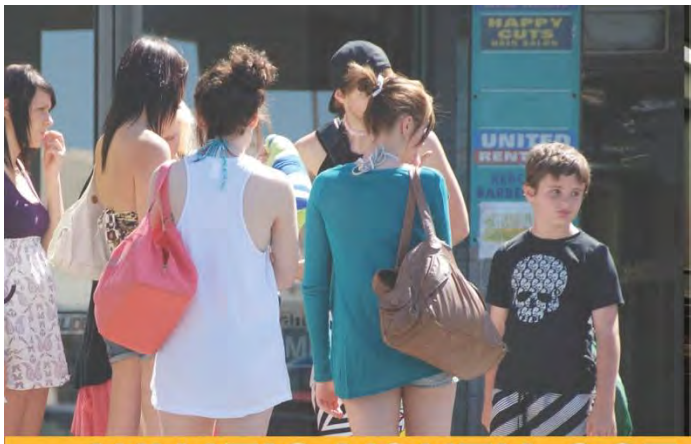
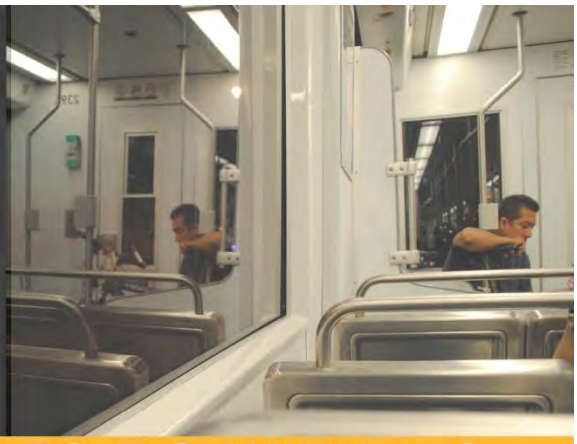
University of California Transportation Center
UCTC-FR-2012-14

What's Youth Got to Do with It? Exploring the Travel Behavior of Teens and Young Adults

Evelyn Blumenberg, Brian D. Taylor, Michael Smart,
Kelcie Ralph, Madeline Wander, and
Stephen Brumbaugh
UC Los Angeles
September 2012





WHAT'S YOUTH GOT TO DO WITH IT?
EXPLORING THE TRAVEL BEHAVIOR OF TEENS AND YOUNG ADULTS

By:

Evelyn Blumenberg, PhD
Brian Taylor, PhD, FAICP
Michael Smart, PhD
Kelcie Ralph
Madeline Wander
Stephen Brumbaugh

Institute of Transportation Studies
Lewis Center for Regional Policy Studies
UCLA Luskin School of Public Affairs
3250 Public Affairs Building
Los Angeles, CA 90095-1656
310-903-3305
eblumenb@ucla.edu

Lewis Center

UCLA ITS INSTITUTE OF TRANSPORTATION STUDIES

Executive Summary

A. Overview

Today's teens are members of the first generation to have never known a world without instantaneous and nearly ubiquitous mobile phone access. They also must surmount greater hurdles to driver's licensing than any previous generation faced. And they are struggling to transition into the most unwelcoming job market since the Great Depression. These tectonic happenings surely augur equally dramatic changes in the travel choices and patterns of young adults in the years ahead. Or will they? This report examines this question.

While scholars have studied the travel choices and patterns of adults extensively over the years, our knowledge of youth travel behavior is surprisingly limited and uneven. There is a growing body of research on how children travel to school and a second body of research on youth and travel safety, in particular, the high rates of crashes and driving fatalities among teenagers. Beyond these two rather focused lines of inquiry, however, studies of travel by children, teens, and young adults are rare.

Researchers have posited several factors to explain differences in the travel behavior of youth and adults, and to support the argument that such differences may persist as today's youth move into adulthood. First, the rapid profusion and adoption of new communication technologies influences how people use their time and may affect how much they travel (Kwan, 2002), and young people tend to be early and frequent adopters of these technologies (Mans et al., forthcoming; Lenhart et al., 2005; Pew Research Center, 2010b). Second, all 50 states have now adopted graduated driver's licensing programs, making teen licensing more difficult and restrictive (with respect to time, trip purpose, and passengers) than in previous eras (Insurance Institute for Highway Safety, 2012). Third, unemployment rates during the current recession are highest for youth, thereby reducing journey-to-work and work-related travel and limiting the resources teens and young adults have to pay for non-work activities (and associated travel) of all types. This prolonged economic downturn may also influence youth travel patterns indirectly; fragmentary evidence suggests that young adults struggling to find work increasingly "boomerang" back home to live with parents (Kaplan, 2009; Pew Research Center, 2010b; Wiemers, 2011), drawn by a free or steeply discounted bedroom, groceries, and, perhaps, access to parents' cars.

B. What We Did

To explore the influence of these and other factors on the travel behavior of youth, we analyze data from the Nationwide Personal Transportation Survey in 1990 and the National Household Travel Surveys in 2001 and 2009. We use the data to examine how the travel behavior of youth

(teens and young adults ages 15–26) compares to that of middle-aged adults (ages 27–61), whether the basic determinants of youth travel behavior are changing, and whether we see evidence that today's youth are likely to travel differently than adults. To do this we focus on four fundamental outcome measures of travel: personal miles traveled (PMT); activity participation (number of daily trips); journey-to-work (or commute) mode choice; and travel mode used for social trips. In analyzing each of these outcome measures, we employ a set of statistical models. These models allow us to assess the influence of life-cycle effects (changes that typically occur of the course one's life), period effects (associated with particular events like an economic downturn), and cohort effects (where the patterns of one generation differ from others) on the travel behavior of youth relative to middle-aged adults.

C. What We Find in a Nutshell

We find that economic factors—employment status, household income, and the like—strongly influence the travel behavior of both adults and youth, the latter of which has been harder hit by our current, prolonged economic downturn. These economic effects help to explain the growth in mobility, trip-making, and driving among both youth and adults during the 1990s, and the subsequent contraction of mobility, trip-making, and driving during the 2000s. When it comes to changes in youth (and adult) travel behavior in recent years, the adage "It's the economy, stupid" appears to hold.

With regard to the effects of young adults "boomeranging" to live at home with parents, the explosion of information and communications technologies, and stricter driver's licensing requirements for teens, the effects are far milder, and mixed. While more young adults appear to be living at home than in years past, the effects on travel behavior are ambiguous at best. Likewise, despite the staggering increase in mobile phone and web access and use, the effects we were able to measure were both mild and tended to be associated with *increases* in travel. That is, when information and communications technologies affect travel, it appears to be as a complement to travel and not as a substitute for it. Finally, while teen licensing requirements have grown considerably stricter over the past two decades and more teens are obtaining their licenses in their late teens and early twenties, the effects of licensing on overall teen mobility are surprisingly muted. Sixteen- and 17-year-olds are driving less, but they appear to be (eventually) getting driver's licenses and moving about as much as earlier generations of adults.

Our quasi-cohort models suggest moderate generational effects on travel behavior. Despite (or perhaps because of) what appears to be youth's increasing reliance on the single-occupant vehicle for the journey to work and social trips, the youngest cohorts in our datasets are making somewhat fewer trips (-4%) and traveling considerably fewer miles (-18%) than was the case for previous generations at the same stage in their lives, all else equal.

Major Findings

- **Economic factors predominate**—(a) employment status, household income, and other measures of economic status strongly influence all forms of youth and adult travel behavior across all three study years, (b) these factors generally have an even greater influence on the travel of youth than adults.

- **The effects of other factors are mixed**— the effects of (a) young adults living with their parents, (b) the explosion of information and communications technologies use, and (c) stricter teen driver's licensing requirements are far milder and more mixed compared to the consistently strong travel behavior effects of economic factors.
    - **Information and communications technology use**—is measured as daily web use and, when significant, tends to be associated with more travel, and not less.
    - **Graduated driver's license regulations**—(a) more teens are licensing later, but most do eventually license and drive, (b) the regulations are associated lower teen person-miles of travel over the short-term, but not much change in trips, and (c) transit commuting is higher in states with stricter licensing regulations, but for adults as well as teens – as such, this probably says more about the states that adopt tough licensing laws than the effect of the laws on transit use.

- **Demographic travel distinctions are fading**—Travel behavior has long been observed to vary by demographic factors, such as race/ethnicity; while we continue to observe racial/ethnic travel patterns among adults, such distinctions are more muted for youth and appear to be lessening over time.

- **Evidence of generational shifts in travel behavior**— Our quasi-cohort models suggest moderate generational effects on travel behavior: all things equal, younger generations appear to (a) travel fewer miles and (b) make fewer trips than was the case for previous generations at the same stage in their lives; however, it also appears that younger commuters appear to drive alone to work more frequently than similarly aged workers from earlier generations.

- **Many findings are suggestive, but not definitive**—While many of our findings are consistent and appear robust, others are merely suggestive due to (a) small sample sizes for some population groups (e.g. 1990 sample, recent birth cohorts, bike travelers, etc.), (b) construct validity questions related to our variables of interest (e.g. reported daily web use as a measure of information and communications technology use), and (c) a lack of true cohort data to allow us to follow the same individuals over time.

Perhaps the most significant overall finding from this analysis is how little youth travel behavior is deviating from that of adults, despite the enormous economic, social, technological, and policy changes over the past two decades. Specifically, we see little evidence in these data that living circumstances, technological innovations, or driving regulations are dramatically altering travel behavior. We do find that economic factors—specifically employment status, educational attainment, and household income—strongly affect youth travel behavior, but these factors strongly affect the travel of older adults as well.

D. What We Find in Each of Our Four Analyses

We summarize the principal findings of each of our four specific analyses—personal miles traveled, trip-making, commute mode choice, and social and recreational trip mode choice—in turn below.

1. What Explains PMT among Teens, Young Adults, and Adults?

The descriptive statistics and multivariate models of the factors affecting personal miles traveled (presented in Chapter V of the report) paint an interesting and nuanced picture of teen and young adult travel, both in comparison with adults and over time. Personal travel, measured here as personal miles traveled (or PMT), generally increases as one moves from teenage, to young adulthood, and into middle age. But personal travel is highly correlated with economic factors, such as employment and income. Indeed, we observe a substantial drop in metropolitan person travel nationwide between 2001 and the recession of 2009 across all age groups examined, though the largest drop (23%) was among teens.

The effect of economic factors on the travel of teens and young adults (measured here in terms of employment), and for that matter middle-age adults, is substantial and unambiguous—but the effect of employment on PMT is stronger for young adults than for teens, and stronger still for middle-aged adults than for young adults or teens. But while being employed is highly correlated with PMT, the effect of "boomeranging" young adults living at home is ambiguous at best; we observe no effect of living with parents on the PMT of young adults in our primary "Driver's Status" model. And our models suggest that, far from acting as a substitute for travel, daily web use either has no effect on travel or, in the most recent 2009 survey, is associated with *increased* PMT across all age categories; this finding is likely because web use, auto access, and PMT are all positively associated with education and income. Finally, although licensing requirements have increased dramatically for teens in states across the country, we find no consistent relationship between license regulations and PMT. We summarize these findings in Table 1 below.

Table 1: Summary Table: PMT and Variables of Interest (1990, 2001, and 2009)

	Teen (15–18)			Young Adult (19–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+	+	+	+
Young Adult Living at Home	*(Not Included)*			0	0	0	*(Not Included)*		
Technology (Web Use)	*n/a*	0	+	*n/a*	0	+	*n/a*	0	+
License Stringency	0	0	0	0	0	+	0	+	0

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

One of the most significant findings of this analysis is how consistent the observed effects on travel are across the three age categories: teens, young adults, and adults. Education (or parents' education for teens), employment, auto access, and being a driver are all positively associated with PMT across almost all age categories and survey years. Likewise, population density is negatively associated with PMT across nearly all age categories and years. There are a few exceptions to this pattern, but not many. Among adults (but not teens or young adults) income (apart from employment) and the presence of children in the household are also associated with greater personal travel. In the most recent survey year (2009), female teens travel more than male teens, a finding that constitutes a break from the past and may portend future changes in the gender division of travel.

One other possible break with the past may be revealed by our quasi-cohort model. This model suggests that those individuals born in more recent decades (the 1980s and 1990s) travel fewer miles per day than did previous cohorts at the same stage in their lives. Such a finding suggests that we may well be observing a gradual shift away from generational increases in PMT long associated with rising wealth and auto ownership. However, because we only have data on those born in the 1990s for *one* of the three data years, these results are suggestive rather than conclusive.

