Fuel Price, State Taxation, and Fleet Mileage Reduction

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Executive Summary

This paper utilizes several models to gauge the annual impact of state gasoline taxes and pump prices on the vehicle miles traveled in the United States. Regression models in first differences were used to analyze annual changes in the variables. The models indicate that annual increases in pump prices correspond to significant decreases in mileage, while state fuel taxes do not significantly impact mileage. With local, state, and federal taxation only composing 12 percent of the pump price of fuel, the impact of changes to these taxes are diminished. This suggests that if policymakers choose to adopt a policy of mileage reduction to combat road and environmental damage, and benefit energy security, current fuel taxation methods alone will likely be unsuccessful in achieving a reduction in the highway mileage of the American fleet given current pump pricing. With the Highway Trust Fund being consistently underfinanced, and a funding formula tied to declining mileage, a policy response is due and further research should be considered to analyze the outcomes of this anticipated policy reform.

Introduction

The Highway Trust Fund (HTF) was established in 1956 with the Federal-Aid Highway Act as a means of financing the growing American highway and bridge system. The HTF was designed to be funded by the users of the system through fuel taxation. With the exception of two increases in 1990 and 1993 in which the amount of the increase was redirected for budget deficit reduction, and later directed back to the HTF, the entire amount of the federal tax is deposited into the HTF. States contribute to the fund with varying levels of state and local taxes and receive reimbursements for federal highway aid based upon contributions. The HTF was established and remains a pay-as-you-go fund, which finances current projects with current revenues. However, in 2008 and 2009 Americans drove fewer miles than the year prior in consecutive years for the first time since World War II. At a time when aging highways and bridges are in dire need of repair, the revenues which finance infrastructure projects are short of what is required and the fund is only being kept solvent with repeated congressional stopgap measures (Steinhouer, 2012). In Fiscal Year 2010 alone, the gap between receipts and expenditures was supplemented with a $19.5 billion transfer from the General Fund to keep the HTF solvent (U.S. DOT, AASHTO, 2011). Transportation officials have been lobbying the federal government to address the issue of reduced revenues from fuel taxes at a time in which federal assistance is becoming increasingly hard to obtain, and now compounded by the fact that Americans are driving less and consequently consuming less fuel (Weiss, 2008).

For decades after the passing of the Federal-Aid Highway Act, vehicle miles traveled increased at a steady rate, providing the necessary funding for the highway system. A number of factors have contributed to American driving behaviors. In their discussion of the American sprawl phenomenon[1] Duany, Plater-Zyberk, and Speck describe how the relatively low price of American fuel has led to a car-centric nation (Duany, et al., 2000). The cost of traveling American roads has been so relatively cheap for so long that it has fostered a driving culture that seems daunting to confront through policy change. Yet the possibility exists to attempt to change this culture due to the stark contrast between American and European taxes and pricing. In a Time article written during the height of the 2008 fuel price surge, it was noted that in the United States state and federal taxes contributed to around 11% of the pump price of fuel (up to 12% in 2012) while in France and the United Kingdom taxes contributed to around 70% of the pump price (Crumley, 2008). The higher tax at the pump obviously leads to a larger price paid by the consumer and is still evident in 2012. In March 2011 the average price of gasoline in the United States was around $3.53 per gallon, yet in Oslo, Norway consumers doled out $9.28 (Smith, 2011). The same article notes the contrast between pump prices in Europe, where they tend to be at their highest, and countries which levy heavy subsidies on fuel, such as member-countries of the Organization of the Petroleum Exporting Countries (OPEC). This latter group includes Venezuela, where the price per gallon in 2008 was reportedly around $0.12 per gallon. The author notes that the political leadership in some of these countries utilize methods that tend to use cheap fuel prices to remain in power. On the occasion that price raises are attempted, often demonstrations will prompt these same governments to bend to the will of the consumer. This is relevant

[1] Duany, Plater-Zyberk, and Speck describe suburban sprawl in contrast to the "traditional neighborhood" of early American cities and conventional European models of habitation. Components of sprawl include housing subdivisions; shopping centers, office parks, and civic institutions often served by large single-level parking lots, and high-volume roadways connecting the various components.

to the United States where the federal tax on gasoline has not risen above 18.4 cents since 1993, yet lawmakers are loathe to approach the topic of raising taxes in general, especially a substantial tax on a good many Americans consider so fundamental to our way of life, according to Duany, et al.

