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

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

By Laura Wheeler and Mels de Zeeuw

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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?

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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

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These…

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And in some cases this…

And this…

But not that…

Distribution of PEVs across States, 2013-2014
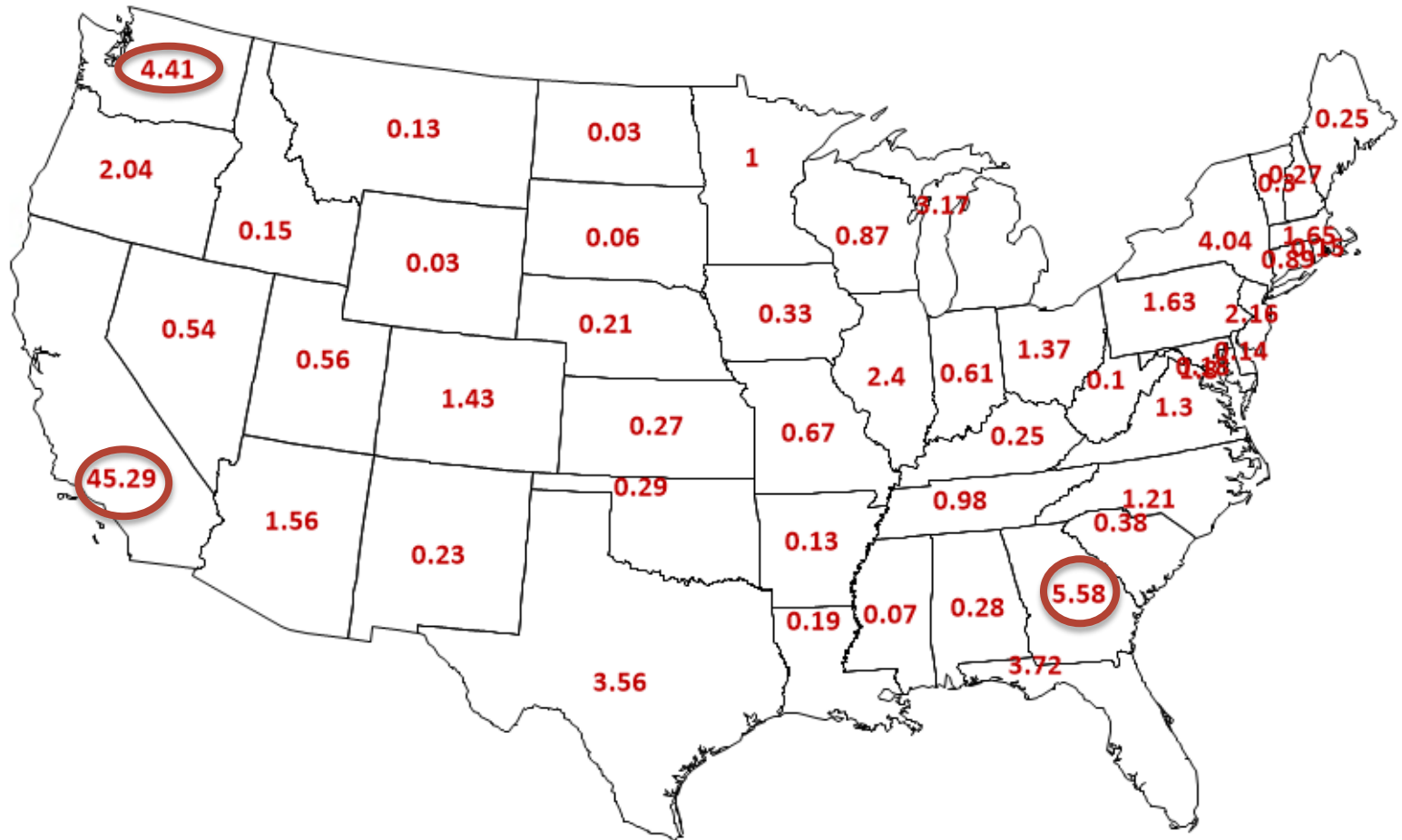
PEV Registrations by State per 1,000 population, 2013-2014
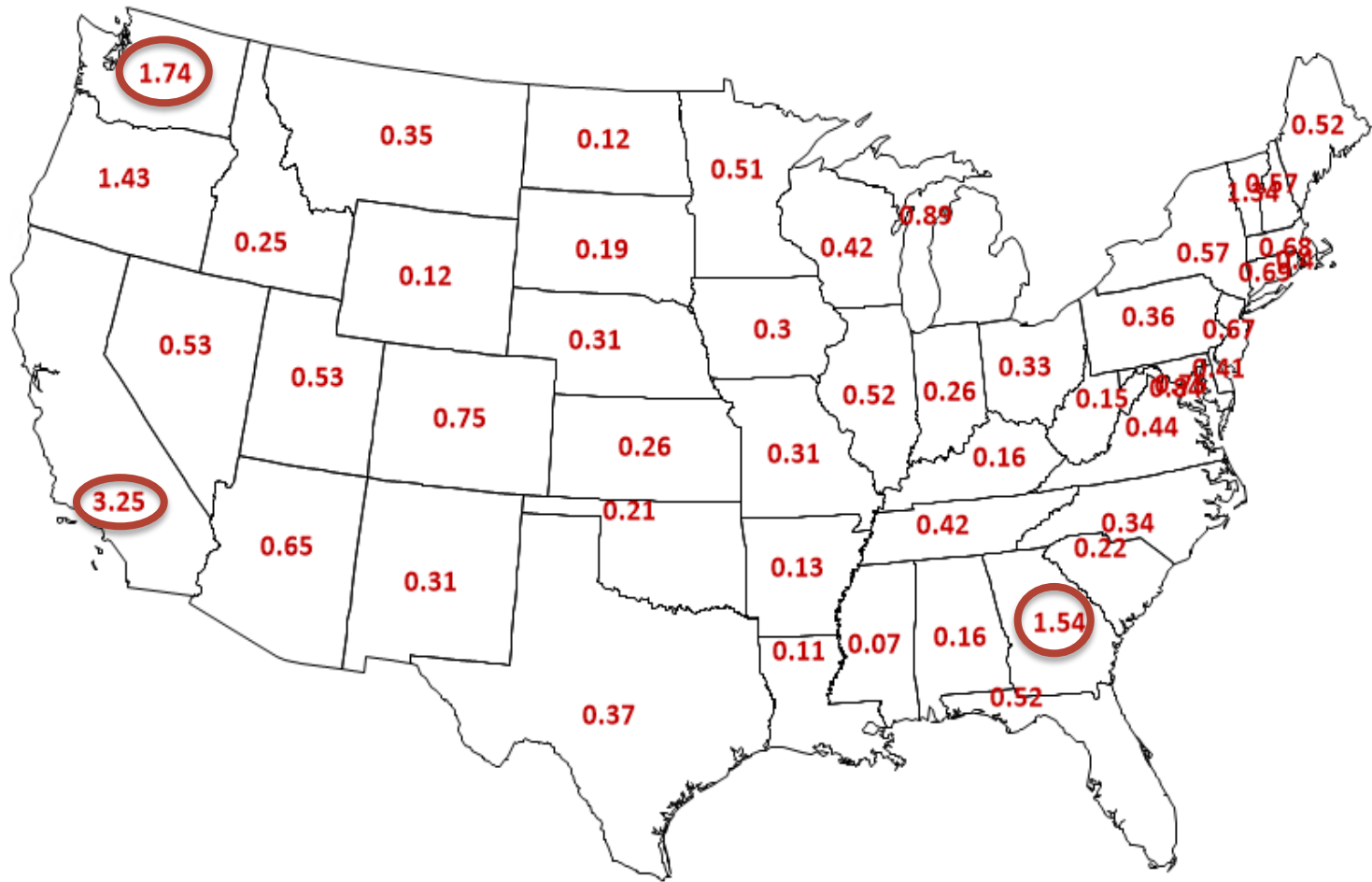
Federal & State Electric Vehicles Incentives

