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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...



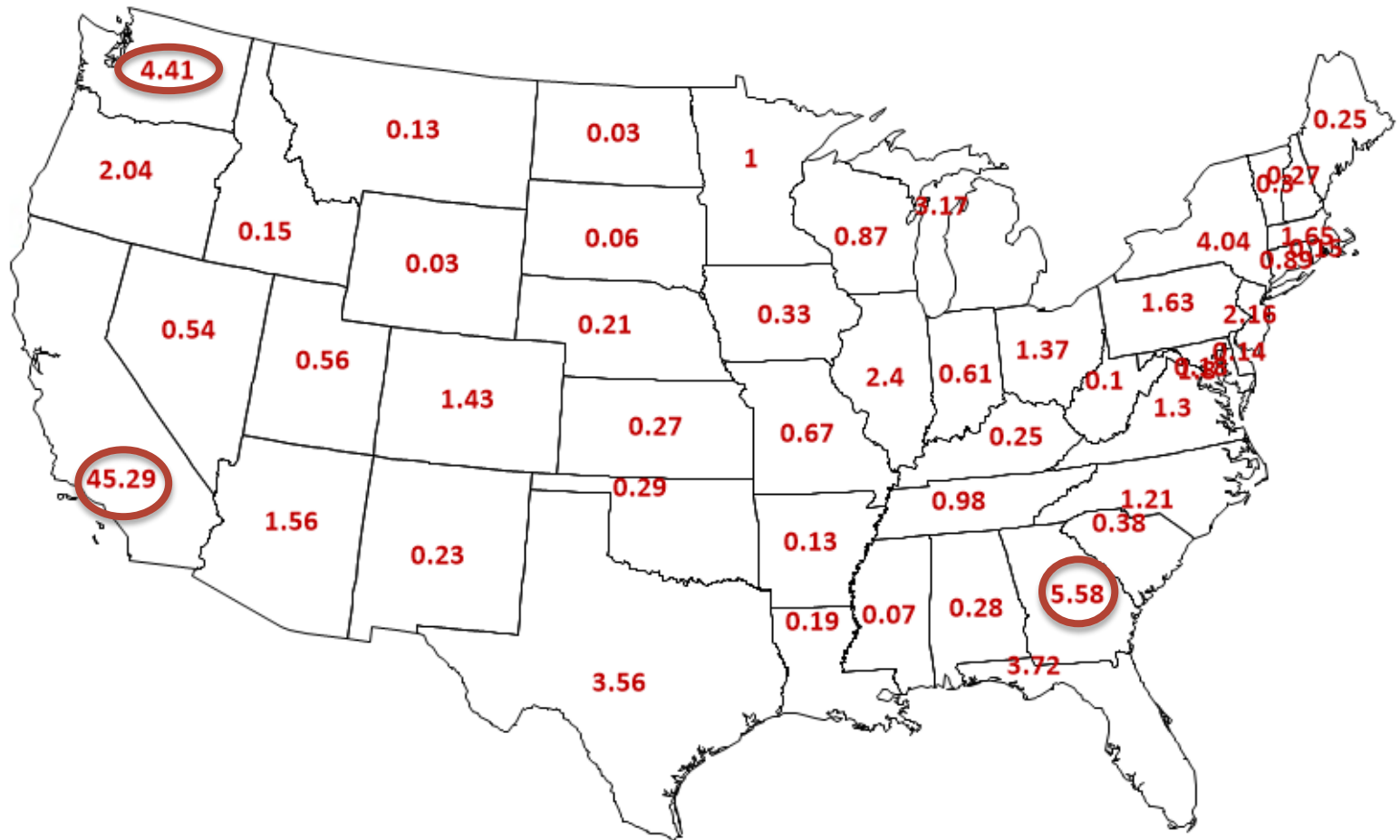
And this...



