5-17-2018

Driverless Cars, Virtual Offices and Their Effects on Local Government Revenues

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THE CENTER FOR STATE AND LOCAL FINANCE

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AGA Atlanta Professional Development Training

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The Future:
Self-Driving to a City Near You

- Jaguar: I-Pace
- 20,000 cars
- 1 million rides/day
- Delivery: 2020

The Future:
Self-Driving to a City Near You

- Chrysler
- 1,000s of vans
- Shared rides
- Delivery: 2020 or sooner

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The Future:
Self-Driving to a City Near You

- Discontinued
- Waymo focused on self-driving systems
- Not cars

All Virtual Offices come with Windows

or macOS

- Telecommuting rates currently at all-time high

- Push to roll out fiber-optic internet

- Rise of augmented reality and virtual reality computing

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The Future: Cost to Local Governments?

- $5 billion FY 2016
  - For 25 largest cities in U.S.
- Parking-related activities, camera and traffic citations, gas taxes, towing, vehicle registration and licensing fees.
- $129 per capita
- Source: Governing Magazine

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Outline of Presentation

- Governing findings

- Other research on commuting costs

- Discuss our research on the effect of driverless cars and virtual offices on property values and why it's important

- Conclusion

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Revenues All Cities by Source ($ millions)

Parking Fees and Taxes	$1,500
Parking Fines	$1,300
Gas Taxes	$697
Licensing/Registration/Ownership Taxes	$677
Traffic Citations/Camera	$593
Towing	$81

Total Revenues (millions $ FY16)

City	Total Revenues (millions $ FY16)
Chicago	
San Francisco	
Los Angeles	
Washington, D.C.	
Philadelphia	
Phoenix	
Seattle	
Boston	
Denver	
Detroit	
Indianapolis	
San Diego	
Charlotte	
Nashville	
San Jose	
Columbus	
Memphis	
Austin	
Houston	
Fort Worth	
San Antonio	
Jacksonville	
Dallas	
El Paso	

■ Total Revenues (millions $ FY16)

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Top-10 Cities in Auto Related Revenue FY 2016 ($ millions)

Legend: Lic/Reg/Own | Gas Taxes | Traffic Enf. | Parking/Fines

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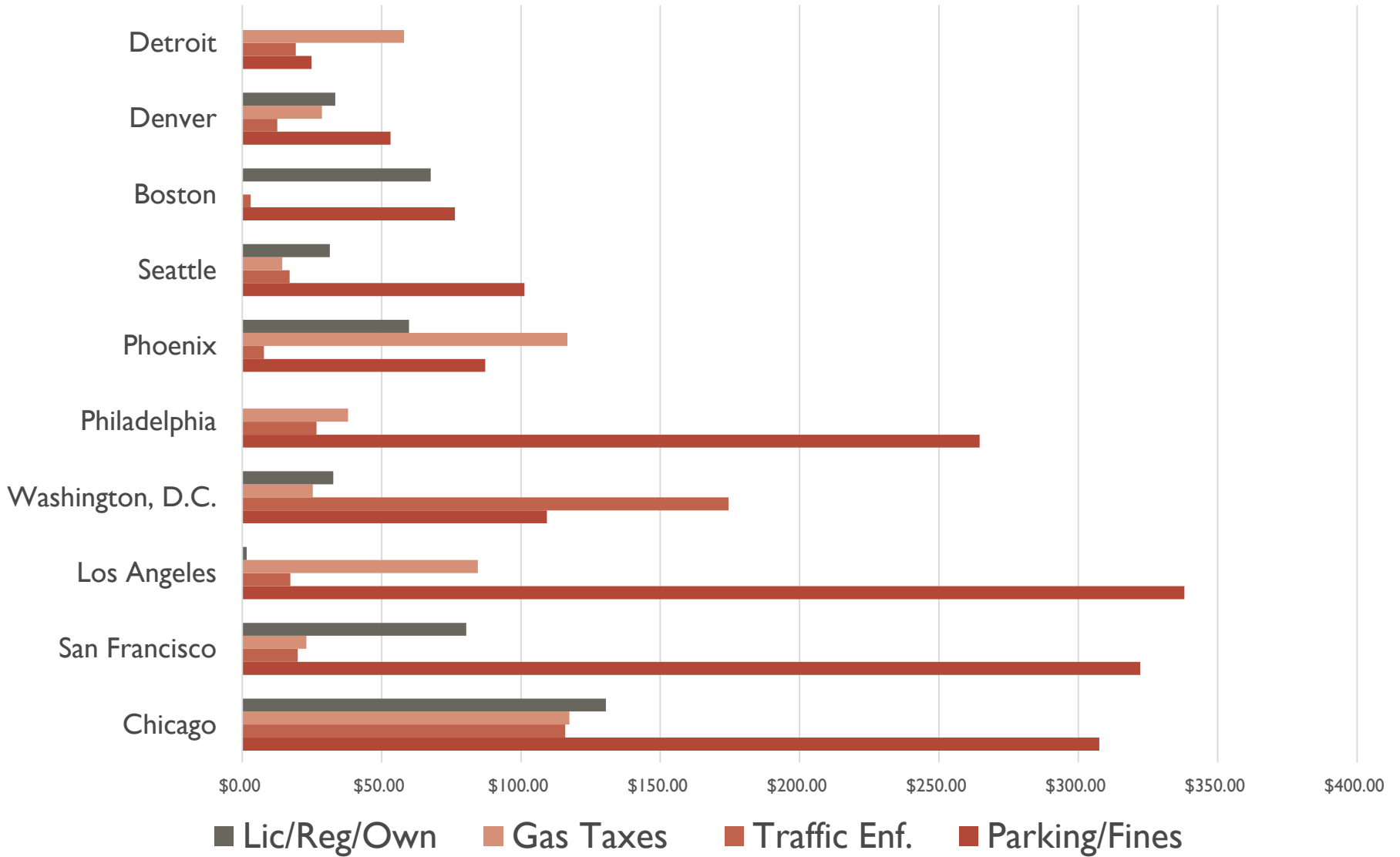
Household: Auto vs. Property Tax Revenue

