

## REPORT DOCUMENTATION

### TITLE

Mode Choices of Millennials:  
How Different? How Enduring?

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### ABSTRACT

It has been written that workers currently aged 15-33—known as the Millennial generation—tend to use cars less often, and use alternative modes more often, than those of previous generations. This analysis seeks therefore to determine whether—in fact—such persons do have high usage of alternative modes (“How Different?”), and whether that behavior is expected to continue in the future (“How Enduring?”), i.e. *whether we should plan for much higher demand for alternative transportation in the future in Hampton Roads*. To answer this question, HRTPO staff isolated generational effects from age and period effects by compiling and regressing a dataset of National Household Travel Survey (NHTS) records from three different years: 1983, 1995, and 2008/2009. The analysis revealed highly significant relationships between alternative mode usage for commuting and nearly all of the independent variables selected, allowing the authors to provide an answer to the stated question.

### ACKNOWLEDGMENTS

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## INTRODUCTION

### Motivation and Purpose

The literature suggests that Millennials (considered by some to be born 1982 through 2000) are more likely to use alternative modes than members of previous generations. The resulting research question is:

“Given these Millennial reports, should we plan for much higher demand for alternative transportation in the future?”

If Millennials’ preference for alternative modes is a function of their age and the current economy (both of which will change)—as opposed to an inherent generational trait (which will not change)—the usage of alternative modes by all generations in the future will likely be similar to that of today. Therefore, in order to answer the research question, this analysis seeks to answer two precedent questions about Millennial travel:

1. “How different is it?” (i.e. Millennial transportation vs. other generations), and
2. “How enduring is this difference expected to be?” (i.e. will Millennials still favor alternative transportation when their age and the economy change? And will future generations have a travel bent similar to that of Millennials?)

To answer these generational questions, one must delve into age and era, as shown graphically in Table 1 below.

1. How does Millennials’ modal behavior differ from that of other generations today?

2. How enduring is this different behavior expected to be?

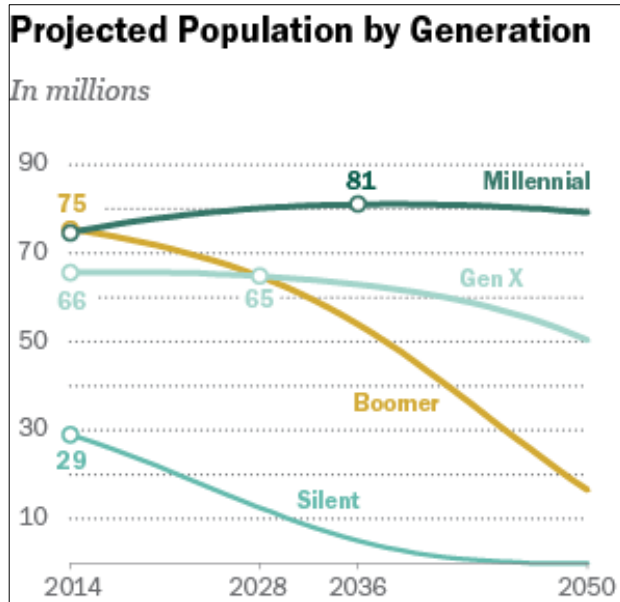
Should we expect Millennials to retain these habits over, say, the next 30 years?

Will the generation that follows Millennials share their travel traits?

**TABLE 1 Era-Age-Generation Relationships of Study Questions**

	Younger People	Older People
2045	Generation Z	Millennials
2015	Millennials	Baby Boomers
1985	Baby Boomers	Silent Generation

Source: HRTPO Staff



**FIGURE 1 Projected population by generation, U.S.**

Note: *Millennial* refers to those aged 18-34 as of 2015.  
 Source: Pew Research Ctr. tabulations of U.S. Census Bureau population projections released Dec. 2014 (2)

In recent years, the U.S. has experienced substantial demographic shifts that have affected employment, diversity, housing, transportation, and other aspects of American life. According to Figure 1, the Millennial generation, also called Generation Y, will outnumber Baby Boomers this year (2). Millennials already make up the largest share of the American workforce at 34%, followed by Generation Xers and Baby Boomers, at 32% and 31%, respectively (3).

Millennials have demonstrated travel behavior that distinguishes them from their predecessors. As communities plan how to invest limited resources to serve future transportation needs, travel behavior is a key indicator of the infrastructure and programs required to move people and goods safely and efficiently.

Before attempting to predict future needs, decision-makers should know whether current trends will last. This knowledge will enable them to make investments reflecting enduring, rather than temporary, changes.

## MODE CHOICES OF MILLENNIALS: HOW DIFFERENT?

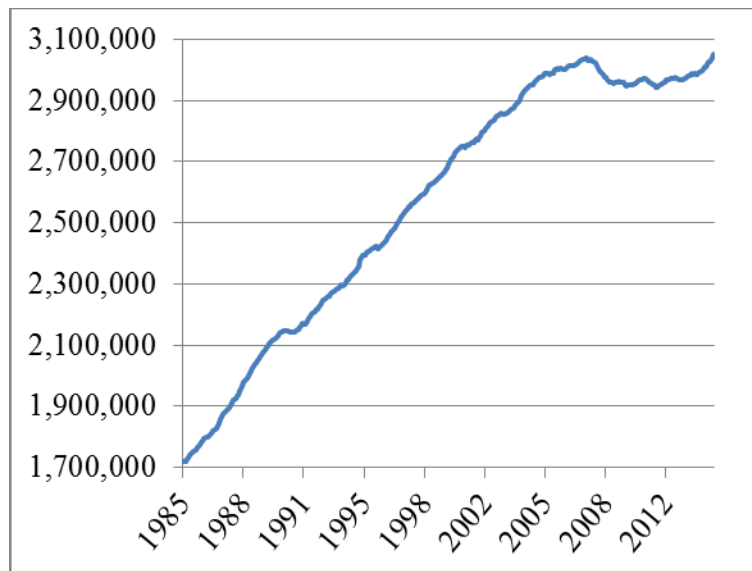
In the first section below, we reviewed appropriate transportation literature to see if someone had already answered the question of how the mode choices of Millennials across the U.S. differ from those of other generations. In the second section, staff performed its own analysis of Millennials vs. others for Hampton Roads.

### United States Data

There is plentiful existing research based on survey data that documents the mode choices of Americans. Most studies examine either the general population or individual groups segregated by age or generation. These will be described in the next sections.

#### *Mode Choice of the General Population*

Concerning the mode choices of the general population, from 1979 to 2007 the U.S. experienced a steady rise in overall annual Vehicle Miles Traveled (VMT). After this trend peaked in 2007 at 3 trillion annual VMT, the number decreased slightly but has remained fairly constant and shown a modest rebound since 2011 (see Figure 2). A report released by the Federal Highway Administration (FHWA) in April 2015 shows that “Americans drove 221.1 billion miles in February [2015] – a 2.8 percent increase over the previous February, and the second-most ever driven in February” and that “over the first two months of 2015, U.S. driving increased over the same period in 2014 by 3.9 percent (9).”



**FIGURE 2 Vehicle-miles traveled in U.S.**

Source: St. Louis Federal Reserve, 2015 (8)

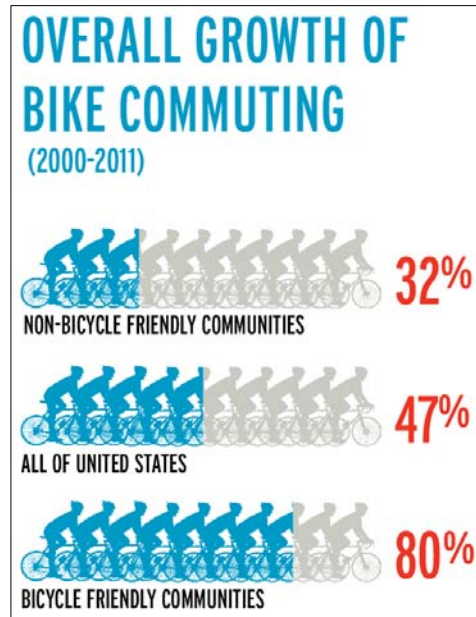
Although VMT is not increasing as steadily as it did before the economic recession that began in 2008, Americans still exude a strong predisposition to commute by car. In fact, in 2000, 87.9% of American workers used an automobile to get to work (10), and 86.1% did the same in 2013 (11).

Although much less prevalent than driving, biking to work has become more popular nationally, even doubling in some cities. For instance, from 1990 to 2011 Philadelphia’s portion of bike commuters has more than doubled; Washington, D.C. experienced a threefold increase (315%), and Lexington, Kentucky’s share of commutes by bike more than quadrupled (a 435% increase) (12). Related growth is shown in Figure 3.

Although biking is an increasingly popular mode choice in some cities, it still represents only a small fraction of commuting in the nation’s largest metros: New York (1.2%), Los Angeles (1.2%), and Chicago (1.4%) (13, p. 3).

#### *Mode Choice of Millennials*

According to the literature, Millennials place high importance on the ability to get around without a car. Fifty-four percent of them would consider moving to another city for a better, wider range of transportation options (14, p. 9). In addition, parents under age 30 who have school-age children are more likely to use transit than those over age 30 (5, p. 6). Some studies have found that certain lifestyle characteristics of Millennials decrease their propensity to drive when compared to previous generations. These include complex living arrangements, lower incomes, lower licensure rate (6, p. 62), living in walkable neighborhoods, and usage of mobile technologies (7, pp. 23, 25).



**FIGURE 3 Overall growth of bike commuting, U.S.**

Source: The Growth of Bike Commuting (The League of American Bicyclists, 2014) (10)

From 2001 to 2009, among young workers (aged 16 to 34, therefore born between 1967 and 1993, therefore consisting of Generation Xers and Millennials), the percentage of trips per capita by car decreased. Meanwhile, the percentage of trips by transit, walking, and biking increased, as shown in Figure 4.

