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Laura Wheeler  
*Georgia State University*

Mels Zeeuw  
*Georgia State University*

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# Analysis of the Impact of Tax Incentives on the Consumption of Electric Vehicles

By Laura Wheeler and Mels de Zeeuw

# Motivation for Research

BUSINESS

## Atlanta's Incentives Lift Electric Car Sales

Tax Credit, Cheap Power Help Make Georgia Capitol a Hotbed for Battery Buggies

How Georgia became the biggest electric vehicle market in the US

Why Are Electric Vehicle Sales Booming in Atlanta?

# Define Electric Vehicles

## PEV – Plug-in Electric Vehicles

- BEVs – Battery-only propulsion
- PHEV – may have a backup combustion engine, as well as a battery power source

These...



And in some cases this...



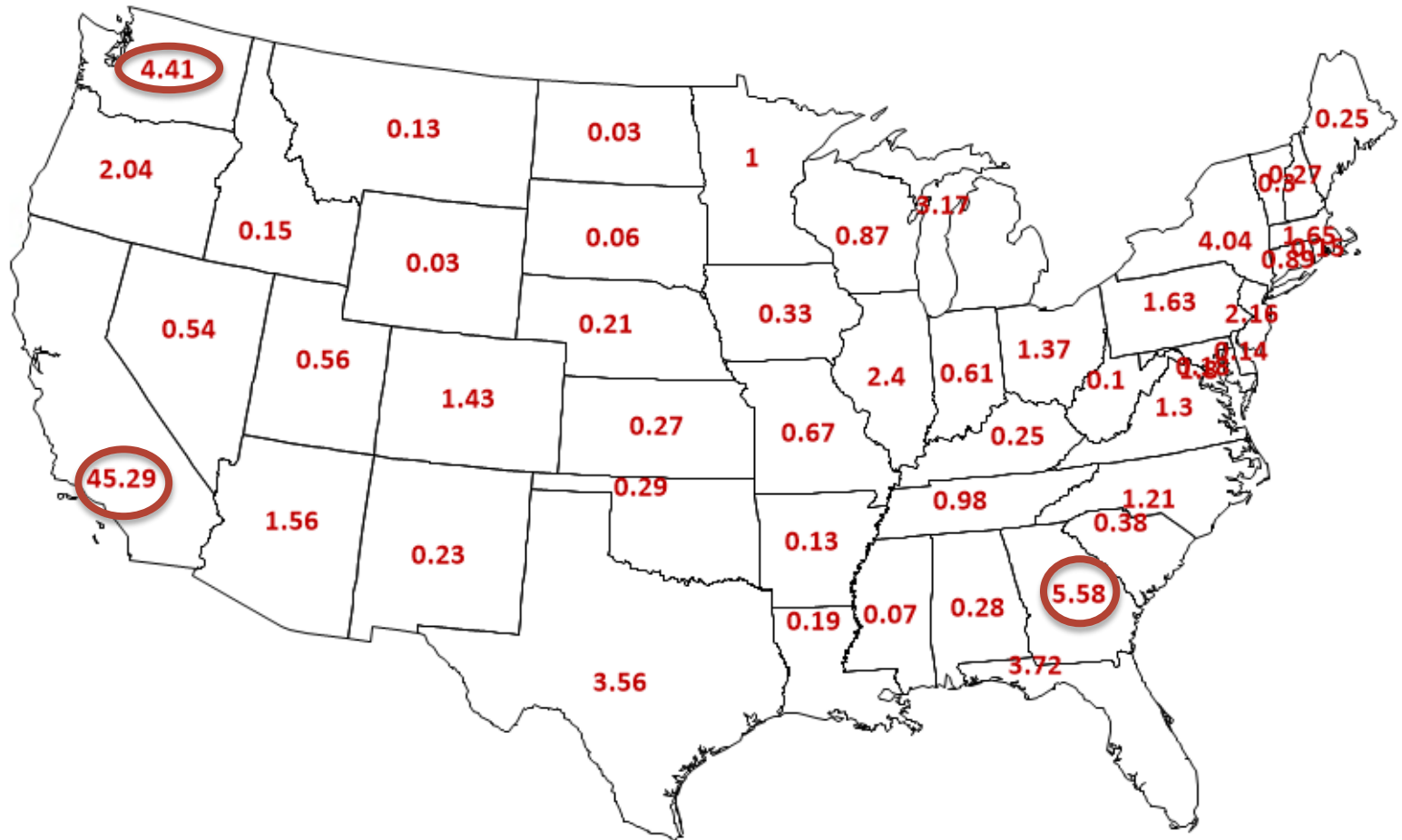
And this...



