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

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September 29, 2015

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

THE

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CENTER

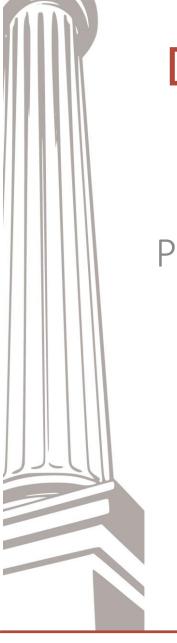
By Laura Wheeler and Mels de Zeeuw





University.

CENTER FOR STATE & LOCAL FINANCE



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















And this...





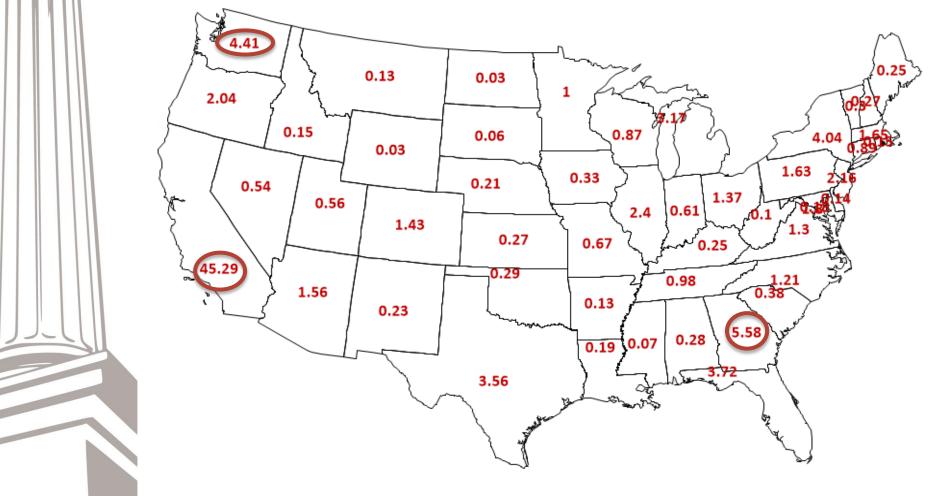


But not that...