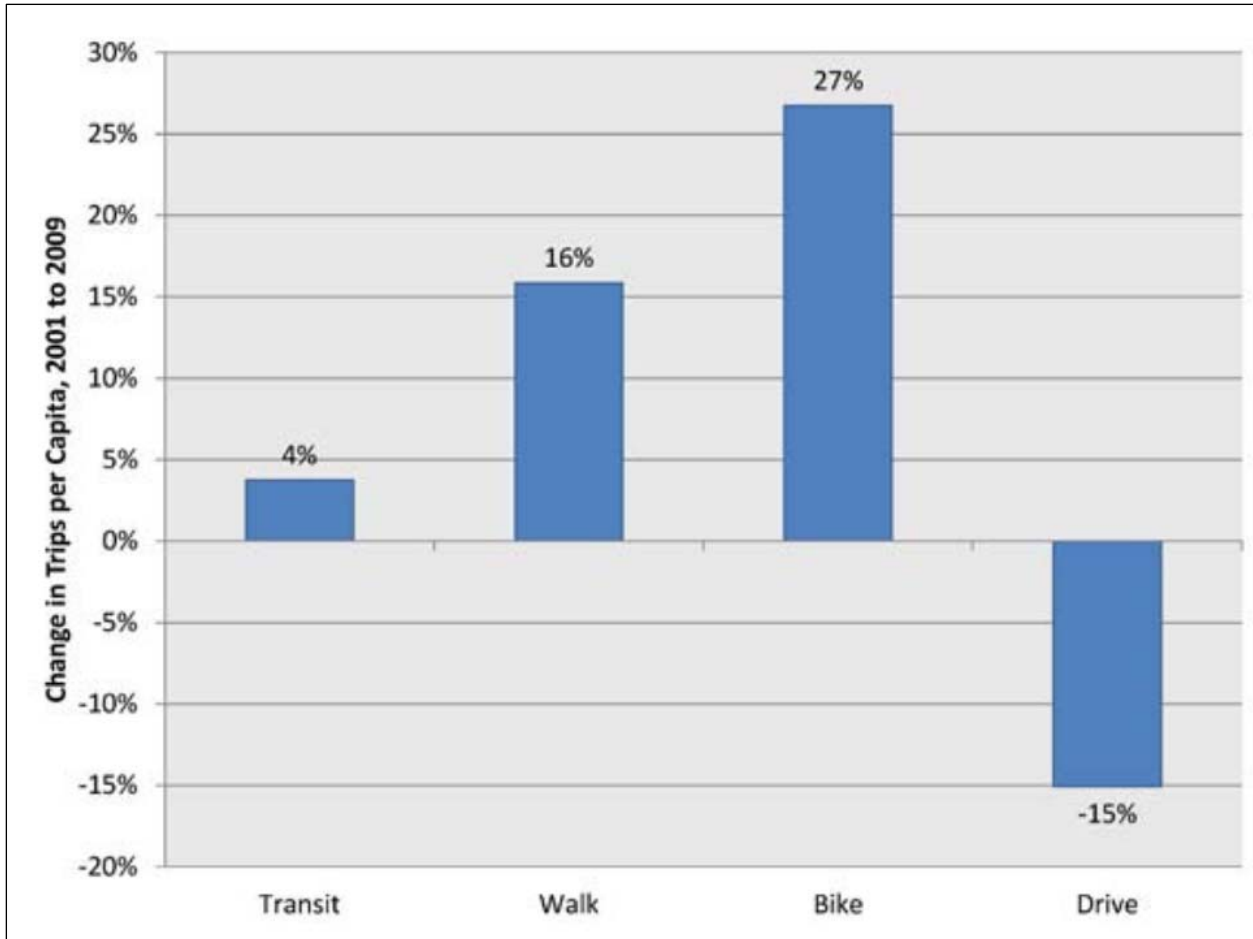
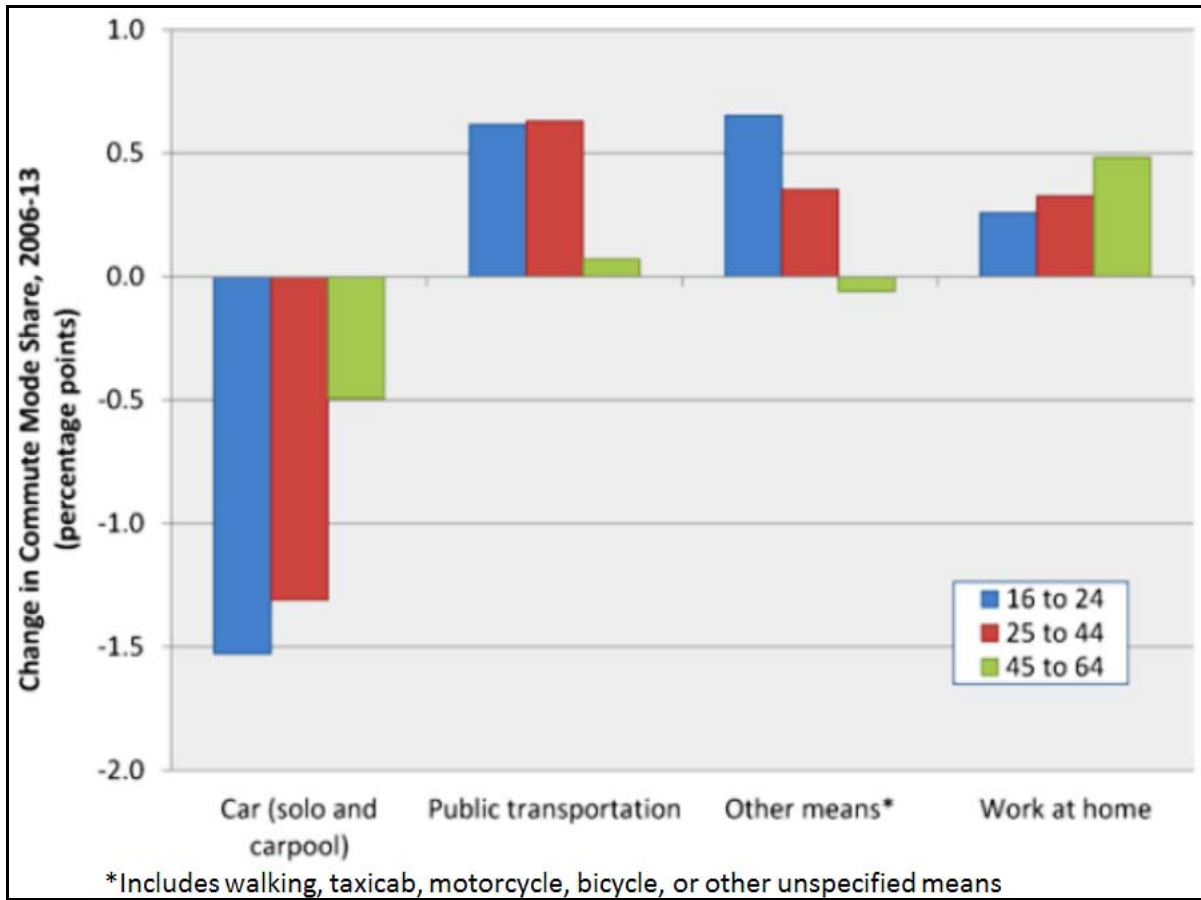


FIGURE 4 Change in number of trips per capita among 16 to 34 year-olds, 2001 to 2009, U.S.  
Source: Millennials in Motion (U.S. PIRG, 2014) (16, p. 11)

Between 2006 and 2013, young workers (aged 16 to 24, therefore born between 1982 and 1997, and thus part of the Millennial generation) experienced the greatest decrease in commute trips made by car (both driving alone and commuting by carpool), as shown in Figure 5 below.



**FIGURE 5 Change in commute mode share, 2006 to 2013, by age group, U.S.**

Source: Millennials in Motion (U.S. PIRG, 2014) (16, p. 12)



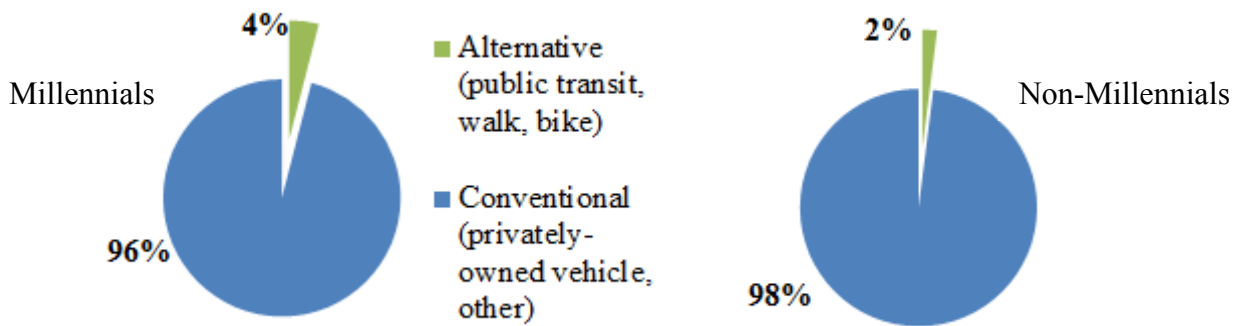
## Hampton Roads Data

To examine how the mode choices of Millennials (born 1982 through 2000) differ from those of other ages and generations in Hampton Roads, HRTPO staff used the 6,690 Hampton Roads person records in the most recent National Household Travel Survey (NHTS) dataset (2008/2009). Those whose mode to work was either unknown or appropriately skipped were excluded from the table.

