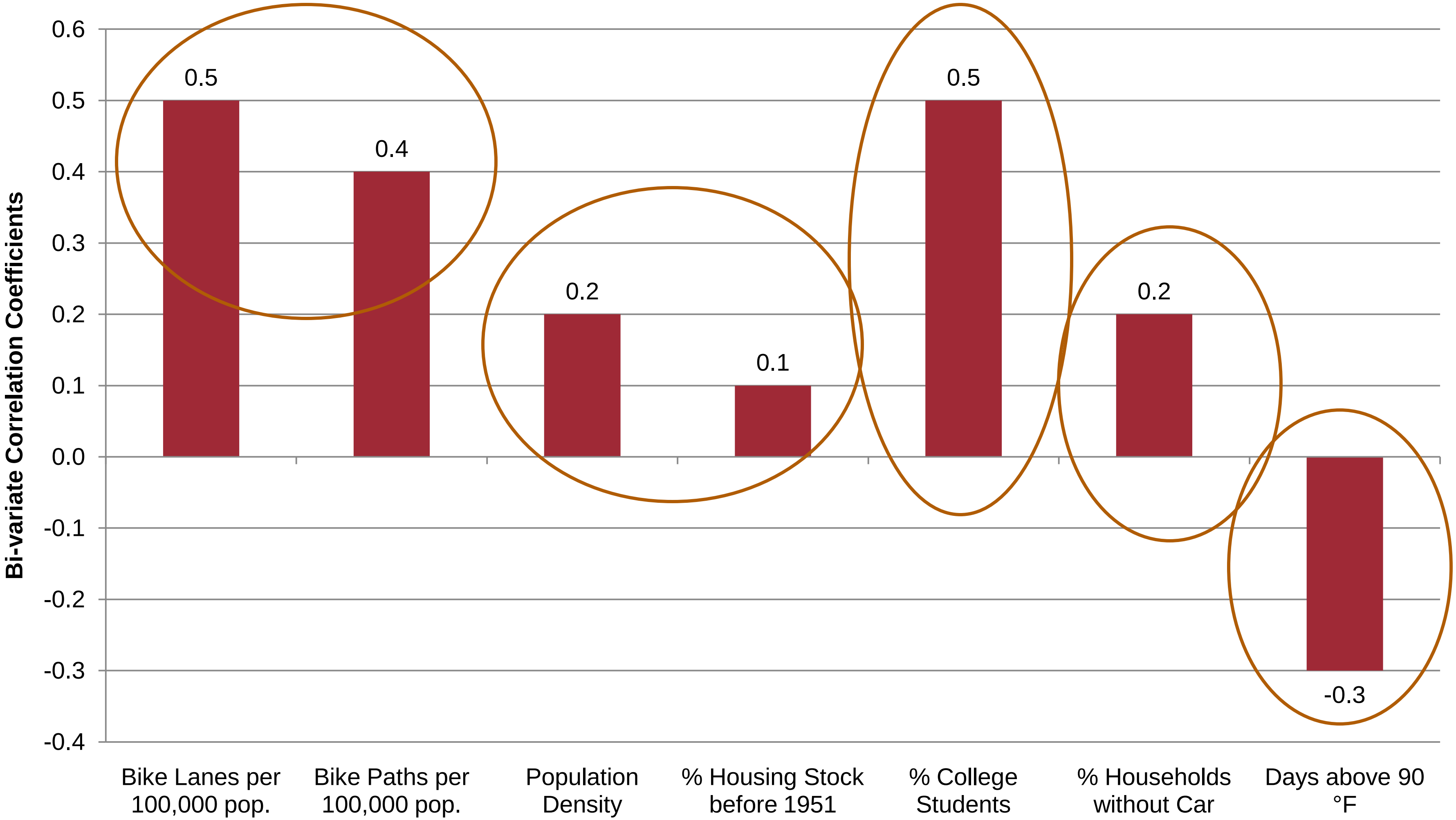
Bivariate Correlation Coefficients of Independent Variables with Bike Commuters per 10,000 Pop.



