

THE EFFECTS OF BABY BOOMER RETIREMENT ON U.S. HIGHWAY FUEL DEMAND

Senior Honors Thesis

by

Daniel S. Dempsey

College of Arts and Science
New York University
Spring, 2006

Advisor: _____
Dermot Gately, Ph.D.
Professor of Economics

THE EFFECTS OF BABY BOOMER RETIREMENT ON U.S. HIGHWAY FUEL DEMAND

*Daniel S. Dempsey**

ABSTRACT

This paper examines the effects of baby boomer retirement on highway fuel demand through 2030. By analyzing licensed driver data by age group, I project the growth of licensed drivers through 2030. I then combine the licensed driver analysis with analysis of vehicle miles traveled by age group to produce a projection of total vehicle miles traveled in the U.S. through 2030 (by age group). These projections are then combined with U.S. vehicle fleet fuel efficiency projections (miles per gallon) from the Department of Energy to produce a projection of highway fuel demand through 2030. Baby boomer retirement proves to have a significant effect on highway fuel demand.

The intuition driving the analysis is that as a segment of the population gets to and past retirement age, the number of drivers within that population decreases and the number of vehicle miles traveled per licensed driver in that same age group also decreases. Because the baby boomer cohort is so large, its retirement will have important implications for lessening projections of highway fuel demand.

* I would like to thank Professor Dermot Gately for his invaluable input and assistance. I would also like to thank Professor Kfir Eliaz and my Honors' Seminar classmates for their helpful comments.

Table of Contents

Abstract	i
Table of Contents	ii
List of Figures	iii
List of Tables	iii
List of Abbreviations	iv
Chapter 1: Introduction	1
Background/Related Literature	2
Chapter 2: Analysis	4
Licensed Drivers	6
Vehicle Miles Traveled by Age Group	10
A. Midpoint & Annual Growth Techniques	11
i. Method 1	12
ii. Method 2	13
iii. Method 3	14
Total Vehicle Miles Traveled	16
A. Department of Energy (DOE) Data Inconsistencies	17
Highway Fuel Demand	20
Chapter 3: Conclusion	22
Appendix A	24
Appendix B	25
Data Sources	26
References	27

List of Figures

Figure 1. Outline of Methodology	4
Figure 2. Licensed Drivers by Age Group	6
Figure 3. Median Historical Change in # Drivers as a birth group moves from one age group to the next	7
Figure 4. Births Relative to 20-24 year old Drivers (20-24 years later)	8
Figure 5. Total # of Licensed Drivers through 2030	9
Figure 6. Total # of Licensed Drivers by Age Group through 2030	9
Figure 7. Vehicle Miles Traveled by Age Group (for 1968, 1977, 1990 & 2001)	10
Figure 8. Method 1: Vehicle Miles Traveled per Licensed Driver	12
Figure 9. Method 2: Vehicle Miles Traveled per Licensed Driver	13
Figure 10: Method 3: Vehicle Miles Traveled per Licensed Driver	14
Figure 11. Total Vehicle Miles Traveled through 2030	16
Figure 12. Total Vehicle Miles Traveled through 2030, Adjusted Method 3	18
Figure 13. Fuel Efficiency through 2030 (DOE's assumptions)	20
Figure 14. Highway Fuel Demand through 2030	21
Figure 15. Percent DOE is over-projecting highway fuel demand, annually to 2030	22
Figure 16. Absolute amount DOE is over-projecting highway fuel demand to 2030 (million barrels per day)	22

List of Tables

Table A. Average Annual Miles per Licensed Driver by Driver Age	24
Table B. Total Vehicle Miles Traveled	25

List of Abbreviations

AEO	Annual Energy Outlook (published by Department of Energy)
CB	Census Bureau
CLT	Commercial Light Truck
DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
LDV	Light Duty Vehicles
M1	Method 1
M2	Method 2
M3	Method 3
MBD	Million Barrels per Day
MPG	Miles per Gallon
MPLD	Miles per Licensed Driver
VMT	Vehicle Miles Traveled

CHAPTER 1: INTRODUCTION

Transportation is responsible for two-thirds of U.S. oil consumption¹. Gasoline demand has been steadily increasing since the mid-1980s and has shown no sign of slowing down. This is of concern because it forces the U.S. to increase its dependence on foreign oil at the expense of economic security. Fortunately, there is a glimmer of relief on the horizon and it doesn't come from technological advances or the discovery of new oil reserves, it comes in the form of baby boomer retirement².

Baby boomers reaching retirement age, over 65, has recently been looked upon as a bad thing for society because of fears that the Social Security and income tax systems will collapse from this retirement "boom". This paper looks at the other side of the coin, at the benefits of an aging population in the form of a decrease in highway fuel demand (gasoline and diesel fuel). Historical data show that as one ages past 55, one drives less, and that as a birth year ages past 55, the number of drivers in that birth year steadily decreases. If we project these historical patterns to the future, we can estimate the effect baby boomer retirement will have on transportation and highway fuel demand. This is the focus of this thesis.

You may be wondering, why has this question not been asked before? This is most likely because a large retirement phenomenon has not occurred in an oil dependent economy of the U.S.'s size before. Recently, retirees have not been the largest segment of the U.S. population and pondering questions of retirement affecting highway fuel demand was of little use³. Furthermore, U.S. dependence on oil was not of the same

¹ DOE: EIA: Annual Energy Review 2004. Diagram 2: Petroleum Flow.

² A baby boomer is one who was born between 1946 and 1964 in a period of high birth rates that followed World War II.

³ From the Census Bureau: "In all of the projection series, the future age structure of the population will be older than it is now. In the middle series, the median age of the population will steadily increase from 34.0 in 1994 to 35.5 in 2000, peak at 39.1 in 2035, then decrease slightly to 39.0 by 2050. This increasing

importance during the relatively tranquil 1990s as it seems to be today. Growing global demand, Middle East uncertainties, and natural disasters are putting the issue of oil demand and conservation back into the public spotlight with intensity not witnessed since the 1970s. Consequently, U.S. policy makers, industry, and other interested parties need as much good information as they can get a hold of, and this paper is an attempt to help those parties better project future highway fuel demand. I hypothesize that baby boomer retirement will have a significant effect on highway fuel demand in the next quarter century.

median age is driven by the aging of the population born during the Baby Boom after World War II (1946 to 1964). About 30 percent of the population in 1994 were born during the Baby Boom. As this population ages, the median age will rise. People born during the Baby Boom will be between 36 and 54 years old at the turn of the century. In 2011, the first members of the Baby Boom will reach age 65, and the Baby Boom will have decreased to 25 percent of the total population (in the middle series). The last of the Baby-Boom population will reach age 65 in the year 2029. By that time, the Baby-Boom population is projected to be only about 16 percent of the total population (Day 2001).”

BACKGROUND/RELATED LITERATURE

The inspiration for, and foundation of, my paper is analysis done by economist Dermot Gately on highway fuel demand growth in the 1970s and 1980s⁴. Gately was the first to suggest and study the importance of baby boomers to demand growth. From his 1991 work entitled “U.S. Demand for Highway Travel and Motor Fuel,” he states:

“In the decade prior to 1977 there was rapid growth in the number of drivers, averaging 2.9% annually. The baby boomers reached driving age and the percentage of drivers in the driving-age population grew from 80% to 89%. But this growth has slowed in the past decade, to 1.6% annually, and will slow further in the 1990s, to 1.1% annually. All the baby-boomers have now reached driving age, and the percentage of drivers in the driving age population is close to its likely upper limit (p. 63).”