**TABLE 2 Millennial vs. Non-Millennial Workers, Hampton Roads, 2008/09, Unweighted**

Binary Variables	<u>Millennials</u>				<u>Non-Millennials</u>			
	Observations	Share (%)	Min	Max	Observations	Share (%)	Min	Max
<u>Age</u>								
16-17	38	14	0	1	0	0	0	0
18-34	233	86	0	1	189	8	0	1
35-54	0	0	0	0	1321	55	0	1
55-74	0	0	0	0	846	35	0	1
75+	0	0	0	0	29	1	0	1
	271	100			2385	100		
<u>Gender</u>								
Male	130	48	0	1	1238	52	0	1
Female	141	52	0	1	1137	48	0	1
	271	100			2385	100		
<u>Total Annual Household Income</u>								
<\$20,000	8	3	0	1	81	3	0	1
\$20,000-\$39,999	35	13	0	1	244	10	0	1
\$40,000-\$59,999	50	18	0	1	397	17	0	1
\$60,000-\$99,999	105	39	0	1	839	35	0	1
\$100,000+	73	27	0	1	824	35	0	1
	271	100			2385	100		
<u>MSA Population</u>								
<1 million	0	0	0	0	0	0	0	0
1 million-3 million	271	100	1	1	2385	100	1	1
>3 million	0	0	0	0	0	0	0	0
Household not in MSA	0	0	0	0	0	0	0	0
MSA size not identified	0	0	0	0	0	0	0	0
	271	100			2385	100		
<u>Urbanized Area Status</u>								
Household in Urbanized Area	240	89	0	1	2059	86	0	1
HH not in Urbanized Area	31	11	0	1	326	14	0	1
Urbanized Area status unknown	0	0	0	0	0	0	0	0
	271	100			2385	100		
<u>Mode to work</u>								
<b>Alternative modes (public transit, walk, bike)</b>	<b>12</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>55</b>	<b>2</b>	<b>0</b>	<b>1</b>
Conventional modes (privately-owned vehicle, other)	259	96	0	1	2330	98	0	1
	271	100			2385	100		

Source: HRTPO staff analysis of NHTS data



**FIGURE 6 Mode to work by generations, Hampton Roads, NHTS, 2008/2009, unweighted**  
 Source: HRTPO Staff

As shown in Table 2 and Figure 6 above, Millennials in Hampton Roads use alternative modes to work *twice as frequently* as Non-Millennials.

**Summary: How Different?**

In the first section above—examining the literature for U.S. data—staff discovered that:

- From 2001 to 2009, workers age 16 to 34 (Generation Xers and Millennials) shifted somewhat from cars to public transit, walking, and biking.
- Workers age 16 to 24 (Millennials) shifted somewhat from cars to transit and other means between 2006 and 2013.

In the second section above—staff analysis of local NHTS data—staff discovered that:

- Millennials in Hampton Roads use alternative modes to work twice as frequently as Non-Millennials.

## MODE CHOICES OF MILLENNIALS: HOW ENDURING?

### Literature Review

In order to a) determine whether someone has already answered the second precedent question—“How enduring do we expect Millennial mode choices to be?”—and b) determine how to design an original analysis to answer this question, HRTPO staff reviewed appropriate transportation literature.

#### *Millennial Mode Choice in the Future*

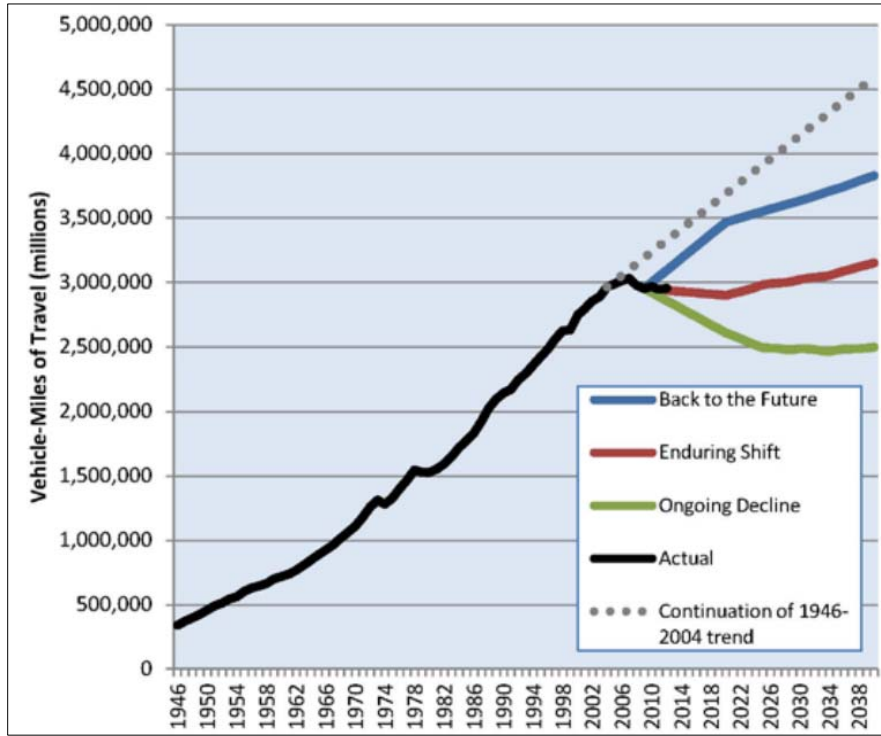
Some studies attempt to predict travel behavior of Millennials based on current observations and comparisons to other generations. For example, Millennials are characterized as embracing new technologies that could shape their future travel behavior (18, pp. 19-22).

Housing can be used to forecast alternative mode usage. One study found that construction of multifamily housing has rebounded to the level experienced prior to the Great Recession, while construction of single-family residences remains sluggish (16, p. 15). In addition, it has been predicted that multifamily housing construction will continue to accelerate faster than single-family (19, p. 29). This is an important finding because workers living in multifamily housing are more likely to use alternative transportation.

Dutzik and Baxandall have suggested three possible travel growth scenarios (7, pp. 29-30):

1. *Back to the Future* Under this scenario, the U.S. decline in driving since 2004 is assumed to be temporary. This is consistent with the view that the recent decline in driving is due to poor economic conditions and higher gas prices. As these conditions reverse, the travel preferences of Millennials will increasingly mimic those of previous generations.
2. *Enduring Shift* In this scenario, the shift in travel behavior that has occurred over the last decade is assumed to be lasting. This is consistent with the view that the shift in preferences embraced by Millennials will be embraced by future generations as they reach driving age.
3. *Ongoing Decline* This scenario assumes that the decline in driving over the last decade is the beginning of a broader change that makes driving less necessary. The outcome of this scenario is that driving will stabilize at a much lower level per capita.

These scenarios are represented graphically in Figure 7 below.



**FIGURE 7 Vehicle-miles traveled under three scenarios, U.S.**

Source: A New Direction (U.S. PIRG, 2013) (5, p. 30)

*Conceptual Framework for Original Analysis*

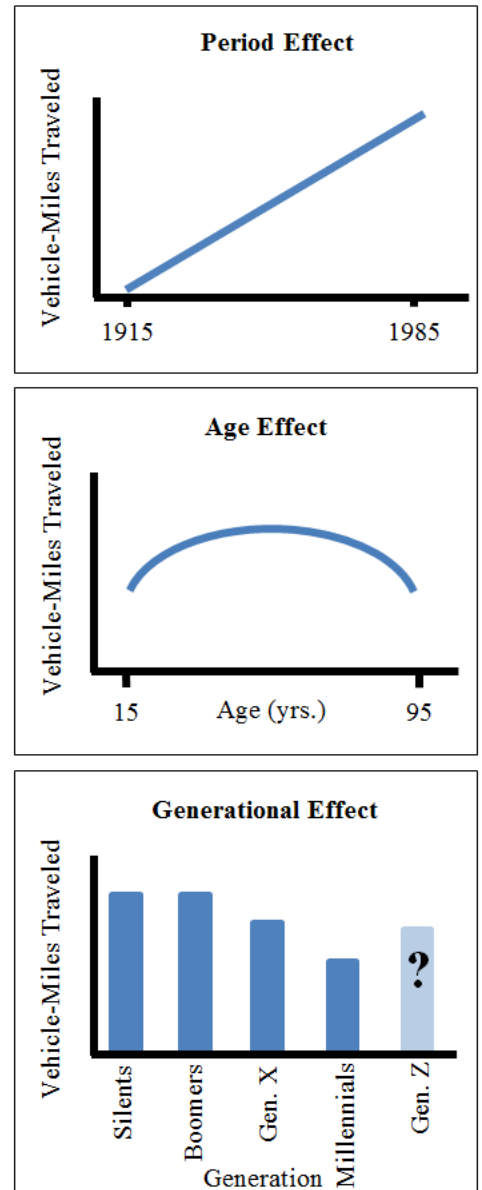
HRTPO staff reviewed the literature to aid in designing an original analysis that would help answer the research question.

For generational research, the literature identifies the following types of effects on travel behavior (3, p. 9), (4, p. 3):

1. *Period (or Era) Effect* The effect of a situation that impacts an entire population for a period of time.
  - Example: WWII
2. *Age Effect* An effect associated with a particular person age.
  - Examples: Being of high school age, being of working age, being of retirement age
3. *Generational Effect* The effect of an event whose consequences follow a group of people, born at a specific time, throughout their lifetimes.
  - Example: The Great Depression’s effect on the Silent Generation

These are represented graphically in Figure 8.

Based on the literature, staff designed the original analysis to consider each of these three effects on mode choice. This allowed us to determine what portion of the current mode choices of Millennials can be explained by income and age (which will change) and by generation (which will not change).



**FIGURE 8 Three types of effects on VMT.**

Source: HRTPO Staff

## **Original Research**

Having found no study that answers the second precedent question—“How enduring do we expect Millennial mode choices to be?”—HRTPO staff designed a regression analysis to answer it.

### *Source of Data*

In order to conduct an original analysis that considers each of the above effects on mode choice from the literature—age, era, and generation—HRTPO staff chose the National Household Travel Survey (NHTS), a comprehensive travel survey conducted by FHWA approximately every 7 years since 1969. A lone “snapshot” survey (taken once, in a particular year) may contain person ages, and from this generation can be calculated, but—given the snapshot—it does not enable the analyst to parse the age and generational effects. A multi-year survey like the NHTS, on the other hand, enables the analyst to isolate age, generation, and era effects using multiple regression.

### *Variables for Regression*

**Dependent Variable** The second precedent question being related to mode choice, HRTPO staff chose usage of alternative mode to work (i.e. for commuting) as the dependent variable. In the 1983 and 1995 NHTS surveys, this was described as “principal (or main) means of transportation to work.” In the 2008/2009 survey, this variable was labeled as “transportation mode to work last week.”

HRTPO staff categorized each mode as either “alternative” or “conventional” in each year’s dataset as shown in Table 3.