*Residential property digest only

Source: DataUSA.io, Governing Magazine, and Author's calculations

	Prop. val. median ($1000s)*	Prop. Taxes*	Share*	Auto rev/household
San Francisco	$1,002	$3,000+	87%	$1,245
Seattle	$606	$3,000+	76%	$514
Los Angeles	$593	$3,000+	71%	$320
Washington, D.C.	$576	$3,000+	55%	$1,216
Boston	$495	$3,000+	54%	$550
Denver	$360	$3,000+	22%	$437
Atlanta	$262	$3,000+	48%	**NA**
Chicago	$243	$3,000+	62%	$639
Phoenix	$213	$3,000+	15%	$489
Philadelphia	$154	$3,000+	18%	$568
Detroit	$43	$3,000+	13%	$395

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How Do Driverless Cars and Telecommuting Effect Property Tax? – the Monocentric City Model

Scenarios - Monocentric City Model with Driverless Cars and Telecommuting

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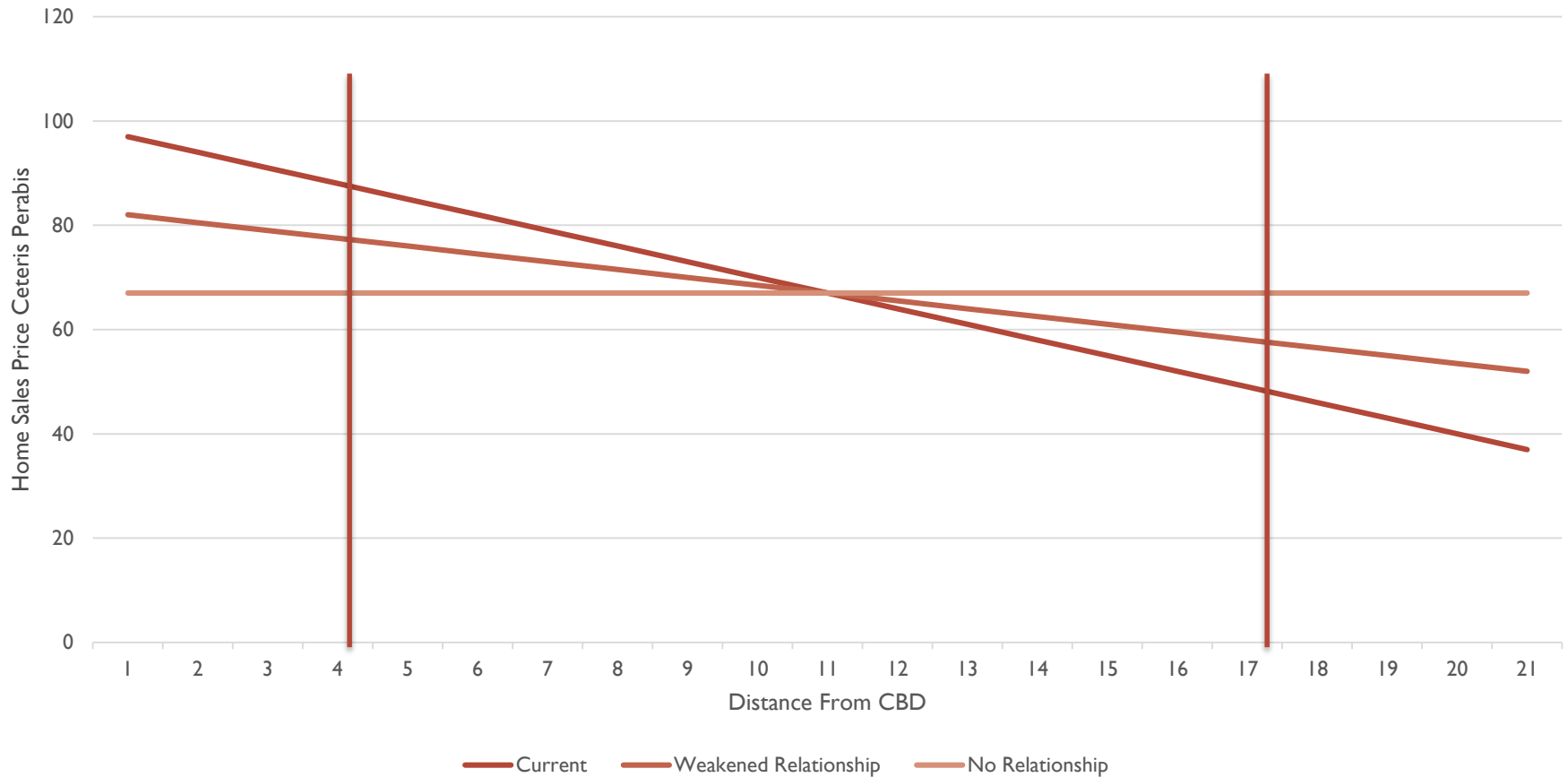
Why is the Property Tax Important?

- The property tax funds local governments and schools.

- Local governments may face political pressure to keep millage rates down even in the face of falling property values.

- Rate caps: Constrain local governments and school systems

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Monocentric City Model: Commute Time Literature

Two fundamental strands of relevant literature:

1. Willingness to pay for shorter commutes frequently using the implementation of highway tolling [See: Lam and Small (2001) and Brownstone et al. (2003).]

2. Home price capitalization from transportation infrastructure investment, usually distance from transit stations or major corridors [See: Anas, Arnott and Small (1998), Bartholomew and Ewing (2011)]

3. Important aside: Actual commute times rather than proxies for commute time are relevant. Sherry (1999) finds that distance from the central business district can give results inconsistent with the model.

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Shorter Commute Times: Tolling Results

- How much would you be willing to pay to cut your commute time by 5 minutes?
    - $1.00-$1.50
    - $1.51-$2.00
    - Less than $1.00

  Studies find $1.50-$2.50.

  Lam and Small (2001) and Brownstone et al. (2003).

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Shorter Commute Times: Transit Stations

- How much more would you be willing to pay for a home to live one mile or less from a transit station?
  - $2,000-$6,000
  - $6,001-$12,000
  - Less than $2,000

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Shorter Commute Times: Transit Stations

- Bay Area Rapid Transit (BART) stations: $74 per foot within the first quarter of a mile (change of $97,680 at 1/4 mile!)
  - $30 per foot for those houses greater than a quarter of a mile away. Sedway Group (1999)

- Study of five large U.S. cities, Boston, Atlanta, Chicago, Portland, and Washington, D.C. Baum-Snow and Kahn (2001)
  - Moving from three miles to one mile away from a transit station creates a housing premium of $4,972.
  - Rents rose by $19 per month for the same distance.

Metro Link St. Louis Garrett (2004)

  $14 per foot closer   (change of $18,480 at 1/4 mile!)