2. What Explains Patterns of Activities and Trips among Youth and Adults?

People travel in order to access opportunities to do, acquire, or sell. Thus trips, as opposed to traveling, act as a proxy for activity participation; the more trips one completes, the more activities in which one participates. Up to a point, therefore, more trips mean more activities and access to a higher quality of life. Likewise, more time and/or money spent traveling to a fewer number of destinations means fewer trips and lower levels of personal access and activities, in spite of high levels of mobility.

We find in our analysis presented in Chapter VI of this report that adults make more trips than youth, and that higher incomes and greater private vehicle access are associated with higher levels of trip-making and, hence, activity participation. In general, trip-making increases year to

year as people age from their early teens through late middle age, and then it declines gradually thereafter. Trip-making is highly correlated with economic activity, as we observe that trips per person increased between 1990 and 2001, but declined between 2001 and the recession of 2009. Unemployment in 2009 was substantially higher among youth than adults, and the drop in trip-making between 2001 and 2009 was greater for youth than for adults. At a more micro level, our analysis shows that both income and employment are associated with greater levels of trip-making.

We constructed a set of structural equation models (SEMs) and find that income is a powerful predictor of trip-making among adults, and its importance in predicting youth trips increased substantially between 1990 and 2009 and is now on par with that of adults. The most important effect of income is in increasing automobile access, which in turn encourages more trips. While income and working are strongly associated with increased trip-making among both adults and, increasingly, youth, time spent commuting to and from work—reflects the opportunity cost of time and tends to depress trip-making.

Table 2: Summary Table: Number of Trips and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+
Young Adult Living at Home	*(Not included in the model)*					
Technology (Web Use)	*n/a*	0	0	*n/a*	+	+
License Stringency	-	+	-	-	+	-

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

We summarize our findings with respect to the variables of interest in this study in Table 2. While the effects of the economy, income, auto access, and working are all positively associated with trip-making among both adults and youth, internet access appears to have no effect on youth trip-making, and may actually be associated with a slight increase in trip-making among adults in 2009. Likewise, and remarkably, increasingly strict licensing regimes for teens appear to have decidedly mixed effects on youth trip-making. Finally, we note in these models that the independent effects of race/ethnicity on trip-making appear to be waning over time, especially among youth.

Finally, our quasi-cohort model suggests that, despite having high levels of auto access and higher incomes than previous generations did at the same stage in their lives, the most recent cohort (those born in the 1990s) appear to be making fewer trips (roughly 4% fewer) than did previous cohorts, all else equal.

3. How Do Commute Mode Choice Patterns Compare between Youth and Adults?

While the previous two analyses found that working has a substantial influence on both personal miles traveled and the number of daily trips, this analysis focused specifically on the mode choices of workers. As with the previous analyses, the effects of the recession on travel behavior, particularly on youth, are substantial. The proportion of working adults declined from 85 percent to 80 percent of the eligible population between 2001 and 2009; in contrast, the number of working youth dropped precipitously, from 70 percent in 2001 to just 56 percent in 2009.

In Chapter VIII of the report we focus on how those who do work get there. We find, not surprisingly, that household income is a consistent predictor of commute mode choice for both youth and adults. In general, income is strongly and positively associated with driving alone to work; put another way, as incomes go up, the probability of commuting via carpool, public transit, bicycle, or foot all go down—for both youth and adults, and across all three survey years.

With respect to the effect of the bad economy causing a growing number of youth to "boomerang" home to live with parents, we find that young working adults living at home are less likely to carpool and more likely to use public transit than other workers. Likewise, those who use the web daily were *less* likely to carpool (2001 and 2009) and *more* likely to commute via public transit (2001 only). Last, in terms of our variables of interest, youth in places with stricter teen licensing regimes were more likely to commute to work via public transit; however, we find that the strictness of licensing regimes has no significant effect on an individual's choice to commute via carpool.

The analysis also revealed important differences between youth and adult workers. Previous studies have consistently shown that being female, Hispanic, or foreign born increases the likelihood of commuting by carpool over driving alone. Our analysis shows that this trend remains strongly consistent over time for adults, but not for young workers. This finding suggests that the relationship between travel mode and broad social categories, like sex, race/ethnicity, and immigration status, may be weakening over time. The findings from these models are summarized in Table 3 below.

Finally, the quasi-cohort model suggests that those born in more recent decades (the 1970s, 1980s, and 1990s) are far more reliant on the single-occupancy vehicle for their journey to work than were previous generations, though this effect appears to be diminishing over time.

Table 3: Summary Table: Commute Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
Carpool (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	-	-	*n/a*	0	+
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	+	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	+	0	*n/a*	+	0
License Stringency	+	+	+	+	+	-
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	+	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	0	-
License Stringency	-	0	+	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	0	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	0	0	+	0	0

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

4. How Do Social/Recreational Mode Choice Patterns Compare Over Time?

Social travel has received relatively little attention from researchers compared with other types of travel—in particular, the commute to work. While the previous analyses show that the recession has had a large effect on the travel behavior of teens and young adults, our analysis presented in Chapter IX finds that the effects of the economic downturn on social travel are less clear. The total number of social trips declined slightly from 2001 to 2009, but the share of social trips relative to other types of trips actually increased slightly. This finding contradicts expectations that people are most likely to reduce discretionary travel in worsening economic circumstances.

While the recession may have had unexpected effects on the amount of social travel, it has more expected effects on mode choice. As discussed in the previous section, household income strongly affects commuter mode choice, increasing the likelihood of driving alone, and we observe similar results for social trip mode choice. For youth, income has a negative effect on

carpooling, transit use, and walking; for adults, income has a negative effect on transit use and bicycling. However, the models suggest that higher-income adults are more likely to carpool than drive alone for social trips, an unexpected—but highly social—result.

On the other hand, trip characteristics frequently had statistically significant effects on mode choice. For example, trip distance, the number of social trips taken in the survey day, and weekend travel all had positive effects on carpooling for both youth and adults. Conversely, trip distance had a negative effect on bicycling and walking for both groups. Geographic characteristics had less of an effect overall, but population density and living in New York both had positive effects on transit use.

As for other variables of interest (see the summary of our results in Table 4 below), daily Internet use had almost no effect for youth and adults, and licensing had either no or inconsistent effects. Young adults living at home were more likely to drive alone in most of the models, including the carpooling models. This finding perhaps reflects their desire to maintain a measure of independence while living with their parents.

Our analysis further revealed some differences in social travel between youth and adults. As noted previously, studies have shown that being Hispanic or an immigrant increases the likelihood of carpooling or walking over driving alone. As with our commuting analysis, the social trips analysis shows that this trend remains consistent over time for adults, but not for youth. In other words, the relationship between socio-demographic categories and mode choice for recreational travel may be weakening as well.

Finally, the quasi-cohort model finds that being born in the 1970s and especially the 1980s is associated with more driving alone (perhaps to bowl alone) to social destinations, while being born in earlier decades or in the 1990s has no effect on driving alone on social trips. While the 1990s results compares only the social travel mode choice of 15 to 19 year olds with similar age cohorts born in the 1980s and 1970s, this finding does suggest that rates of driving alone, after controlling for a wide array of other factors, is down among the latest generation of teens.

Table 4: Social Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
Carpool (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	-		*(Not included)*	
Technology (Web Use)	*n/a*	-	-	*n/a*	0	-
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	0		*(Not included)*	
Technology (Web Use)	*n/a*	+	0	*n/a*	0	0
License Stringency	-	?	-	+	?	?
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	-	0		*(Not included)*	
Technology (Web Use)	*n/a*	0	0	*n/a*	0	0
License Stringency	0	+	0	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	-		*(Not included)*	
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	+	-	+	?	+

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; blue (0) indicates no statistically-significant relationship; and white (?) means no consistent effect.

What's Youth Got to Do With It?
Exploring the Travel Behavior of Teens and Young Adults

Evelyn Blumenberg, PhD
Brian D. Taylor, PhD, FAICP
Michael Smart, PhD
Kelcie Ralph
Madeline Wander
Stephen Brumbaugh

Institute of Transportation Studies
Lewis Center for Regional Policy Studies
UCLA Luskin School of Public Affairs
3250 Public Affairs Building
Los Angeles, CA 90095-1656
310-903-3305, 310-903-3228
eblumenb@ucla.edu, btaylor@ucla.edu

Acknowledgments

We conducted this research with funding from both the University of California Transportation Center and the U.S. Federal Highway Administration (the latter through a contract with Jack Faucett Associates, Incorporated). The authors are grateful for this support. All errors or omissions are the responsibility of the authors, and not the funding organizations.

Table of Contents

List of Tables

List of Figures

Chapter I. The Next Generation of Personal Travel

Who knows about kids these days? Today's teens are members of the first generation to have never known a world without instantaneous and nearly ubiquitous mobile phone access. They must surmount greater hurdles to driver's licensing than any previous generation faced. And they are struggling to transition into the most unwelcoming job market since the Great Depression. These tectonic happenings surely augur equally dramatic changes in the travel choices and patterns of young adults in the years ahead. Or will they? This report examines this question.

While scholars have studied the travel choices and patterns of adults extensively over the years, our knowledge of youth travel behavior is surprisingly limited and uneven. There is a growing body of research on how children travel to school (i.e., McDonald, 2007, 2008; McMillan et al., 2006; Schlossberg et al., 2006; Yarlagadda and Srinivasan, 2008), much of it linked to rising childhood obesity and the decline in so-called "active travel" among children. This is an important area of study, but it addresses only a small portion of travel by youth. Data from the 2009 American Community Survey show that less than 35 percent of young adults (16–30) attend school; the remainder—almost 37 million people—are not in school. A second body of travel research relevant to youth focuses on travel safety, and, in particular, the high rates of crashes and driving fatalities among teenagers (i.e., Goodwin and Foss, 2004; Hedlund et al., 2003; McCartt et al., 2010; Williams and Shults, 2010; Williams, 2012).

Beyond these two rather focused lines of inquiry, studies of travel by children, teens, and young adults are rare. The little information that we have suggests that while, like adults, most youth travel by automobile, their patterns of automobile travel differ from those of older adults, and these differences might be waxing. For example, teens tend to obtain driver's licenses at later ages than in previous years. In 1995, 59 percent of 17-year-olds had driver's licenses. By 2009, less than half (49%) were licensed (Federal Highway Administration, 1995 and 2009). Further, youth (16-30) tend to drive slightly fewer miles than adults (31-55) and have lower average daily trip rates (Booz, Allen, and Hamilton, 2011).

Researchers have posited several factors to explain differences in the travel behavior of youth and adults, and to support the argument that such differences may persist as today's youth move into adulthood. First, the rapid profusion and adoption of new communication technologies influences how people use their time and may affect how much they travel (Hjorthol, 2002; Kwan, 2002; Mokhtarian and Salomon, 2002; Viswanathan and Goulias, 2001), and youth tend to be early and frequent adopters of these technologies (Mans et al, forthcoming; Lenhart et al., 2005; Pew Research Center, 2010b). Second, all 50 states have now adopted graduated driver's licensing programs, making teen licensing more difficult and restrictive (with respect to time, trip purpose, and passengers) than in previous eras (Insurance

Institute for Highway Safety, 2012). Third, unemployment rates during the current recession are highest for youth, thereby reducing journey-to-work and work-related travel and limiting the resources teens and young adults have to pay for non-work activities (and associated travel) of all types. This prolonged economic downturn may also influence youth travel patterns indirectly; fragmentary evidence suggests that young adults struggling to find work increasingly "boomerang" back home to live with parents (Pew Research Center, 2010b), drawn by a free or steeply discounted bedroom, groceries, and, perhaps, access to parents' cars.

To explore the influence of these and other factors on the travel behavior of youth,[1] we use data from the 1990 Nationwide Personal Transportation Survey (NPTS) and the 2001 and 2009 National Household Travel Surveys (NHTS) to examine three specific questions:

(1) How does the travel behavior of youth compare to that of adults?

(2) Are the basic determinants of youth travel behavior changing?

(3) Given (1) and (2), do we see evidence that as today's youth age into adulthood, they are likely to travel differently than adults of today?

