Vehicle Miles Traveled (VMT) and Gasoline Consumption

B. Starr McMullen
Oregon State University
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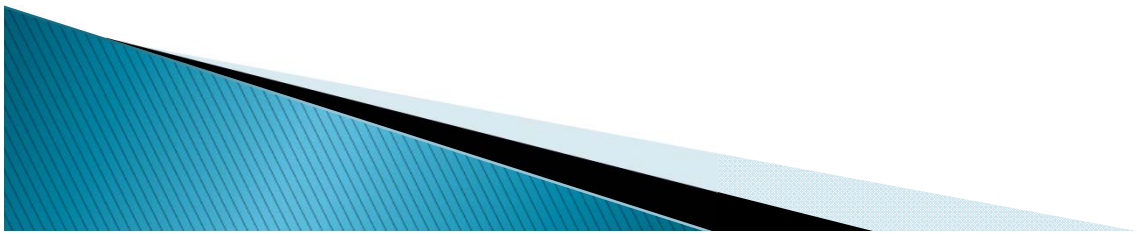
Related Research

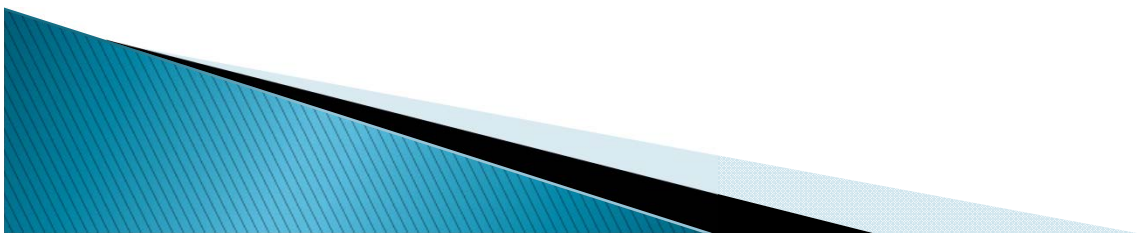
- McMullen and Eckstein, “Relationship between vehicle miles traveled and economic activity,” Journal of the Transportation Research Board, No. 2297 21-28 (2012)
- McMullen and Eckstein,”Determinants of VMT in Urban Areas: A Panel Study of 87 US. Urban Areas 1982-2009” Journal of the Transportation Research Forum, Vol. 52, No. 3 5-24 (2013)
- Ke and McMullen, “Regional Differences in the Determinants of Oregon VMT”, forthcoming Transportation Research Procedia (2017)



Caveats

- While there is a relationship between VMT and gasoline consumption, the price or income elasticity of demand for VMT is ***not*** the same as the price or income elasticity of demand for gasoline

- The exact relationship depends on the fuel economy of the vehicles being used which, in turn, may depend on the location (Urban/Rural) and preferences of the drivers