Using a fixed rate fuel tax to fund infrastructure repairs is inherently problematic. It is true that increased driving leads directly to higher rates of atmospheric pollution, highway damage, and driver injury and fatality, and as a result it should be desirable to mitigate this behavior. However, as roadways decline in quality and increase in volume, sufficient funding is only achieved if revenues, and mileage, continue to grow as well. Further, while the fuel efficiency of the average American vehicle has not yet increased significantly, the current method of taxation will become increasingly less advantageous as vehicles are able to travel further, and contribute to more road damage, on a lesser amount of fuel, contributing less to the HTF. Now that mileage is finally downward trending the real revenues from fuel taxes have declined to the point that they cannot fully finance the HTF.

This paper addresses the impact of annual changes in fuel pricing, state taxation, and economic factors on the vehicle miles traveled (VMT) by the American fleet. The method of analysis is one of multiple regression models in first differences to account for annual changes while utilizing time series data. The pricing and taxation variables were compared because the pump price of fuel in the United States is contributed to by local, state, and federal taxes to a relatively small degree. The federal tax was excluded in the model because, unlike state fuel taxation, it has remained at the same nominal level for nearly twenty years, and thus would appear to have had no significant impact on recent mileage fluctuation. Economic factors may be particularly indicative of driving trends. It may not be coincidence that the US is running low on revenues for needed infrastructure repairs at the same time that potential supplemental funds are becoming increasingly difficult to obtain if fuel consumption is as correlated to the economic environment as tax revenues are. In the wake of a recessed economy and cuts to many government agencies we also see the reduction in VMT (the source of the highway funding), suggesting that economic factors may dictate the dependent variable to a large degree. This author contends that the results of this analysis will show that increases in fuel pricing and taxation can achieve a reduction in the highway mileage of the American fleet, but that economic factors will have the greatest impact.

Literature Review

The intent of this proposal is to investigate any correlation between fuel prices and taxes and the mileage driven by the American public. The implication is that a reliance on personal automobiles results in greater fuel consumption and a greater burden on our nation's roadways. Further, if low prices lead to more miles driven, and miles driven leads to wear on the highway, we should be concerned that the funding to repair the damage to the roadways is generated from the very tax which is so low as to encourage driving. This vicious cycle could be addressed with policy change. A 2000 article in *America* notes that during the energy crisis of the 1970's, affected by OPEC policy, drivers around the world reacted by changing their driving behaviors to the point that OPEC had to react to reduced consumption and lower prices again (Gasoline Prices 2000). Unfortunately, as the author notes, if fuel taxes are not regularly adjusted to reflect the current economic environment or inflation consumers settle in to the lower prices created in that market. The author may be troubled to find that twelve years after writing that editorial the federal fuel tax would remain at its 1993 level.

Robin Lindsey has written an extensive literature review regarding the lack of consensus among economists regarding road pricing. In his analysis, he writes that road pricing is not a new concept for dealing with the wear and tear on roadways. Such tolling was prevalent into the 19th Century in Britain and the United States, and was advocated by Adam Smith as being the most appropriate means of paying for roadway repairs (Lindsey 292). His review not only includes a discussion of the benefits provided by road pricing in terms of repairs, but also their effect on congestion. Noting that economists generally disagree on the practical aspects of tolling, including "how to set tolls, how to cover common costs, what to do with any excess revenues, whether and how 'losers' from tolling previously free roads should be compensated, and whether to privatize highways," Lindsey does suggest that economists are generally in agreement in principle that "highway congestion should be solved by pricing," (Lindsey 296). This is relevant to this proposal in noting that congestion, and the damage caused by excessive mileage, is a problem that is often dealt with by the consumers of the good.

Willenborg and Pitts conducted a consumer panel survey in 1973 and 1974 regarding the elasticity of gasoline based upon the responses of 900 households in South Carolina (Willenborg and Pitts 25). They included in their survey a series of questions regarding intentions to purchase more fuel efficient vehicles. The responses revealed that during a period of rapid price increases around December of 1973, consumers considered "reducing gasoline expenditures by trading down in automobiles, but not by reducing the number of miles driven," (28). They do however go on to note that "intentions are subject to many influences and it would be folly to attribute changes solely to energy-related variables," (28). The authors note that as prices stabilized the intentions to purchase smaller automobiles eased. They conclude by noting that during a period between 1973 and 1974 prices rose by 45-50% yet the effect on miles driven were essentially negligible (30). There were also a slightly higher number of vehicles per household and the trend slightly favored using smaller vehicles with smaller engines. The authors note limitations in isolating the effect of gasoline demand, and it should also be noted that other variables exist, such as the implementation in the National Maximum Speed Law in 1973. Nonetheless, these results are interesting and may be again reflected in my attempt at a longer-term analysis of miles driven and gasoline prices.