To answer these three questions we focus on four fundamental outcome measures of travel: (1) personal miles traveled (PMT), (2) activity participation (number of daily trips), (3) journey-to-work (or commute) mode, and (4) travel mode used for social trips. In analyzing each of these outcome measures, we employ a set of statistical models to assess the influence of three types of effects on travel:

1. *Life cycle effect*s are those associated with particular stages of the life cycle and which typically do not "follow" people through the various stages of life. For example, parents with young children and retirees tend to exhibit travel patterns consistent with their particular life cycle stage.

2. *Period effects* are events, such as the current recession, that affect all population groups but may affect one population, in this case youth, more than others.

3. *Cohort effects* are the opposite of life cycle effects in that they "follow" groups of similarly situated people through time. For example, women three-quarters of a century

[1] Throughout the analyses in this report, we define "youth" as individuals aged 15–26. We detail the rationale for selecting these ages below.

ago were much less likely than men to get driver's licenses, and these lower licensing and driving rates persisted throughout their lives.[2]

In a nutshell, we find that economic factors—employment status, household income, and the like—strongly influence the travel behavior of both adults and youth, the latter of which has been harder hit by our current, prolonged economic downturn. These economic effects help to explain the growth in mobility, trip-making, and driving among both youth and adults during the 1990s, and the subsequent contraction of mobility, trip-making, and driving during the 2000s. When it comes to changes in youth (and adult) travel behavior in recent years, the adage "It's the economy, stupid" appears to hold.

With regard to the effects of young adults "boomeranging" to live at home with parents, the explosion of information and communications technologies, and stricter driver's licensing requirements for teens, the effects are far milder, and mixed. While more young adults appear to be living at home than in years past, the effects on travel behavior are mixed at best. Likewise, despite the staggering increase in mobile phone and web access and use, the effects we were able to measure were both mild and tended to be associated with *increases* in travel. That is, when information and communications technologies affect travel, it is as a complement to travel and not a substitute for it. Finally, while teen licensing requirements have grown considerably stricter over the past two decades, and more teens are obtaining their licenses in their late teens and early twenties, the effects on overall teen mobility are surprisingly muted. Sixteen- and 17-year-olds are driving less, but they appear to be (eventually) getting driver's licenses and moving about as much as earlier generations of adults.

Our quasi-cohort analysis suggests that there may be some moderate generational changes afoot. Despite (or perhaps because of) what appears to be an increasing reliance on the single-occupant vehicle among the youngest cohorts in our datasets, our models suggest a moderate decrease in trip-making (-4%) and a stronger effect on miles traveled (-18%) for those born in the 1990s. However, as our datasets comprise only a small "window" (1990-2009), we urge caution in interpreting these results. Further analysis with additional data years will allow researchers to test whether these trends are indeed robust.

Perhaps the most significant overall finding from this analysis is how little teen and youth travel behavior is deviating from that of adults, given the enormous economic, social, technological, and policy changes over the past two decades. Specifically, we see little evidence in these data that living circumstances, technological innovations, or driving regulations are dramatically altering travel behaviors. We do find that economic factors—specifically employment status,

---

[2] The NPTS and NHTS data are cross-sectional and are not samples of the same individuals over time. We, therefore, conduct a pseudo-cohort analysis by linking observations across survey years by birth decade.

educational attainment, and household income—strongly affect the travel behavior of teens and young adults, but these factors strongly affect the travel of older adults as well.

Following this opening chapter, the second chapter of the report briefly reviews the research literature on teen and young adult travel. The third chapter discusses the methodology used to examine our four travel outcome measures. In chapter four, we discuss previous research on each of our factors of interest—(i) information and communications technology use, (ii) graduated driver's licensing, and (iii) macro-economic effects on employment status and young adults living at home—and provide descriptive statistics on each from the NPTS/NHTS data. Chapters six through nine present the findings from our analyses of (1) personal miles traveled (PMT), (2) activity participation (number of daily trips), (3) trip purpose (4) commute mode, and (5) social trip mode. Finally, in the last chapter of the report, we summarize our findings and discuss the implications of these findings for both public policy and future research.

Chapter II. The Travel of Teens and Young Adults: State of the Literature

As we mentioned above, research on teenagers and travel behavior is limited—and research on young adults and travel behavior is nearly non-existent. In our literature scan, we identified fewer than 50 articles on the topic; moreover, many of the studies come from a small group of authors writing about a limited number of topics.[3] The vast majority of research in the field has been conducted in the last decade, with only a handful of studies occurring earlier.[4] Most of this research focuses on teenagers in the United States, although a few studies examine teenagers in Canada, Australia, and Great Britain. Research on young adults and travel behavior is even more limited, with only a handful of studies focusing on this age group specifically.

The literature we examine only includes studies that examine travel behavior and demographics in some fashion; it excludes a much larger body of work examining teenage travel exclusively in terms of accident rates. For example, many authors have examined the effect of graduated drivers' license programs on teenager crash and fatality rates (e.g., Williams and Ferguson, 2002; Shope, 2007); these studies consistently demonstrate that such programs reduce crashes (Shope, 2007). However, few of the studies have analyzed the effects of graduated driver's licensing programs in terms of mode choice or trip-making—for example, whether the laws cause teenagers to travel less overall or substitute transit trips for automobile trips.

While researchers in the fields of engineering and urban planning are the main producers of youth travel behavior studies, a look at the publications citing this literature suggests that researchers in public health departments are currently the main consumers of the research. For example, references to youth travel behavior studies appear frequently in articles exploring the linkages between physical activity—or lack thereof—and childhood and adolescent obesity.[5]

Six major themes appear in the research on youth and travel behavior:

- Descriptive data on travel patterns;
- Travel to and from school;
- Alternative modes of travel (i.e., not single-occupant vehicle travel);

[3] Other recent studies, such as Marzoughi (2011), also note the limited amount of research.

[4] The earliest known work is Gurin (1974), which assesses the mobility needs of working-class suburban teenagers in Boston.

[5] See for example, Bungum et al. (2009), Dalton et al. (2011), Lambert and Min (2010), Landsberg et al. (2008), and Voorhees et al. (2011).

- The relationship between travel and urban form;
- Travel behavior differences by gender; and
- Safety.

While these six themes are distinct, many of the articles included in our review cover more than one theme. For example, articles focusing on travel to school frequently mention safety issues for children traveling via alternative modes. We describe each of these themes in turn below.

A. Descriptive Data

As the name implies, these studies offer general, descriptive statistics on teenagers' mode choice and trip characteristics. These studies clearly demonstrate that teenagers use cars for the majority of their trips—whether they drive the cars themselves or someone else drives them.

The 2001 NHTS is the most-cited source for information on youth and travel behavior. According to the NHTS, children under 18 years in the United States make 3.5 trips on average per day—slightly less than the 4.3 daily trips adults make (McDonald, 2006). As with adults, children make the majority of their trips by automobile, but not to the degree that adults do (McDonald 2006). Summarizing previous studies, Copperman and Bhatt (2011) find that youth make roughly 65–70 percent of their trips by car, 12–16 percent of their trips by walking, and smaller shares by school bus, bicycle, and public transit.[6] As one might expect, teenagers tend to abandon alternative modes of travel as soon as they can drive automobiles (Clifton, 2003). Automobile access quickly follows for teenagers who obtain a license: 40 percent of 16-year-olds in the 2001 NHTS reported having primary access to a vehicle (McDonald, 2006). Teenagers 16–18 years old drive themselves for nearly half their trips, with walking and transit trips declining correspondingly with age (Clifton, 2003; McDonald, 2006). Younger teenagers, who lack licenses, use alternative modes of transportation more than older teenagers, and have slightly lower trip rates as well (Clifton, 2003; McDonald, 2006).

At the same time, however, decreases in licensing rates do not necessarily correspond with decreases in automobile travel. Marzoughi (2011) analyzes travel data in Toronto, where only 38 percent of 16- to 19-year-olds have a driver's license. Although solo driving rates have declined for teenagers—a trend correlated with a decline in driver's license rates for teens—automobile passenger travel among teens has increased so that, in net, overall personal automobile travel has actually increased.

[6] The variation occurs because researchers use different age ranges in their studies.

B. Travel to and from School

Travel to school is the most common trip purpose for children aged 0–18—at least on school days. On those days, travel to school accounts for over a third of total trips (McDonald, 2006). While a subset of studies focuses on teenagers' travel to and from school, they are usually in the context of analyses of children's overall school travel. Cars remain the most important mode of travel, accounting for 54 percent of all children's trips to school, but buses and walking are also important modes, accounting for 30 and 15 percent of school trips, respectively (McDonald, 2006; Copperman and Bhatt, 2011). Walking was once a very important mode for travel to school, but its share of trips has dropped dramatically in the past few decades—from 40 percent in 1970 to 15 percent in 2000 (McDonald, 2007). This downward trend has prompted efforts in communities around the country to encourage more walking through Safe Routes to School programs (Hubsmith, 2006).

Trip distance affects mode choice greatly: for trips to school under a mile, walking accounts for 40 percent of trips—again, down from 90 percent in 1970 (McDonald, 2007). Gender and race, meanwhile, do not appear to have large effects on children's mode choice when they travel to school (McDonald 2008). At the same time, however, Emond and Handy (2012) do find that female high school students are less likely than are their male counterparts to bike to school, though only a small number of high school students use bicycles at all.[7] Finally, unlike their trip-chaining parents who tend to make stops on their way to and from work, children generally travel directly to school and about three-fourths of children go directly home after school (Clifton, 2003; McDonald, 2005; Copperman and Bhatt, 2011). However, over half of those children make additional trips after returning home.

C. Alternative Modes of Travel

While most teens drive, and the vast majority of teen trips are in private vehicles as either drivers or passengers, most research on teen travel mode has focused on alternative, non-automobile modes of travel. A number of these studies focus on walking and cycling. Examining African-American high school students in Baltimore, Voorhees et al. (2011) find that built environment factors and self-efficacy affected physical activity and walking. Emond and Handy (2012), surveying high school students in Davis, California, find that comfort with bicycling and perceived distance affect teenager's decisions to cycle, echoing the finding in Voorhees et al.

[7] Emond and Handy (2012) report that nationally only one percent of students bicycle to school. However, the rate among high school students at Davis High School in northern California was substantially higher: 33 percent. This rate reflects the fact that Davis, California has some of the most bicycle-friendly policies in the country.

(2011) about self-efficacy. Parents' attitudes and behavior also play an important role: teenagers are less likely to bicycle if their parents readily offer rides (Emond and Handy, 2012).

A few other studies have examined transit use. For example, one study of a yearlong program giving free bus passes to low-income teenage students in San Francisco found that bus passes increased both transit use and participation in after-school activities, although they did not increase school attendance as the program administrators had intended (McDonald et al., 2004).

D. Urban Form and Travel Behavior

Some researchers have attempted to examine the effects of urban form on travel behavior for teenagers. For example, Trowbridge and McDonald (2008), perhaps unsurprisingly, find that teenagers in sprawling areas are more likely to drive than teenagers who live in denser areas. McMillan (2007), examining density and other urban form variables on youth travel, finds that urban form has a small but significant effect on travel behavior. That effect, however, applies more to children in high-income and white households than to children in low-income and minority neighborhoods (McMillan, 2007). Dalton et al. (2011) examine more specific urban form factors influencing rural teenagers' travel to and from school. They find that the teenagers were more likely to walk or bicycle in neighborhoods with many intersections, places to eat, and tall buildings close to the streets—all of which correspond to higher-density areas.

E. Gender Differences in Travel Behavior

General research on women's travel behavior shows a clear difference between women and men. Likewise, several researchers have discovered important differences between teenage girls and boys. In urban areas, teenage women travel in cars for a higher share of their trips than do boys; correspondingly, they are less likely to take transit (Clifton et al., 2009) or to walk. When parents chauffeur their teenagers, mothers are roughly twice as likely as fathers to do the chauffeuring (McDonald, 2006; Yoon et al., 2011). Finally, Thakuriah et al. (2009) and McCray and Mora (2011) find that young adult women are more likely to perceive difficulties in their daily travel, most notably safety.

F. Mobility and Safety

A final strand of research examines the ways in which safety—both actual and perceived—affects travel behavior and mobility. As mentioned earlier, females, both younger and older, consistently report feeling less safe than boys and men when they travel (McCray and Mora, 2011), and they travel more frequently by car as a result. However, McCray and Mora (2011) also find that teenagers tended to perceive places as less safe when they accessed them by car. Parents' perception of safety also plays a role in mode choice—particularly in parents

discouraging young females from using transit (Marzoughi, 2011). Safety concerns can also appear in other studies of teenagers and travel behavior: Trowbridge and McDonald (2008), for example, introduce their research on the relationship between sprawl and driving for teenagers by noting that teenagers have higher fatality rates per miles driven than people in other age groups.