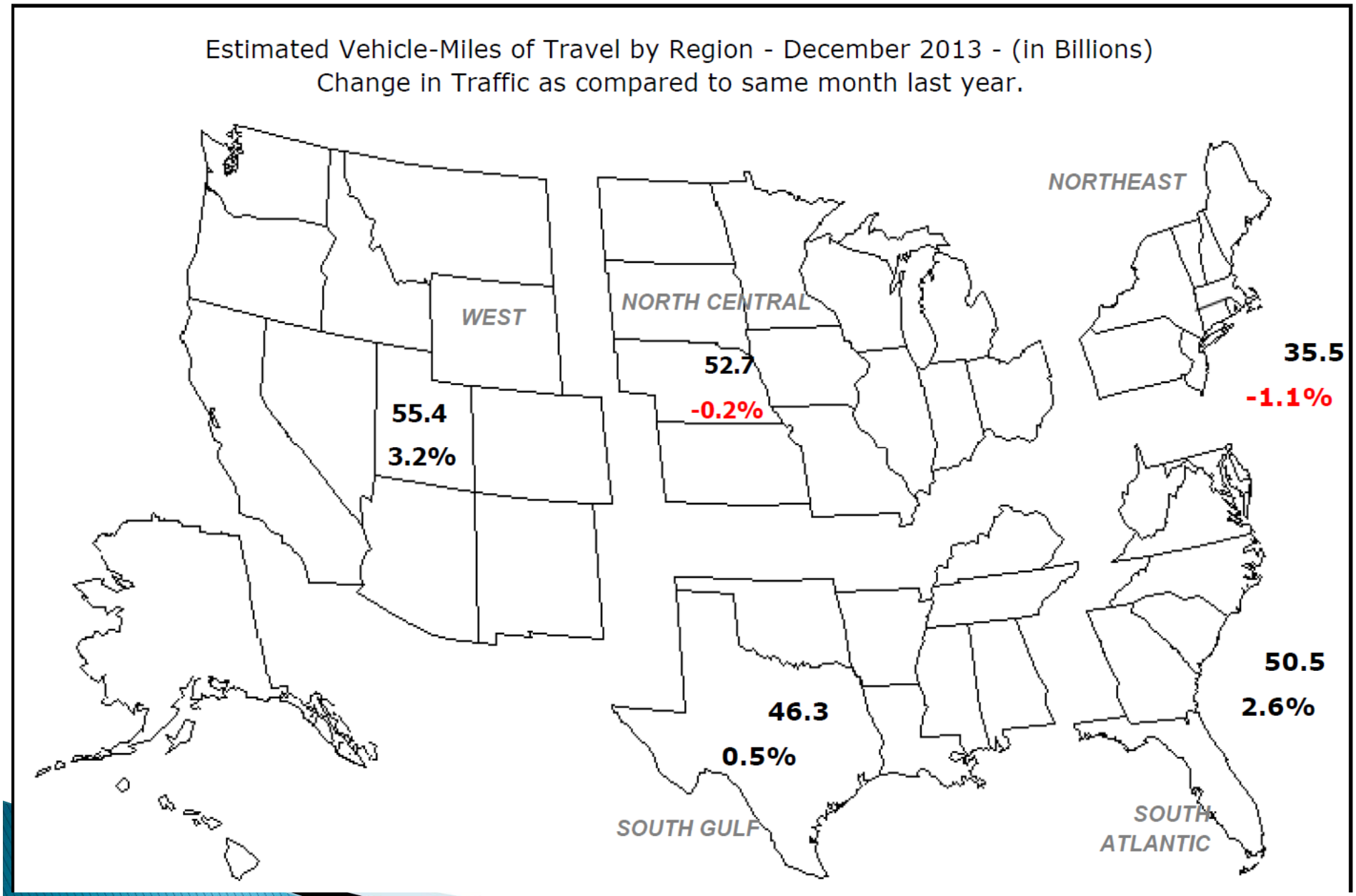
Income and VMT

- Overall in the U.S. Granger Causality suggests that Changes in Income lead to Changes in VMT
- This is definitely the case in periods of economic upturn, in economic downturns, results are mixed
- Relationship is not as significant for individual Urban areas