**TABLE 3 Mode to Work Variables in the Three Datasets**

1983		1995		2008/2009	
Alternative	Conventional	Alternative	Conventional	Alternative	Conventional
Bus	Auto	Bus	Automobile	Local public bus	Car
Train	Station wagon	Amtrak	Van	Commuter bus	Van
Streetcar	Pass. van	Commuter train	Sport utility vehicle	City to city bus	SUV
Elevated rail/subway	Other van	Streetcar/trolley	Pickup truck	Shuttle bus	Pickup truck
Bicycle	Pickup truck	Subway/elevated rail	Other truck	Amtrak/intercity train	Other truck
Walk	Pickup with camper	Bicycle	RV	Commuter train	RV
	Other truck	Walk	Motorcycle	Subway/elevated train	Motorcycle
	Motorized camper coach	Other public transit	Other private vehicle	Street car/trolley	Light electric veh (golf cart)
	Motorcycle		Plane	Ferry	School bus
	Motorized bicycle/moped		Taxi	Bicycle	Charter/tour bus
	Work at home		School bus	Walk	Taxi
	Other (POV)		Other	Special transit-people w/disabilities	Plane
	Plane				Other
	Taxi				
	School bus				
	Other				

Source: HRTPO staff analysis of NHTS data

Records without mode choice information (no answer, legitimate/appropriate skip, not ascertained, refused, don't know, and unknown) had to, of course, be omitted from the dataset.

**Independent Variables- Policy Variables** The second precedent question being related to Millennials, HRTPO staff used a Millennial binary variable (Millennial=1, other=0) as the policy variable.

**Independent Variables- Control Variables** In order to isolate the effect of the policy variable—Millennial—HRTPO staff included era, age, and other generations as control variables, as guided by the literature.

*Era* NHTS Datasets from the Reagan Era (1983), Clinton Era (1995), and Bush/Obama Era (2008/2009) were selected. (The 2008/2009 NHTS contains survey results from March 2008 through May 2009 (1).)

*Age* To improve the likelihood of obtaining statistically significant results, ages were grouped into the following categories:

1. 16-17 years old
2. 18-34 years old
3. 35-54 years old
4. 55-74 years old
5. 75+ years old

*Generation* Although authors disagree on generational year boundaries, HRTPO staff used NHTS year and age data to calculate generation based on the following ranges of birth years:

1. Lost Generation (b. 1883-1900)
2. G.I. Generation (b. 1901-1924)
3. Silent Generation (b. 1925-1945)
4. Baby Boomer Generation (b. 1946-1964)
5. Generation X (b. 1965-1981)
6. Millennial Generation (b. 1982-2000)

In addition to era, age, and generation; the literature and logic dictate controlling for other demographic characteristics when studying mode choice, as follows.

*Gender* Males and females having shown different travel patterns in the literature, gender was included as a control variable.

*Household Income* In the 1983 and 1995 NHTS datasets, HRTPO staff calculated household income by combining family and non-family incomes. Then, this number was adjusted for inflation to 2009 dollars using the Bureau of Labor Statistics' Consumer Price Index. In 2009, with total household income being reported as a single figure, no adjustment was necessary.

Total household income was divided into five categories:

1. <\$20,000
2. \$20,000-\$39,999
3. \$40,000-\$59,999
4. \$60,000-\$99,999
5. \$100,000+

*MSA Population Category* Concerning Metropolitan Statistical Areas (MSAs), respondents' household locations were classified as follows:

1. Household not in MSA
2. MSA size not identified
3. MSA with population <1 million
4. MSA with population 1 million - 3 million
5. MSA with population >3 million



*Urbanized Area Status* In the 1983 and 2008/2009 NHTS person datasets, all respondents were classified as either living in an Urbanized Area, or not. For the 1995 dataset, HRTPO staff had to transfer this variable from the household dataset to our person dataset.

### *Data Preparation*

The raw 1983 NHTS dataset (national) contains 17,383 observations. The 1995 and 2008/2009 sets contain 95,361 and 308,902 observations, respectively. Due to computational limitations, HRTPO staff reduced the sizes of the later two sets to approximately that of the first set using random selection. Then, HRTPO staff combined all three sets into one for the analysis.

All variables (dependent and independent) in this analysis were entered into the regression in binary form. For the discrete variables in the NHTS dataset (era, generation, gender, MSA population category, and Urbanized Area status), a set of sub-variables was created for each. For example, HRTPO staff created an “era” set containing three sub-variables: “Reagan Era (1983),” “Clinton Era (1995),” and “Bush/Obama Era (2008/2009).” The record of a person from the 1995 NHTS survey was given a “1” in “Clinton Era (1995)” column, and a “0” in each of the other “era” columns. For the continuous NHTS variables—age and income—HRTPO staff transformed each into a categorical variable set as described on the previous page.

The dependent variable—mode to work—was categorical in the NHTS data set. Given our focus on alternative transportation, HRTPO staff converted the NHTS mode data into a binary variable: alternative vs. conventional. Records that had missing or unknown responses to the mode question were excluded from the analysis.

**Handling Missing Data** As written above, the dependent variable being mode to work, persons who did not go to work were excluded from the final dataset. Records with missing data on income (an independent variable), however, were given the average income of respondents reporting such data.

### *Description of Data Set*

The values of the variables used in this analysis are shown in Table 4 below.

**TABLE 4 Descriptive Statistics (unweighted)**

Binary Variables	Observations	Share (%)	Min	Max
<u>Era</u>				
Reagan Era (1983)	7,560	34	0	1
Clinton Era (1995)	8,352	37	0	1
Bush/Obama Era (2008/2009)	6,571	29	0	1
	22,483	100		
<u>Age</u>				
16-17	508	2	0	1
18-34	7,288	32	0	1
35-54	10,369	46	0	1
55-74	4,164	19	0	1
75+	154	1	0	1
	22,483	100		
<u>Generation</u> <u>Years born</u>				
Lost Generation	1883-1900	5	0	1
G.I. Generation	1901-1924	696	3	1
Silent Generation	1925-1945	5,065	23	1
Baby Boomer Generation	1946-1964	11,830	53	1
Generation X	1965-1981	4,266	19	1
Millennial Generation	1982-2000	621	3	1
	22,483	100		
<u>Gender</u>				
Male	11,707	52	0	1
Female	10,776	48	0	1
	22,483	100		
<u>Total Annual Household Income</u>				
<\$20,000	1,573	7	0	1
\$20,000-\$39,999	4,168	19	0	1
\$40,000-\$59,999	4,582	20	0	1
\$60,000-\$99,999	7,649	34	0	1
\$100,000+	4,511	20	0	1
	22,483	100		
<u>MSA Population</u>				
<1 million	6,489	29	0	1
1 million-3 million	4,744	21	0	1
>3 million	6,605	29	0	1
Household not in MSA	4,237	19	0	1
MSA size not identified	408	2	0	1
	22,483	100		
<u>Urbanized Area Status</u>				
Household in Urbanized Area	14,704	65	0	1
Household not in Urbanized Area	7,733	34	0	1
Urbanized Area status unknown	46	0	0	1
	22,483	100		
<u>Mode to work</u>				
Alternative modes (public transit, walk, bike)	1,837	8	0	1
Conventional modes (privately-owned vehicle, other)	20,646	92	0	1
	22,483	100		

In our dataset of 22,483 NHTS person records from the 1983, 1995, and 2008/2009 surveys, 8% of the (working) persons used alternative means to get to work, 0.5% bike, 3.0% walk, and 4.6% use public transportation.

Baby Boomers, not surprisingly, comprise half of the dataset, with the Silent and X generations contributing approximately one-fifth of the records, each. Millennials, who only appear as workers in the latest survey, comprise 9% of the 2008/2009 set and 3% of the total database. Records are evenly split between males and females. Median household income is approximately \$60,000 per year. Four-fifths of the persons lived in an MSA, and two-thirds lived in an Urbanized Area.

### Regression

Given the binary nature of the dependent variable (alternative mode to work), binary logistic regression was performed (using SPSS). Coming from a logistic regression, the model estimates the odds of the subject person using alternative transportation to work, as follows:

$$\text{Odds}_i = e^{(\beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_n X_n)}$$

where  $\text{Odds}_i$  is the odds of using an alternative mode,  $X_1$  through  $X_n$  are the regressors,  $\beta_1$  through  $\beta_n$  are the coefficients of those regressors, and  $\beta_0$  is the “Constant” at the end of the regression results. In addition, for ease of interpretation, “Odds Factors” have been calculated for the coefficients of the (binary) independent variables (Table 6, following page). Each “Odds Factor” indicates the impact of the subject regressor/variable being 1 (or true) on the odds of using an alternative mode, vs. the basis. For example, if an odds factor for a “male” variable (vs. basis variable “female”) is 0.9 and the odds of Betty using alternative transportation is 0.50:1 (for:against, i.e. a 33% chance), then the odds of Betty’s twin brother Bill using alternative transportation—all other things (besides gender) being equal—would be 0.45:1 ( $0.50 \times 0.9 = 0.45$ ; 0.45:1 odds is a 31% chance).

A basis variable in each set of independent variables being needed for the regression and the calculation of odds factors, basis variables were selected as summarized in Table 5 below.