Studies examining travel behavior and safety for teenagers can highlight important issues that studies might neglect if they focus only on accident rates. A British study by Hillman et al. (1990) finds that accident rates declined during the 1980s for child pedestrians and bicyclists, but not because Britain had become a safer place for children to walk or cycle: instead, parents severely curtailed their children's mobility. In other words, the decline in accident rates was not an entirely positive trend.

G. Methodological Issues

The researchers who have explored the topic draw from a wide variety of mostly small data sources, such as surveys conducted near the authors' home institutions. The National Household Travel Survey (NHTS) is one exception, however: multiple studies have relied on the 2001 NHTS (e.g., Clifton, 2003; McDonald, 2006; McDonald, 2008), and this report uses data from the 2009 NHTS. Most of the studies examine their available data at the aggregate level, which restricts their ability to examine important individual-level characteristics. For example, while some research has incorporated neighborhood data to test urban form variables, some aspects of urban form can vary greatly from household to household in the same neighborhood.

We also find no consistent definition of age categories across studies, a fact which limits meaningful cross-study comparisons. In the studies examined, the age limits for youth range anywhere from 0–19 years old; for teenagers, the ages range from 13–19. In most cases, the data available determine the age ranges rather than conscious decisions on the part of the researchers. For example, surveys administered to high school students necessarily tend to restrict the ages studied from 15–18.

H. Conclusion

Youth travel behavior remains an understudied phenomenon; nonetheless, these studies collectively present a surprisingly coherent narrative. Whereas studies of younger children's travel have observed substantial decreases in autonomous walking and biking, and corresponding increases in parental chauffeuring over the past quarter century, the studies of travel by teenagers have by contrast observed substantial similarities between adult and (licensed) teen travel. These similarities are understandable, given that teenagers are on the cusp of adulthood. However, a few differences persist. Teens travel slightly less than adults, make fewer work and more school and recreational trips than adults, and are auto passengers

more often than they are drivers. In addition, parents can continue to influence teenagers' travel behavior directly by imposing travel restrictions or indirectly by conveying certain attitudes about a given transportation mode.

For teens, as with adults, licensing and auto access are major determinants of travel behavior. Young teens and older teens without licenses have dramatically different travel patterns than adults—specifically fewer trips and fewer miles traveled. But for licensed teens, travel patterns and choices appear to rather quickly converge on adult travel patterns with age, most notably in the reliance on private vehicles for the vast majority of travel.

Should we expect this convergence on automobility—or "auto-dependency," as some might say—to hold in the years ahead? Or will the near-ubiquity of information and communication technologies, the recently observed drop in licensing among "middle-aged" teens (e.g., 15–17-year olds), and a persistent economic downturn collectively cause a substantial, and enduring, shift from driving? It is to these questions that we now turn.

Chapter III. Methodology

Our analysis uses national travel survey data to examine four dimensions of intra-metropolitan travel:

- *Personal miles traveled (PMT):* the summed distance of all trips by all modes on the survey day;
- *Activity participation (number of trips):* the log of the number of trips made per day;
- *Commute mode:* the mode used for the longest (in terms of time) leg of an individual's journey to work; and
- *Social trip mode:* the mode used for each social trip an individual makes, where social trips are defined in the surveys as trips "visiting friends or relatives" or trips for "other social or recreational" purposes.

The specific methodology we use to model each outcome measure varies. Therefore, in this chapter, we focus on elements of our methodology common across all four analyses.

A. Data

The U.S. Department of Transportation (DOT) periodically conducts a nationally representative travel survey of households. The survey includes a travel diary in which respondents provide details about mode, purpose, distance traveled, etc. for every trip on the survey day. Survey days include both weekdays and weekends. In addition, the survey includes a wealth of personal and household level data. In this study, we use data from 1990 Nationwide Personal Transportation Survey (NPTS), and the 2001 and 2009 National Household Travel Surveys (NHTS),[8] as these three surveys correspond roughly with the 1990, 2000, and 2010 decennial censuses. We exclude respondents who live outside a Metropolitan Statistical Area (MSA), as well as respondents who made a single trip over 75 miles in length on the travel day.[9]

We had access to the confidential version of the two NHTS datasets (2001 and 2009), so for those two survey years we were able to supplement the datasets with census-tract level data from the U.S. Census on residential density. As we discuss below, the models also include a variable identifying the driver's licensing regulation of the state in which the respondent lives.

---

[8] The NHTS is an updated version of the NPTS that includes long-distance travel data. Before introducing the NHTS, the agency collected long-distance travel data in a separate survey series called the American Travel Survey (ATS).

[9] Table 48 in the appendix shows the number and percentage of trips by length and survey year.

B. Age Groups

Because we are primarily interested in the activity participation of teens and young adults, we first had to develop a clear and defensible definition of that group. Unfortunately, scholars have not arrived at a consensus definition for teens and/or young adults—likely because no natural or obvious cutoffs exist for the wide range of phenomena (even within transportation scholarship) that one might wish to study. As such, we developed a technique to identify a reasonable break between a "teens and young adults" category and an "adult" category. Using average daily personal miles traveled (PMT) by age as a proxy for travel behavior and activity participation more generally, we employed an iterative cutoff-search technique that minimizes the root mean square error (RMSE) of regression line-fits for a number of age-based subsamples. We used the NHTS datasets from 2001 and 2009 to estimate appropriate cutpoints. As Figure 1 and Figure 2 show, the procedure determined an age classification system that grouped ages according to *trends* in PMT. Despite changes in absolute PMT between these two datasets, the cutpoints remained relatively stable. While the cutpoint search procedure suggested a cutpoint at 60/61 years in 2001, the procedure suggested a cutpoint of 62/63 in 2009. In this case, we simply split the difference and used a cutpoint of 61/62.

In three of our four analyses (trips, commute mode, and social trip mode), we use the following two age groups:

1. Teens and young adults (ages 15–26, during which time PMT grows rapidly); and
2. Adults (ages 27–61, during which time PMT remains relatively unchanged);

Figure 1: PMT Breakpoints, 2001 NHTS

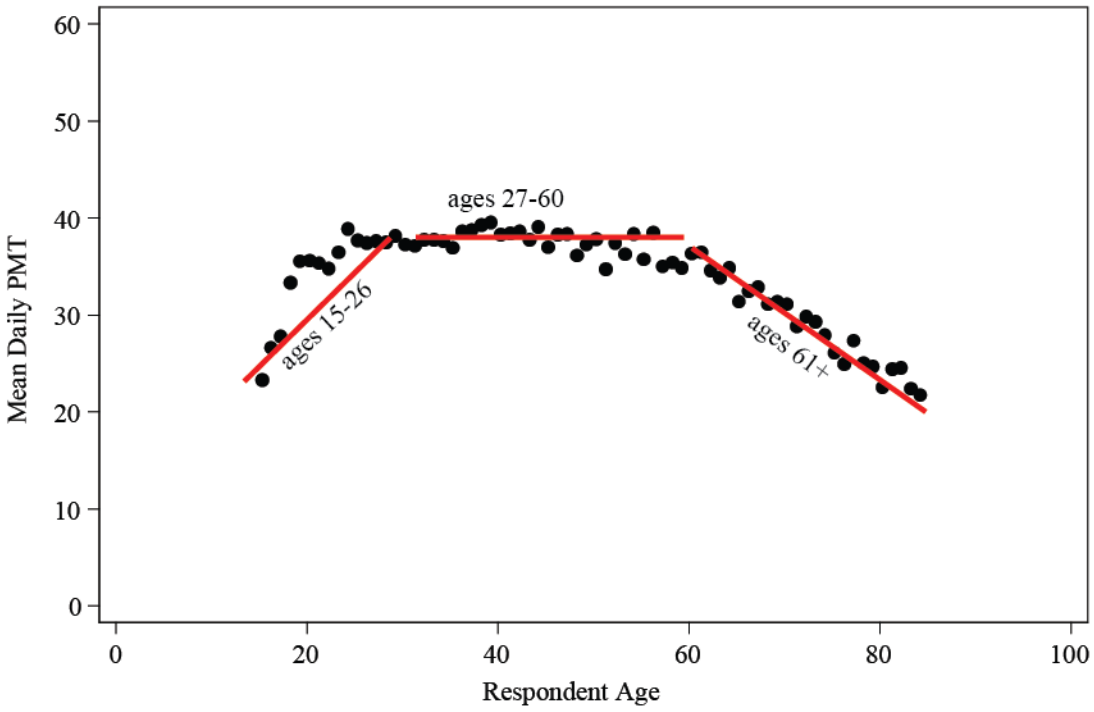
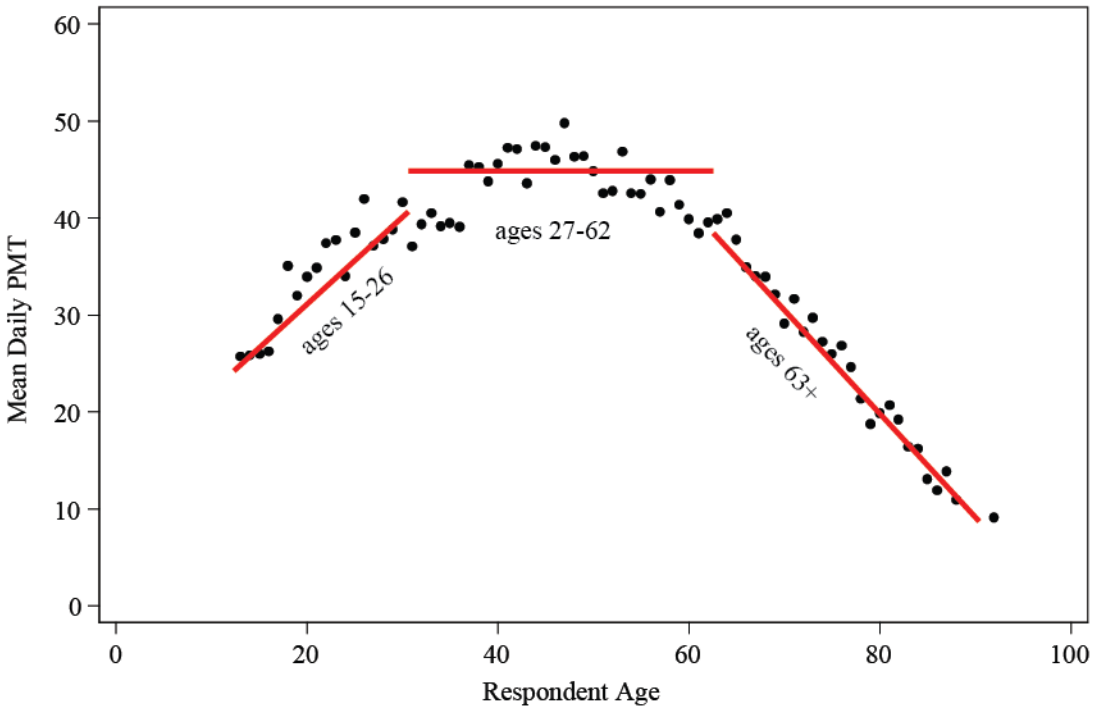


Figure 2: PMT Breakpoints, 2009 NHTS



For our analysis of personal miles traveled, we use three age groups: teens aged 15–18 (Group 1A), young adults aged 19–26 (Group 1B), and adults aged 27–61 (Group 2). Although there is no agreed upon definition of "teen" in the travel behavior literature, restricting our analysis to youth ages 15–18 has two advantages. First, this age group captures the transformational period for travel behavior when most teens obtain driver's licenses. Second, travel decisions often take place at the household level and many young people begin to move away from home at age 19. In 2009, approximately 88 percent of respondents aged 15–18 lived with their parents, but at age 19 the figure fell to 74 percent and declines steadily thereafter with age.

C. Statistical Models

We construct a set of *cross-sectional models* using three years of data (1990, 2001, and 2009) to examine: (a) the determinants of travel, and (b) changes in these determinants over time. As noted above, the years chosen roughly correspond to a decade of change and the microdata data can be linked to census-tract level data from the decennial census and other supplemental data in a consistent manner. Drawing from the broader travel behavior literature, our models control for the major determinants of travel including variables that measure individual, household, neighborhood, and trip characteristics as well as the driver's licensing regulations in the state in which the respondent lives.