In their 2006 paper with the National Bureau of Economic Research, Hughes, Knittel, and Sperling compare the short-run price elasticity of gasoline between two periods of relatively high prices, 1975-1980 and 2001-2006 (Hughes, et al. 2006). During these periods the income elasticity was not significantly different; however, their results indicated gasoline had become more price inelastic by the 2001-2006 time period. The authors suggest a number of factors that have likely affected the change in elasticity such as a greater dependence on automobiles, impact of suburbia on distance between destinations, a lesser reliance on public transit, a growth in incomes which could lead to more discretionary trips, and more fuel efficient vehicles which soften the blow of higher prices. It should be noted that this paper primarily addresses elasticity in the short-run, and therefore long-term policy change may not be appropriate based on such evidence. This paper is notable in suggesting that an increase in price to the consumer might not necessarily result in a decrease in use. Therefore, an increase in gasoline taxes could potentially be used to close the gap on infrastructure needs even if it does not directly lead to reduced consumption. Changes in driving behaviors may need to be coerced through multiple approaches if needed road infrastructure repairs are to be fully funded.

In a paper published in *Applied Economics Letters*, Yu Hsing analyzes the potential impact of the gasoline tax increase that was about to occur with the Budget Reconciliation Bill, which raised the tax to its current level, on gasoline consumption (Hsing 1). He notes the importance of separating the tax from the price of gasoline in an analysis to measure the impacts of each, rather than bundling the two. The author used a regression model in which gross domestic product, gasoline price, and federal tax were the independent variables affecting the dependent consumption variable, and used data from 1978 through 1990 (Hsing 2). He estimates that with every one cent increase in the tax, U.S. drivers would consume 12.43 million fewer barrels of gasoline. Hsing concludes by noting that GDP was positively correlated with consumption while price and tax are negatively correlated to consumption based upon his model. It should be noted that in 1995, the year after this article was published, the federal tax represented around 15 percent of the fuel pump price, while in 2010 the same tax composed just over 6 percent of the pump price and was as low as 5.5 percent in 2008. This is due to the nominal federal tax remaining the same since 1993, while it has decreased in real terms. Therefore the impact of the tax today should be less pronounced than it was in when the article was published.

This research tests whether there are any correlations between the either the tax and price of fuel and the vehicle miles driven, the implication being that the more miles driven with the current vehicle status quo the more likely drivers are to contribute to carbon emissions, congested roadways, overused infrastructure, a greater likelihood of driving fatalities, and increased sprawl. The timing of this research is unique given the recent downward trend in American mileage, as well as shifts in attitude regarding the environment, responsible consumerism, and economic prudence.

Research Design

Data

The data for the dependent variable in this analysis, vehicle miles traveled, was obtained from the Federal Highway Administration and includes observations between 1970 and 2009. For the data utilized in these models, vehicle miles traveled was represented by a mean of just over 2.1 trillion miles annually in the United States, with a minimum observation of 1.1 trillion miles in 1970 and a maximum of just over 3 trillion in 2007. The mean adjusted gasoline price variable data displayed a mean of $1.82, with a minimum of $1.30 in 1998 and a maximum of $3.05 in 2008. Over the sixteen years of observed data, the mean adjusted state gasoline tax indicates an average of $0.22, a minimum of just under $0.20 in 2010 and a maximum of just under $0.24 in 1995. The mean percent change in gross domestic product over the 41 years from 1970-2010 was 2.8%, a minimum of -3.5% in 2009 and a maximum of 7.2% in 1984. Data for the number of all American highway vehicles indicated a mean of 224 million, a minimum of 192 million in 1991 and a maximum of 256 million in 2008. Public road mileage was represented with a mean of 3.93 million miles, a minimum of 3.85 million miles in 1981 and a maximum of 4.07 million miles in 2009. Fuel efficiency data indicated a mean of

17.02 miles per gallon for all highway vehicles with a minimum of 16.74 miles per gallon in 1993 and a maximum of 17.6 in 2009.