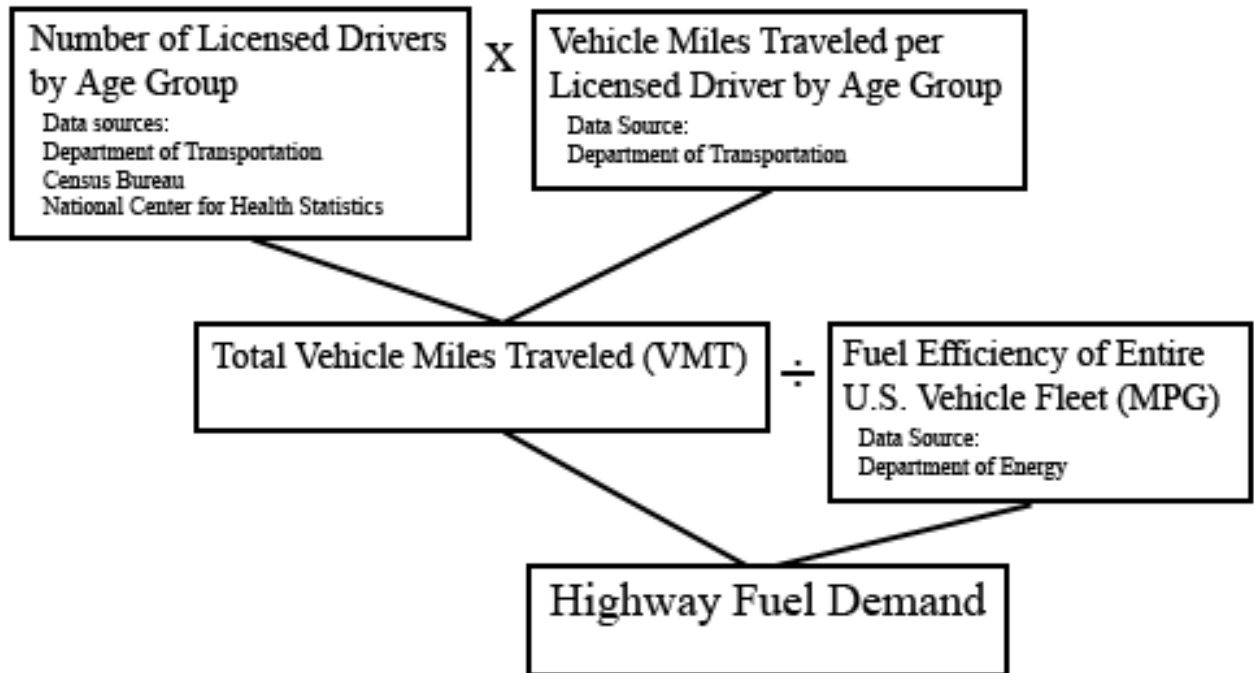
This analysis, combined with another of Gately’s works, got me to thinking: what about after the 1990s, what will happen when baby boomers begin to retire? Will that growth in drivers cease and start to decline or will nothing change? When you combine these questions with his observation that vehicle miles traveled per driver is significantly less in older age groups⁵, it becomes an even more interesting question: how will baby boomer retirement affect transportation demand (demand for mileage)? This brought me to my thesis question: will baby boomer retirement have an effect on highway fuel demand? If it does, will it be minor or significant?

⁴ Gately 1991, Gately 1992, Gately and Rappoport 1988

⁵ Gately 1992. Figure 6

CHAPTER 2: ANALYSIS

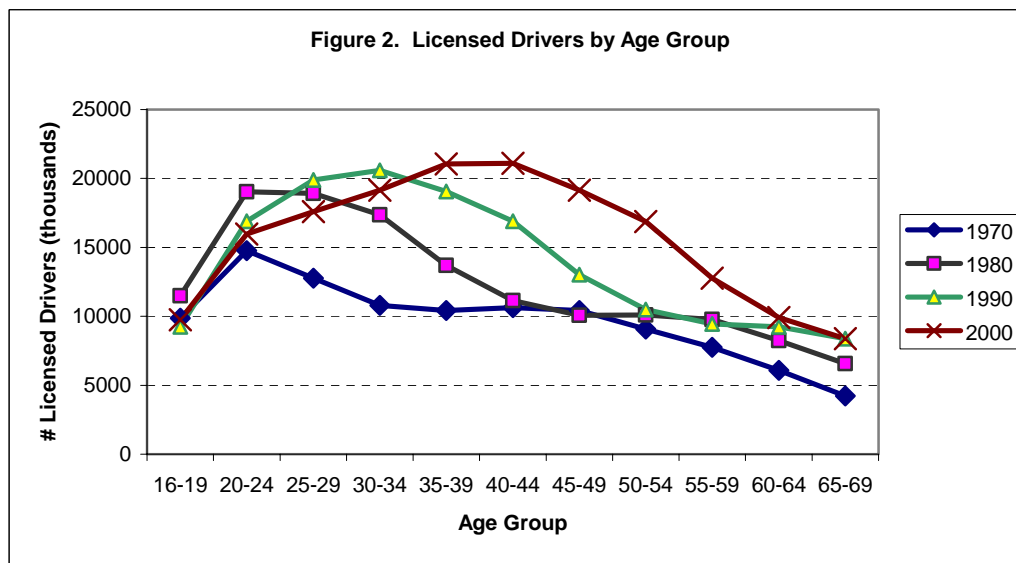
Figure 1. Outline of Methodology



Before we begin, let's look at a brief outline for how I am going to handle the question of baby boomer retirement's effect on highway fuel demand (Figure 1). I begin my analysis with licensed drivers. By analyzing the changing internal age composition of the licensed driver populations of the past, I make projections as to how that internal change will continue through 2030. From there, I analyze vehicle miles traveled per licensed driver (by age group) and its underlying historical trends and project how those trends will continue through 2030. Once the first two sections, licensed driver population and vehicle miles traveled per licensed driver, are complete they will be combined to give us total vehicle miles traveled estimates for the entire U.S. vehicle fleet through 2030. At that point, I combine the projections of total vehicle miles traveled with the Department of Energy's (DOE) assumptions on fuel efficiency through 2030 and get total U.S.

highway fuel demand through 2030. I then compare my projections with those of the DOE and draw some meaningful conclusions about the effect of an aging population on highway fuel demand.

Licensed Drivers

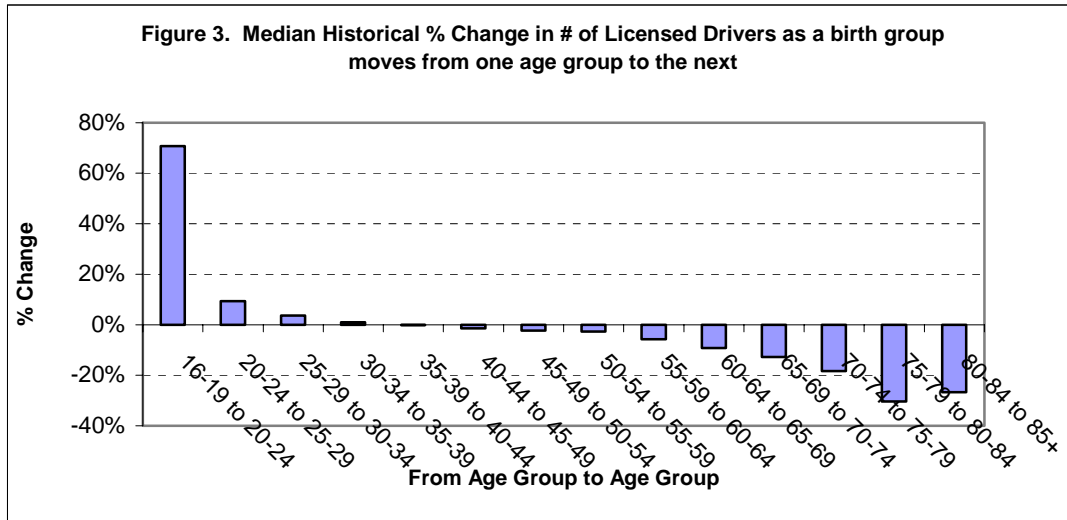


To analyze the effect of baby boomers on the amount of licensed drivers, I required data on the licensed driving population separated into age groups. The Federal Highway Administration (FHWA), a creature of the Department of Transportation (DOT), collects yearly data on the number of licensed drivers and publishes it in its annual Highway Statistics Report. These reports go back to 1963 and provide rich licensed driver data by age group.