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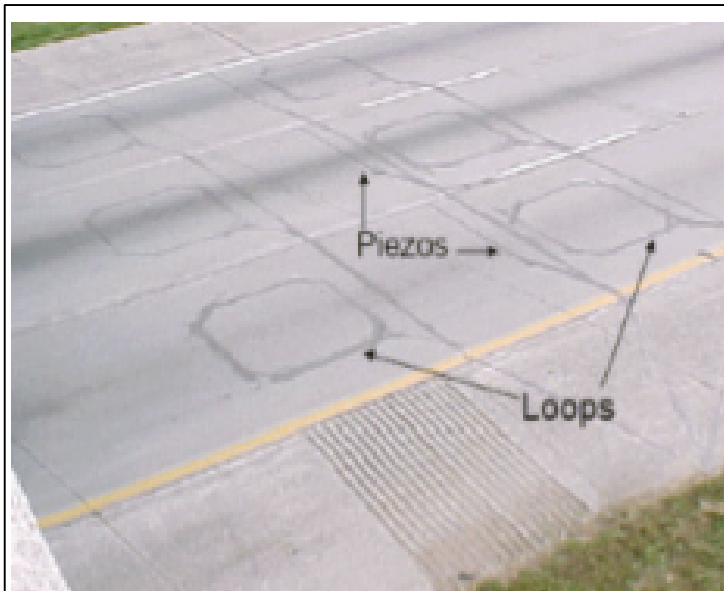CENTER FOR STATE & LOCAL FINANCE

Center for State and Local Finance Study

- How would changes to commute time affect property values in the Atlanta metro area?

- Our contribution would be to estimate this change from observable data on commute times at the census tract/block group level combined with rich home sales data.

- Our empirical strategy attempts to control for endogenous determinants of changes in commute times.

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Data Home Sales and Distance to Work

- Homes sales data: All counties in metro Atlanta from Data Quick with information on property characteristics, condition, age, bedrooms, square feet, and other relevant information.

- Zoned elementary schools' Criterion-Referenced Competency Tests (CRCT) scores from the preceding year

- Longitudinal-Employer Household Dynamics Program Origin-Destination Employment Statistics (LODES) is used to estimate the straight-line distance to work.

- Census tract level mean minutes to work 2009 – 2013

- Permanent traffic measurement station data from Georgia Department of Transportation (GDOT)

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Data

**Continuous Count Stations (CCS or permanent)**

There are approximately 300 CCS locations, including the permanent WIM stations, throughout Georgia that

- Count and classify traffic 24/7/365
- Utilize two Inductive Loop Sensors and a Piezoelectric Sensor embedded in the pavement in each lane to detect and classify vehicles
- Use sensors that are connected to a controller cabinet mounted on a pole adjacent to the roadway

Continuous Count Station

Source: GDOT

Data

Average straight-line distance that employees travel to work calculation visual yields 5.75 mile distance to work.