The federal gasoline tax has remained at the same nominal level, 18.4 cents per gallon of gas, since 1993, so that the real tax in current dollars has decreased by 36.5% to an equivalent in 1993 dollars of 11.7 cents per gallon, while the CPI has increased from 144.4 to 227.6. Likewise, the diesel tax has also remained at its current nominal level of 24.2 cents per gallon for nearly twenty years. As a result, the models in this paper utilized the average annual state fuel taxation rates between 1995 and 2010, using the data available from the Federal Highway Administration. Annual data was utilized in order to account for seasonal changes in driving behaviors. Gross Domestic Product data from the Bureau of Economic Analysis is adjusted for inflation and chained to 2005. Gasoline and diesel price and state tax data from the Federal Highway Administration and the Energy Information Agency have also been adjusted for inflation and are expressed in constant 2005 dollars. Additional data was obtained from various federal sources. The Federal Reserve Economic Data on unemployment use the seasonally adjusted unemployment rate[2]. The Federal Reserve also provided US population data. Consumer price index data are from the Bureau of Labor Statistics with both the CPI for all items for all urban consumers used as well as the CPI for transportation for all consumers. Data obtained from the Bureau of Transportation Statistics on the number of registered vehicles includes all highway vehicles such as motorcycles, passenger cars,

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[2] According to the Federal Reserve Economic Data, the unemployment rate represented here is the"U3" rate, or the, "number of unemployed as a percentage of the labor force. Labor force data are restricted to people 16 years of age and older, who currently reside in 1 of the 50 states or the District of Columbia, who do not reside in institutions (e.g., penal and mental facilities, homes for the aged), and who are not on active duty in the Armed Forces." This is the unemployment rate often referenced by government and media.

light trucks, heavy trucks, and buses. Due to the dependent variable in this analysis being based on all motor vehicles, it was important to include vehicle and fuel data for every category which contributes to that variable. As a result, the fuel consumption variable, miles per gallon, is the mean consumption rate for all highway vehicles and was obtained from the Federal Highway Administration. The same agency contributed data for public road mileage, which includes any publicly administered road which is fully available to the public.

Certain variables were so highly correlated that a single variable was sufficient for purposes of regression and to avoid issues of high multicollinearity leading to large standard errors of estimates. Gasoline and diesel prices were over 99 percent correlated. Therefore, gasoline price data was utilized for the models due to the greater number of available observations. Because state taxes for gasoline and diesel were also over 99 percent correlated, gasoline taxes were used to maintain continuity. Population was also correlated at over 99 percent to the number of registered vehicles, and so population was utilized. In practice, given the limited number of observations, it is impossible to differentiate the effects of gasoline versus diesel price, or population versus registered vehicles.

Table 1. Variable Descriptions

Variable	Description
VMT	Total vehicle miles traveled in the US (in millions)
Gasoline Price	Retail motor gasoline price (dollars per gallon)
Gasoline Tax	Mean state gasoline tax (cents per gallon)
Diesel Price	On-highway diesel price (dollars per gallon)
Diesel Tax	Mean state diesel tax (cents per gallon)
Percent Change GDP	Annual percent change in US GDP
Unemployment	Seasonally adjusted civilian "U3" unemployment rate
CPI All Items	Consumer Price Index for all items, all urban consumers
CPI Transportation	Consumer Price Index for all transportation items, all urban consumers
Population	Total US population (in thousands)
Vehicles	Total registered highway vehicles (in millions)
Public Road Mileage	Total mileage of roads maintained by a public authority and open to the public
MPG	Average miles traveled per gallon of fuel consumed for all US vehicles

Research Model

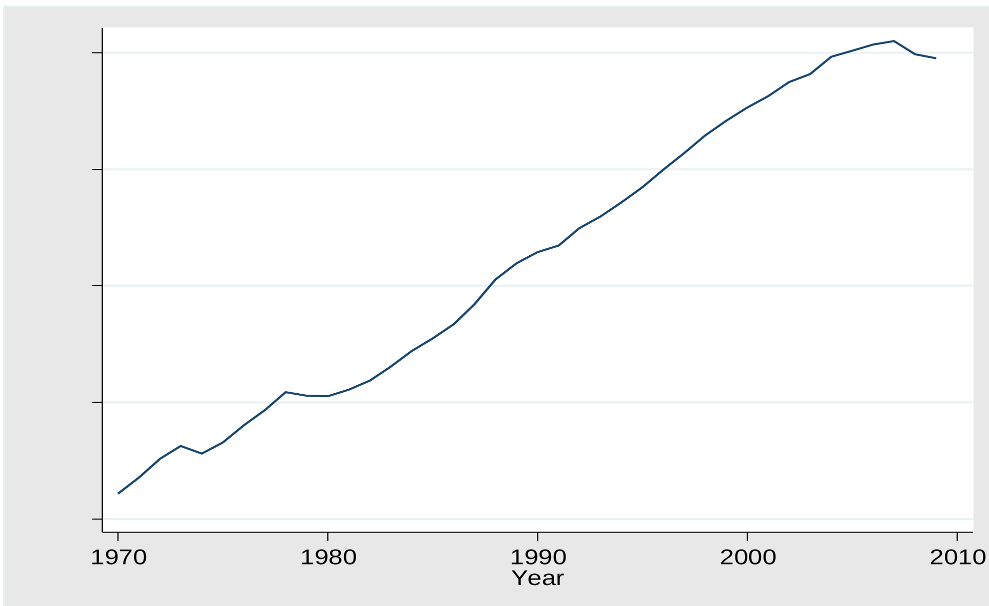
OLS regression cannot be used with time series variables with trends. All trends up or down predict each other with high coefficient of determination (r^2) because the increases or decreases over time are perfect linear functions. Imagine one series growing at 1% per year and another declining at 2% per year. Net of the constant starting point, twice the first perfectly matches the second, and that does not depend on what they are at all. Using an OLS linear regression model for the time series data used in this analysis would have resulted in a spurious regression, with an artificially high R-squared, which may not actually indicate a causal relationship. Prices of gasoline really should predict miles driven, but the spurious correlation makes drawing a conclusion from a model in levels impossible. Therefore, the models utilized throughout this paper were conducted with a regression in first differences, i.e. changes over time, accounting for comparative yearly changes in the data, rather than a time series in levels.