The FHWA presents the age data in the form of five year age groups (as you can see in Figure 2). Consequently, we can, for example, take the number of licensed drivers in the 20-24 age group in 1995 and compare it to the number of licensed drivers in the 25-29 age group in 2000 and see what the rate of change is for that birth group – those born in 1971-75. After we do this for all age groups and over all years we have data on, we see a standard pattern of change in birth groups as they travel through time (Figure 3)⁶. Because this rate of change has remained more or less constant over time, we can

⁶ Figure 2 also tells an interesting story in that one can see the baby boomer population “wave” steadily moving through the age groups over time. That population wave is precisely the focus of this paper.

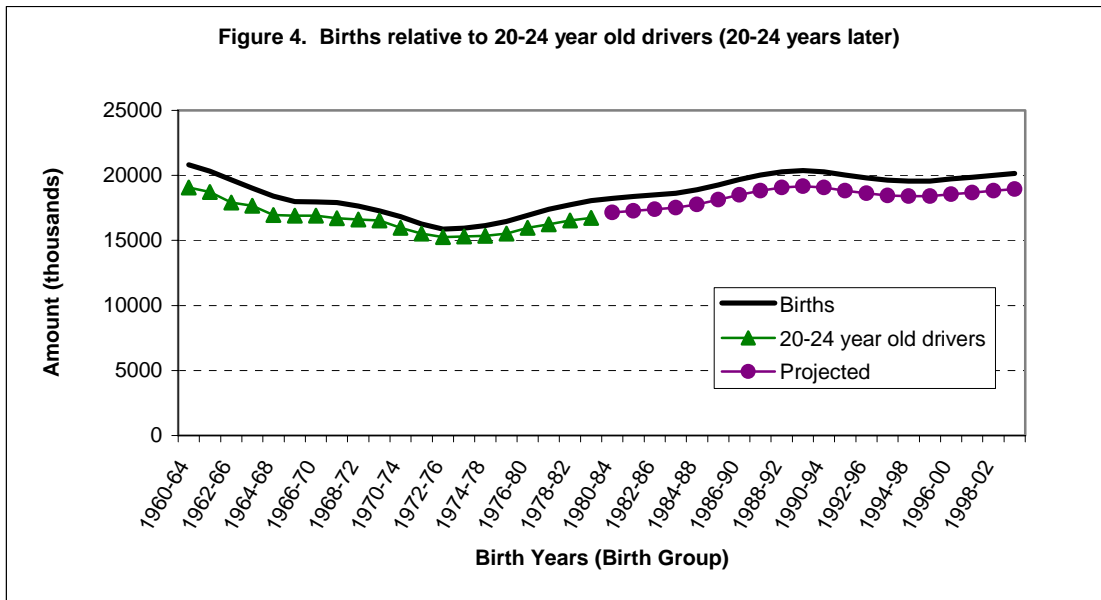
use the rates to project what will happen to current birth groups in the future. Of course the limit to this approach is how to project for birth groups that haven't started driving yet and to resolve this issue we turn to historical birth data.



The simplest way to address the problem of future licensed drivers is to get historical birth data and compare it to the historical 20-24 licensed driving age group. For example, if one were 20-24 in 1990 then that individual was born between 1971-75; so, if we take the number of licensed drivers aged 20-24 in 1990 and divide that by the number of babies born in 1971-75, we get a ratio telling us the number of babies born that go on to be 20-24 year old licensed drivers (Figure 4). Once this is done across all of the data available, we have a relatively constant ratio that represents the percentage of those that are born that will go on to be 20-24 year old drivers⁷. With this percentage, we can project the number of 20-24 year old drivers based on the number of births 20-24 years earlier (the projected portion of Figure 4). Unfortunately, we only have birth data

⁷ The same thing is done for the 16-19 year old age group. However, the 16-19 year old age group is not sufficient to project off of because the DOT's data show it to be much more volatile than the 20-24 year old age group.

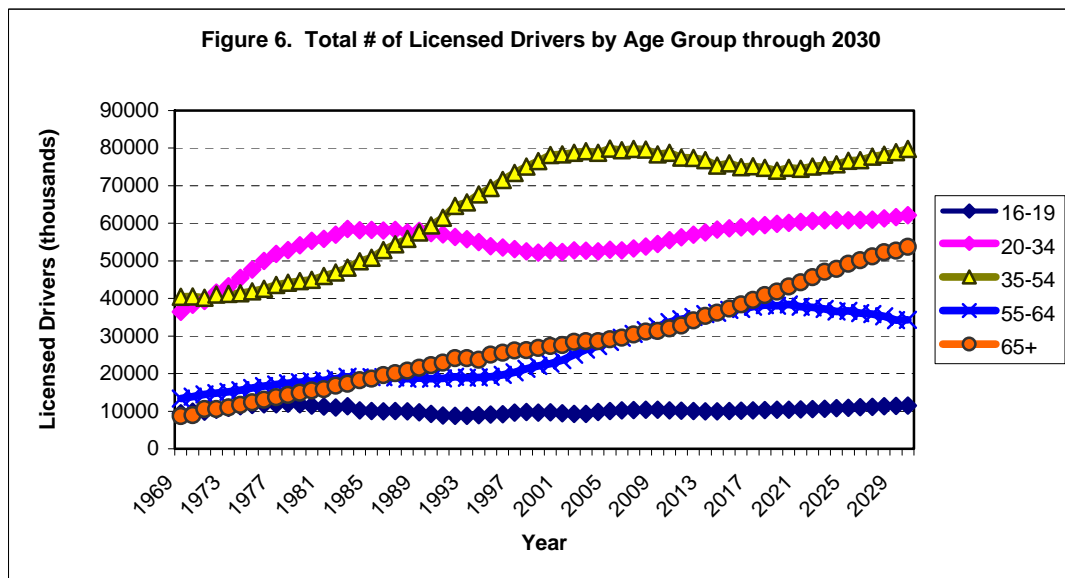
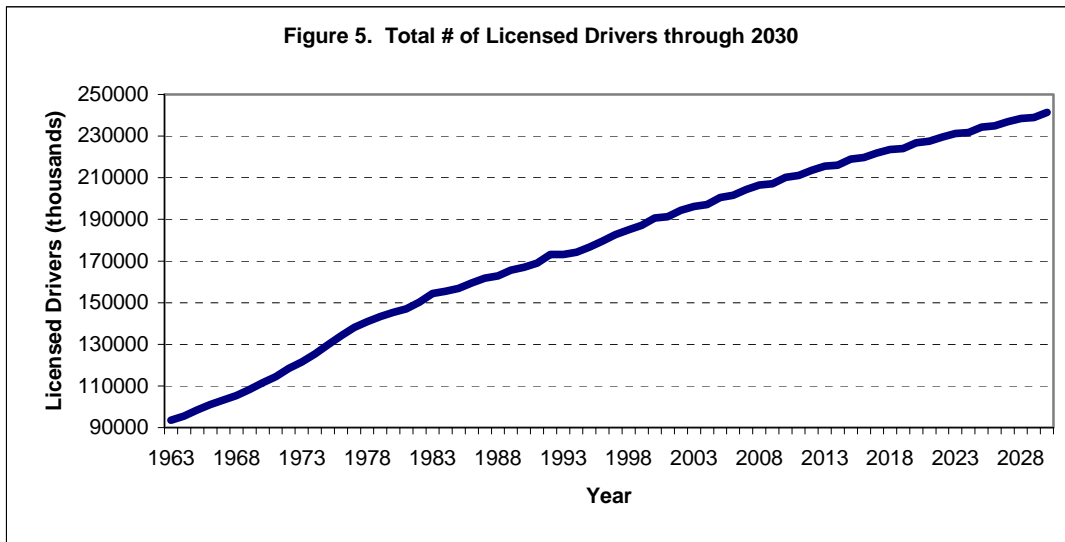
through 2003 and because we want to project through 2030, we must get birth data projections. For that we turn to the Census Bureau.