**TABLE 5 Basis Variables**

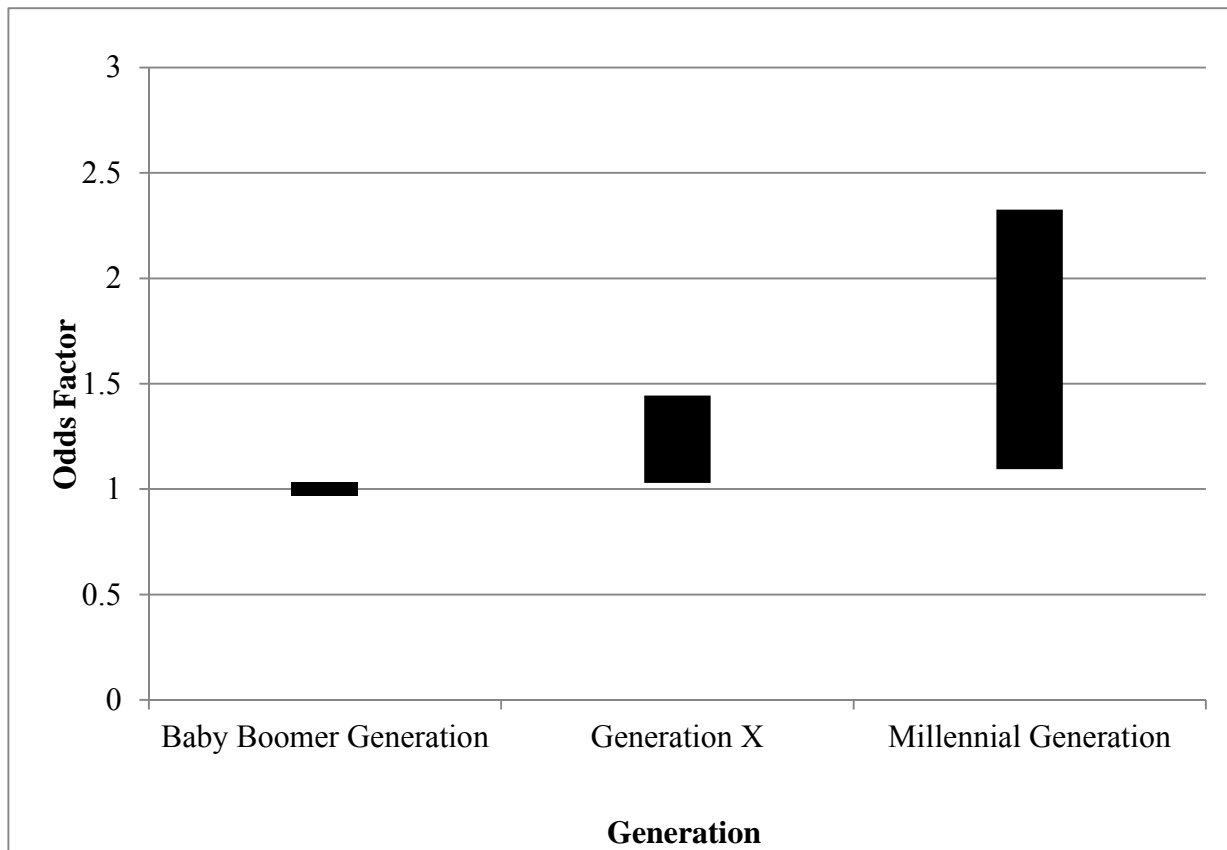
Variable Set	Basis Variable (to which other variables are compared)
Era	Reagan Era (1983)
Age	16-17
Generation	Baby Boomer Generation
Gender	Female
Total Annual Household Income	\$40,000-59,999
MSA Population	Household not in MSA
Urbanized Area	Household not in Urbanized Area

The regression results are summarized in Table 6 on the following page.



Statistically, the model has great explanatory power (to be interpreted carefully given the inherent causation issues of regression). The -2 Log Likelihood was 11,269, the Nagelkerke R-Square was 0.145, and 24 of the 29 independent variables are statistically significant at the 95% level.

The odds factor results are represented in the charts below, by independent variable category. Each chart includes the odds factor of the basis variable (1.000), to which all other factors in the category are compared. The odds factors are shown as a combination of their lower and upper 95% confidence levels.

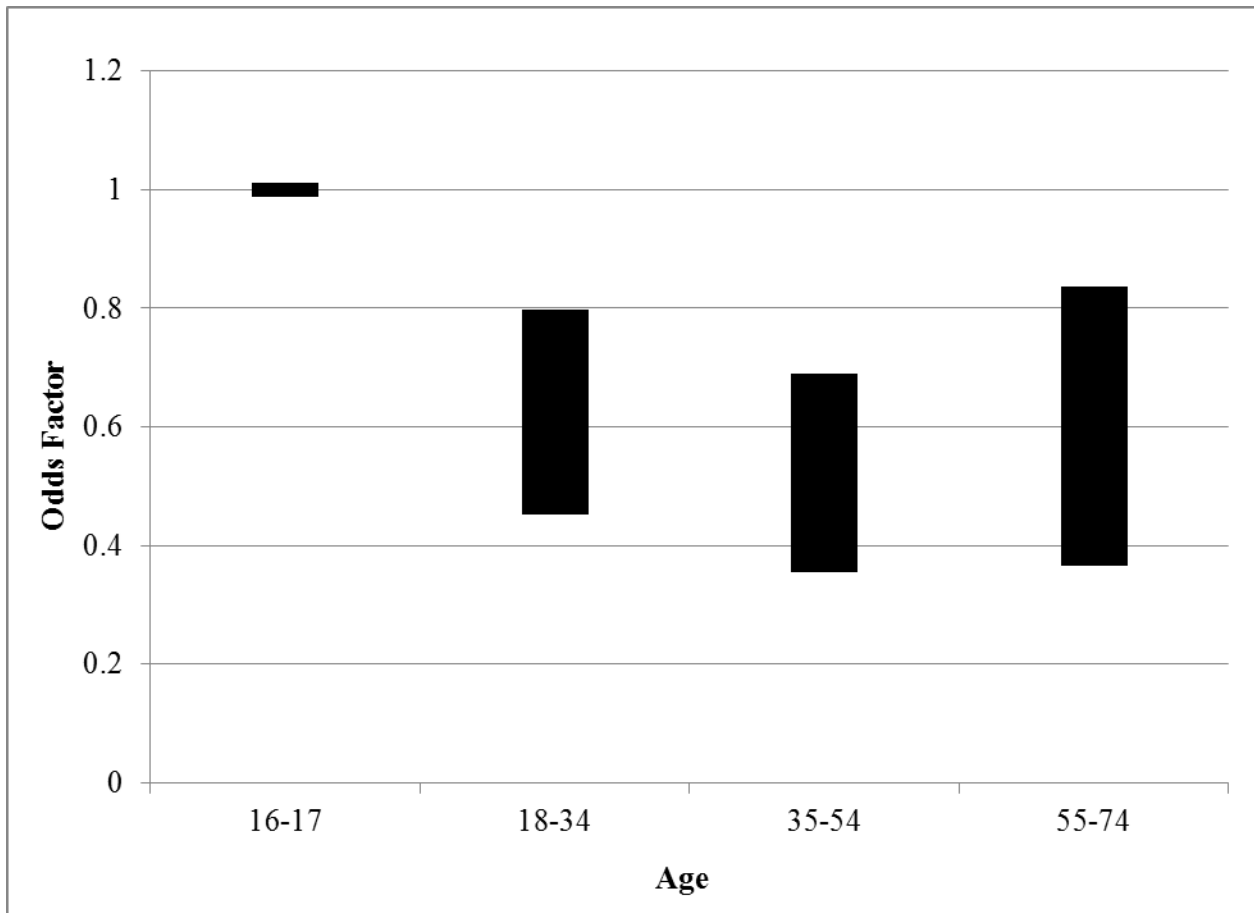


**FIGURE 9 Alternative mode to work, by generation, odds factor (vs. Boomers), U.S., NHTS.**

Note: Bars represent 95% confidence interval.

The model coefficients for the Lost Generation, the G.I. Generation, and the Silent Generation being statistically insignificant, odds factor estimates for those generations are not shown on the above figure.

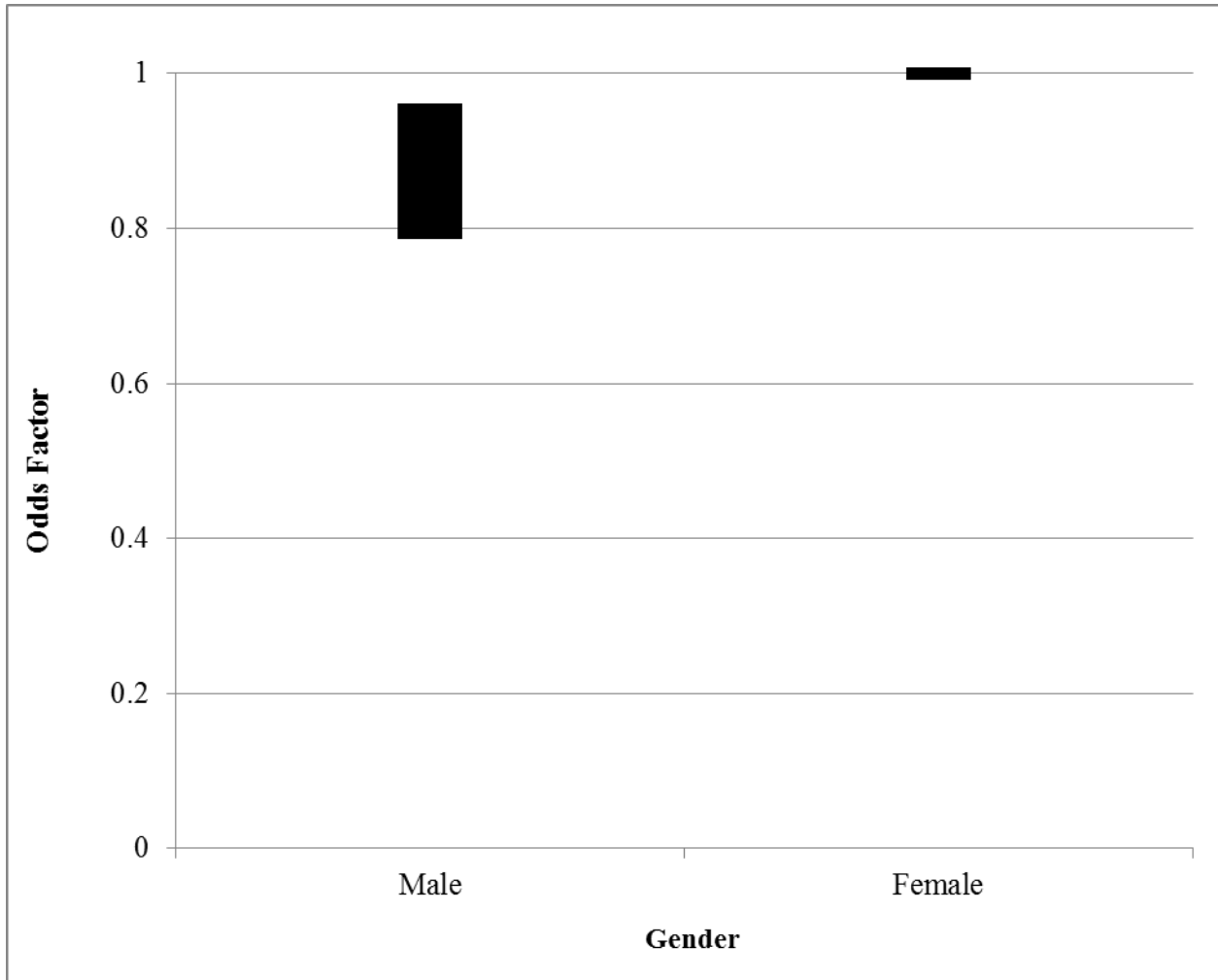
As shown in Figure 9, all other things being equal, the predisposition to use alternative modes increased slightly with each generation following the Baby Boomers.