Table 2. Summary Statistics

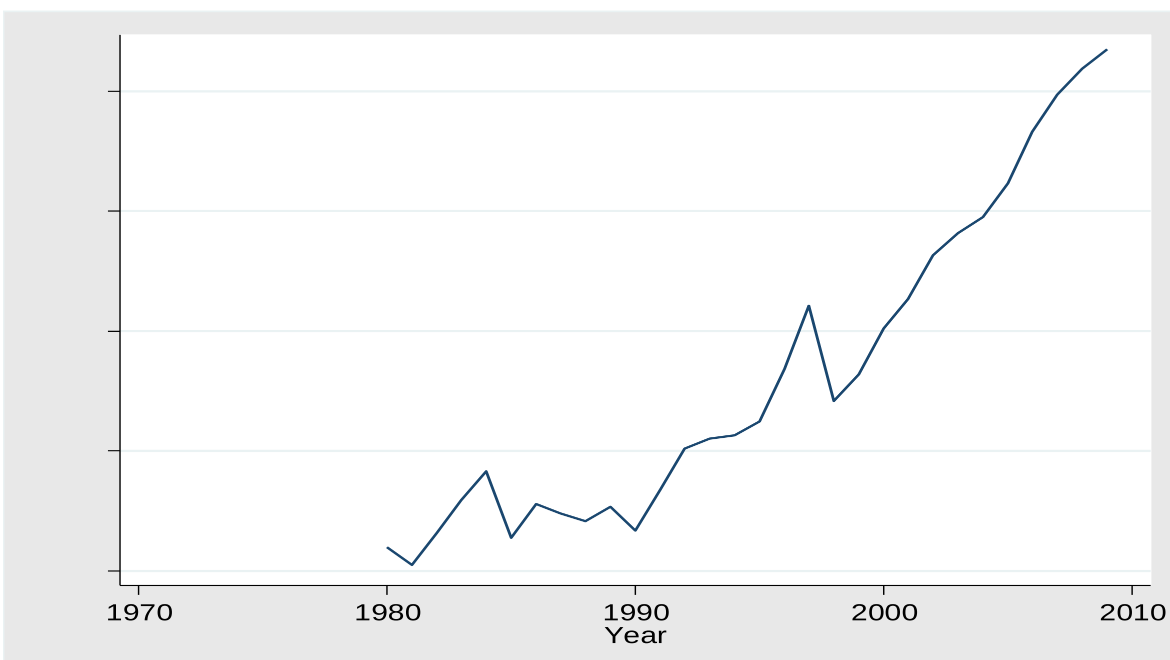
Variable	Obs	Mean	Std. Dev.	Min	Max
VMT	40	2114504	636491.7	1109724	3049027
Gasoline Price	41	1.82	0.4405527	1.30	3.05
Gasoline Tax	16	21.62	1.615473	19.57	23.70
Diesel Price	16	1.94	0.6678832	1.22	3.50
Diesel Tax	16	21.87	1.500898	19.82	23.78
Percent Change GDP	41	2.8	2.225977	-3.5	7.2
Unemployment	41	6.29	1.512315	4	9.7
CPI All Items	41	127.41	55.83651	38.8	218.06
CPI Transportation	41	115.86	47.04208	37.5	195.55
Population	41	3052716	385195.6	2459788	3716784
Vehicles	20	224	226	192	256
Public Road Mileage	30	3931362	65499.99	3852473	4067396
MPG	19	17.02	0.2139068	16.74	17.6