The Census Bureau (CB) publishes population projections every ten years based on the latest census information. The problem is that they only conduct national censuses every ten years and their latest projections (published in 2000) are based off of the 1990 census. Consequently, the CB's most recent birth rate projections, for 1999-2100, already have real data to compare against and see whether the projections are accurate. Upon comparison of the CB's projections through 2003 to the actual number of births reported by the Department of Health and Human Services to 2003, the CB's projections are lower than actual births by at least 1.5% every year, ranging all the way up to 3.6%⁸. So, if I took the CB's projections for 2004 without adjusting them upwards I would get a significant dip between 2003 and 2004 which doesn't correspond with the growth rate in the CB's projections. Therefore, I decided to take the median error in the CB's

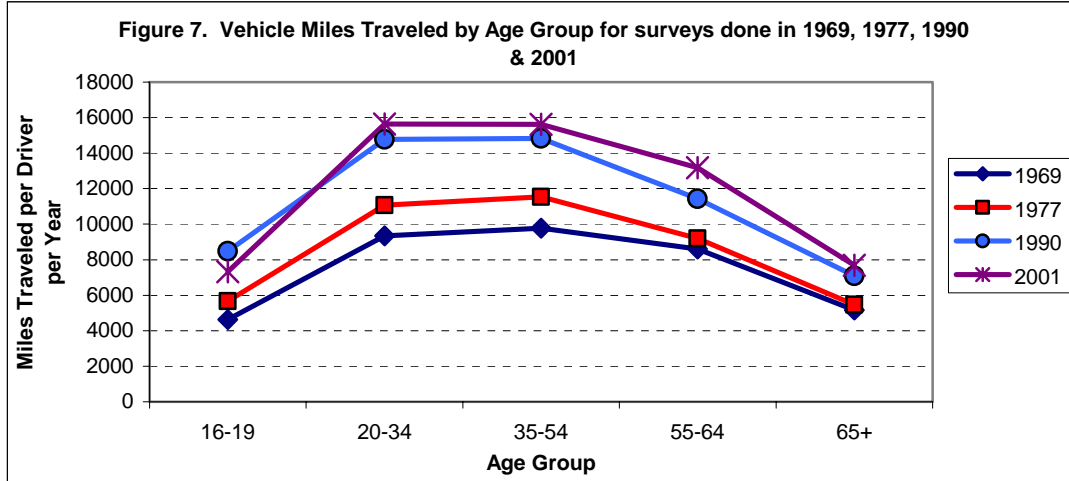
⁸ The Census Bureau's birth projections were under the actual amount of births by 1.5% in 1999, 3.6% in 2000, 2.3% in 2001, 1.7% in 2002, and 2.7% in 2003.

projections and apply it to adjust all of their projections upwards⁹. I assume this is unproblematic for my analysis because, if anything, adjusting the projections on the number of births upwards will increase the number of drivers and work against my hypothesis. So, now we have projections for the number of births through 2030 and consequently projections on the number of licensed drivers through 2030. The licensed driver projections are complete (Figures 5 & 6).



⁹ Median error: -2.3%

Vehicle Miles Traveled by Age Group



Every five to ten years the Department of Transportation (DOT) publishes the results of its National Household Travel Survey (NHTS; formerly known as the National Personal Transportation Survey). The survey includes data on the average annual miles per licensed driver according to driver age. An important feature of this data is that it encompasses commercial as well as personal driving because it asks respondents this question: “About how many miles did you personally drive during the past 12 months in all licensed motorized vehicles? Include miles driven as a part of work (Pickrell 1998, p. 6).” The survey’s sample size is more than 40,000 households, so it is reasonable to assume that all forms of driving are well covered (freight, commercial light truck, and light duty)¹⁰. By analyzing the historical trends in the data I can make projections on driving habits through 2030. Unfortunately, the way the age group data is presented forces me to disaggregate it further.

¹⁰ Because the data is based on a driver’s self estimate, it is vulnerable to over- or underestimation. The DOT published a paper by Picknell and Schimek (1998) analyzing the problem. They looked at different methods of obtaining the total vehicle miles traveled annually in the U.S. and concluded that driver self estimates are “remarkably consistent” with odometer based methods.

A. Midpoint & Annual Growth Techniques

The historical vehicle miles traveled data is organized into five age groups (see Figure 7, x-axis). Because these age groups are not the same size – i.e. the 20-34 age group covers 15 ages and the 35-54 age group covers 20 ages – they cannot be offset and analyzed by birth year, as was done in the licensed driver section. In order to get past this data problem, I set the data for a given age group as a midpoint between the highest and lowest age in that same group¹¹. With the midpoints set, I interpolated the vehicle miles traveled at every age and used the expanded data to analyze the rates of change for a given birth year as it progressed through time. Being able to analyze a given birth year as it progressed through time allowed me to estimate the rate of change for every birth year as it moved from one age to the next¹². Once this is done over all ages and all years, we get a growth rate to project from. This technique is important because it reflects the baby boomers' effect on each age group's mileage and can be used to project what effect they will have on later age groups. I refer to this as the midpoint technique.

Unfortunately, like the licensed driver analysis, a way is needed to project for those that do not drive yet; however, unlike the licensed driver analysis we cannot project from birth rates, we can only project from historical rates of change between years and the same age group¹³. So, instead of looking at the rate of change between age groups, we look at the movement between years of the same age group. I refer to this as the annual growth technique. Because of these two distinct techniques, I make three

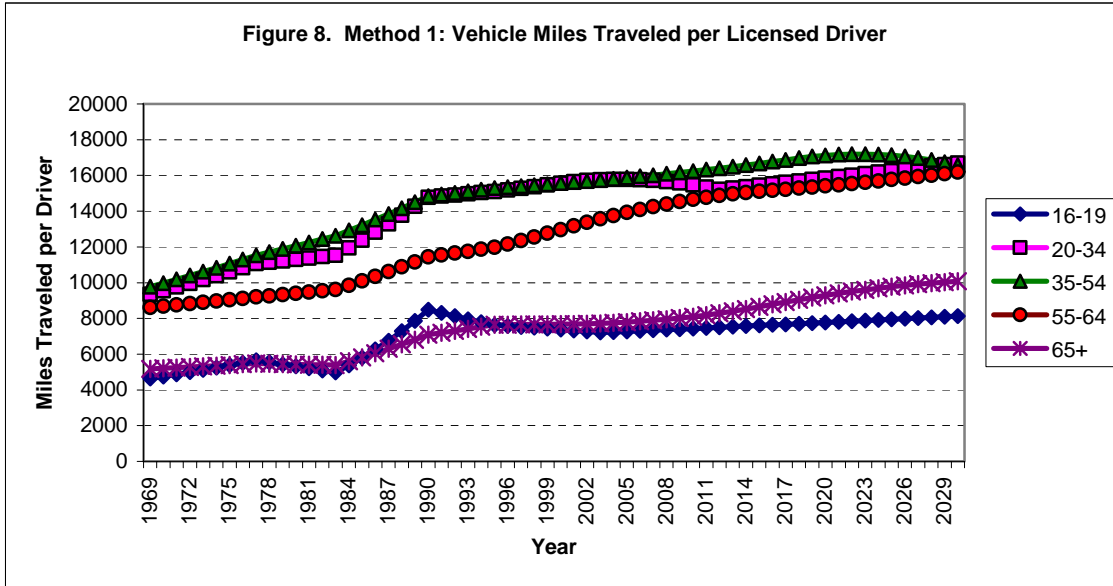
¹¹ For example, the 20-34 age group midpoint was set at 27.5 and the 35-54 group's midpoint was set at 45. For the 65+ group, the midpoint was set at 75.