**FIGURE 10 Alternative mode to work, by age, odds factor (vs. 16-17), U.S., NHTS.**  
 Note: Bars represent 95% confidence interval.

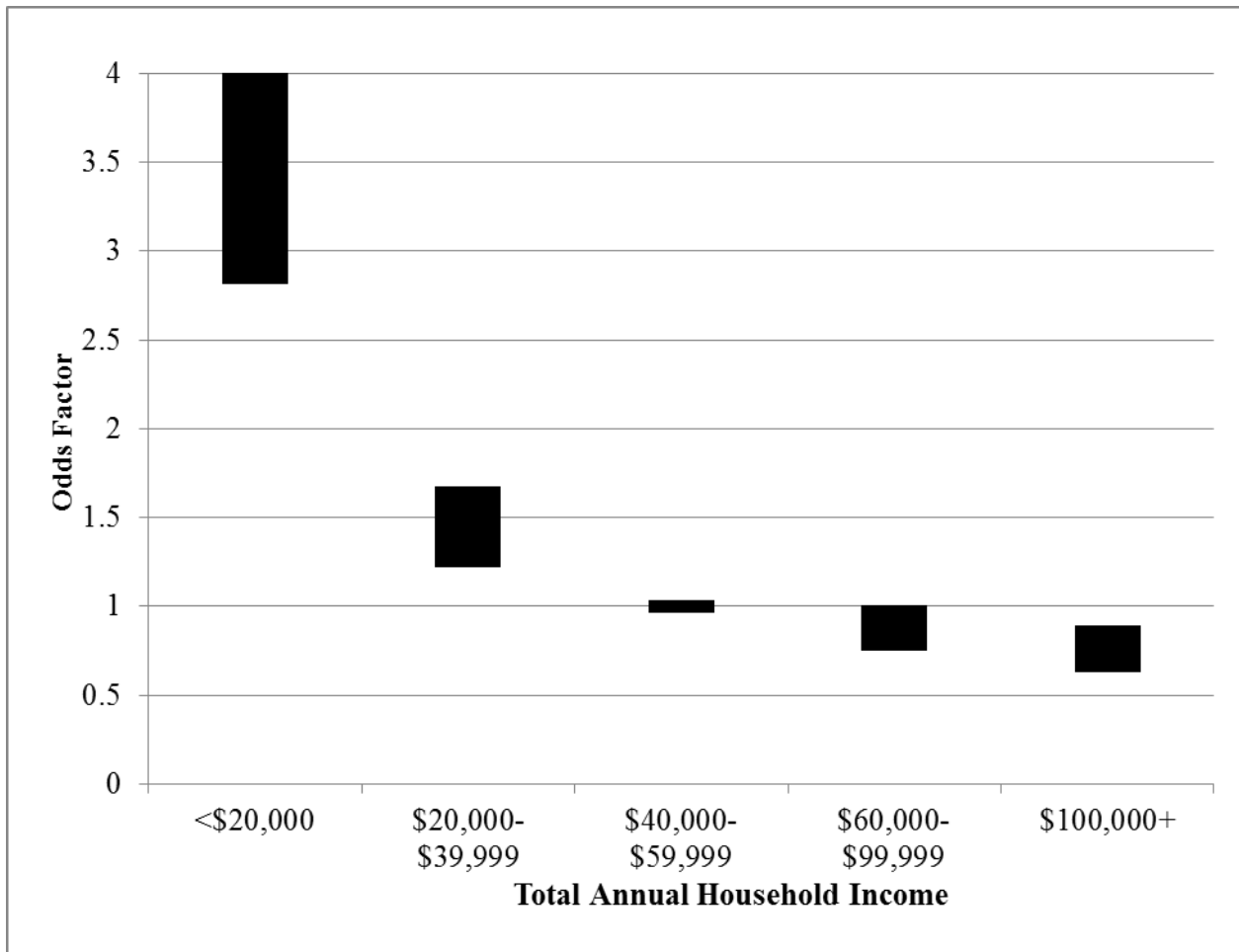
The model coefficients for age 75+ not meeting the 95% statistical significance level, the odds factor estimate for that age group is not shown on the above figure.

Figure 10 shows that, all other things being equal, the predisposition to use alternative modes is highest for those aged 16-17, the other age groups being lower and similar to each other.



**FIGURE 11 Alternative mode to work, by gender, odds factor (vs. female), U.S., NHTS.**  
 Note: Bars represent 95% confidence interval.

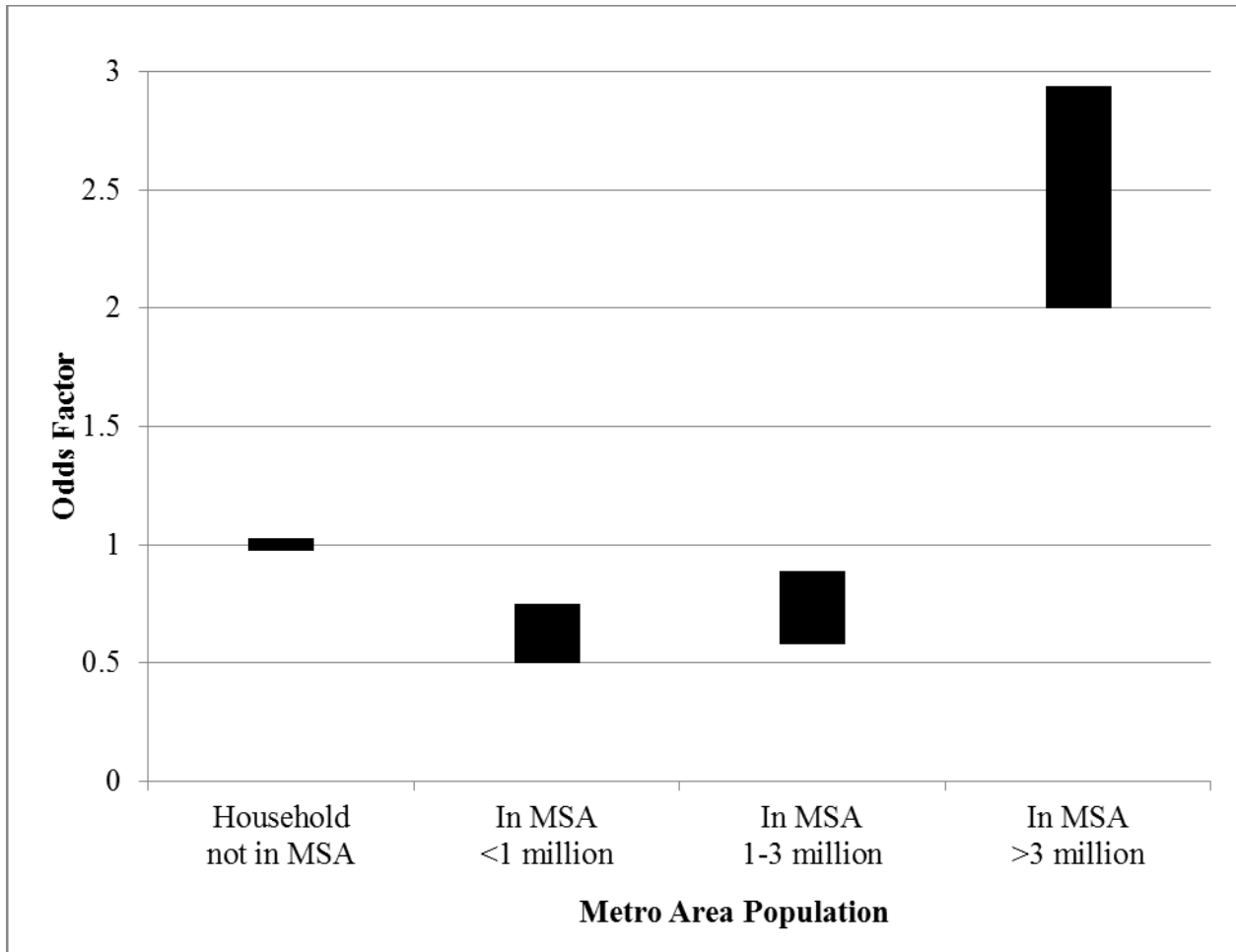
Figure 11 shows that, all other things being equal, the predisposition to use alternative modes is slightly lower for males than for females.



**FIGURE 12 Alternative mode to work, by income, odds factor (vs. \$40-\$60k), U.S., NHTS.**  
 Note: Bars represent 95% confidence interval.

In Figure 12, it is evident that, all other things being equal, the predisposition to use alternative modes decreases as income rises, particularly comparing the lowest category to the mid-low category.