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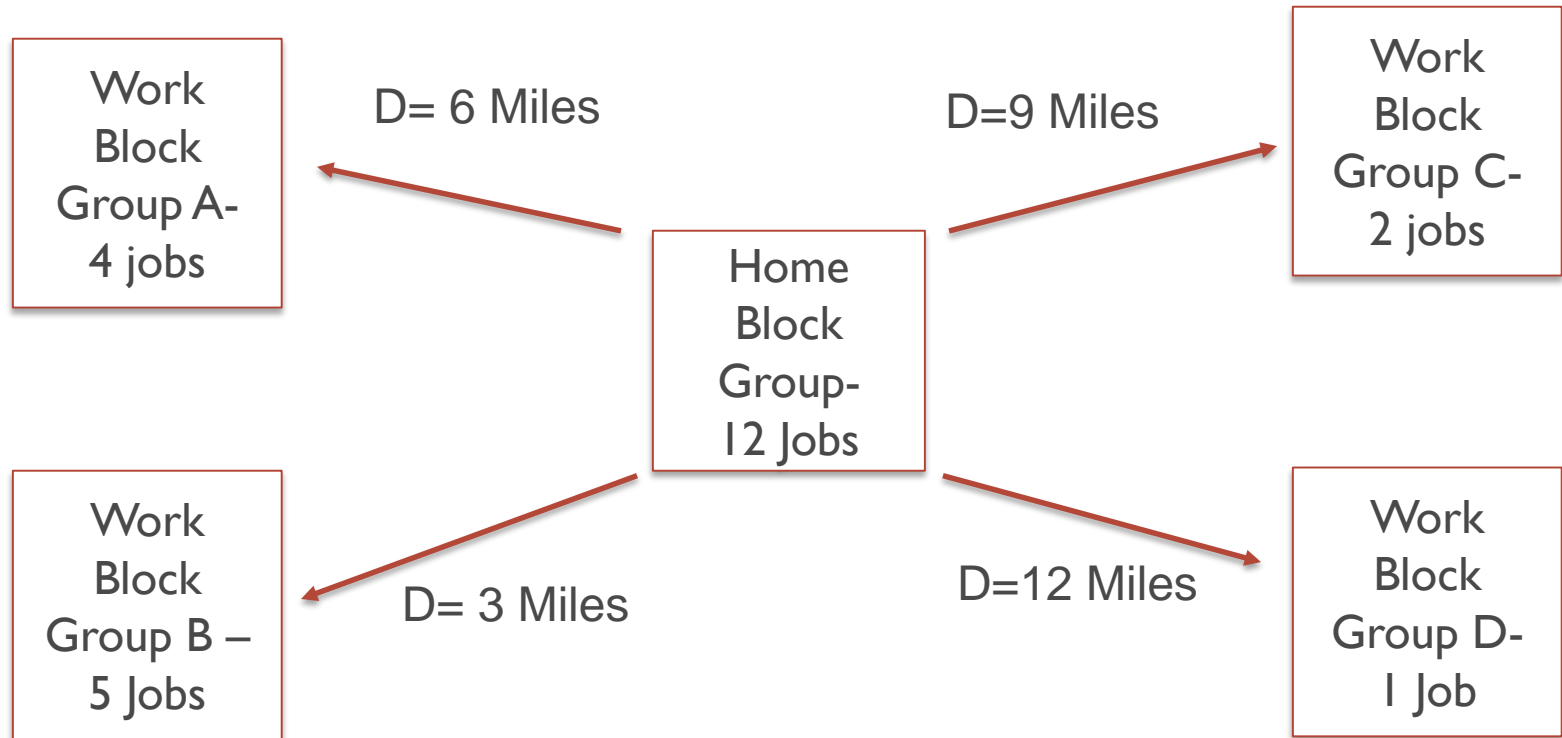
Summary Statistics: Key Variables

Variable	Obs.	Mean	Std. Dev
Minutes to Work	208572	28.57	9.52
S.L. Distance to Work	208587	18.27	7.44
Percent Exceeds of CRCT	208587	0.29	0.17
Log Sales Price	208587	11.80	0.99
Square Feet	208587	2027.00	1109.31

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Model 1: Naïve Hedonic Price Model

$$Ln(P_{hmy}) = \beta_1 T_{bt} + \boldsymbol{\beta X}_{hy} + \beta TS_{ts} + \delta MY + \varepsilon$$

P_{hmy} is sales price of home(h) in month year (my)