The following graphs represent the time series trends of the observations for vehicle miles traveled, gasoline price, and gasoline tax

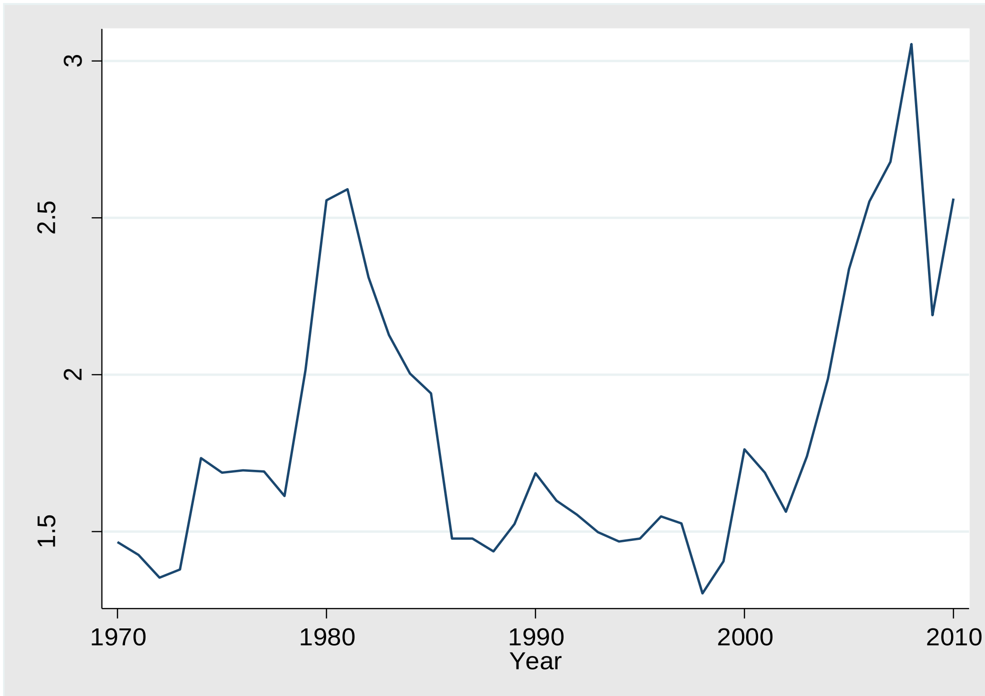
U.S. VMT 1970-2009



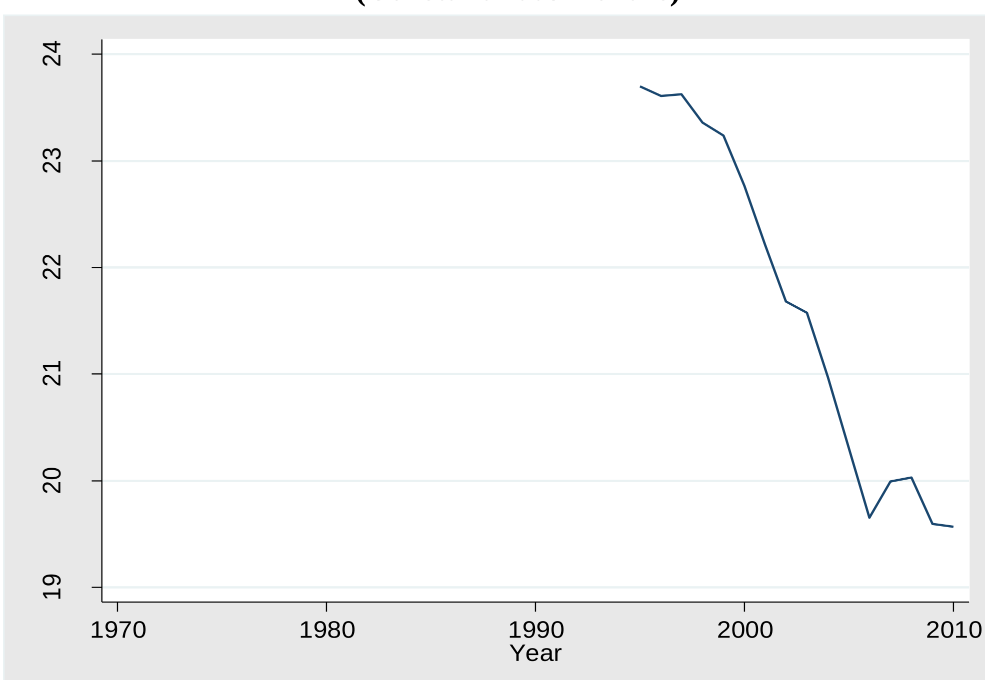
U.S. Public Road Mileage 1980-2009



U.S. Gasoline Pricing 1970-2010
(Constant 2005 Dollars)



U.S. State Gasoline Tax 1995-2010
(Constant 2005 Dollars)



To determine economic indicators relevant to a study of vehicle miles traveled, a time series regression in first differences was conducted using first differences in vehicle miles traveled, gross domestic product, the unemployment rate, the consumer price index for all items, the consumer price index for transportation, and controlled for population. This included data from 1970-2009.