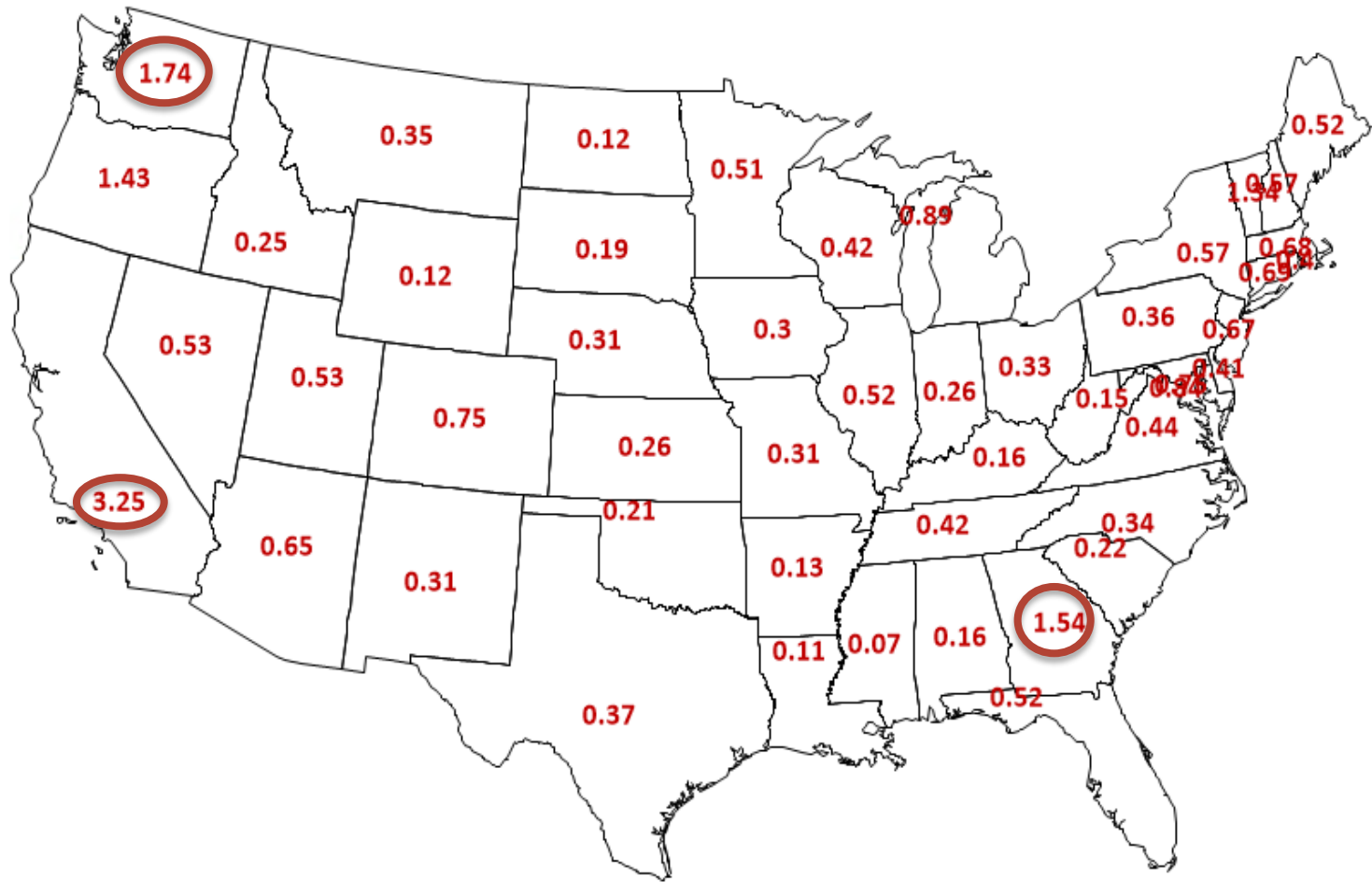
But not that...