¹² For example, if 29 year olds drove 11,103 miles per licensed driver (mpld) in 1977 and 30 year olds drove 11,219 mpld in 1978, I could estimate the rate of change of those born in 1948 as they aged from age 29 to 30.

¹³ For example, the 20-34 age group drove 15,557 mpld in 2000 and the 20-34 age group drove 15,650 mpld in 2001. The rate of annual change for the 20-34 age group from 2000 to 2001 would be .6%.

different projections for vehicle miles traveled per licensed driver and use them in varying combinations.

i. Method 1



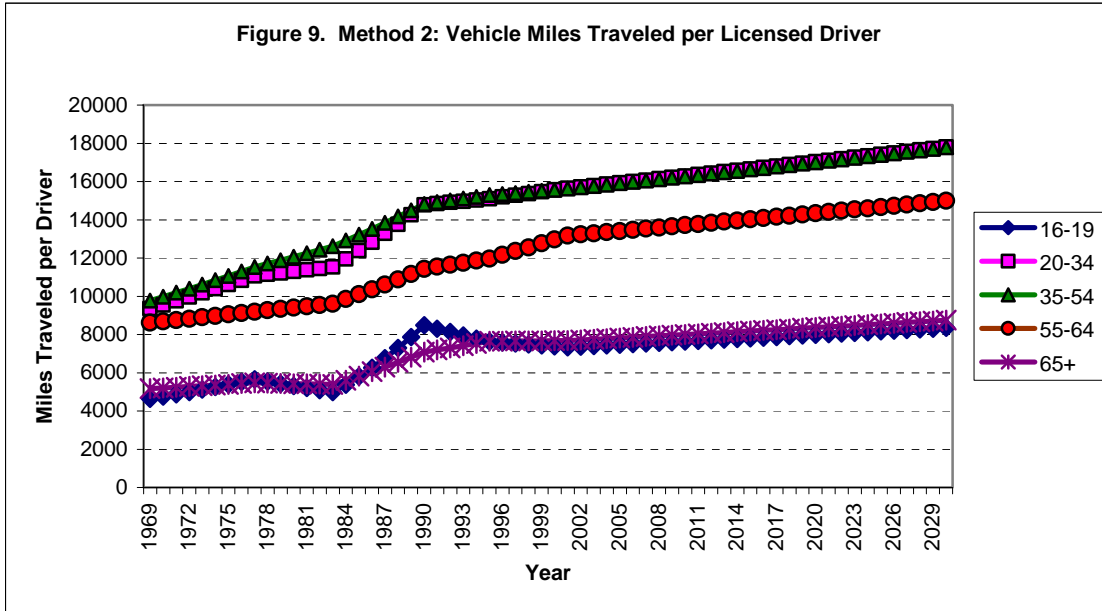
As I mentioned in the previous section, the midpoint technique has no way to project for those that do not drive yet and so the annual growth technique must be used to compensate. The annual growth rate I decided to use for the 16-19 year old age group was .45%. This rate is derived from the annual rate of change from 1990-2001 in each age group¹⁴. I only use 1990-2001 because prior to 1990 the growth rate was much larger and using it would skew the percentage upwards¹⁵. Also, I decided to use the annual growth rate of miles driven for *all* drivers, .45%, for the 16-19 year old age group because it is difficult to assume that the decline of 1% annually from 1990-2001 will continue through 2030. To assume that the 1% decline annually will continue would

¹⁴ See Appendix A.

¹⁵ I assume this is ok because much of that growth was attributed to women starting to drive more miles in the 1980s and since 1990 their numbers have stabilized (Hu 2004, Table 23). I see no reason to assume that their numbers will increase more rapidly than any other drivers in the near future.

skew my projections downwards and help my hypothesis, so by not assuming it, I can be more confident in my results.

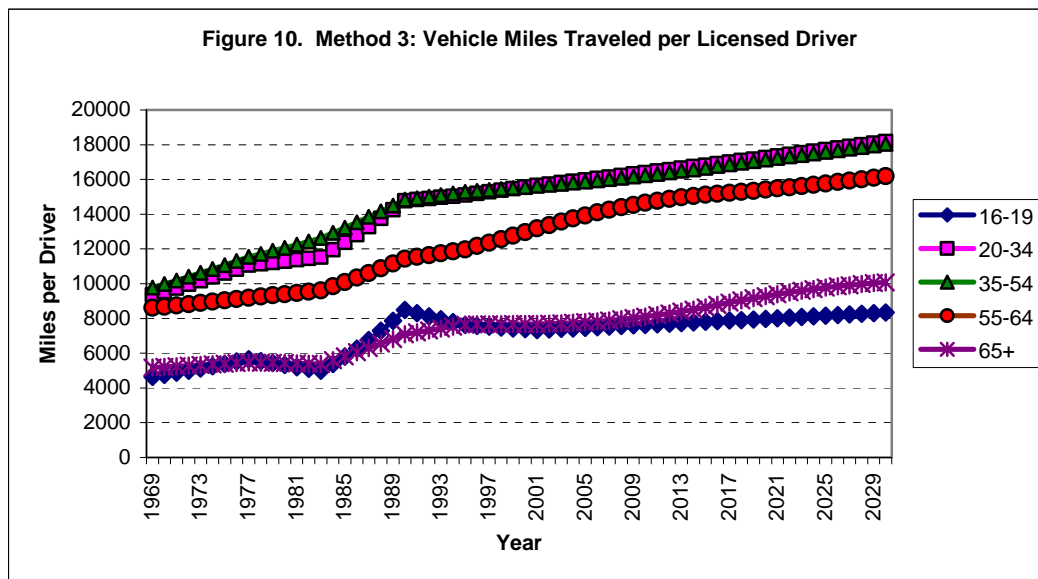
ii. Method 2



Which methodology is more accurate, midpoint or annual growth, could be debated so I decided to include a pure annual growth projection for comparison's sake. Determining what rate to use is not a simple task and I have decided to use the .45% rate for all drivers because if I use it to increase all groups by the same rate then the average will continue at the same rate as it has since 1990¹⁶. Moreover, to assume that the rate from 1990 to 2001 will deviate dramatically upwards would be unwise because there is no reason to assume the trends of the 1990s will not continue. If anything, it might be reasonable to assume that the growth rate will be less than it was in the 1990s because of recent increases in oil prices. Applying the annual rate of .45% to all groups produces Figure 9.

¹⁶ See Appendix A.