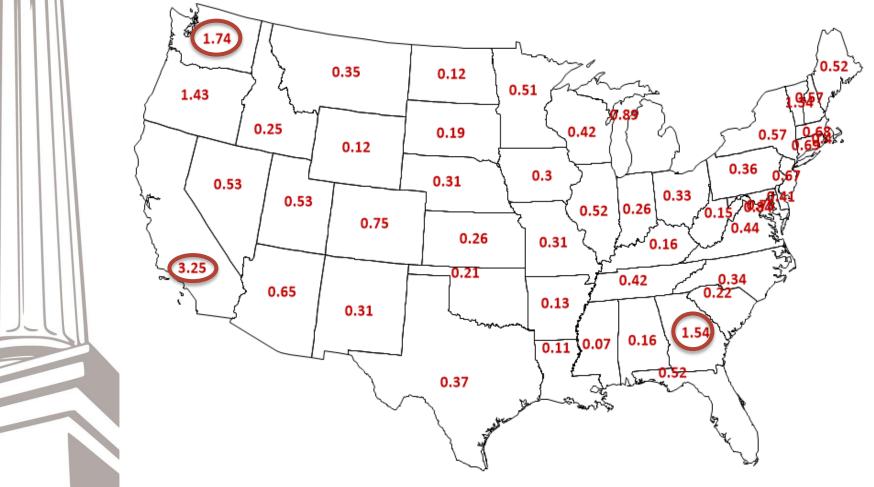


Distribution of PEVs across States, 2013-2014



GeorgiaState University. CENTER FOR STATE & LOCAL FINANCE

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



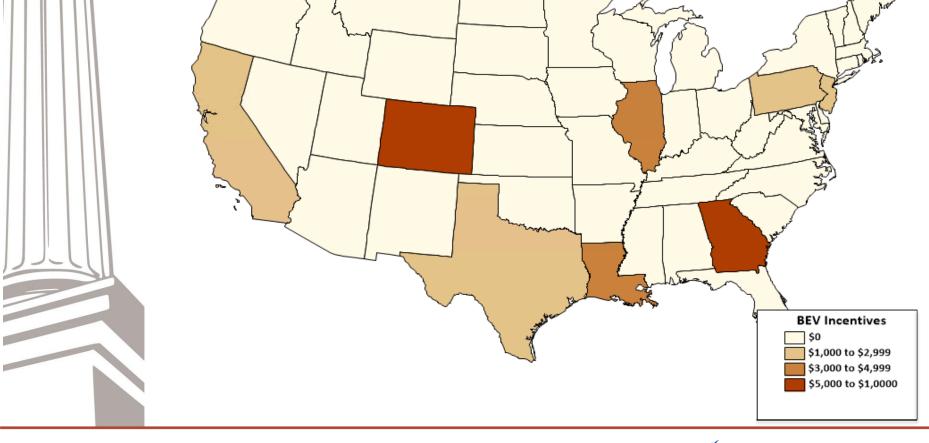


Federal & State Electric Vehicles Incentives

- 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











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



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)
opulation		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)
Basoline 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)			
and 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
ζ-squared		0.570 rs in parentheses * p<0.05, * p<0.1	0.608	0.598

VARIABLES	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Tax Incentive	2.76e-06***	2.26e-06***	2.47e-06***	2.51e-06***
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	<i>(0.00786)</i>	(0.00791)	(0.00808)	(0.00786)
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	(0.0258)	(0.0255)	(0.0261)	(0.0254)
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ARIABLES	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** <i>(0.000193)</i>	0.000377** (0.000183)	
Commute<20	-0.000974 <i>(0.00207)</i>	-0.000494 (0.00167)	0.000378 <i>(0.00180)</i>		
Commute>30	-0.00143 (0.00286)	-0.00561** (0.00266)	-0.00560** (0.00264)		
IOV	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)				
and area			-8.79e-09 (7.04e-09)	-7.45e-09 (6.69e-09)	
Constant	-0.0484*** <i>(0.0171)</i>	-0.0394*** (0.0141)	-0.0458*** <i>(0.0149)</i>	-0.0525*** (0.0151)	
Observations	50	50	50	50	
R-squared	0.535	0.690	0.702	0.666	

VARIABLES	Model 1	Model 2	Model 3	Model 4	
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Constant	-0.0484*** <i>(0.0171)</i>	-0.0394*** (0.0141)	-0.0458*** <i>(0.0149)</i>	-0.0525*** (0.0151)	
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ARIABLES	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)	-1.78е-07 (5.96е-07)	
Liberal	0.000601** (0.000234)	0.000477** <i>(0.000191)</i>	0.000435** <i>(0.000193)</i>	0.000377** (0.000183)	
Commute<20	-0.000974 <i>(0.00207)</i>	-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*** <i>(0.0171)</i>	-0.0394*** (0.0141)	-0.0458*** (0.0149)	-0.0525*** (0.0151)	
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ARIABLES	Model 1	Model 2	Model 3	Model 4
Population $(1.53e-08)$ $(1.54e-08)$ Population $-1.03e-06$ $-8.70e-07$ $(7.41e-07)$ $(7.47e-07)$ Liberal 0.000601^{**} 0.000477^{**} (0.000234) (0.000191) (0.000193) Commute<20	Tax Incentive				-1.95e-07 (4.68e-07)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Personal Income				1.02e-08 (1.22e-08)
(0.000234) (0.000191) (0.000193) Commute<20	opulation				-1.78e-07 (5.96e-07)
(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 (0.00138) (0.00120) (0.00119) Gasoline Price $0.0116**$ $0.00974**$ $0.0118**$ (0.00524) (0.00435) (0.00461) Electricity Price -0.000148 -0.000124 -0.000113 Per capita personal income $1.71e-05$ (0.000124) $-8.79e-09$	Liberal				0.000377** <i>(0.000183)</i>
$\begin{array}{ccccccc} (0.00286) & (0.00266) & (0.00264) \\ (0.00241* & 0.00101 & 0.00104 \\ (0.00138) & (0.00120) & (0.00119) \\ \end{array}$ Gasoline Price $\begin{array}{cccccccccccccccccccccccccccccccccccc$	Commute<20				
(0.00138) (0.00120) (0.00119) Gasoline Price 0.0116** 0.00974** 0.0118** (0.00524) (0.00435) (0.00461) Electricity Price -0.000148 -0.000124 -0.000113 (0.000160) (0.000131) (0.000131) (0.000131) Per capita personal income 1.71e-05 (0.000124) -8.79e-09	Commute>30				
(0.00524) (0.00435) (0.00461) Electricity Price -0.000148 -0.000124 -0.000113 (0.000160) (0.000131) (0.000131) Per capita personal income 1.71e-05 -0.000124) Land area -8.79e-09	HOV				0.00113 (0.00122)
(0.000160) (0.000131) (0.000131) Per capita personal income 1.71e-05 (0.000124) Land area -8.79e-09	Fasoline Price				0.0137*** (0.00466)
(0.000124) Land area -8.79e-09	Electricity Price				-0.000106 (0.000135)
	Per capita personal income				
(7.04e-09)	Land area			-8.79e-09 (7.04e-09)	-7.45e-09 (6.69e-09)
Constant -0.0484*** -0.0394*** -0.0458*** (0.0171) (0.0141) (0.0149)	Constant				-0.0525*** (0.0151)
Observations 50 50 50 R-squared 0.535 0.690 0.702					50 0.666