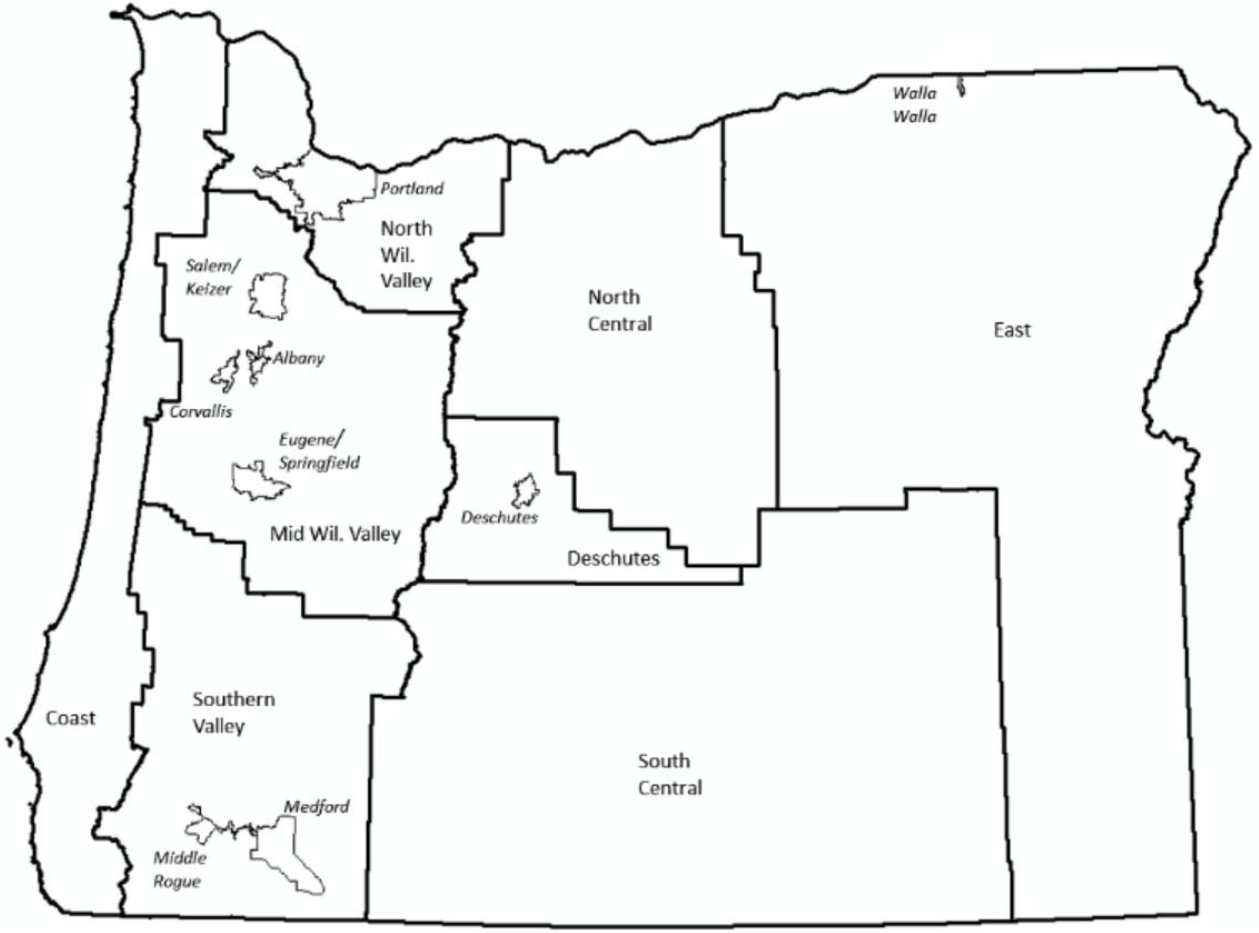
Aggregate Results Hide a Lot

VMT in Urbans Areas are dependent on:

- Transit availability
- Urban density
- Industry Mix


Estimated Vehicle-Miles of Travel by Region - December 2013 - (in Billions)
Change in Traffic as compared to same month last year.
WEST
55.4
3.2%
NORTH CENTRAL
52.7
-0.2%
NORTHEAST
35.5
-1.1%
SOUTH GULF
46.3
0.5%
SOUTH ATLANTIC
50.5
2.6%

Case Study: Regions and MPOs in Oregon



Key Preliminary Results—Oregon Statewide

- Price Elasticity: -0.1595
- Income Elasticity: .1196
- Households with hybrids overall drive 13.5% less
- Rural households drive more than other location types
- Note: Having a hybrid vehicle is associated with lower VMT---shorter household commutes, or households that have different preferences? This is not what the *rebound effect* would suggest

Rural Regions Not the Same

- South Central and East
  - Predominantly rural
  - Similar demographic

- EAST
- Price coefficient negative and significant at 10%
- Income coefficient positive and significant at 1%
- Having a Hybrid (or high fuel economy) vehicle reduces VMT

- SOUTH CENTRAL:
- Neither price or income elasticities (as measured by regression coefficients) significant
- Having Hybrid (or high fuel economy) vehicle has no significant impact on VMT

Two Oregon MPOs

- Albany and Corvallis MPOs are located eleven miles apart.