In a separate set of models, we use the travel survey data to construct a set of *quasi-cohort models*. The NPTS and NHTS data are cross-sectional and are not samples of the same individuals over time. We, therefore, construct a set of pseudo-cohort models by linking observations across survey years by birth decade. Specifically, in each of these models (PMT, trips, commute mode, and social trip mode), we include data from all three survey years. Similar to the cross-sectional models, we control for the major determinants of travel behavior. To test whether cohorts that are more recent travel differently from prior cohorts, controlling for other factors, we introduce a series of decade-of-birth (cohort) variables. Figure 3 shows the ages of these birth cohorts for each of the three data years. This figure illustrates that, particularly for the most recent birth cohorts (1980s and 1990s), the observed behavior of that group only spans a limited range of life years. The 1990s birth cohort is included only in the 2009 dataset, and thus we interpret the coefficients associated with this birth decade with some caution. For instance, if the model suggests that those born in the 1990s have different travel patterns than those of other birth decades, this finding must be interpreted with the caveat that we have only provided the model with "overlapping" observations (of similar life years) for two other birth cohorts: those born in the 1970s and 1980s.

Figure 3: Ages of Cohorts Included in the Model by Data Year

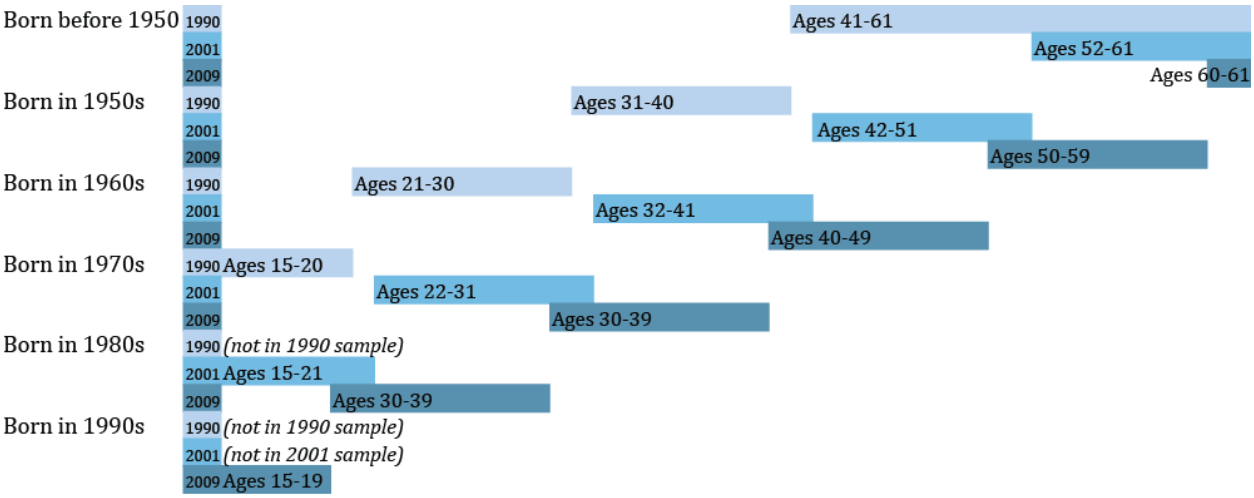


Table 17Table 5 shows the total number of person records in our model for each cohort across the three data years. While the 1990s birth cohort is the smallest of the six cohorts, it still contains over eleven thousand records. The largest cohorts in the study are those of participants born in the 1950s and 1960s, as these birth cohorts are not truncated at either end for any of the three data years.

Table 5: Number of Person Records per Cohort and Data Year

	1990	2001	2009	Total
Born before 1950	2,930	14,929	13,913	31,772
Born in 1950s	4,429	19,713	43,398	67,540
Born in 1960s	4,277	18,270	32,960	55,507
Born in 1970s	1,571	12,114	20,152	33,837
Born in 1980s	0	23,024	11,895	34,919
Born in 1990s	0	0	11,805	11,805
Total	13,207	88,050	134,123	235,380

D. Independent Variables

Although they vary in structure, the cross-sectional and cohort statistical models included in this analysis control for four, and for the mode split analyses five, categories of travel determinants:

1. Individual characteristics,
2. Household characteristics,

3. Neighborhood characteristics,
4. Driver's licensing regulations, and
5. Trip characteristics.

Table 6 summarizes the variables used in this analysis. Unfortunately, the NPTS/NHTS datasets do not include variables to measure some of our variables of interest. We also had difficulty incorporating external variables such as graduated driver's licensing regulations.[10] Therefore, in the text that follows, we discuss our construction of four of these variables: young adults living with parents, daily web use, graduated driver's licensing regulations, and education.

[10] We were also interested in controlling for the unemployment rate of the metropolitan area in which respondents lived. Unfortunately, the NHTS/NPTS surveys do not identify metropolitan areas for respondents who live in areas with populations of less than one million. To attach metropolitan unemployment rates, we would have had to omit data for over 330,000 trips that occur in MSAs smaller than 1 million.

Table 6: Summary of Independent Variables

Variables	Definition
Individual Characteristics	
Age	Age
Sex	Female = 1, Male = 0
Race/Ethnicity[11]	Non-Hispanic Black, Non-Hispanic Asian, Non-Hispanic Other, Hispanic (omitted: Non-Hispanic White)
Foreign born	Not born in the United States
Employed	Yes =1, No = 0
Web Use	Uses internet almost every day (Yes = 1, No = 0)
Driver	Driver =1, Non-Driver = 0
Medical condition	Has medical condition making it hard to travel
Education	For adults (27–61): High School, Some College, College Graduate, Professional Degree (omitted: less than HS) For youth (15–26): maximum education attained by any relative in household
Young Adult Lives with Parents	Lives with a parent and is between the ages of 19 and 26
Household Characteristics	
Household Income	Log of household income
Number of adults	Number of adults
Number of children	Number of children
Childrearing responsibilities	Ratio of children to adults
Single parent	Single parent with at least one child under the age of 21
Single family home	Lives in detached single house
Access to cars	Autos per adult in household; for social trips: number of autos in household
Neighborhood Characteristics	
Residential density	Log of census-tract residential population density
Large metropolitan areas	MSA > 3 million
New York	Lives in New York City
License Regulation Stringency	Lowest, Low, Medium, and High
Trip Characteristics	
Distance	Trip distance (in miles)
Commute time	Hours spent commuting on survey day (door to door)
Weekend travel	Trip on Saturday or Sunday
Peak period travel	Commute journey start time from 6:00 AM to 8:59 AM

Young adult living with parents: This variable captures the potential effect of a "boomerang" lifestyle—returning to live with one's parents after a period of living apart—on youth travel

[11] In the NPTS and NHTS datasets, race/ethnicity data exist only for the household respondent, the individual who interacts with the telephone survey worker. Thus, this is an imperfect measure of the race/ethnicity of the individual.

behavior. The variable is dichotomous, taking a value of "1" if the respondent lives with a parent and is between the ages of 19 and 26. This is an imperfect measure because it does not distinguish between young people who have returned home and young people who never left the home in the first place. To minimize the risk of including youth who have not yet left the home, we do not include people younger than 19 in this variable.

Daily Web Use: This variable is also dichotomous and takes a value of "1" if the respondent uses the internet "almost every day." Youth who use the web daily may travel less than their peers who use the web less frequently if web use is a substitute for travel. Conversely, we expect web use to increase travel for youth if it is a complement. The 1990 NHTS did not include questions regarding web use. We assume daily web use was virtually non-existent in 1990, particularly for youth.

Licensing Regulations: Graduated drivers licensing (GDL) regulations typically include some combination of components to phase in driving privileges, including minimum permit age, required hours of supervised driving, restrictions on nighttime driving, and restrictions on driving with passengers. In general, states have gradually ratcheted up their GDL regulations over the past two decades. For this research, we used the GDL Ranking system developed by the Insurance Institute for Highway Safety (IIHS), which many traffic safety researchers use to assess safety outcomes of GDL regulations. We include the criteria for the IIHS rating system in Table 7 below.

We applied the rating system to historical licensing information provided by Federal Highway Administration (FHWA) for 1990, and the IIHS for the years 1995 to 2009 (U.S. Department of Transportation, 1992; Sims, 2012). Neither of these two sources provides complete license information for all three years (1990, 2001, and 2009). The FHWA data only include states with license regulations specifically for juveniles. As a result, 23 states do not appear in the data. Accordingly, we assumed the lack of juvenile specific regulations was equivalent to having a GDL poor ranking. The IIHS data did not contain information on regulations in Massachusetts, New Jersey, or Washington DC. We used 2011 data and information about implementation dates to determine license regulations in 2009, which we use as a proxy for the 2008 figures in these three locations. We were unable to estimate the level of licensing restrictions in those states in 2000.

Wherever possible we followed the standard of the safety literature by using the licensing information for the year preceding the year of interest. In other words, for analysis of travel behavior in 2009 we used the licensing requirements that were in effect in 2008. This step is necessary because many states do not retroactively apply restrictions to young drivers who have already received a license. Therefore, a driver who received a license at the beginning of 2009 would not be subject to restrictions if tougher laws came into effect later in the calendar year. Unfortunately, we could not secure licensing information for 1989. However, we are

confident that licensing regulations were not yet undergoing dramatic changes and that our 1990 information accurately reflects the state of licensing regulations in 1989. Based on the IIHS point system, we categorized state driver's licensing regulations from least to most stringent—lowest (< 2 points), low (2-3 points), medium (4-5 points), and high (6+ points).

Table 7: Insurance Institute for Highway Safety Graduated Drivers License Rating Scheme

Component	Specific Restriction	Points
Learner's Phase		
Minimum permit age	16 or older	1
	Less than 16	0
Permit holding period	6 or more months	2
	3-5 months	1
	Less than 3 months	0
Required practice hours	30 or more hours	1
	Less than 30 hours	0
Intermediate Phase		
Restriction on night driving	10 pm or earlier	2
	After 10 pm	1
	No restriction	0
Restriction on underage passengers	Zero or 1 passenger	2
	2 passengers	1
	3 or more passengers	0
Duration of night driving restriction	12 months or more	1
	Less than 12 months	0
Duration of passenger restriction	12 months or more	1
	Less than 12 months	0
IIHS Graduated Licensing Rating*	**In this Report: License Stringency**	
Good	High	6+ points
Fair	Med	4-5 points
Marginal	Low	2-3 points
Poor	Lowest	< 2 points

*No state is rated higher than "marginal" if people younger than 16 can get an intermediate license or if driving restrictions are lifted before age 16 ½ .

Education: This variable takes five possible values: Less than a High School Degree, High School Graduate, Some College, College Graduate, and Professional Degree. In the regression models that follow, "Less than High School" is the omitted category. Educational attainment is self-reported in the NHTS. Measuring adult educational attainment is straightforward, but measuring education for youth is more complicated. Educational attainment for people 15 to 26 is highly correlated with age. Moreover, there is no clear way to establish whether a 17-year-old

without a high school degree will complete a high school degree in the coming year. In this research, we assume parent's education is a better predictor of future educational attainment than current educational attainment for youth. Therefore, for each young person we created a variable representing the educational attainment of their parent by assigning the value of the maximum education attained by any relative in their household.

E. Missing Data

The travel surveys differ slightly from year to year, complicating multi-year comparisons considerably. Nevertheless, to the greatest extent possible, the following analyses contain variables that are identical across the three survey years. As Table 8 shows, within a given survey year, some questions were only asked of respondents of a certain age. For example, in 2001 and 2009, respondents aged 15 were not asked about their use of the internet or their employment status, but respondents over age 16 were asked those questions. Similarly, in 1990, respondents aged 15 were not asked about their driver status, while their older peers were. Yet in many states, 15-year-olds are allowed to drive with permits. Fortunately, we were able to infer some information about these variables from other questions in the survey, which we detail below.

Employed: If a 15-year-old indicated a trip purpose that was a commute or a work-related trip on their travel day, we coded them as employed. This method inevitably misses many workers, particularly because youth have irregular work schedules. The correlation between actual work status and an identically constructed estimate of work status for 16, 17, and 18-year-olds in 2009 was .19, .39, and .53, respectively. So while we were able to correctly add worker information for some 15 year-olds using this method, others are unavoidably missing information.