iii. Method 3

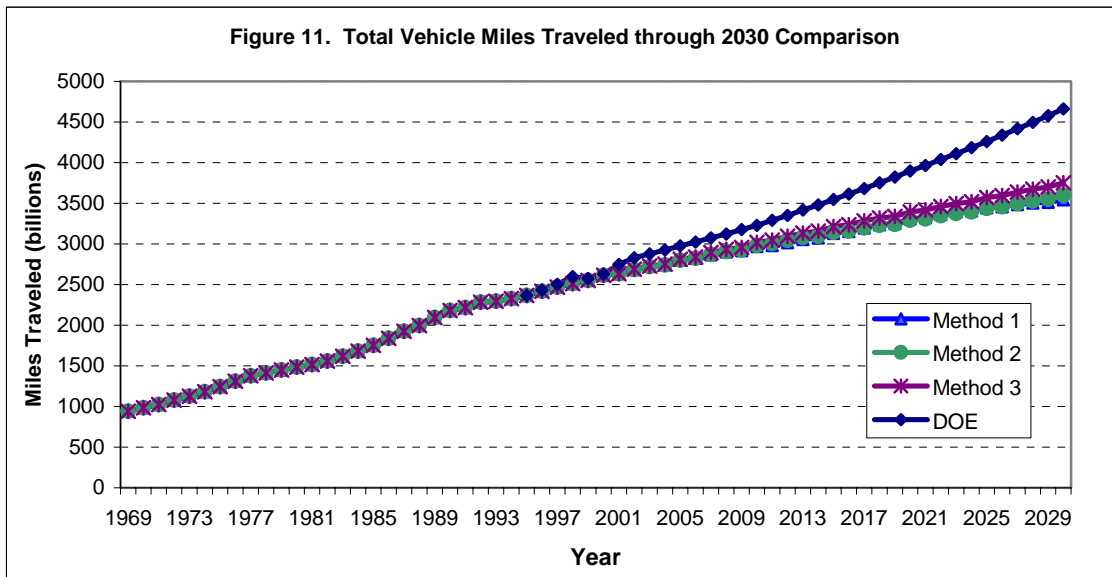


Method 3 is an attempt to correct for peculiarities resulting from method 1. The problem with method 1 is that it reverberates the decrease we see in the 16-19 year old mileage from 1990-2001 throughout all later age groups. We wouldn't expect this to occur because of two observations: one, we see a decrease in 16-19 year olds' mileage from 1990-95 but not a corresponding decrease in 20-34 year olds' mileage from 1995-2001, as one would expect. In fact, we don't see any effect, the 20-34 age group actually increases more in 2001 than it did in 1995. Second, we see the same decrease in 16-19 year olds in 1977-83 without a corresponding decrease in 20-34 year olds in 1983-90. Once again, the 20-34 year old group actually grew faster from 1983-90 than from 1977-83. So, making projections of what later age groups will do based on what the highly volatile 16-19 year old age group has done is unwise. Therefore, I decided to use the annual growth technique to project 20-34 year olds but keep all later age groups projecting off of the midpoint technique¹⁷ (Figure 10).

¹⁷ This is necessary to ensure that the 16-19 year old age group doesn't project what happens to the 20-34 year old group.

Method 3 is the most likely of all three scenarios because it reflects mileage growth from baby boomers entering the 65+ group based on their effects on prior age groups and discounts the highly volatile 16-19 year old age group. With the projections of licensed drivers and vehicle miles traveled per licensed driver completed, we can combine them to get projections for total vehicle miles traveled and highway fuel demand.

Total Vehicle Miles Traveled



In order to get annual total vehicle miles traveled (VMT) projections we must multiply the licensed driver projections for each age group by their corresponding VMT per licensed driver projections. After doing this for each age group, the groups are summed together to get the annual total vehicle miles traveled for all drivers through 2030. This is done for each of the three VMT scenarios. For comparison, I also take the DOE’s data on historical and projected total VMT (Figure 11).

We can see that the DOE’s projections on total VMT begin to significantly deviate from my own, particularly from 2010 onwards; this seems to be because the DOE’s projections do not account for an aging population. The DOE’s Annual Energy Outlook (AEO) publications hint at this fact and their transportation demand model documentation confirms it:

“VMT per capita estimates are based on the fuel cost of driving per mile, per capita disposable income, and an adjustment of female-to-male driving ratios. Total VMT is calculated by multiplying VMT per capita by the driving age population (EIA 2003, p. 39).”

The DOE accounts for the “driving age population” as a whole and not the age composition of that “driving age population.”¹⁸¹⁹ Furthermore, in their transportation section under oil and gas projections in the 2006 Annual Energy Outlook, the DOE says: “improvements in technology increase the efficiency of motor vehicles and air craft, but growth in demand for each mode of transit far outpaces increases in fuel efficiency, as transportation grows in proportion to increases in population and GDP (AEO 2006, p. 95).” Transportation demand in their models is affected by increases in population and not changes in the age composition of the population. Consequently, the DOE’s projections show no decrease in the growth rate of total VMT, as would be expected with an aging population.

A. DOE Data Inconsistencies

Historical DOE data inconsistencies complicate the comparison of the DOE and my projections. From 1995 to 2001, my total vehicle miles traveled estimates are consistent with the DOE’s – with the exception of 1998 which is a complete oddity relative to previous DOE estimates and my own²⁰. The DOE also has larger than normal growth in its 2001 estimates but not afterwards: from 2001 to 2004 the estimates resume a historically normal annual growth rate.

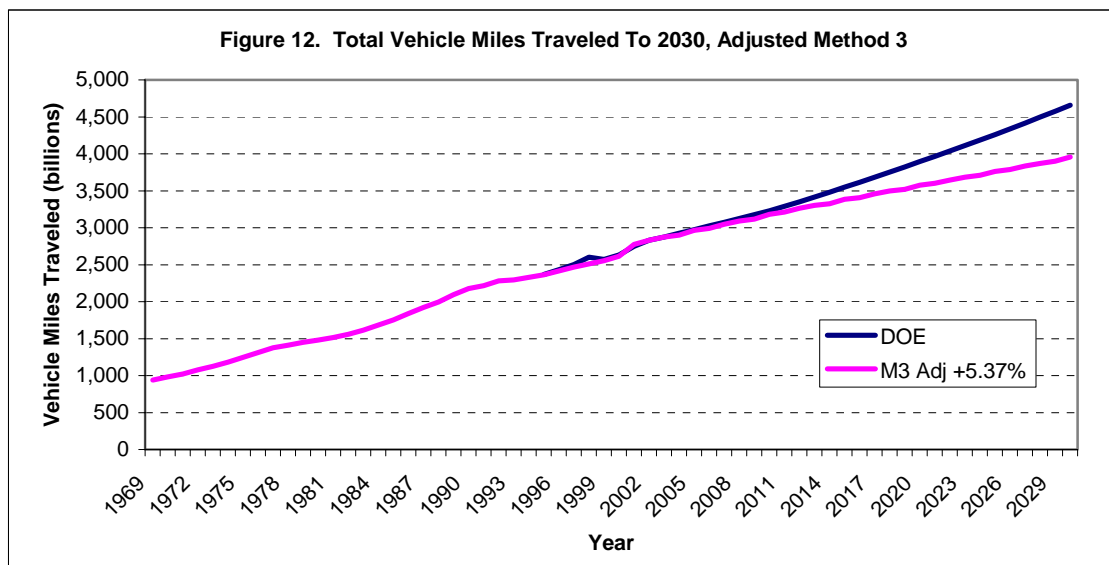
Now, if I compare my estimates from 2001-04 to the DOE’s estimates, my estimates are under by an average of 5.37%. This is strange because prior to 2001 they

¹⁸ Driving age population is defined by the DOE as the population age cohort greater than or equal to 16.

¹⁹ On a side note, it is interesting that the DOE accounts for the sex composition, male-to-female ratio, of the driving age population but not the age composition. One would think that the difference in miles traveled between a 20-24 year old driver and a 65-69 year old driver would be at least as large as the difference between a 20-24 year old male driver and 20-24 year old female driver.

²⁰ In 1997, the DOE estimates 2.503 trillion vehicle miles traveled in the U.S. but that estimate jumps to 2.6 trillion in 1998 only to drop back down to 2.573 trillion in 1999. This relatively enormous growth in 1998, and decline in 1999, doesn’t follow historical growth rates and is rejected as error. Particularly, when compared against data from the NHTS. See Appendix B.

were always less than 1.5% under the DOE's estimates. The only inference I can make is that the DOE changed their estimation methodology permanently in 2001²¹. Whatever the case, I decided to include a set of my total vehicle miles traveled estimates adjusted upwards by 5.37% from 2001 onward. This adjustment is an attempt to compensate for the DOE's appeared change in estimation methodology. Once this adjustment is made, the data show that the DOE and my estimates are parallel through 2009-10 and begin to significantly deviate from there onward (Figure 12). From 2010 to 2030, the gap grows from 1.4% to nearly 5% in 2015 and on to 18% in 2030²².