T_{bt} is a travel distance or commute time

$\boldsymbol{X}_{hy}$ is a vector of home characteristics

TS_{ts} is the preceding year's elementary test score

MY are month year fixed effects
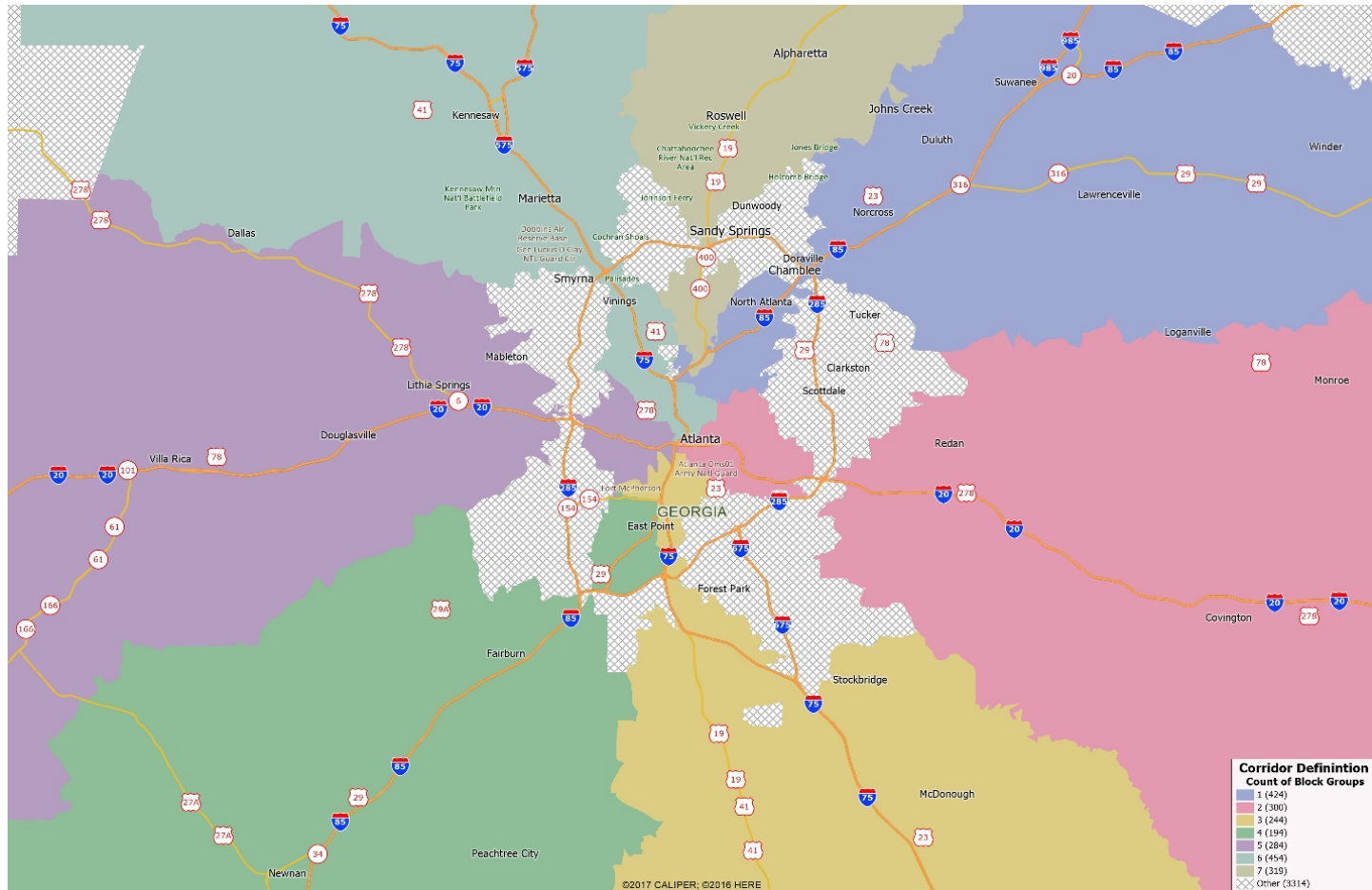
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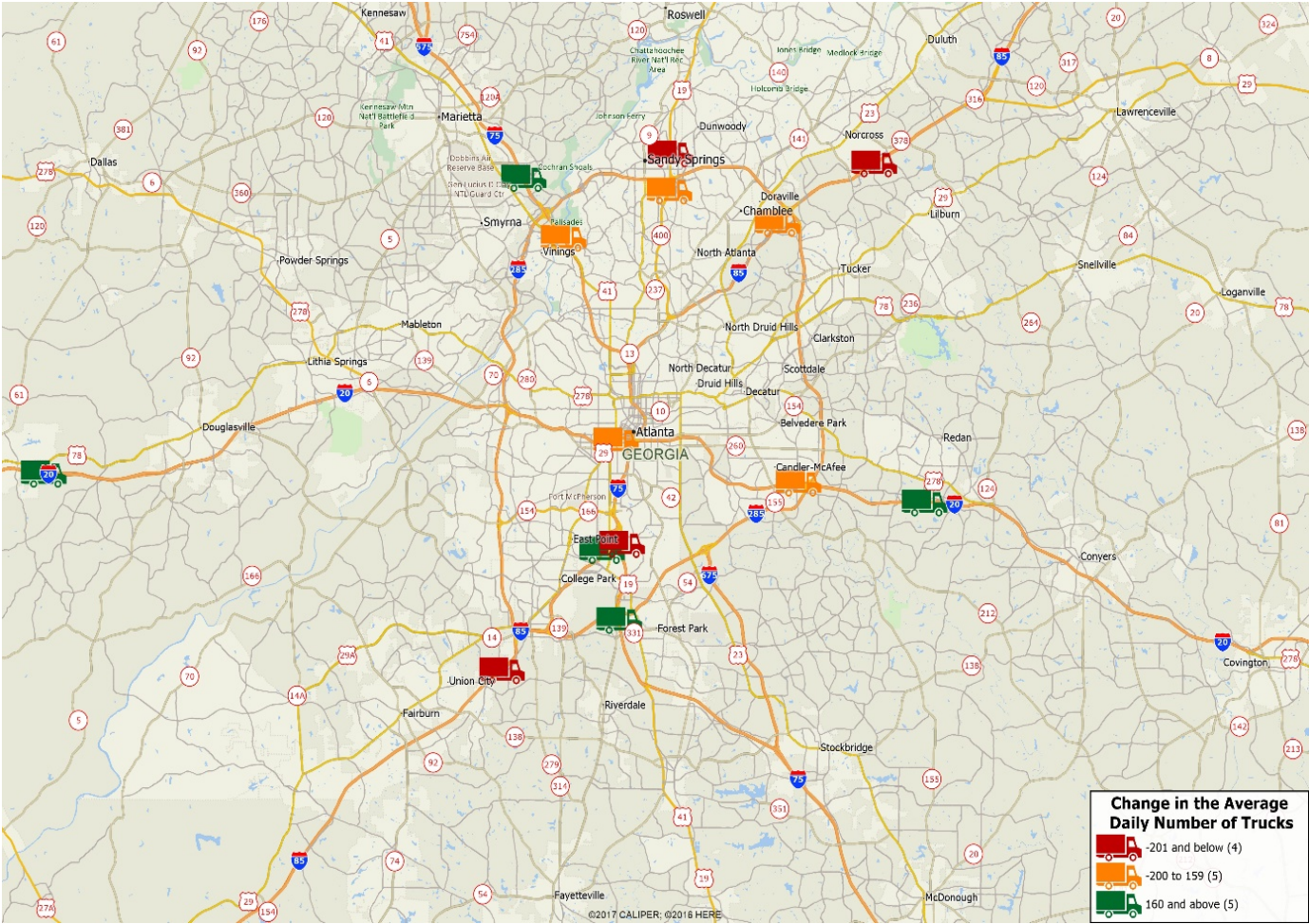
Model 1: Naïve Hedonic Price Model