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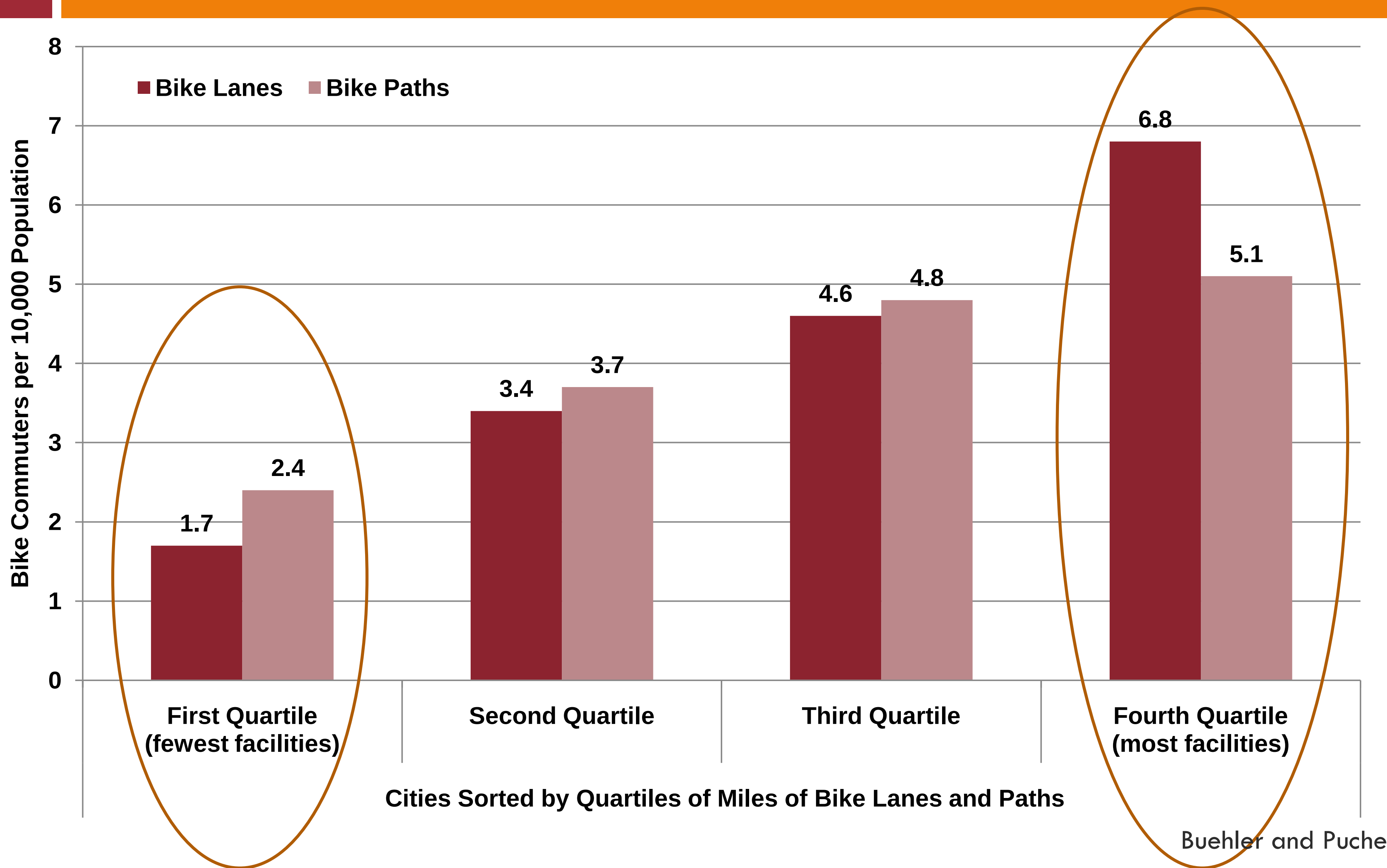
Quartile Analysis Shows That Cities With More Bike Paths and Lanes Have More Cycling



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Different Regression Models

- OLS regression with **<u>dependent variable bike commuters per 10,000 population.</u>**
- OLS regression using a '**<u>factor</u>**' combining 'car access', 'density', and 'age of housing stock'.
- OLS regression **<u>excluding fatality</u>** rates to control for possible collinearity of 'safety' with 'bike lanes and paths'.
- **<u>Binary Logit Proportion</u>**s to model dependent variable 'share of bike trips'.
- **<u>Two-Stage Least Square</u>** to control for endogeneity.