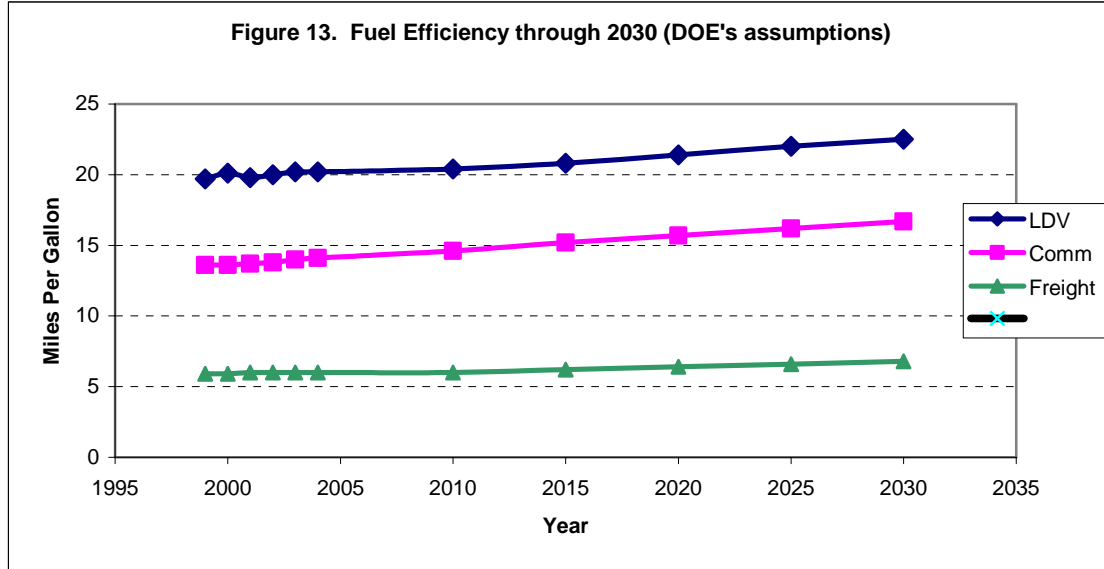
Of course, according to my analysis, I should not have to do this; however, I decided to do it anyways to illustrate the point that even when starting off at the same base in 2001, the DOE and my method remain very close until baby boomer retirement begins. Once the retirement boom begins everything changes. I can now combine these

²¹ I infer this because the NHTS data from 2001 show that people didn't drive extraordinarily more but, rather, that growth remained normal. See Appendix B.

²² See Appendix B.

varying total VMT projections with fuel efficiency assumptions from the DOE to project future highway fuel demand.

Highway Fuel Demand



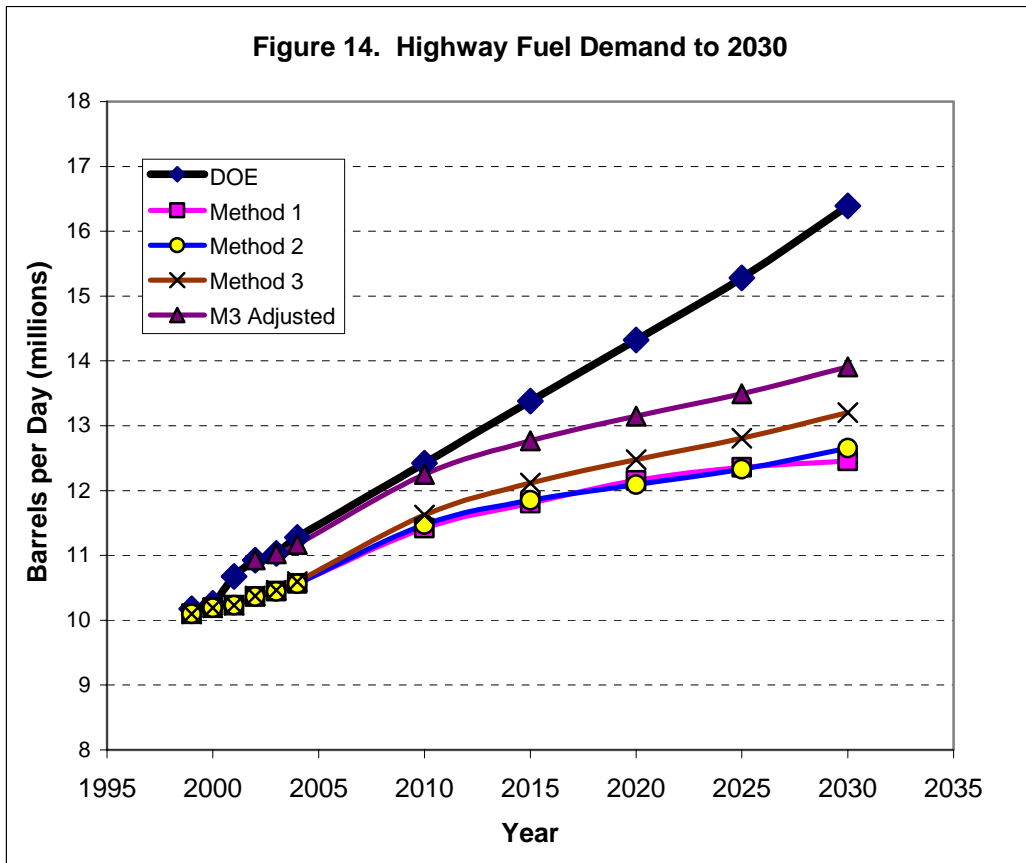
To project highway fuel demand, we need projections of fuel efficiency (miles per gallon) for the entire U.S. vehicle fleet through 2030. The DOE has already produced these projections and in order to keep our estimates comparable I will use the same assumptions²³ (Figure 13).

The DOE has their data on total VMT separated into three categories: light duty vehicles (those less than 8500 pounds), commercial light trucks (8500-10,000 pounds), and freight trucks (those greater than 10,000 pounds). The DOE also has their fuel efficiency projections separated into those same three categories and so, in order to make highway fuel demand projections, I must separate my projections into equivalent categories. To do this, I took each of the DOE's category's VMT and divided it by the sum of VMT for all three categories to get a percentage²⁴. I then applied these

²³ It is certainly true that fuel efficiency may increase more rapidly or slowly than the DOE predicts but that is irrelevant to this analysis. We are interested in the effects of an aging population on highway fuel demand and those effects will be relevant whether the increase in fuel efficiency is rapid or slow.

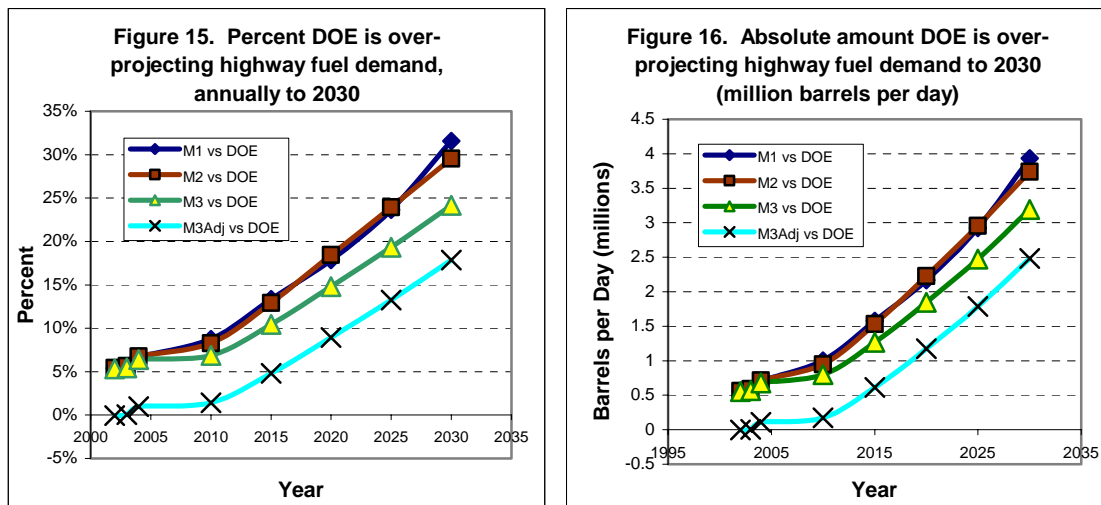
²⁴ For example, the total VMT for light duty vehicles in 2010 is 2,890 million miles and the total VMT for all vehicles is 3,228; therefore, the percentage of light duty vehicles in the entire U.S. fleet is projected to be 90%.

percentages to my projected total VMT and created equivalent categories in my projections. With these categories I can now calculate highway fuel demand by dividing each category's VMT by the DOE's corresponding fuel efficiency projections. I have done this for all four of my methods and the results are in Figure 14.