Driver Status: To estimate driver status in 1990, we used information about which family member drove on a given trip. If a 15-year-old indicated their own ID number for any trip, we considered them a driver.

Daily Web Use: One of the hypotheses we wished to test was whether the use of information technologies can help explain a reduction in the trip making, PMT, and/or automobile use among youth. However, while the 2001 and 2009 NHTS include a number of questions related to the use of the internet, the datasets do not include these data for individuals aged 15 or younger. Because we wished to include 15-year-olds in our models, we opted to use a multiple imputation strategy to estimate internet usage for 15-year-olds.

Multiple imputation is a method for "filling in" missing data in a dataset by using the existing, non-missing data to uncover patterns that predict the outcome of interest, and then using these predictive models to estimate probable values for the missing data.[12] The imputation strategy is "multiple" in that it uses a Monte Carlo estimation technique to create multiple probable outcomes for each missing value. For instance, if the predictive model estimates that an individual has a 51 percent chance of using the internet on a daily basis, the multiple imputation technique would create 10 random but probable records for that individual; in roughly five of those records, the individual would be coded as using the web daily. These records are then used in a series of estimation models that are then averaged together to obtain a final model that accounts for the missing data in a principled fashion.

Education: Similarly, educational attainment is not available for all ages in all datasets. For instance, in the 2009 dataset, educational attainment is only available for individuals age 18 and older. However, this does not present a challenge to our models because we hypothesized that, for school-age youth, the individual level of educational attainment should matter less than the parent's level of education. Thus, we used the highest level of education achieved by any member of the household for youth in many of our models.

Table 8: Data Availability by Year (1990, 2001, and 2009)

	Ages			
	15	16	17	18
1990				
Employed	Missing Data	Data Available		
Driver Status				
Web Use				
Education				
2001				
Employed	Missing Data	Data Available		
Driver Status				
Web Use				
Education				
2009				
Employed	Missing Data	Data Available		
Driver Status				
Web Use				
Education				

[12] For a thorough treatment, see Rubin (1987) and Schafer (1999).

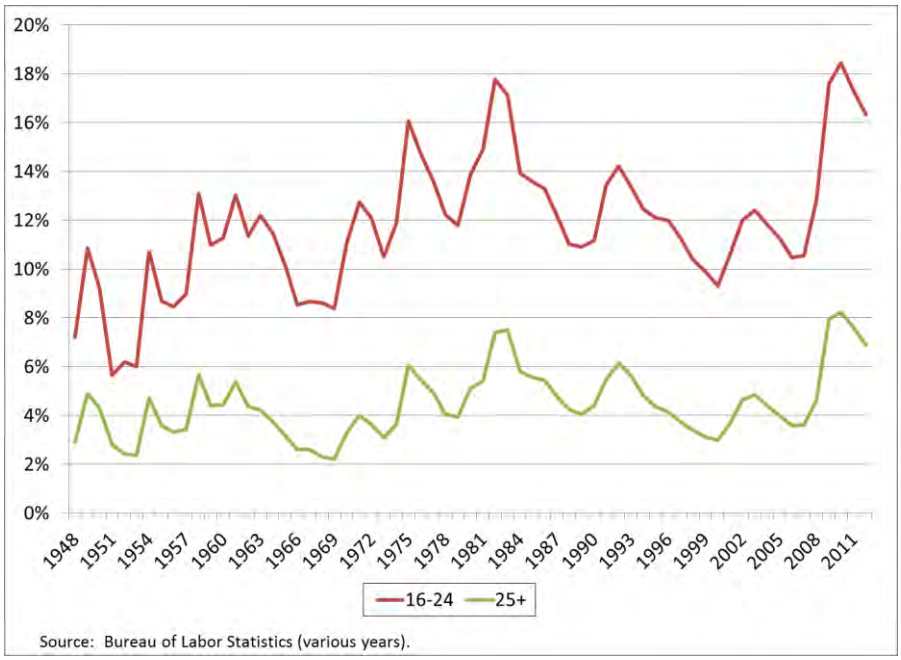
Chapter IV. Variables of Interest

In addition to the standard explanatory variables of travel behavior, we hypothesize that the travel of youth will be uniquely affected by four different factors—high youth unemployment rates, changes in household structure (in part related to high youth unemployment), increased use of information and communications technologies, and the adoption of state graduated driver's licensing regulations. We discuss each of these factors below and present descriptive data for these variables from the three national travel surveys.

A. Unemployment Rates

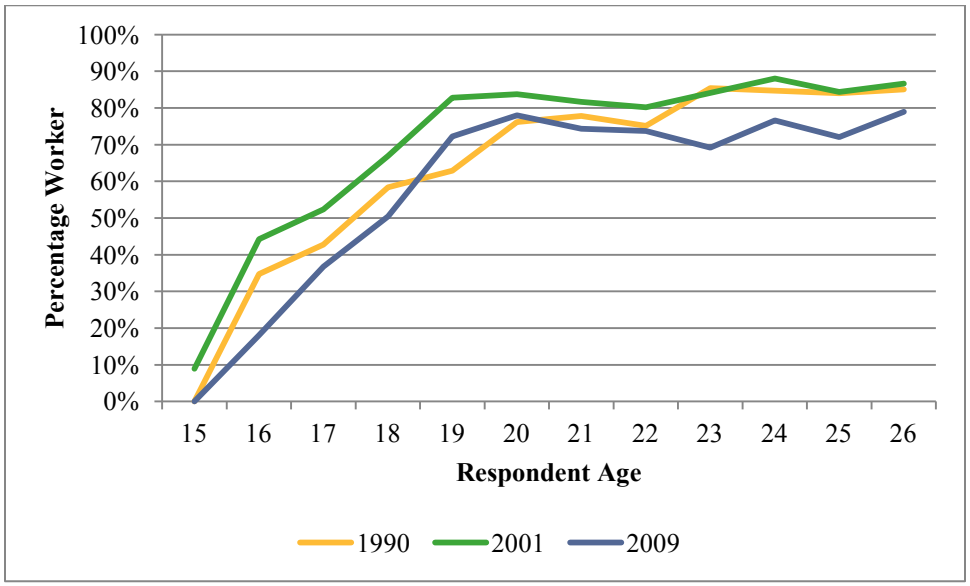
The recession that began in 2008 hit teens and young adults particularly hard. As Figure 4 shows, youth unemployment rates have always been higher than non-youth unemployment rates; however, the gap between the two has widened over time (U.S. Department of Labor, various years). In 2008, one in five young workers (16-24) was unemployed, almost three times the unemployment rate of older individuals (25+).

Figure 4: Unemployment Rates by Age Group (1948-2012)



Similarly, data from the national travel surveys show that the share of youth employed dropped dramatically between 2001 and 2009, particularly for the youngest respondents in our sample. As Figure 5 shows, fewer than 20 percent of 16-year olds in 2009 had a job, while the figure was more than double that in 2001.

Figure 5: Percent Working By Age and Year (1990, 2001, and 2009)



High youth unemployment rates may well explain changes in the travel of youth. The current recession directly contributes to a decline in work travel and, consequently limits the resources that youth have available to travel for other purposes (such as shopping and recreation). The recession may also make it more difficult for youth to afford owning and operating automobiles thereby increasing their travel by alternative modes such as public transit and walking.

B. Household Structure

The downturn in the economy may also influence youth travel patterns through household structure. Studies show that young adults tend to live at home for their own benefit, particularly when they are young, unmarried, and have low-incomes (Di et al., 2002; Kreider, 2007; Messineao and Wojkiewicz, 2004). Further, as discussed above, young adults who face a difficult labor market often "boomerang" back to live with parents. Wiemers (2011) finds that individuals who become unemployed are twice as likely to move in with others, with young adults the most likely to move into shared living arrangements. Kaplan (2009) finds that youth (16-23) who do not attend college frequently move back home and that moves from employment to non-employment substantially increase the likelihood of moving home. Youth who live at home can take advantage of their parents' resources including, perhaps, their automobiles.

Figure 6 illustrates the dramatic increase (58%) in the proportion of young adults who live with their parents in 2009. Figure 7 illustrates the percentage of young people living at home by age for each of the three decades. The data indicate that a higher percentage of young adults lived with their parents in 2009 compared to previous survey years. In 1991 and 2001, there was a sharp decline in living with parents between the ages of 18 and 19. The decline is far more gradual in 2009 and it takes until age 23 to achieve the same percentage of youth living with

parents than we observe for 19 year olds in the earlier decades. The graph also shows that in 2009 almost 10 percent of young teens (15-17) did not live at home with their parents.

Figure 6: Percent of Young People (19–26) Living At Home with Parents (1990, 2001, and 2009)

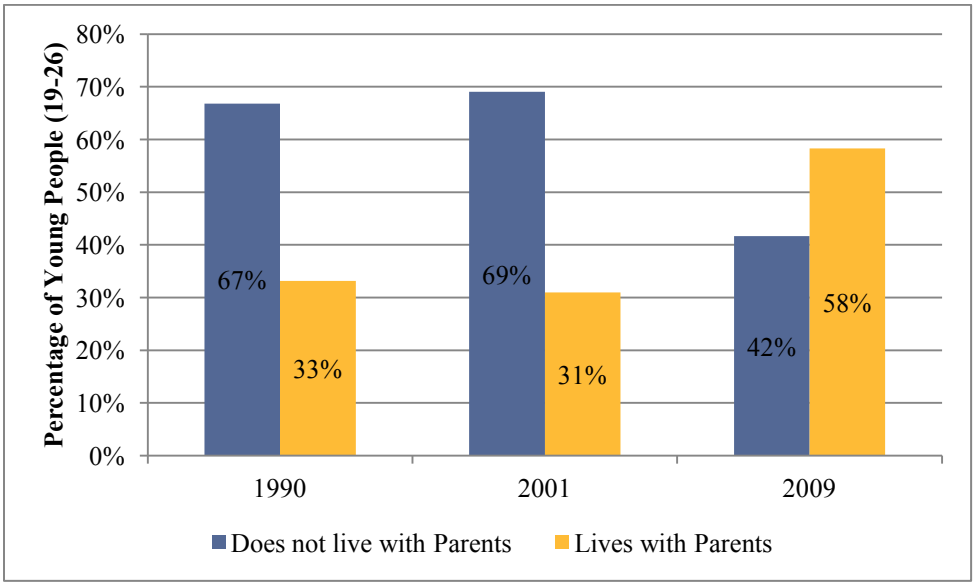
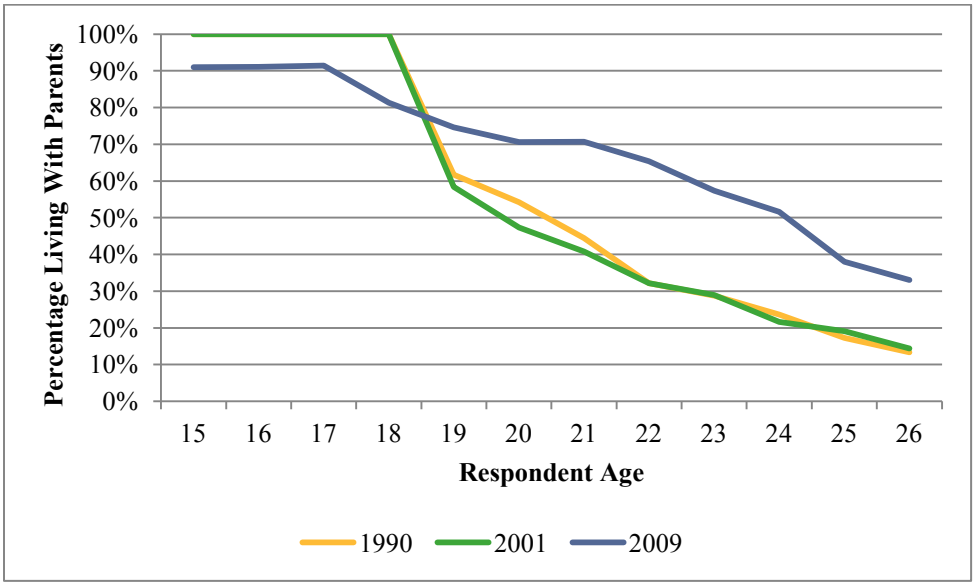