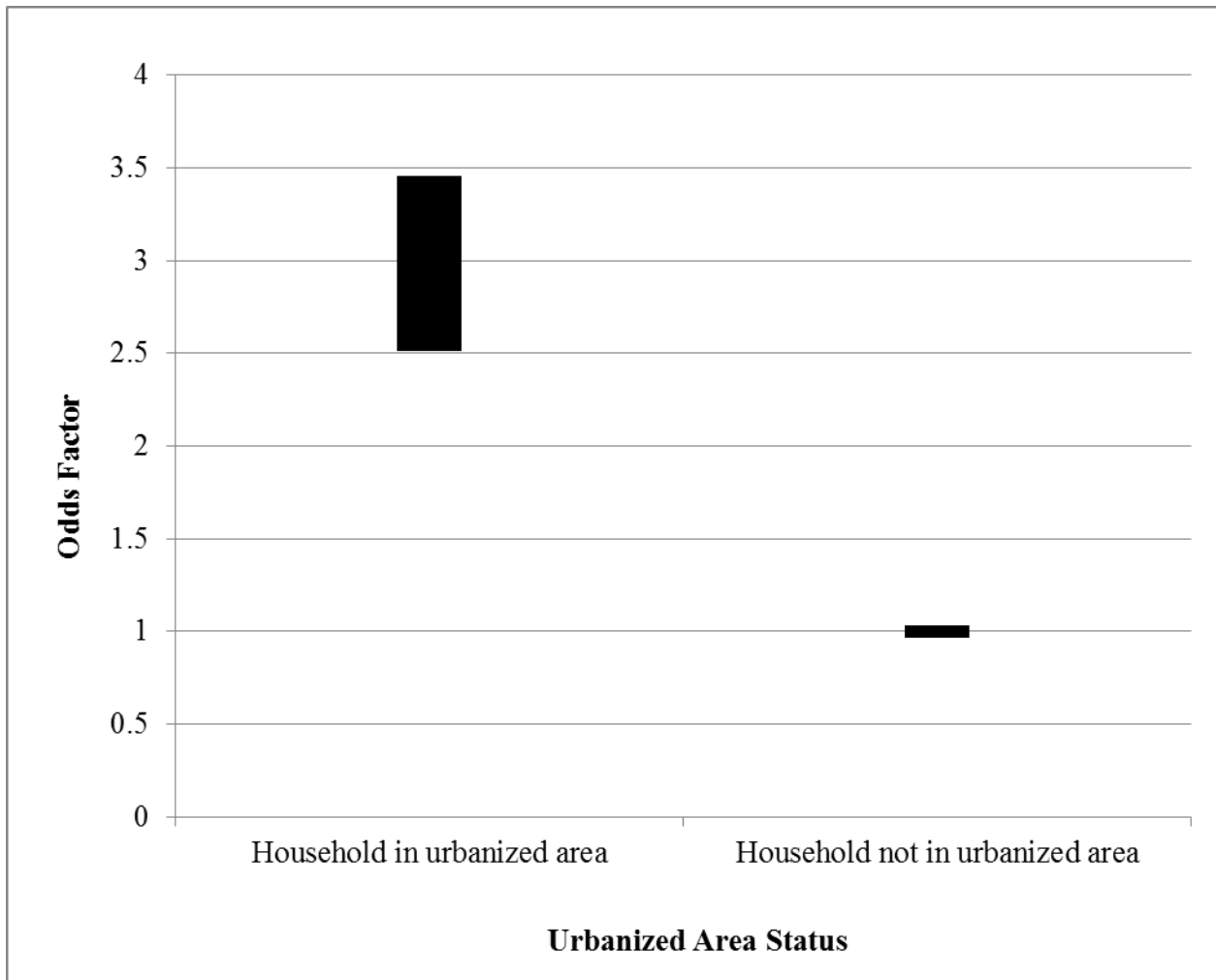




**FIGURE 13** Alternative mode to work, by MSA status, odds factor (vs. not in MSA), U.S., NHTS.

Note: Bars represent 95% confidence interval.

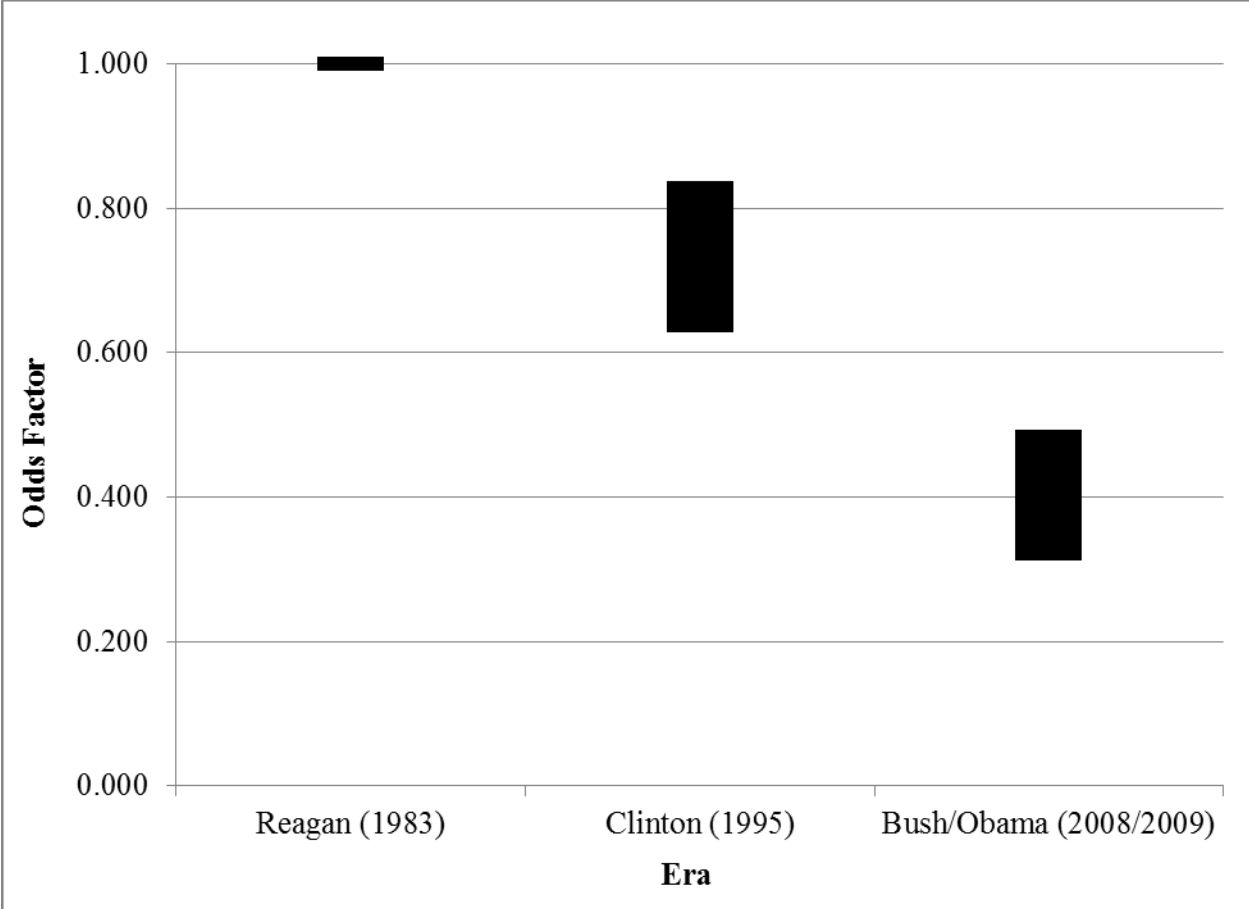
As shown in Figure 13, all other things being equal, the predisposition to use alternative modes increases as metro area population rises. This inclination is particularly high for MSAs with more than 3 million population.



**FIGURE 14 Alternative mode to work, by Urbanized Area status, odds factor (vs. not in Urbanized Area), U.S., NHTS.**

Note: Bars represent 95% confidence interval.

As shown in Figure 14, all other things being equal, the predisposition to use alternative modes is higher for households in Urbanized Areas.



**FIGURE 15 Alternative mode to work, by era, odds factor (vs. Reagan Era), U.S., NHTS.**  
 Note: Bars represent 95% confidence interval.

As shown in Figure 15, all other things being equal, the predisposition to use alternative transportation has decreased a large amount since 1983.

## Findings from Original Research

Several important observations can be made from these results. First, findings concerning the research question are explored, then other findings are examined.

### *Research Question Findings*

Concerning the second precedent question—How enduring do we expect the Millennial tendency toward alternative transportation to be?—the regression shows that, all other things being equal, Millennials *do* have an inherent bent toward alternative transportation (odds factor 1.6 vs. Baby Boomers).

In order to measure the strength of this *Millennial* inclination toward alternative mode usage, HRTPO staff used the above model to compare two hypothetical persons, “Bill Boomer” and “Mark Millennial”. For these two workers, every predictor variable is the same except their *generation*. They are both male, aged 35-54, and live in households with annual incomes of \$40,000-\$59,999, in Urbanized Areas, and in MSAs with populations of 1-3 million (like Hampton Roads). In addition, both hypothetical workers live in the Bush/Obama Era. The only difference is that Bill Boomer is a member of the Baby Boomer generation, and Mark Millennial of the Millennial generation. Plugging these values into the model prepared above, HRTPO staff found that Bill Boomer has a 2.8% chance of commuting via alternative transportation, and Mark Millennial has a 4.3% chance. (Another way of expressing this result is that 2.8% of people like Bill use alternative transportation, and 4.3% of people like Mark use it.) This example, and the odds factors of Boomers (1.0) and Millennials (1.6), show that—all other things being equal—Millennial membership is related to usage of alternative transportation approximately *half-again as high* as Boomer membership.

In addition to this generational trend of higher inclination toward alternative transportation, however, the model also revealed an *era* trend of lower inclination toward such modes. With the Reagan Era as basis (odds factor 1.0), the odds factors of the Clinton Era (0.7) and the Bush/Obama Era (0.4) indicate that, all other things being equal, the bent of American workers toward alternative modes has decreased greatly over recent decades. Income having been controlled for, changing incomes cannot explain this change in bent. Not being explained by age, income, generation, or location—all of which were controlled for—it is not clear why the bent toward alternative transportation has declined over this 26-year period. However, considering the decline in “carless-ness” (in Hampton Roads 12% of households were carless in 1980, but only 6% were carless in 2010), it is possible that the socio-economic stigma of alternative travel has increased as carless-ness has become more nonstandard. This hypothetical stigma trend would explain why a person with a given household income in 2009 (say \$30k/year in 2009\$’s) was less likely to use alternative transportation than a similar person (also having HH income \$30k/year in 2009\$’s) in 1983.

In order to measure the strength of this *era* trend, staff used the model to compare two hypothetical persons, this time “Reba Reagan” and “Olive Obama”. For these two workers, every predictor variable is the same except their *era*. They are both female, aged 18-34, and live in households with annual incomes of \$20,000-\$39,999, in Urbanized Areas, and in MSAs with populations of 1-3 million (like Hampton Roads). In addition, both hypothetical workers are members of Generation X. The only difference is that Reba Reagan lives in the Reagan Era

(1983), and Olive Obama lives in the Bush/Obama era (2008/09). Plugging these values into the model prepared above, HRTPO staff found that Reba Reagan has a 15% chance of commuting via alternative transportation, and Olive Obama has a 6% chance. This example, and the odds factors of the Reagan Era (1.0) and the Bush/Obama Era (0.4), show that—all other things being equal—the earliest era is related to usage of alternative transportation approximately *two-and-a-half times* as high as that of the recent era.