- Corvallis:
  - Price coefficient insignificant
  - Income coefficient positive and significant at 10%
  - Having a Hybrid (or high fuel economy) vehicle *reduce*s VMT

  Albany
  - Price coefficient and income coefficients insignificant
  - Having a Hybrid (or high fuel economy) vehicle *increases* VMT

Conclusions

- While VMT overall seems to be directly correlated with income, the importance of income in determining VMT may vary significantly between locations
- A change in the price of driving that occurs due to more fuel efficient vehicles can either increase or decrease VMT

Table 1: Granger Causality: National Data (1929-2009)

Table 1: Granger Causality: National Data (1929-2009)		
	Probability > Chi2	
Regression Name	VMT causes Economy	Economy causes VMT
VMT-GDP	0.138	0.034*
VMTPC-GDPPC	0.158	0.028*
VMT-GDPPC	0.147	0.026*
VMTPC-GDP	0.148	0.037*
VMT-PI	0.109	0.010*
VMTPC-PIPC	0.181	0.013*
VMT-PIPC	0.167	0.011*
VMTPC-PI	0.119	0.011*
** Represents statistical significance at 5% level.*		

ADDITIONAL SLIDES

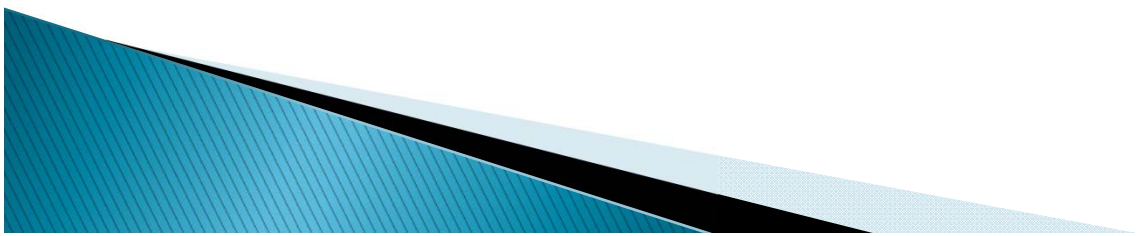


Table 2: Granger Causality: National Data-Structural Break with Economic Downturns (1929-2009)

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	Probability >Chi2	
Regression Name	VMT causes Economy	Economy causes VMT
National Data: During Economic Downturn (n=16 out of the years from 1929-2009)		
VMT-GDP	0.002*	0.159
VMTPC-GDPPC	0.005*	0.183
VMT-PI	0.007*	0.003*
VMTPC-PIPC	0.003*	0.026*
National Data: During Economic Upturn (n=62 out of the years from 1929-2009)		
VMT-GDP	0.113	0.000*
VMTPC-GDPPC	0.140	0.000*
VMT-PI	0.064	0.001*
VMTPC-PIPC	0.217	0.002*
** Represents statistical significance at 5% level.*		

Table 3: Granger Causality: 98 Urban Areas Data (1982-2007)

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	Probability > Chi2	
Regression Name	VMT causes Economy	Economy causes VMT
VMT-PI	0.805	0. 320
VMTPC-PIPC	0. 782	0.037*
VMT-PIPC	0. 932	0. 647
VMTPC-PI	0. 796	0. 941
VMTPC(vlg)-PIPC(vlg)	0. 929	0. 359
VMTPC(lrg)-PIPC(lrg)	0. 170	0.046*
VMTPC(med)-PIPC(med)	0.900	0.381
VMTPC(sml)-PIPC(sml)	0.778	0.148
** Represents statistical significance at 5% level.*		

Regression Results—Statewide

	ln(HHVMT)		ln(HHVMT)
Constant	1.5144*** (0.1516)	North Wil Valley	0.4998*** (0.0515)
ln(ppm.gas.w)	-0.1595*** (0.0345)	Mid-Wil Valley	0.3664*** (0.0474)
ln(dayINC)	0.1196*** (0.0137)	Southern Vally	0.3099*** (0.0489)
ln(HHVEH)	0.4221*** (0.0241)	North Central	0.2397*** (0.0609)
SUBhyb	-0.1452*** (0.0306)	Deschutes	0.2444*** (0.0557)
AGE	0.0222*** (0.0041)	South Central	0.0983 (0.0614)
AGE^2	-0.0003*** (0.0000)	East	-0.1570*** (0.0442)
ln(HHSIZ)	0.3288*** (0.0300)	Isolated City	-0.6582*** (0.0374)
COLLEGE	0.1073*** (0.0188)	Rural Near Major Center	-0.2990*** (0.0419)
HHWRK	0.1382*** (0.0128)	City Near Major Center	-0.6595*** (0.0421)
CHILDREN	-0.0058 (0.0144)	MPO	-0.8174*** (0.0414)
WABIK	-0.3182*** (0.0234)		
RIBUS	-0.1134*** (0.0290)		