Figure 7: Percent of Youth Who Live at Home with Parents by Age and Year (1990, 2001, and 2009)

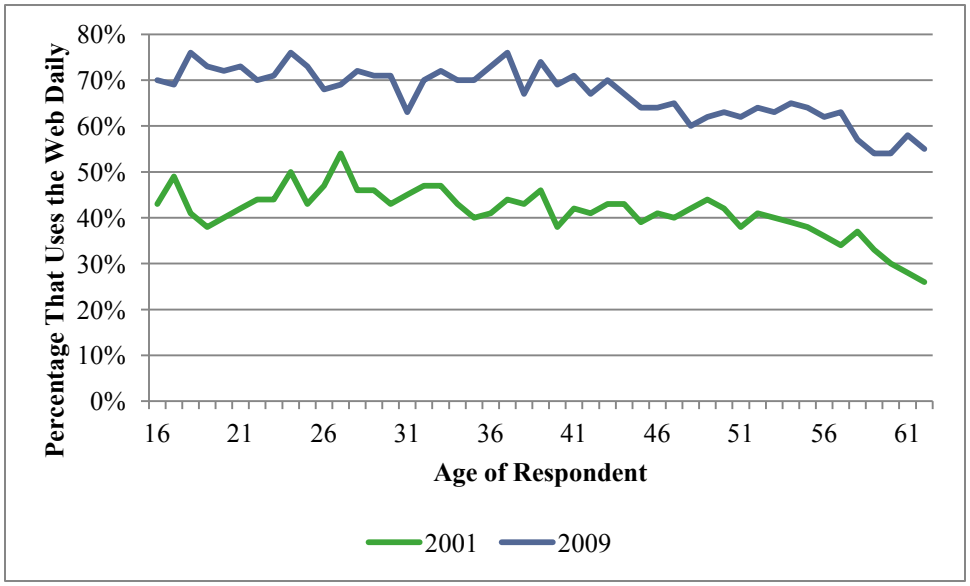


C. Use of Technology

Youth tend to be early and frequent adopters of communication technologies (Mans et al., 2011; Lenhart et al., 2005; Pew Research Center, 2010b). Figure 8 shows the use of technology (daily web use) by age in 2001 and 2009. Even in this relatively short period of less than a decade,

internet usage increased substantially across all ages. While web use is high among all ages, the data suggest that youth and young adults are slightly more likely to use the web daily compared to older adults.

Figure 8: Use of Technology by Age (2001 and 2009)



The rapid profusion and adoption of new communication technologies may influence how people use their time and, therefore, how much they travel (Kwan, 2002). The literature on information and communications technology (ICT) and travel among adults is inconclusive, although a majority of studies find that it is complementary to travel by potentially generating additional travel (Ferrell, 2004; Mokhtarian, 2000, 2002). Viswanathan and Goulias (2001) find high levels of person-to-person variance in the relationship between mobile technology and travel suggesting that individuals use technology in different ways; some individuals use technology to consolidate trips and others use it to reach activity opportunities that require longer travel times. Thus far, studies on this topic have not focused on youth in particular; therefore, the effect of ICT on youth travel behavior remains unknown.

D. Graduated Driver's Licensing Regulations

Stringent licensing regimes may suppress travel if young people can no longer become drivers. On the other hand, it is possible that young people find alternative modes to meet their daily travel needs, such as getting a ride with a parent or older friend, using public transit, walking, or using a bicycle.

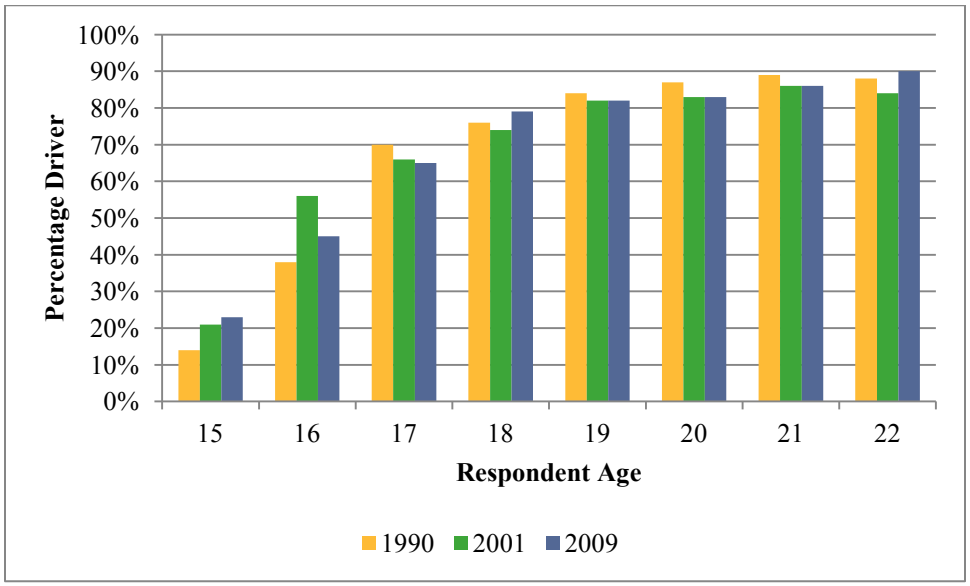
Table 9: Number of States per License Rating (1990, 2000, and 2008)

Ranking	1990	2000	2008
License Stringency: Lowest	42	13	-
License Stringency: Low	9	19	9
License Stringency: Medium	-	14	12
License Stringency: High	-	3	30

Table 9 presents the number of states in each ranking category in each year. As discussed above, we use licensing information for the year preceding our year of interest. Variation in licensing regulations by state was highest in 2000. In 1990, by contrast, the majority of states still had not begun to introduce graduated driver's licensing regulations (GDL) and by 2008, most states achieved the highest ranking from the IIHS. The licensing regimes do not follow a strict urban-rural pattern. The states with the lowest ranking (Marginal) in 2008 were mostly rural states: Arkansas, Idaho, Kansas, Mississippi, Montana, New Mexico, North Dakota, North Carolina, and South Dakota. However, many other rural states also had the highest ranking in 2008, including West Virginia, Nevada, Oklahoma, and Utah.

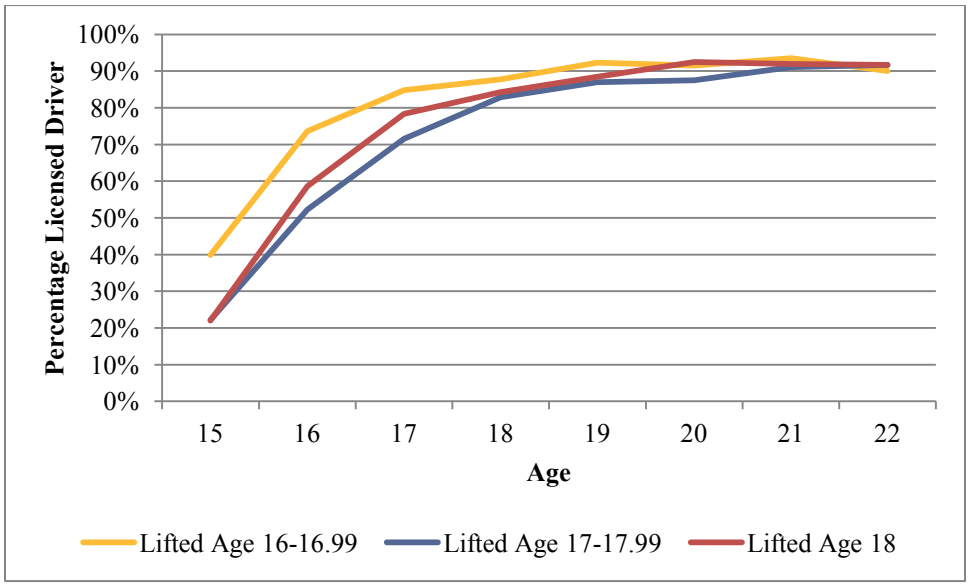
The data show that driver status varies by age and licensing stringency. We can see from Figure 9 that, compared to young adults, a smaller proportion of teens are drivers because many are not legally able to acquire a license. The data also show that 16-year-olds in 2009 were less likely to drive compared to 16-year-olds in 2001; however, they were more likely to drive compared to 16-year-olds in 1990, a period where there were relatively few regulatory restrictions on driving. Unfortunately, the 1990 survey did not ask 15-year-old respondents about their driver status and, therefore, we must rely on our best estimate of driver status, which, as we discuss in Chapter III, substantially underestimates the proportion of 15-year-old drivers.

Figure 9: Percent Drivers by Age, 15–22 (1990, 2001, and 2009)



In Figure 10, we see there are fewer young drivers in states with tough licensing regulations, but by age 22, young people in states with the strictest licensing regulations are just as likely as young people in states with less strict regulations to have a license. This finding suggests that the introduction of more stringent licensing regulations has only a short-term effect on driver status.

Figure 10: Percent Youth with Drivers License by Age when License Restrictions are Lifted (2009)



Finally, Table 10 presents the proportion of people in each age group who are drivers disaggregated by license regulations ranking. For teens, more stringent driver's license

regulations are, in general, associated with a lower proportion of respondents who are drivers in all three years. This finding conforms to expectations because we might expect stricter standards to act as a barrier to driver status or as an incentive to delay licensing. Contrary to expectations, however, the relationship between license stringency and proportion of drivers also materializes, albeit to a lesser extent, for adults and young adults in some years. Yet we do not expect graduated licensing regulations to affect the licensing decisions of young adults or adults.

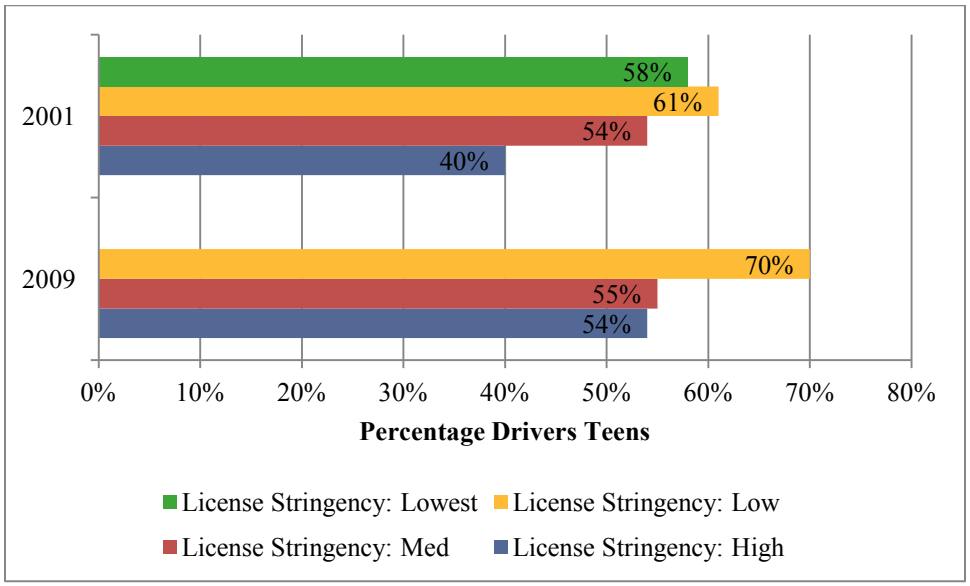
In Figure 11, we can more clearly see how the proportion of drivers has changed over time within each age group. Again, we caution the reader regarding the interpretation of the proportion of young drivers in 1990 because the measure is undoubtedly an underestimate.[13] For this reason, we restrict our comparison of teen drivers to 2001 and 2009 where we see an *increase* in the proportion of teen drivers within each licensing regime over time.

[13] Among respondents aged 16-18 in 1990, 68 percent of respondents in the lowest stringency category and 54 percent in the low stringency category report being drivers.