Table 3. Economic Indicators

VARIABLES	US VMT
Percent Change GDP	12,965***
	(4,693)
Unemployment Rate	6,948
	(8,827)
CPI for all items	-3,123
	(5,237)
CPI for transportation	-489.5
	(2,095)
Population	0.548
	(0.755)
Constant	8,490
	(36,813)
Observations	39
R-squared	0.550

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

As Table 3 indicates, only the annual percentage change in GDP was statistically significant at least at a 90 percent confidence level. At a 99 percent level of confidence, a one percentage point increase in GDP results in an increase of 12.97 billion miles, plus or minus 12.1 billion miles. As a result, percent change in GDP was utilized as the economic indicator in the analyses.

In the United States in February 2012, combined state and federal taxes contributed to around 12% of the pump price of gasoline. Therefore, in order to determine if either price or tax could be considered an explanatory variable for vehicle miles travelled, two regression models were utilized in order to distinguish between the effects of a change in the average price of fuel and a change in the average state tax. Also included in this analysis was the average mileage per gallon of the American fleet, which determines the amount of road travel a driver is able to consume given the fuel efficiency of a given vehicle. Public road mileage was used to represent a supply variable for the American roadways, while the U.S. population was used to indicate the demand for those roads. As was indicated previously, annual change in gross domestic product was the economic indicator utilized. The equations below show levels, but first differences are used with the same variables.

Model 1:

U.S. VMT = Mean Price of U.S. Gasoline + Population + Mean MPG + Public Road Mileage + Percent change GDP

Model 2:

U.S. VMT = Mean State Tax on Gasoline + Population + Mean MPG + Public Road Mileage + Percent change GDP

Analysis

This analysis generated results that were largely consistent with the hypothesis of this paper. However, due to the relatively small fraction of the pricing formula composed by local, state, and federal taxes, the American driver is less likely to react to an increase in current tax rates than to an increase in overall price, which is much more fluid and less predictable. American fuel taxation currently makes up too small of a percentage of the pump price, unlike the taxation formulas of Europe. The economic indicator, percent change in gross domestic product, was the most consistently significant variable in all three models.

Table 4. Fuel Price, Fuel Tax, and VMT

Model 1: First Differences VARIABLES	US VMT
Gasoline Price	-80,961***
	(22,977)
Population	-1.806
	(2.107)
MPG	-1,477
	(42,827)
Percent Change GDP	21,226***
	(3,966)
Public Road Mileage	0.356
	(0.346)
Constant	53,085
	(70,636)
Observations	18
R-squared	0.813

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

Model 2: First Differences VARIABLES	US VMT
Gasoline Tax	-42,604
	(28,499)
Population	3.921
	(4.482)
MPG	-46,002
	(66,632)
Percent Change GDP	9,616*
	(4,908)
Public Road Mileage	-0.0932
	(0.482)
Constant	-130,763
	(155,770)
Observations	14
R-squared	0.703

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

Through the analysis of the effect of gasoline pricing presented in Table 4, it can be observed that the volume of fleet mileage is highly and negatively correlated to the pump price of gasoline. American drivers tend to significantly reduce their mileage with price increases. With every one dollar increase in the pump price of fuel, the American fleet conserves nearly 81 billion miles annually, plus or minus 59.3 billion miles. This same model also predicts that the same drivers during the same period of time tended toward increased mileage with an increase in the gross domestic product from the previous year. Every one percent increase in GDP corresponds to an annual increase of 21 billion miles, plus or minus 10.2 billion miles. The r-squared value indicates that the model explained just over 80 percent of the variance in this sample, so the changes in distance driven are strongly related to the explanatory variables here. Note that this is a valid test of the hypothesis, as the level regression would not have been.

The second analysis in Table 4 evaluating the effect of the gasoline taxation revealed a correlation of lower statistical significance between fleet mileage and gross domestic product, but yielded no significant findings relating state fuel taxation to driver behavior. With a level of confidence of 90 percent, the model predicts an increase of 9.6 billion miles annually with a one percent change in GDP, plus or minus 8.1 billion miles. This result was generated with an r-squared of 0.703.