Therefore, concerning the “How Enduring?” question of this second half of the analysis, although Millennials have a moderate bent toward alternative transportation, based on the above two measurements showing that the negative era trend is *much stronger* than the positive generational trend, the authors conclude that the recent higher usage of alternative transportation by post-Baby Boom generations will likely not endure. Thus, concerning the research question, *the authors do not expect a quantum leap in demand for alternative transportation in the future in Hampton Roads.*

#### *Other Findings*

Before concluding this analysis, the interesting relationships revealed by the regression for the control variables will be explored.

All of the *age* variables (except 75+) were significantly related to mode choice. With the youngest age group (16-17) as basis, the odds factors of the other age groups (18-34, 35-54, and 55-74) all being roughly 0.55 indicates that, all other things being equal, 1) teenagers have a bent toward alternative transportation, and 2) excluding teenagers, the bent of American workers toward such modes doesn't vary with age. The regression having controlled for income, the teenage bent toward alternative transportation cannot be explained by being unable to afford a car, but may perhaps be explained by lack of a driver's license.

Concerning *gender*, all other things being equal, males (odds factor 0.9) are slightly less inclined than females to use alternative modes to work.

All of the *income* variables being significantly related to mode choice, the regression indicates that, all other things being equal, the bent of American workers toward alternative modes drops with increasing income. In particular, those with the lowest income (<\$20k/year) have a large bent toward alternative transportation (odds factor approx. 3.5 vs. middle income [\$40-60k]). This is likely explained by the lower speeds and greater exposure to the elements associated with alternative transportation, and the typical proximity of transit infrastructure and the residences of low-income households.

Not surprisingly, concerning *MSA status and size*, all other things being equal, persons in MSAs with more than 3m population (odds factor approx. 2.5 vs. not being in an MSA) are much more inclined than all others to use alternative modes to work. This can be explained by the higher densities and greater alternative mode infrastructure of large metros.

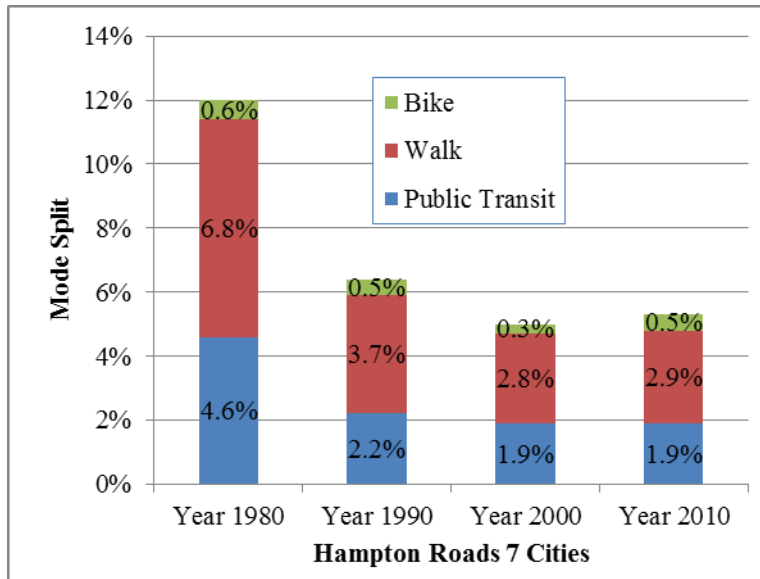
Similarly, all other things being equal, persons in *Urbanized Areas* (odds factor approx. 3.0) are much more inclined than those in non-Urbanized Areas to use alternative modes to work. This too can be explained by higher densities and greater alternative mode infrastructure.

## CONCLUSION

From simple analysis of 2008/09 NHTS data, HRTPO staff found above that Millennials, at that time, used alternative modes twice as frequently as other persons in Hampton Roads (4% vs. 2%).

From regression analysis of multiple NHTS surveys, the authors found above that, although Millennials have a moderate inherent inclination toward alternative transportation, the negative era trend is much stronger than the positive generational trend, and they concluded that the recent higher usage of alternative transportation by post-Baby Boom generations will likely not endure. Thus, concerning the research question, *the authors do not expect a quantum leap in demand for alternative transportation in the future in Hampton Roads*

To flesh out this conclusion, we examined the changes in usage of alternative modes in Hampton Roads over recent decades (i.e. a composite of all ages, incomes, generations, etc.) in Figure 16 below.



**FIGURE 16 Usage of Alternative Modes, Hampton Roads.**

Source: HRTPO processing of U.S. Census data.

In Hampton Roads, alternative transportation has declined significantly since 1980, with a 0.3% rebound in 2010, (and down 0.8% since 2010).

Therefore, the above answer to the research question can be fleshed out as follows:

It appears unlikely that 1980 levels of alternative transportation usage will return to Hampton Roads.

**Next Steps**

Given the explanatory power of the model produced from this original analysis of the usage of alternative modes, HRTPO staff intend to examine individually each of the three components of alternative transportation—transit, walk, and bike—to see how generation, age, era, income, and area type are related to each individual mode, enabling the HRTPO to apply these relationships to transportation planning and programming in Hampton Roads.

## REFERENCES

1. U.S. Department of Transportation, Federal Highway Administration. 2009 National Household Travel Survey. <http://nhts.ornl.gov>.
2. Fry, R. *This year, Millennials will overtake Baby Boomers*. Pew Research Center, Washington. <http://www.pewresearch.org/fact-tank/2015/01/16/this-year-millennials-will-overtake-baby-boomers/>. Accessed June 22, 2015.
3. Blumenberg, E., B. D. Taylor, M. Smart, K. Ralph, M. Wander and S. Brumbaugh. *What's Youth Got to Do with It? Exploring the Travel Behavior of Teens and Young Adults*, University of California Transportation Center, Los Angeles. <http://www.uctc.net/papers/UCTC-FR-2012-14.pdf>. 2012. Accessed June 17, 2015.
4. Iacono, M. and D. Levinson. *Travel Behavior Over Time, Task 6: Cohort Analysis of Travel Behavior*, University of Minnesota, Minneapolis, 2014.
5. RSG. *Who's on Board 2014: Mobility Attitudes Survey*, TransitCenter, New York. <http://transitcenter.org/wp-content/uploads/2014/08/WhosOnBoard2014-ForWeb.pdf>. 2014. Accessed June 17, 2015.
6. Polzin, S. E., C. Xuehao and J. Godfrey. *The impact of millennials' travel behavior on future personal vehicle travel*, Energy Strategy Reviews, Center for Urban Transportation Research, University of South Florida, vol. 5, pp. 59-65, Tampa, 2014.
7. Dutzik, T., and P. Baxandall. *A New Direction: Our Changing Relationship with Driving and the Implications for America's Future*, U.S. PIRG, Boston. <http://www.uspirg.org/sites/pirg/files/reports/A%20New%20Direction%20vUS.pdf>. 2013. Accessed June 17, 2015.
8. St. Louis Federal Reserve, *Moving 12-Month Total Vehicle Miles Traveled*. <https://research.stlouisfed.org/fred2/series/M12MTVUSM227NFWA>. 2015. Accessed June 17, 2015.
9. Hecox, D. *New Data Show February Driving Topped 221 Billion Miles*, Federal Highway Administration. <http://www.fhwa.dot.gov/pressroom/fhwa1527.cfm>. 2015. Accessed April 27, 2015.
10. American Fact Finder. *Means of Transportation to Work for Workers 16 Years and Over*, U.S. Census Bureau. <http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none>. 2015. Accessed June 17, 2015.
11. American Fact Finder. *Means of Transportation to Work by Age*, U.S. Census Bureau. [http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_13\\_5YR\\_B08101&prodType=table](http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_B08101&prodType=table). 2015. Accessed June 17, 2015.
12. The League of American Bicyclists. *The Growth of Bike Commuting*. <http://www.bikeleague.org/sites/default/files/League-info-BikeCommuting.pdf>. 2014. Accessed June 17, 2015.
13. The League of American Bicyclists. *Where we Ride: Analysis of bicycle commuting in American cities*. [http://bikeleague.org/sites/default/files/ACS\\_report\\_2014\\_forweb\\_edit.pdf](http://bikeleague.org/sites/default/files/ACS_report_2014_forweb_edit.pdf). 2013. Accessed June 17, 2015.
14. Global Strategy Group. *Rockefeller Millennials Survey*. <http://t4america.org/wp-content/uploads/2014/04/RF-Millennials-Survey-Topline.pdf>. 2014. Accessed June 18, 2015.



15. Miller, V. *Record 10.7 Billion Trips Taken on U.S. Public Transportation in 2013: The Highest Transit Ridership in 57 Years*, American Public Transportation Association, Washington.  
[http://www.apta.com/mediacenter/pressreleases/2014/Pages/140310\\_Ridership.aspx](http://www.apta.com/mediacenter/pressreleases/2014/Pages/140310_Ridership.aspx). 2014. Accessed June 18, 2015.
16. Dutzik, T., J. Inglis and P. Baxandall. *Millennials in Motion: Changing Travel Habits of Young Americans and the Implications for Public Policy*, U.S. PIRG, Boston.  
<http://uspirg.org/sites/pirg/files/reports/Millennials%20in%20Motion%20USPIRG.pdf>. 2014. Accessed June 18, 2015.
17. Sakaria, N. *Serving the Mobility Preferences of Generation Y*. In *Transit Cooperative Research Program, Project J-11/Task 17, Web Only Document 61*, Transportation Research Board of the National Academies, Washington, D.C., 2013.
18. Davis, B., T. Dutzik and P. Baxandall. *Transportation and the New Generation: Why Young People Are Driving Less and What It Means for Transportation Policy*, U.S. PIRG, Boston.  
[http://www.uspirg.org/sites/pirg/files/reports/Transportation%20%26%20the%20New%20Generation%20vUS\\_0.pdf](http://www.uspirg.org/sites/pirg/files/reports/Transportation%20%26%20the%20New%20Generation%20vUS_0.pdf). 2012. Accessed June 18, 2015.
19. Rappaport, J. *The Demographic Shift From Single-Family to Multifamily Housing*, Kansas City Federal Reserve Economic Review, Fourth Quarter.  
<https://www.kansascityfed.org/publicat/econrev/pdf/13q4Rappaport.pdf>. 2013. Accessed June 18, 2015.