University center for state & local finance

ARIABLES	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* (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**	0.000477**	0.000435**	0.000377**
	(0.000234)	<i>(0.000191)</i>	<i>(0.000193)</i>	<i>(0.000183)</i>
Commute<20	-0.000974 <i>(0.00207)</i>	-0.000494 <i>(0.00167)</i>	0.000378 (0.00180)	
Commute>30	-0.00143 (0.00286)	-0.00561** (0.00266)	-0.00560** <i>(0.00264)</i>	
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 (7.04e-09)	-7.45e-09 (6.69e-09)
Constant	-0.0484***	-0.0394***	-0.0458***	-0.0525***
	(0.0171)	(0.0141)	<i>(0.0149)</i>	(0.0151)
Observations	50	50	50	50
R-squared	0.535	0.690	0.702	0.666

CHOOL

dent Variable – BEVs per 10	00 population		
VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352	-3.197***	-2.810***
Commute>40	(0.303) -0.0210 (0.0526)	(0.621) -0.0575 (0.0525)	(0.646) -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
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
	ndard errors in par p<0.01, ** p<0.05		

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ndent Variable – BEVs per 10	000 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***	0.375***	0.305***
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	(01205)	(01110)	0.0184
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 R-squared	636 0.178	636 0.184	636 0.208
Sta	ndard errors in par p<0.01, ** p<0.05		

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oendent Variable – BEVs per 10	00 population		
VARIABLES	Model 1	Model 2	Model 3
Commute<15	0.352	-3.197***	-2.810***
Commute>40	(0.303) -0.0210 (0.0526)	(0.621) -0.0575 (0.0525)	(0.646) -0.0480 (0.0522)
Population Density	(0.0520)	(0.0525)	0.000156 (0.000174)
Democratic Vote Share	0.000269	-0.000187	-0.00102
	(0.00150)	(0.00156)	(0.00162)
HOV	0.328*** (0.0732)	0.375*** (0.0881)	0.305*** (0.0915)
Personal Income		0.203***	0.185***
Population		(0.0294) -0.00728*** (0.00122)	(0.0294) -0.00686*** (0.00130)
Average Gasoline Price	-0.182*	-0.299***	-0.0586
Average Gasonne Thee	(0.109)	(0.113)	(0.127)
2012 dummy	(01205)	(01110)	0.0184
2013 dummy			(0.0625) 0.0798 (0.0619)
2014 dummy			0.264*** (0.0659)
Per capita personal income	2.77e-05***		()
Constant	(3.73e-06) -0.0863 (0.407)	1.216*** (0.388)	0.322 (0.440)
Observations	636	636	636
R-squared	0.178	0.184	0.208
	ndard errors in par p<0.01, ** p<0.05		

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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***
			(0.00130) -0.0586 (0.127) 0.0184 (0.0625) 0.0798 (0.0619)
Per capita personal income	2.77e-05***		
Constant	(3.73e-06)	1 714***	0 222
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
St	andard errors in pa	rentheses	

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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		
	ors in parentheses ** p<0.05, * p<0.			

e ANDREW YOUNG SCHOOL



Thank You.

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

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