A third model, represented by Table 5, was run including both explanatory variables, fuel price and tax, in addition to the original set of independent variables.

Table 5. Fuel Price and Tax

Model 3: First Differences VARIABLES	US VMT
Gasoline Price	-83,364**
	(26,524)
Gasoline Tax	-16,950
	(21,251)
Population	-2.776
	(3.750)
MPG	8,889
	(49,086)
Percent Change GDP	22,624***
	(5,343)
Public Road Mileage	0.351
	(0.361)
Constant	76,359
	(125,872)
Observations	14
R-squared	0.877

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

In this model it is again observed that changes in the pump price of fuel are negatively correlated with changes in the mileage of the American driving fleet. While the t-statistic remains low for fuel taxation, the price variable is significant with a P-value of .05. Within this model, every one unit increase in the price of fuel corresponds to a decrease of 83.4 billion miles, plus or minus 68.4 billion miles. Additionally, a one percent annual increase in GDP corresponds to a 22.6 billion mile increase of the American fleet, plus or minus 13.8 billion miles. The r-squared for this regression was also relatively high at 0.877. This result confirms the rejection of the null hypothesis in this analysis.

Discussion

Recommendations

This research indicates an opportunity for policymakers to make serious changes to the way one of America's most valuable resources is funded. Currently, revenues for highway maintenance are dependent upon the amount of highway mileage accumulated by the American fleet. However, the damage suffered by the roadways is contributed to continually, while the funding remains pay-as-you-go and determined by a fixed amount. That the federal gas tax is not even adjusted for inflation should be disconcerting to policymakers and suggestive of its unsustainability as a reliable revenue source.

A number of variables affect the pump price of fuel across the globe, several of which have been discussed and analyzed in this paper. Recently, social unrest and poor weather conditions in the Middle East have disrupted supply, raising the cost of crude oil, which in February 2012 determined 72 percent of the $3.58 average retail price of US gasoline (EIA). This stands in sharp contrast to the United Kingdom where one writer noted that the average price in February 2012 was equivalent to $9.85, 60 percent of which is composed of taxes (Foxall, 2012). Drivers in the UK are also subject to a Value Added Tax upon the final pump price. Of course, the contrast in price is also as stark as the contrast in geography between the United States and Europe, but it remains true that European governments have more control over the price of fuel paid by their drivers. This lack of control should be concerning to policymakers due to how devastating increased fuel costs can be when the economy struggles. However, United States Secretary of Energy Steven Chu recently indicated his reluctance to back any plans to increase the pump price of fuel as he had previously, presumably through tax increases

(Koenig, 2012). While an election year is a particularly unlikely time for an executive branch appointee to make provocative policy claims, this incident indicates the lack of political will to make a change in energy policy.

As the trends for American vehicle mileage continue to evolve, more research could be conducted to address the issues raised by this paper. Particularly interesting will be the federal response to the repeated shortfalls in the Highway Trust Fund. Given that the approach at the time of this paper has been repeated stopgap measures to temporarily extend funding, a policy response should be due within the next few years. The reaction of the American driving public to this anticipated policy change should have implications for how the federal government plans to deal with the eventual decline in the use of gasoline and diesel fuels. While the volume of our roadways is unlikely to decline, the finite source of our fuel, and thus the source of our current maintenance revenues, is inevitable.

Limitations

While the findings of this analysis are fairly clear, a broader analysis using the parameters laid out in this paper would likely reveal similar but more exhaustive results. This analysis was somewhat limited in scope due to the data available. For example, the relevance of this topic is indicated by the data trends in the vehicle miles traveled variable. 2008 was the first year in which Americans drove less than the year prior, however, due to the timing of this paper, the Federal Highway Administration has only published VMT data through 2009. While 2008 and 2009 revealed downward trends in vehicle mileage, continued analyses over the coming years should more accurately depict any correlations between these variables. Further, fuel efficiency (MPG) data was only available from 1991 through 2009, a period which saw little change in average fuel efficiency (but large increases in vehicle miles traveled). This variable, when population and road mileage are controlled for, might have had more explanatory power decades earlier when vehicles were less fuel efficient on average. Finally, a more thorough analysis of these variables should include taxation and pricing data dating from the end of World War II. Such an analysis would present a clearer and more accurate representation of modern American driving behaviors regarding pricing and taxation.

Taxes contribute to the price of gasoline, so sufficiently high taxes to change the price of gasoline by as much as the worldwide demand and supply have changed that price would affect how much Americans drive. At the present low level and very small changes of taxes, however, no economically important effects will occur.

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