But not that...

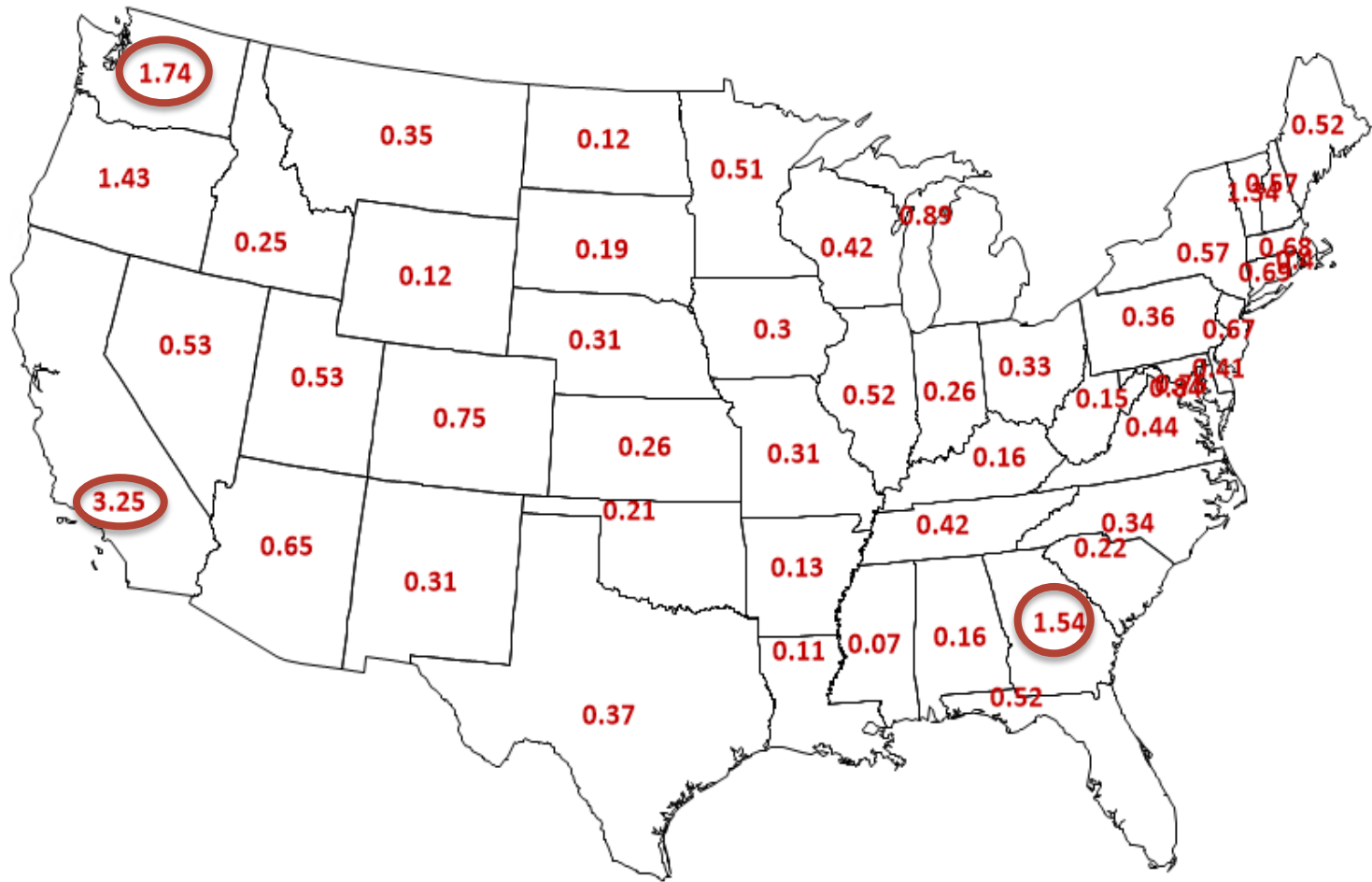


# Distribution of PEVs across States, 2013-2014





# PEV Registrations by State per 1,000 population, 2013-2014

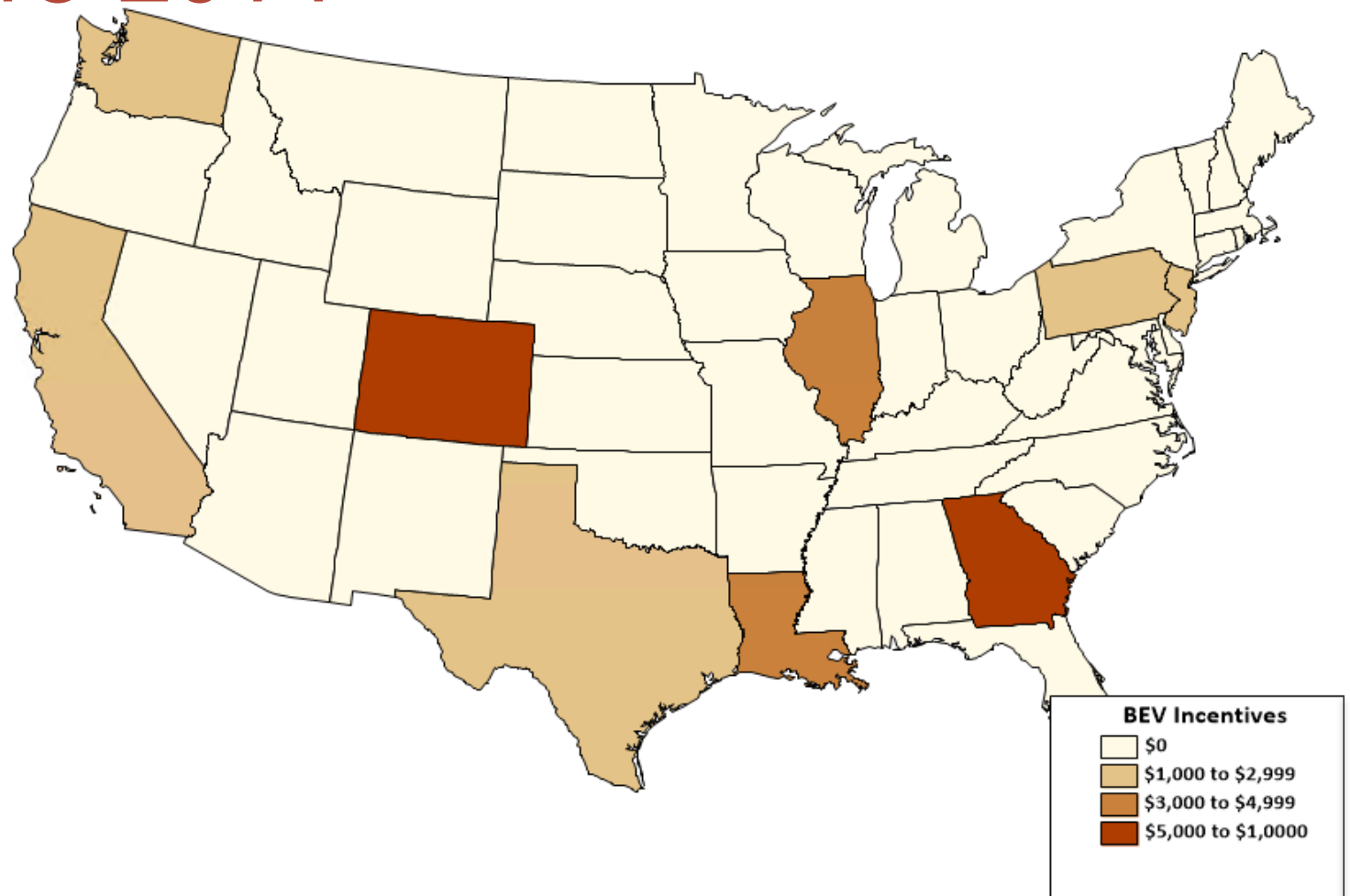




# Federal & State Electric Vehicles Incentives

- Up to \$7,500 federal incentive
- State Financial Incentives – income tax credits, sales tax exemptions
- HOV access
- Discount on electricity usage
- Emission testing exemption
- Parking fee exemptions

# State Electric Vehicle Incentives, 2013-2014





# Previous Studies

- Sierzchula, Bakker, Maat, van Wee (2014)
- Gallagher and Muehlegger (2011)
- Diamond (2009)
- Chandra, Gulati, and Kandlikar (2010)

# Models

National –

BEVs/PHEVs = f(tax incentive, personal income, population, liberal voters, commuting distance, HOV exemption, gasoline prices, electricity prices)

GA County –

BEVs = f(personal income, population, liberal voters, commuting distance, population density, gasoline prices)



# Data Sources

- Alternative Fuels Data Center
- National Auto Dealers Association
- GA Department of Revenue
- Gallup State of the States
- Bureau of Economic Analysis
- Census Bureau
- Federal Highway Administration
- Energy Information Administration