Econometric concerns with the naïve hedonic price model:

1. Unobserved neighborhood characteristics are not controlled for. Commute time is function of distance to CBD (time invariant) and congestion (endogenous to changes in demand for housing).

- Solutions
  - Block group fixed effects: Unobserved neighborhood characteristics
  - Two-stage least squares: Potential congestion endogeneity from higher demand for home leading to increases commutes and higher home values. IV is average annual truck traffic.

Model 1: Atlanta Major Corridor Map

Model 1: Change in Average Daily Truck Traffic

Change in the Average Daily Number of Trucks
- -201 and below (4)
- -200 to 159 (5)
- 160 and above (5)

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Model 1: Naïve Model Results
Preliminary Results Only
(Please do not reference.)

Hedonic Price Model Result				
VARIABLES	Log of Sales Price	Log of Sales Price	Log of Sales Price	Log of Sales Price -IV
Miles to Work	-0.0142***		-0.0133***	0.0213
	(0.00207)		(0.00197)	(0.0459)
Travel Time to Work		-0.00907***	-0.0083***	
		(0.00142)	(0.00132)	
Block Group FE	No	No	No	Yes
Number of Trucks IV	No	No	No	Yes
R-squared	0.477	0.475	0.483	0.588

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Model 2: Effect of New Transportation Infrastructure

- In October 2008, a $155 million project in Gwinnett County was completed that included HOV lanes, two new flyover bridges, and made other commute reducing investments.

- "A key segment of I-85 took 28 minutes to travel before the improvement and 17 minutes after and a typical commute to the city center was reduced by 15 minutes" - GDOT