CHAPTER 3. CONCLUSIONS

From 2010 onwards, there is a steadily growing gap between my projections of highway fuel demand and the DOE's. Figure 15 shows this difference as a percentage and Figure 16 shows it as an absolute number (million barrels per day). Remarkably, if the DOE does not account for baby boomer retirement than their estimates of highway fuel demand in 2020 and 2030 will be over by 1.3 million barrels per day (mbd; or ~9%) and 2.5 mbd (~18%) respectively, when using adjusted method 3. Moreover, adjusted method 3 is the closest of my projections to the DOE's and the other three projections show much larger differences²⁵. This leads me to conclude that accounting for baby boomer retirement is critical to highway fuel demand models; my data show that not accounting for it will result in rapidly decreasing predictive power as one looks past 2010.



Whether it is the U.S. or elsewhere, population age composition is an important factor to account for in highway fuel demand models. Between the results of this paper

²⁵ Method 1 shows the DOE over projecting by almost 4 million barrels a day in 2030. Method 2 shows a DOE over projection of 3.7 million barrels a day in 2030. However, as I argued in chapter two, I believe method 3 to be the most accurate of the three, particularly adjusted method 3.

and the results of Dermot Gately's numerous works, it would seem silly not to account for age composition in every highway fuel demand equation. Government organizations, oil companies, futures traders, basically any individual or firm with a stake in highway fuel demand should take a careful look at their demand models and evaluate whether or not they are accounting for it. Whether one is a refinery builder looking into building excess capacity or a policy maker attempting to estimate future greenhouse gas emissions, accounting for baby boomer retirement will make one's projections that much more accurate and make our economy run that much more efficiently. Baby boomer retirement will have a significant effect on highway fuel demand.

APPENDIX A – Vehicle Miles Traveled by Age Group

Age Groups	Average Annual Miles per Licensed Driver by Driver Age						% Change Annual Rate 1990-2001
	1969	1977	1983	1990	1995	2001	
16-19	4,633	5,662	4,986	8,485	7,624	7,331	-1.32%
20-34	9,348	11,063	11,531	14,776	15,098	15,650	0.52%
35-54	9,771	11,539	12,627	14,836	15,291	15,627	0.47%
55-64	8,611	9,196	9,611	11,436	11,972	13,177	1.30%
65+	5,171	5,475	5,386	7,084	7,646	7,684	0.74%
ALL (from NHTS)	8,685	10,006	10,536	13,125	13,476	13,785	0.45%

APPENDIX B – Total Vehicle Miles Traveled

Table B. Total Vehicle Miles Traveled (billions)
(2002 & onward is projected)

	(2002 & onward is projected)					Difference Between DOE and			
	DOE	Method 1	Method 2	Method 3	Adj M3	Method 1	Method 2	Method 3	Adj M3
1995	2,368	2,365	2,365	2,365	2,365	0.12%	0.12%	0.12%	0.12%
1996	2,432	2,416	2,416	2,416	2,416	0.66%	0.66%	0.66%	0.66%
1997	2,503	2,467	2,467	2,467	2,467	1.46%	1.46%	1.46%	1.46%
1998	2,600	2,511	2,511	2,511	2,511	3.56%	3.56%	3.56%	3.56%
1999	2,573	2,553	2,553	2,553	2,553	0.79%	0.79%	0.79%	0.79%
2000	2,631	2,613	2,613	2,613	2,613	0.69%	0.69%	0.69%	0.69%
2001	2,750	2,635	2,635	2,635	2,777	4.35%	4.35%	4.35%	-0.97%
2002	2,831	2,686	2,685	2,688	2,832	5.39%	5.43%	5.32%	-0.05%
2003	2,876	2,723	2,722	2,728	2,875	5.60%	5.65%	5.42%	0.05%
2004	2,927	2,743	2,742	2,751	2,899	6.70%	6.76%	6.39%	0.97%
2010	3,228	2,968	2,982	3,021	3,183	8.77%	8.25%	6.86%	1.41%
2015	3,548	3,130	3,142	3,213	3,385	13.35%	12.91%	10.44%	4.81%
2020	3,896	3,306	3,290	3,394	3,576	17.85%	18.43%	14.79%	8.94%
2025	4,261	3,446	3,438	3,571	3,763	23.66%	23.95%	19.32%	13.24%
2030	4,660	3,542	3,597	3,753	3,955	31.57%	29.54%	24.17%	17.84%

DATA SOURCES

National Center for Health Statistics, Center for Disease Control. *National Vital Statistics Report: 2001*. Washington, D.C. (historical birth data)

U.S. Bureau of the Census. *Components of Change for the Total Resident Population: Middle Series, 1999 to 2100*. Washington, D.C. (birth projections)

U.S. Department of Energy, Energy Information Administration. *Annual Energy Outlook 2006; Annual Energy Outlook 2005; Annual Energy Outlook 2004; Annual Energy Outlook 2003; Annual Energy Outlook 2002; Annual Energy Outlook 2001; Annual Energy Outlook 2000; Annual Energy Outlook 1999; Annual Energy Outlook 1998*. (vehicle miles traveled data, fuel efficiency data)

U.S. Department of Transportation, Federal Highway Administration. *Highway Statistics 2003; Highway Statistics 2002; Highway Statistics 2001; Highway Statistics 2000; Highway Statistics 1999; Highway Statistics 1998; Highway Statistics Summary 1997; Highway Statistics 1996; Highway Statistics Summary to 1995*. (licensed drivers by age group data)

U.S. Department of Transportation, Center for Transportation Analysis. *2001 National Household Travel Survey; 1995 National Personal Transportation Survey; 1990 National Personal Transportation Survey; 1983 National Personal Transportation Survey; 1977 National Personal Transportation Survey, 1969 National Personal Transportation Survey*. (vehicle miles traveled by age group data)

REFERENCES

- Day, Jennifer Cheeseman. "National Population Projections". U.S. Census Bureau: 18 Jan 2001 <<http://www.census.gov/population/www/pop-profile/natproj.html>>
- Energy Information Administration (EIA), Office of Integrated Analysis and Forecasting. "The National Energy Modeling System: An Overview 2003". Department of Energy: March 2003 <<http://tonto.eia.doe.gov/FTP/forecasting/05812003.pdf>>
- Gately, Dermot (1992). "Imperfect Price-Reversibility of U.S. Gasoline Demand". *The Energy Journal* 13(4): 179-207.
- Gately, Dermot (1990). "The U.S. Demand for highway Travel and Motor Fuel". *The Energy Journal* 11(3): 59-73.
- Gately, Dermot and Peter Rappoport (1988). "The Adjustment of US Oil Demand to the Price Increases of the 1970's". *The Energy Journal* 9(2): 93-107.
- Hu, Patricia S. "Summary of Travel Trends: 2001 National Household Travel Survey". Department of Transportation: Dec 2004 <<http://nhts.ornl.gov/2001/pub/STT.pdf>>
- Pickrell, Don & Paul Schimek. "Trends in Personal Motor Vehicle Ownership and Use: Evidence from the National Personal Transportation Survey". Department of Transportation: 23 April 1998 <<http://npts.ornl.gov/npts/1995/Doc/Envecon.pdf>>.
- Schipper, Mark & Vicki Moorhead (2000). "Odometer Versus Self-Reported Estimates of Vehicle Miles Traveled". Energy Information Administration: 3 Aug. 2000 <<http://www.eia.doe.gov/emeu/consumptionbriefs/transportation/vmt/vmt.html>>.