Observations	14,174
R^2	0.2465
Adjusted R^2	0.2453
Residual Std. Error	1.0004 (df = 14150)
F Statistic	201.3002*** (df = 23; 14150)
Notes:	***Significance 1%

SM1

Regression Results—2 Rural Regions

	ln_HHVMT	
	South Central	East
Constant	1.8474** (0.9082)	0.1160 (0.6702)
ln(ppm.gas.w)	0.0412 (0.2292)	-0.2926* (0.1742)
ln(dayINC)	0.1303 (0.0825)	0.2421*** (0.0629)
ln(HHVEH)	0.2539* (0.1329)	0.3119*** (0.1006)
SUBhyb	0.1687 (0.2131)	-0.3141** (0.1395)
AGE	0.0194 (0.0227)	0.0361* (0.0190)
AGE^2	-0.0001 (0.0002)	-0.0004** (0.0002)
ln(HHSIZ)	0.6530*** (0.1773)	0.5420*** (0.1322)
COLLEGE	0.2905*** (0.1114)	0.0744 (0.0811)
HHWRK	-0.0027 (0.0775)	0.1324** (0.0588)
CHILDREN	-0.0326 (0.0901)	-0.1032* (0.0556)
WABIK	-0.0131 (0.1486)	-0.4070*** (0.0999)
RIBUS	0.3724 (0.2334)	-0.2644 (0.2307)
Isolated City	-1.4596*** (0.1900)	-0.5955*** (0.0845)
Rural Near Major Center	-0.4706*** (0.1656)	-0.0128 (0.1686)
City Near Major Center	-0.9351*** (0.1366)	-0.5336*** (0.1314)
Observations	441	958
R^2	0.2831	0.2367
Adjusted R^2	0.2578	0.2246
Residual Std. Error	1.0696 (df = 425)	1.1550 (df = 942)
F Statistic	11.1907*** (df = 15; 425)	19.4768*** (df = 15; 942)
Notes:	**Significance 5%	***Significance 1%

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Slide 17

SM1 In south central there is no significant response to price, buggesting that a change in price may have little impact---indeed the coefficient is the wrong sing

Starr M, 5/10/2016

SM2
SM3
SM4

Regression Results—2 MPOs

	ln(HHVMT)	
	Albany	Corvallis
Constant	0.8088 (1.2423)	0.5083 (1.1002)
ln(ppm.gas.w)	-0.4067 (0.3113)	0.0858 (0.2483)
ln(dayINC)	0.1542 (0.1067)	0.1712* (0.0990)
ln(HHVEH)	0.4458** (0.2036)	0.5147*** (0.1685)
SUBhyb	0.1830 (0.2723)	-0.1479 (0.2157)
AGE	0.0556* (0.0313)	0.0576* (0.0323)
AGE^2	-0.0007** (0.0003)	-0.0005* (0.0003)
ln(HHSIZ)	0.2732 (0.2470)	0.3145 (0.2162)
COLLEGE	0.4622*** (0.1436)	0.2356 (0.1664)
HHWRK	0.0133 (0.1061)	0.1061 (0.0897)
CHILDREN	-0.0647 (0.1287)	0.0408 (0.0988)
WABIK	-0.1346 (0.1778)	-0.4354*** (0.1294)
RIBUS	-1.1589*** (0.3434)	-0.1663 (0.1815)
City Near Major Center	-0.0841 (0.4084)	-0.4067 (0.4190)
MPO	-0.8301*** (0.2317)	-0.3867** (0.1644)
Observations	210	278
R^2	0.3875	0.2668
Adjusted R^2	0.3435	0.2277
Residual Std. Error	0.9650 (df = 195)	0.9421 (df = 263)
F Statistic	8.8102*** (df = 14; 195)	6.8345*** (df = 14; 263)
Notes:	** Significance 5%	* Significance 10%

Slide 18

SM2 Since this is an economics conference, I think you should show this table
Starr M, 5/10/2016

SM3 Starr M, 5/10/2016

SM4 Again, stress the no significant impact of price on VMT
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