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Model 2: Effect of New Transportation Infrastructure
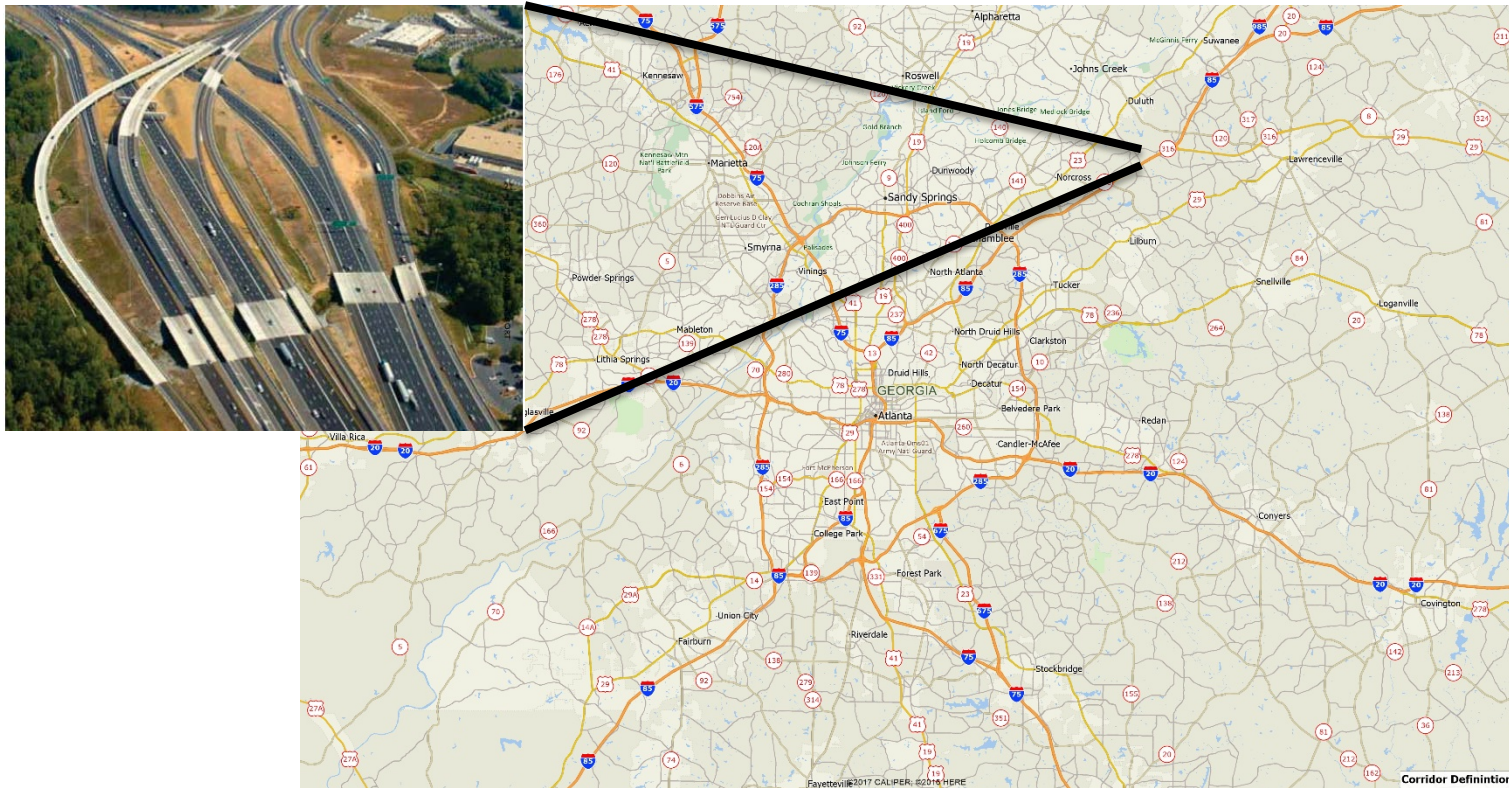
Model 2: Effect of New Transportation Infrastructure

- Before and after treatment effects:
  - Treatment group are sales along this corridor benefiting from the investment.
  - Control group are outside-of-the-perimeter matched sales.

Model 2: Effect of New Transportation Infrastructure
Preliminary Results Only
(Please do not reference.)

Average Treatment Effects from I-85 Project			
	Before	After	
VARIABLES	Log of Sales Price	Log of Sales Price	Difference
T.E. of 85 Corridor	0.115***	0.147***	.0327***
	(0.00943)	(0.00833)	T-Stat
			2.6002

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Model 3. Difference-in-Difference on outside-of-the-city traffic pressure

Permanent Traffic Station Map

Model 2: Nearest Neighbor Matching for Difference-in-Difference and Average Treatment Effects

- We construct a neighborhood matching protocol similar to Patrick and Mothorpe (2016)

- Restrict sales to those in treatment or control neighborhoods

- Implement difference-in-difference for inside a treatment neighborhood after 2008

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Summary of Results to Date

- Home prices do reflect changes in commute times.
- If driverless cars or other technological advances weaken or break this relationship:
  - In places where the negative commute effect on home prices is high, property could appreciate faster than expected.
  - In places benefitting from the premium to live closer to work with the associated shorter commute times, digests could appreciate slower than expected or even decline, with potential implications for policy makers trying to fund local public services.

Thank you!

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Check out our research at cslf.gsu.edu

or on social media.

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