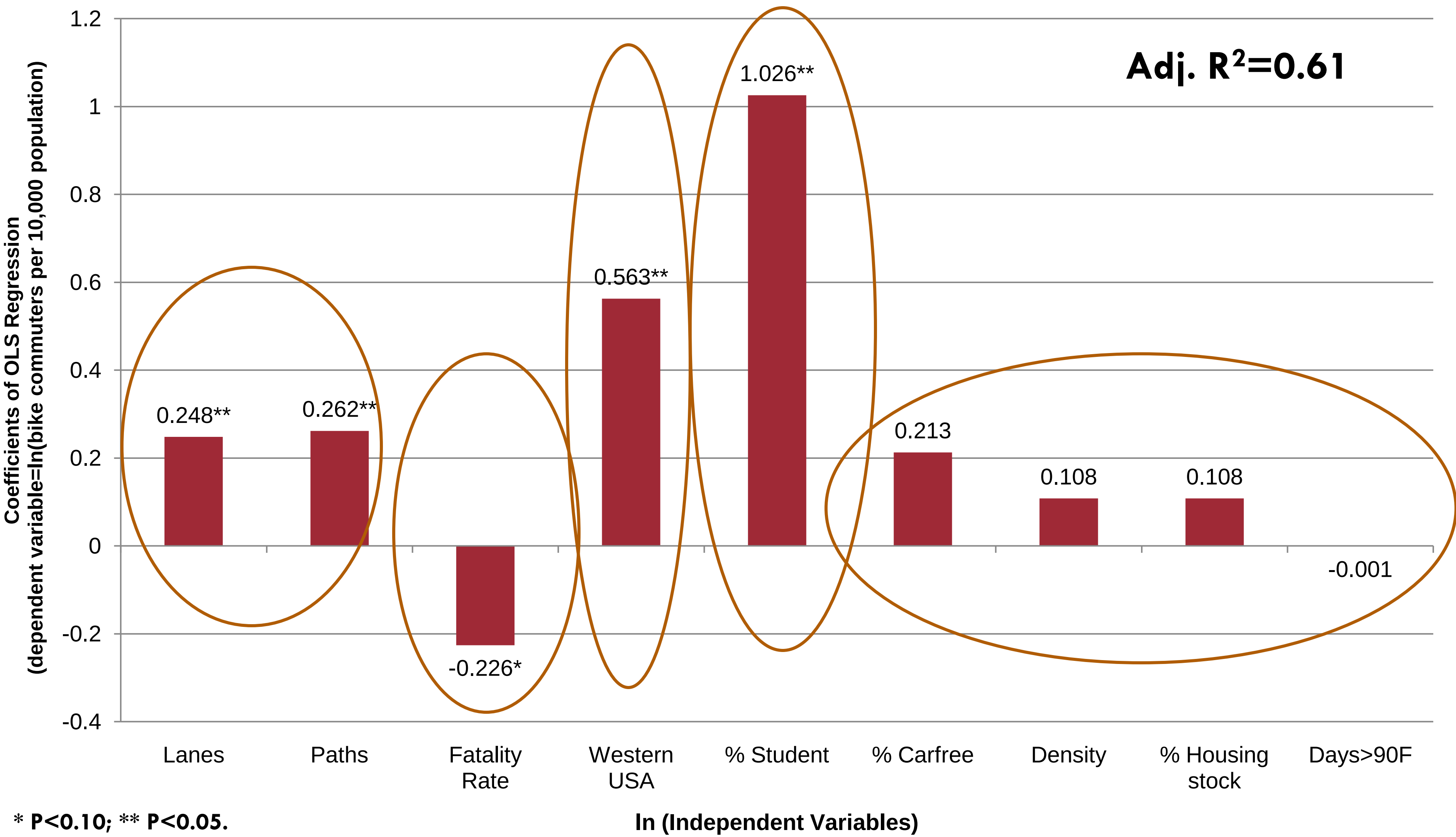
	OLS Regression of ln(bike commuters per 10,000 population)				**Binary Logit Proportions Model for Share of Bike Commuters**[1]	
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
ln(bike lanes per 100,000 population)	**0.248** (3.40)**	**0.247** (3.43)**	**0.236** (3.22)**	**0.235** (3.25)**	**0.329** (4.10)**	**0.294** (3.45)**
ln(bike paths per 100,000 population)	**0.262** (3.21)**	**0.266** (3.31)**	**0.312** (4.06)**	**0.315** (4.19)**	**0.176** (2.46)**	**0.215** (2.95)**
ln(fatality rate per 10,000 cyclists)	**-0.226** (1.66)*	**-0.226** (1.66)*			**-0.380** (3.23)**	**-0.393** (2.82)**
Geography (1= Western Census Region)	**0.563** (2.61)**	**0.545** (2.66)**	**0.713** (3.61)**	**0.694** (3.73)**	**0.493** (2.90)**	**0.408** (2.48)**
ln(percent of students in population)	**1.026** (4.13)**	**1.030** (4.21)**	**1.080** (4.34)**	**1.086** (4.43)**	**0.911** (4.29)**	**0.864** (3.53)**
ln(percent hh w/o car)	0.213 (1.02)		0.220 (1.05)		0.265 (1.58)	
ln(population density)	0.108 (0.93)	**0.314†** (3.71)**	0.130 (1.12)	**0.353†** (4.29)**	-0.052 (0.50)	**0.408†** (3.53)**
ln(percent of housing stock built prior to 1950)	0.108 (1.07)		0.128 (1.26)		**0.260** (3.28)**	
ln(number of days above 90 °F)	-0.001 (0.01)	-0.004 (0.06)	-0.034 (0.45)	-0.039 (0.54)	-0.026 (0.46)	-0.010 (0.19)
Constant	**-3.636** (3.22)**	**-2.070** (2.93)**	**-4.383** (4.19)**	**-2.588** (4.04)**	**-8.586** (9.95)**	**-7.464** (11.04)**
Observations	90	90	90	90	90	90
Adjusted R^2	0.61	0.62	0.60	0.61	*Pseudo LL (Intercept):* -9.049	-9.050
F-Statistic	16.37 0.000**	21.54 0.000**	17.71 0.000**	24.15 0.000**	*Pseudo LL(Full):* -3.395	-3.403
					Pseudo R^2 (McFadden): 0.62	0.62