Dependent Variable – BEVs/Total New Vehicle Registrations

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Tax Incentive	2.76e-06*** (7.24e-07)	2.26e-06*** (7.43e-07)	2.47e-06*** (7.25e-07)	2.51e-06*** (7.12e-07)
Personal Income		-1.51e-08 (2.82e-08)	-2.17e-08 (2.74e-08)	-3.44e-08 (2.12e-08)
Population		9.64e-07 (1.37e-06)	1.36e-06 (1.34e-06)	1.94e-06* (1.03e-06)
Liberal	0.000108 (0.000356)	-3.64e-05 (0.000354)	-0.000147 (0.000347)	-0.000184 (0.000316)
Commute<20	-0.00144 (0.00319)	-0.00209 (0.00309)	0.000308 (0.00323)	
Commute>30	-0.00247 (0.00429)	-0.00439 (0.00482)	-0.00470 (0.00466)	
HOV	0.000172 (0.00216)	-0.000542 (0.00226)	-0.000500 (0.00218)	-0.000424 (0.00213)
Gasoline Price	0.0300*** (0.00786)	0.0297*** (0.00791)	0.0348*** (0.00808)	0.0360*** (0.00786)
Electricity Price	0.000373 (0.000247)	0.000345 (0.000245)	0.000374 (0.000238)	0.000378 (0.000235)
Per capita personal income	-0.000278 (0.000190)			
Land area			-2.45e-08* (1.26e-08)	-2.30e-08* (1.14e-08)
Constant	-0.102*** (0.0258)	-0.111*** (0.0255)	-0.127*** (0.0261)	-0.131*** (0.0254)
Observations	50	50	50	50
R-squared	0.564	0.570	0.608	0.598

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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Per capita personal income	-0.000278 (0.000190)			
Land area			-2.45e-08* (1.26e-08)	-2.50e-08* (1.14e-08)
Constant	-0.102*** (0.0258)	-0.111*** (0.0255)	-0.127*** (0.0261)	-0.131*** (0.0254)
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Personal Income		2.83e-08* (1.53e-08)	2.54e-08 (1.54e-08)	1.02e-08 (1.22e-08)
Population		-1.03e-06 (7.41e-07)	-8.70e-07 (7.47e-07)	-1.78e-07 (5.96e-07)
Liberal	0.000601** (0.000234)	0.000477** (0.000191)	0.000435** (0.000193)	0.000377** (0.000183)
Commute<20	-0.000974 (0.00207)	-0.000494 (0.00167)	0.000378 (0.00180)	
Commute>30	-0.00143 (0.00286)	-0.00561** (0.00266)	-0.00560** (0.00264)	
HOV	0.00241* (0.00138)	0.00101 (0.00120)	0.00104 (0.00119)	0.00113 (0.00122)
Gasoline Price	0.0116** (0.00524)	0.00974** (0.00435)	0.0118** (0.00461)	0.0137*** (0.00466)
Electricity Price	-0.000148 (0.000160)	-0.000124 (0.000131)	-0.000113 (0.000131)	-0.000106 (0.000135)
Per capita personal income	1.71e-05 (0.000124)			
Land area			-8.79e-09 (7.04e-09)	-7.45e-09 (6.69e-09)
Constant	-0.0484*** (0.0171)	-0.0394*** (0.0141)	-0.0458*** (0.0149)	-0.0525*** (0.0151)
Observations	50	50	50	50
R-squared	0.535	0.690	0.702	0.666

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### Dependent Variable – BEVs per 1000 population

VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352 (0.303)	-3.197*** (0.621)	-2.810*** (0.646)
Commute>40	-0.0210 (0.0526)	-0.0575 (0.0525)	-0.0480 (0.0522)
Population Density			0.000156 (0.000174)
Democratic Vote Share	0.000269 (0.00150)	-0.000187 (0.00156)	-0.00102 (0.00162)
HOV	0.328*** (0.0732)	0.375*** (0.0881)	0.305*** (0.0915)
Personal Income		0.203*** (0.0294)	0.185*** (0.0294)
Population		-0.00728*** (0.00122)	-0.00686*** (0.00130)
Average Gasoline Price	-0.182* (0.109)	-0.299*** (0.113)	-0.0586 (0.127)
2012 dummy			0.0184 (0.0625)
2013 dummy			0.0798 (0.0619)
2014 dummy			0.264*** (0.0659)
Per capita personal income	2.77e-05*** (3.73e-06)		
Constant	-0.0863 (0.407)	1.216*** (0.388)	0.322 (0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Dependent Variable – BEVs per 1000 population

VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352 (0.303)	-3.197*** (0.621)	-2.810*** (0.646)
Commute>40	-0.0210 (0.0526)	-0.0575 (0.0525)	-0.0480 (0.0522)
Population Density			0.000156 (0.000174)
Democratic Vote Share	0.000269 (0.00150)	-0.000187 (0.00156)	-0.00102 (0.00162)
HOV	0.328*** (0.0732)	0.375*** (0.0881)	0.305*** (0.0915)
Personal Income		0.203*** (0.0294)	0.185*** (0.0294)
Population		-0.00728*** (0.00122)	-0.00686*** (0.00130)
Average Gasoline Price	-0.182* (0.109)	-0.299*** (0.113)	-0.0586 (0.127)
2012 dummy			0.0184 (0.0625)
2013 dummy			0.0798 (0.0619)
2014 dummy			0.264*** (0.0659)
Per capita personal income	2.77e-05*** (3.73e-06)		
Constant	-0.0863 (0.407)	1.216*** (0.388)	0.322 (0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Dependent Variable – BEVs per 1000 population

VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352 (0.303)	-3.197*** (0.621)	-2.810*** (0.646)
Commute>40	-0.0210 (0.0526)	-0.0575 (0.0525)	-0.0480 (0.0522)
Population Density			0.000156 (0.000174)
Democratic Vote Share	0.000269 (0.00150)	-0.000187 (0.00156)	-0.00102 (0.00162)
HOV	0.328*** (0.0732)	0.375*** (0.0881)	0.305*** (0.0915)
Personal Income		0.203*** (0.0294)	0.185*** (0.0294)
Population		-0.00728*** (0.00122)	-0.00686*** (0.00130)
Average Gasoline Price	-0.182* (0.109)	-0.299*** (0.113)	-0.0586 (0.127)
2012 dummy			0.0184 (0.0625)
2013 dummy			0.0798 (0.0619)
2014 dummy			0.264*** (0.0659)
Per capita personal income	2.77e-05*** (3.73e-06)		
Constant	-0.0863 (0.407)	1.216*** (0.388)	0.322 (0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Dependent Variable – BEVs per 1000 population

VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352 (0.303)	-3.197*** (0.621)	-2.810*** (0.646)
Commute>40	-0.0210 (0.0526)	-0.0575 (0.0525)	-0.0480 (0.0522)
Population Density			0.000156 (0.000174)
Democratic Vote Share	0.000269 (0.00150)	-0.000187 (0.00156)	-0.00102 (0.00162)
HOV	0.328*** (0.0732)	0.375*** (0.0881)	0.305*** (0.0915)
Personal Income		0.203*** (0.0294)	0.185*** (0.0294)
Population		-0.00728*** (0.00122)	-0.00686*** (0.00130)
Average Gasoline Price	-0.182* (0.109)	-0.299*** (0.113)	-0.0586 (0.127)
2012 dummy			0.0184 (0.0625)
2013 dummy			0.0798 (0.0619)
2014 dummy			0.264*** (0.0659)
Per capita personal income	2.77e-05*** (3.73e-06)		
Constant	-0.0863 (0.407)	1.216*** (0.388)	0.322 (0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Charging Station variable

VARIABLES	Model 1	Model 2
Charger Density	69.01*** (12.28)	
Commute<15	-2.283*** (0.638)	-0.00567*** (0.00204)
Commute>40	-0.0414 (0.0509)	-6.30e-05 (0.000162)
Population Density	-0.000202 (0.000181)	5.07e-06*** (5.41e-07)
Democratic Vote Share	-0.00151 (0.00159)	7.79e-06 (5.05e-06)
HOV	0.360*** (0.0898)	-0.00100*** (0.000287)
Personal Income	0.146*** (0.0295)	0.000431*** (9.41e-05)
Population	-0.00558*** (0.00129)	-1.38e-05*** (4.13e-06)
Average gasoline price	-0.0300 (0.124)	-0.000373 (0.000394)
2012 dummy	-0.0201 (0.0614)	0.000546*** (0.000194)
2013 dummy	0.0366 (0.0609)	0.000569*** (0.000193)
2014 dummy	0.187*** (0.0658)	0.000930*** (0.000208)
BEV per capita registrations		0.000699*** (0.000124)
Constant	0.285 (0.429)	0.000311 (0.00137)
Observations	636	636
R-squared	0.246	0.693

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



# Thank You.

This work is preliminary. Please do not cite with contacting the authors.

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