- 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

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State Electric Vehicle Incentives, 2013-2014

BEV Incentives
- $0
- $1,000 to $2,999
- $3,000 to $4,999
- $5,000 to $1,0000

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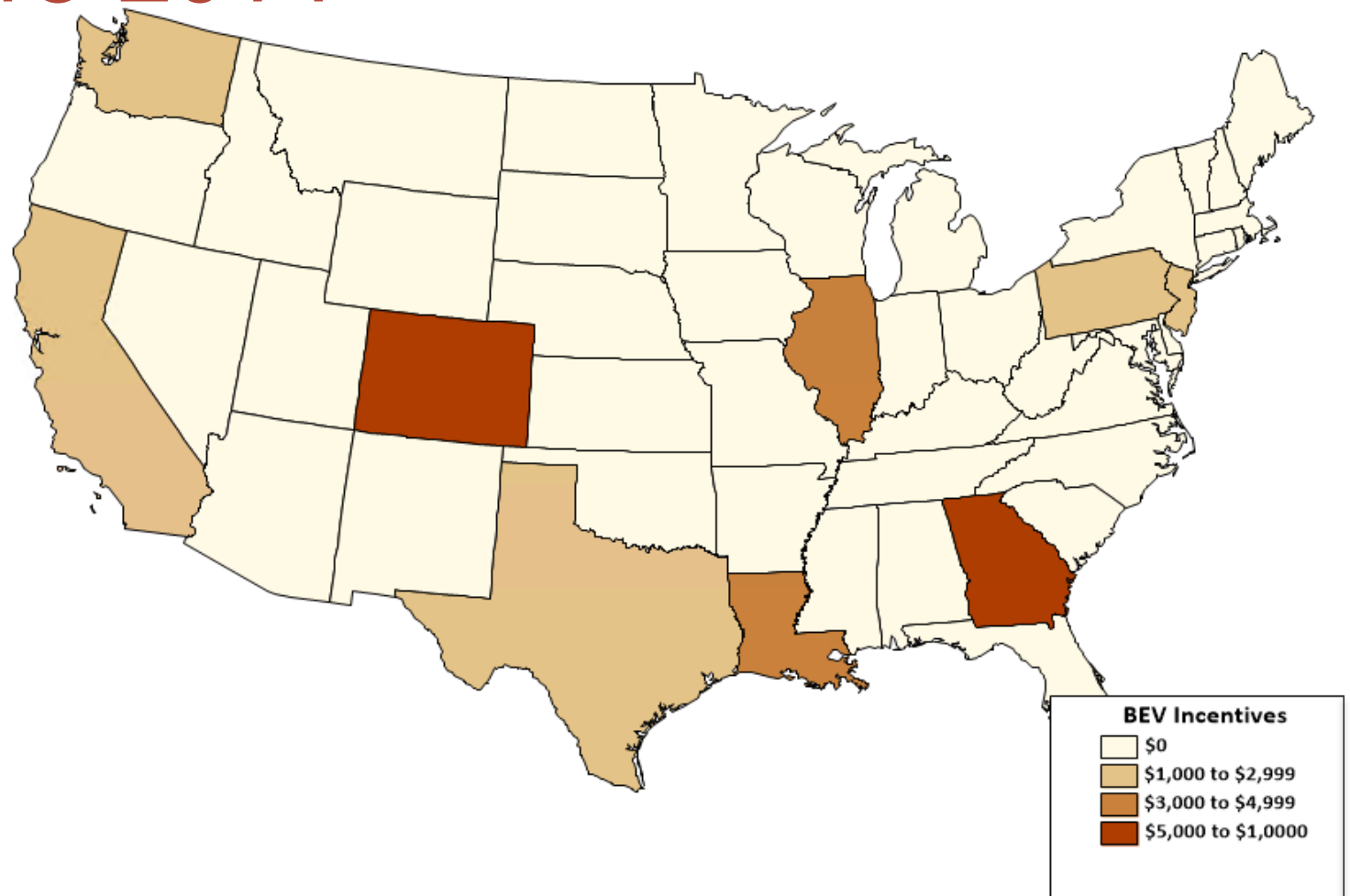
Previous Studies

- Sierzchula, Bakker, Maat, van Wee (2014)

- Gallagher and Muehlegger (2011)

- Diamond (2009)

- Chandra, Gulati, and Kandlikar (2010)

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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)

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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

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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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	(0.00319)	(0.00309)	(0.00323)	
Commute>30	-0.00247	-0.00439	-0.00470	
	(0.00429)	(0.00482)	(0.00466)	
HOV	0.000172	-0.000542	-0.000500	-0.000424
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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	-5.27e-07	-4.03e-07	-1.95e-07
	(5.44e-07)	(4.61e-07)	(4.69e-07)	(4.68e-07)
Personal Income		2.83e-08*	2.54e-08	1.02e-08
		(1.53e-08)	(1.54e-08)	(1.22e-08)
Population		-1.03e-06	-8.70e-07	-1.78e-07
		(7.41e-07)	(7.47e-07)	(5.96e-07)
Liberal	0.000601**	0.000477**	0.000435**	0.000377**
	(0.000234)	(0.000191)	(0.000193)	(0.000183)
Commute<20	-0.000974	-0.000494	0.000378	
	(0.00207)	(0.00167)	(0.00180)	
Commute>30	-0.00143	-0.00561**	-0.00560**	
	(0.00286)	(0.00266)	(0.00264)	
HOV	0.00241*	0.00101	0.00104	0.00113
	(0.00138)	(0.00120)	(0.00119)	(0.00122)
Gasoline Price	0.0116**	0.00974**	0.0118**	0.0137***
	(0.00524)	(0.00435)	(0.00461)	(0.00466)
Electricity Price	-0.000148	-0.000124	-0.000113	-0.000106
	(0.000160)	(0.000131)	(0.000131)	(0.000135)
Per capita personal income	1.71e-05			
	(0.000124)			
Land area			-8.79e-09	-7.45e-09
			(7.04e-09)	(6.69e-09)
Constant	-0.0484***	-0.0394***	-0.0458***	-0.0525***
	(0.0171)	(0.0141)	(0.0149)	(0.0151)
Observations	50	50	50	50
R-squared	0.535	0.690	0.702	0.666