* significant at 10%; ** significant at 5%. Absolute value of t/z statistics in parentheses.

† variable created by factor analysis, measuring the combined effect of population density, car access, and age of housing stock

[1] Logistic Regression estimated via STATA GLM (Generalized Linear Models) with Logit Link Function and Binomial Distribution

Multiple Regression Analysis of ln(Bike Commuters per 10,000 Population)



* P<0.10; ** P<0.05.

Impact of Bike Paths and Lanes

- **Bike lanes and paths** per 100,000 population are **significant** predictors for bike commuters per 10,000 population.
  - A 10% greater supply of **bike lanes** per 100,000 population is associated with a **2.5% greater** number of bike commuters per 10,000 population.
  - A 10% greater supply of **bike paths** per 100,000 population is associated with a **2.6% higher** level of bike commuters per 10,000 population.
- Coefficients for bike lanes and paths are **not** statistically significantly different from each other at the 95% level.

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Impact of Control Variables

- A 10% higher **bike fatality** rate per 10,000 cyclists is associated with a **2.3% lower** number of bike commuters per 10,000 population.
- A 10% higher share of **students** in the population is associated with **10% more** bike commuting.
- Compared to other parts of the USA, cities in the **West**ern Census Region average **56% more** bike commuters per 10,000 population.
- The coefficient for the number of days per year with temperatures of **90°F** or higher is **not** statistically **significant**.

Limitations

- Cross-sectional study
- Aggregate, city-level data
- Endogeneity
- Data on bike lanes and paths:
  - Reliability of local data
  - Lanes vary by widths, markings, signage, coloring, intersection treatments
  - Different maintenance and car parking enforcement policies
  - Paths vary by width, pavement, design, shared with pedestrians
  - Traffic calming

Conclusions

- Cities with a **<u>greater supply of bike paths and lanes</u>** have **<u>higher cycling levels</u>**—even after controlling for other determinants of cycling.
- **<u>Bike paths and lanes</u>** have a **<u>comparable</u>** relationship with cycling levels for the commute.
- The multiple regression coefficients in all variants of the models estimated in this paper indicate **<u>inelastic demand</u>** with respect to the supply of cycling facilities.

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