Distribution of PEVs across States, 2013-2014



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

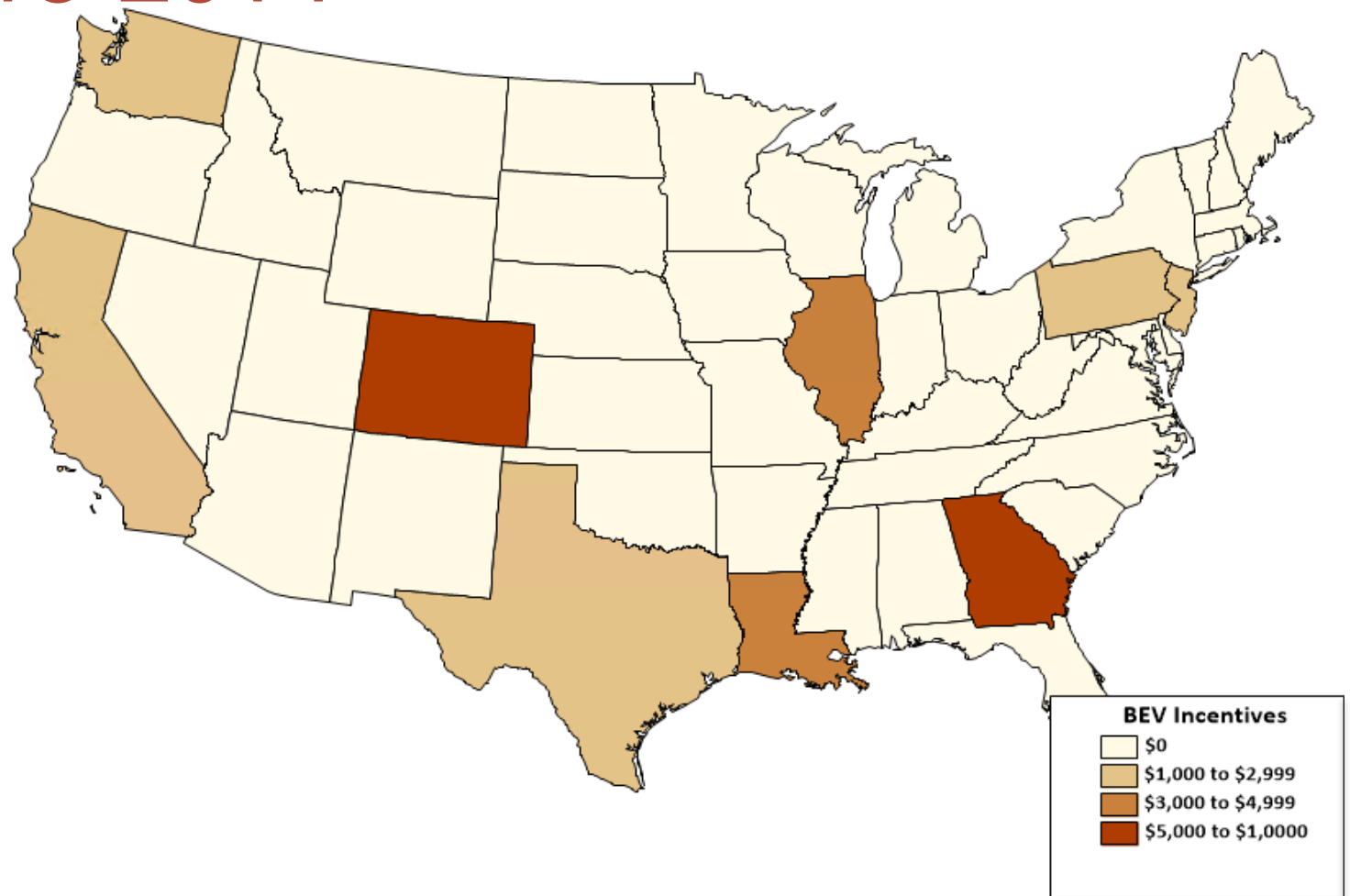




Federal & State Electric Vehicles Incentives

- 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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Dependent Variable – PHEVs /Total New Vehicle Registrations

VARIABLES	Model 1	Model 2	Model 3	Model 4
Tax Incentive	2.78e-08 (5.44e-07)	-5.27e-07 (4.61e-07)	-4.03e-07 (4.69e-07)	-1.95e-07 (4.68e-07)
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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