Standard errors in parentheses
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	(0.00138)	(0.00120)	(0.00119)	(0.00122)
Gasoline Price	0.0116**	0.00974**	0.0118**	0.0137***
	(0.00524)	(0.00435)	(0.00461)	(0.00466)
Electricity Price	-0.000148	-0.000124	-0.000113	-0.000106
	(0.000160)	(0.000131)	(0.000131)	(0.000135)
Per capita personal income	1.71e-05			
	(0.000124)			
Land area			-8.79e-09	-7.45e-09
			(7.04e-09)	(6.69e-09)
Constant	-0.0484***	-0.0394***	-0.0458***	-0.0525***
	(0.0171)	(0.0141)	(0.0149)	(0.0151)
Observations	50	50	50	50
R-squared	0.535	0.690	0.702	0.666

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

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Dependent Variable – BEVs per 1000 population

VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352	-3.197***	-2.810***
	(0.303)	(0.621)	(0.646)
Commute>40	-0.0210	-0.0575	-0.0480
	(0.0526)	(0.0525)	(0.0522)
Population Density			0.000156
			(0.000174)
Democratic Vote Share	0.000269	-0.000187	-0.00102
	(0.00150)	(0.00156)	(0.00162)
HOV	0.328***	0.375***	0.305***
	(0.0732)	(0.0881)	(0.0915)
Personal Income		0.203***	0.185***
		(0.0294)	(0.0294)
Population		-0.00728***	-0.00686***
		(0.00122)	(0.00130)
Average Gasoline Price	-0.182*	-0.299***	-0.0586
	(0.109)	(0.113)	(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	1.216***	0.322
	(0.407)	(0.388)	(0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208

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

YOUNG SCHOOL
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Dependent Variable – BEVs per 1000 population

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Population Density			0.000156
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Democratic Vote Share	0.000269	-0.000187	-0.00102
	(0.00150)	(0.00156)	(0.00162)
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		(0.00122)	(0.00130)
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	(0.109)	(0.113)	(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***		
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Dependent Variable – BEVs per 1000 population

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	(0.0526)	(0.0525)	(0.0522)
Population Density			0.000156
			(0.000174)
Democratic Vote Share	0.000269	-0.000187	-0.00102
	(0.00150)	(0.00156)	(0.00162)
HOV	0.328***	0.375***	0.305***
	(0.0732)	(0.0881)	(0.0915)
Personal Income		0.203***	0.185***
		(0.0294)	(0.0294)
Population		-0.00728***	-0.00686***
		(0.00122)	(0.00130)
Average Gasoline Price	-0.182*	-0.299***	-0.0586
	(0.109)	(0.113)	(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	1.216***	0.322
	(0.407)	(0.388)	(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***	-0.00567***
	(0.638)	(0.00204)
Commute>40	-0.0414	-6.30e-05
	(0.0509)	(0.000162)
Population Density	-0.000202	5.07e-06***
	(0.000181)	(5.41e-07)
Democratic Vote Share	-0.00151	7.79e-06
	(0.00159)	(5.05e-06)
HOV	0.360***	-0.00100***
	(0.0898)	(0.000287)
Personal Income	0.146***	0.000431***
	(0.0295)	(9.41e-05)
Population	-0.00558***	-1.38e-05***
	(0.00129)	(4.13e-06)
Average gasoline price	-0.0300	-0.000373
	(0.124)	(0.000394)
2012 dummy	-0.0201	0.000546***
	(0.0614)	(0.000194)
2013 dummy	0.0366	0.000569***
	(0.0609)	(0.000193)
2014 dummy	0.187***	0.000930***
	(0.0658)	(0.000208)
BEV per capita registrations		0.000699***
		(0.000124)
Constant	0.285	0.000311
	(0.429)	(0.00137)
Observations	636	636
R-squared	0.246	0.693

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

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Thank You.

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

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