Table 10: Percent of Drivers by Age Group and Strength of Licensing Regulation (1990, 2001, and 2009)

	1990	2001	2009
Teen (15–18)			
License Stringency: Lowest	59%	58%	
License Stringency: Low	41%	61%	70%
License Stringency: Med		54%	55%
License Stringency: High		40%	54%
Difference (lowest observed-highest observed)	*18*	*18*	*16*
Young Adult (19–26)			
License Stringency: Lowest	92%	91%	
License Stringency: Low	82%	93%	83%
License Stringency: Med		85%	86%
License Stringency: High		85%	87%
Difference (lowest observed-highest observed)	*10*	*6*	*-4*
Adult (27–61)			
License Stringency: Lowest	95%	96%	
License Stringency: Low	91%	96%	94%
License Stringency: Med		94%	94%
License Stringency: High		93%	93%
Difference (lowest observed-highest observed)	*4*	*3*	*1*

Figure 11: Percent Drivers by Licensing Regime and Year, Teens 15–18 (2001 and 2009)



Chapter V. Personal Miles Traveled (PMT)

A. Introduction

The NPTS and NHTS offer a wide variety of measures of travel behavior to estimate daily mobility. Personal miles traveled (PMT) is a standard measure of mobility that combines both the number and length of trips. While generally mode- and area-neutral, PMT do tend to be higher among drivers and among those who live in suburbs. In this chapter, we begin by describing our methodology for analyzing PMT, focusing on aspects of the methodology unique to this analysis. We then present descriptive data for our outcome measure (PMT) and for a few of our variables of interest. Finally, the chapter concludes with our statistical models and overall findings.

B. Methodology

Our cross-sectional models predict personal miles traveled (*PMT*) according to the following function:

$$PMT = f(I, H, N, R, u)$$

To determine individual PMT values we summed the distance of all trips by all modes on the survey day.[14] Individual characteristics (*I*) include a set of personal characteristics shown to influence travel behavior such as sex, age, race/ethnicity, education, employment status, driver. In this category, we also include daily use of the web, a variable that has not been widely tested relative to PMT. To each individual record we also attach household characteristics (*H*), including household income (ln), the number of adults and children in the household, and the number of autos per adult in the household. For youth, we add to these standard determinants a variable identifying whether young adults live with their parents. Residential location characteristics (*N*) include population density of the respondent's census tract and whether the individual lives in a large metropolitan area. Finally, we include a variable (*R*) identifying the stringency of the state driver's licensing regulations.

As we described previously, for this analysis, we analyze three age groups: teens (15–18), young adults (19–26), and adults (27–61). The inclusion of the teen age group captures the transformational period for travel behavior when most teens obtain driver's licenses. These age groupings also correspond to a period when teens are likely to move out of their parents'

14 In 1990, 19,414 trips were less than half a mile and did not include a numeric trip length. We coded these trips as ¼ of a mile.

homes. In 2009, approximately 88 percent of respondents aged 15 to 18 live with their parents, but at age 19 the figure falls to 74 percent and declines steadily thereafter with age.

We specified a large variety of models to predict PMT. In our analysis, we sought to compare regression coefficients for specific variables across these models and survey years. As a result, we needed to apply the same overall model specification to each year and age group. The optimal model would explain the variation in PMT equally well in each of the three model years and for each of the three age groups. This presents obvious analytical challenges, particularly because any given model is likely to fit one year and age group better than the other years. Moreover, any changes made to a single model required making changes to each of the eight additional models.

Initially we tried to model license regulations and driver status in the same PMT model. We found that license regulations were not statistically significantly related to PMT, but such models had serious endogeneity issues, especially for teens. To address these issues we ran two separate models—one with driver status (Table 17) as an independent variable and the other with information on licensing regulations (Table 18). Contrary to our expectations, the stringency of license regulations does not appear to influence PMT for teens. As a result, we consider the model with driver status our primary model.

In a separate model, we test to see whether there are cohort effects. The quasi-cohort model is a standard linear regression model of PMT, and it closely resembles the cross-sectional models. To test whether individuals in more recent age cohorts travel differently from prior cohorts, controlling for other factors, we introduce a series of decade-of-birth (cohort) variables. We include a year variable to account for period effects (such as the economic boom of the 1990s and the economic collapse of the late 2000s) not captured by any of the other independent variables.

C. Descriptive Statistics

In this section, we describe our data, starting with data on PMT by age group and year. We then highlight some of the data related to other variables of interest—driver status and graduated driver's licensing, employment, living with parents, and web use.

PMT: Figure 12 presents mean PMT levels for each of the age categories over the three research periods. Between 1990 and 2001, PMT increased for individuals in all three age categories before declining again in 2009, undoubtedly related to the recession. In general, PMT is positively related to age, and PMT typically increases dramatically as teens transition into young adulthood. However, in 1990, young adults traveled more miles than both teens (expected) and adults (not expected). This pattern changed with the 2001 and 2009 surveys

wherein teens travel less than young and older adults, and the primary increase in PMT occurs by the time respondents are young adults.

Figure 12: Personal Miles Traveled by Age Group and Year (1990, 2001, and 2009)

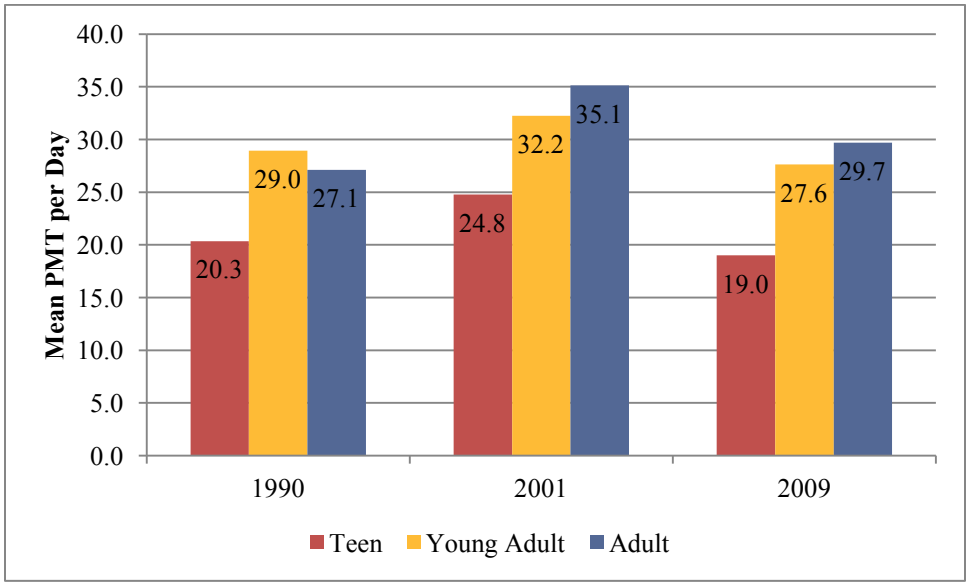
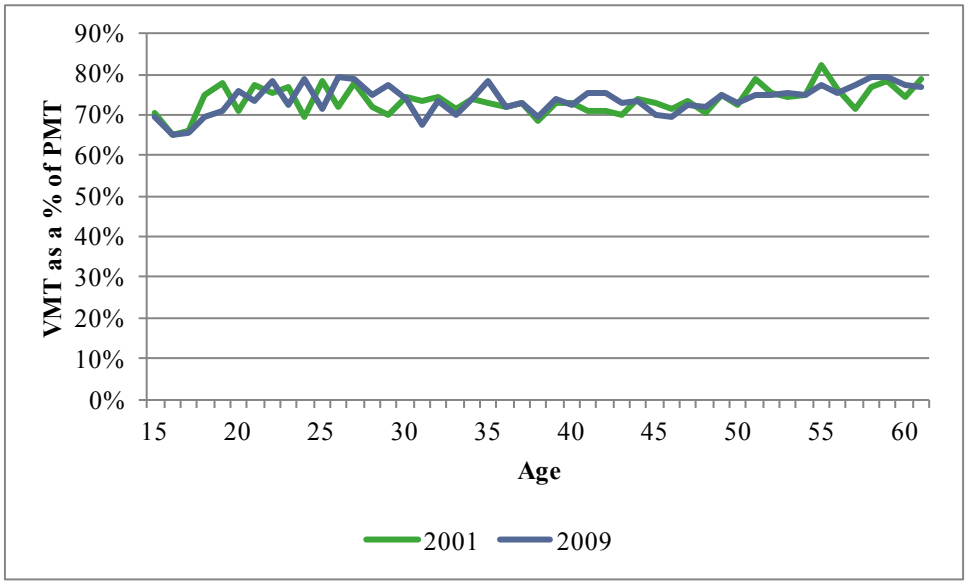


Table 11 and Figure 13 show vehicle miles traveled (VMT) as a percentage of PMT by age. As expected, for both years, the percentage of VMT to PMT is lowest for young teens, under 70 percent. However, the percentage of VMT to PMT is slightly higher for young adults than adults. Finally, between 2001 and 2009, the percentage of VMT to PMT increased slightly for both young adults and adults; however, it declined for teens.

Table 11: Vehicle Miles Traveled as a Percentage of PMT by Age Group (2001 and 2009)

	2001	2009
Teen (15-18)	69.6%	67.7%
Young Adult (19-26)	74.5%	75.1%
Adult (27-61)	73.4%	74.1%

Figure 13: Vehicle Miles Traveled as Percentage of PMT by Age (2001 and 2009)



Driver Status: We hypothesize that being a driver ("driver status") will influence PMT. Individuals who can drive will be more likely to travel by automobile than other, slower modes of transportation and, therefore, will likely travel more miles than non-drivers. Having a driver's license (a proxy for driver status) is positively associated with the number of person trips and negatively associated with transit and non-motorized travel (Kitamura et al., 1997).

Table 12 presents PMT by age group and driver status for each survey year. There are several noteworthy aspects of the table. First, as predicted, drivers have substantially higher average PMT than non-drivers do. However, the difference in PMT for drivers and non-drivers is greater for adults than for teens. Figure 12 also depicts an increase in PMT between 1990 and 2001, and a subsequent decrease in 2009 to figures similar to or lower than 1990 values.

Table 12: Average PMT by Driver Status, Age Group and Year (1990, 2001, and 2009)

	1990	2001	2009
Teen (15–18)			
Non-Driver	15.7	18.5	14.3
Driver	25.9	30.0	22.8
% Difference (Driver/Non-Driver)	65.0%	62.2%	59.4
Young Adult (19–26)			
Non-Driver	14.9	13.6	13.0
Driver	30.6	34.8	29.9
% Difference (Driver/Non-Driver)	105.4%	155.9%	130.0%
Adult (27–61)			
Non-Driver	11.9	14.5	10.1
Driver	28.1	36.3	31.1
% Difference (Driver/Non-Driver)	136.1%	150.3%	207.9%
PMT are significantly different for drivers and non-drivers for all ages and all years (alpha=.05)			

Table 13 presents PMT by age group and stringency of the licensing regime. We can see that PMT is significantly lower for respondents in states with stricter license regimes in every year. Surprisingly, this result holds for all ages in most years, suggesting some underlying effect in those states on both licensing regimes and PMT, rather than an independent effect of licensing on PMT.

Table 13: PMT by Age Group and Strength of Licensing Regime (1990, 2001, and 2009)

	1990	2001	2009
Teen (15–18)			
License Stringency: Lowest	20.8	27.5	
License Stringency: Low	16.9	24.5	25.3
License Stringency: Med		24.8	19.3
License Stringency: High		21.8	18.5
Average for all Teens	*20.3*	*24.8*	*19.0*
Young Adult (19–26)			
License Stringency: Lowest	29.3	34.4	
License Stringency: Low	28.1	34.5	31.1
License Stringency: Med		29.7	27.4
License Stringency: High		33.0	27.5
Average for all Young Adults	*29.0*	*32.2*	*27.6*
Adult (26-61)			
License Stringency: Lowest	27.5	36.1	
License Stringency: Low	25.9	35.4	32.7
License Stringency: Med		34.2	30.2
License Stringency: High		36.7	29.3
Average for all Adults	*27.1*	*35.1*	*29.7*

PMT is significantly different (alpha = .05) by license stringency for all age groups in all years, except young adults in 1990.

Employment: Being employed is positively related to PMT as traveling to, from, and during work contribute significantly to total trips and miles. Data from the 2009 NHTS show that commute and work-related travel comprise 19 percent of all person trips and 25 percent of all PMT (Santos et al., 2011).

Table 14 presents PMT figures by employment status in 2009. The figures for 2001 and 1990 are broadly similar and can be found in the Appendix (Table 49). We see that employed respondents of any age have higher average PMT than people who are unemployed. Adults and young adults travel further on average if they are employed full-time. Teenagers have higher average PMT if they are employed part-time than if they are employed full-time or not employed at all. This finding reflects the fact that teenagers with part-time employment are likely still in school and, therefore, might need to travel to more destinations.

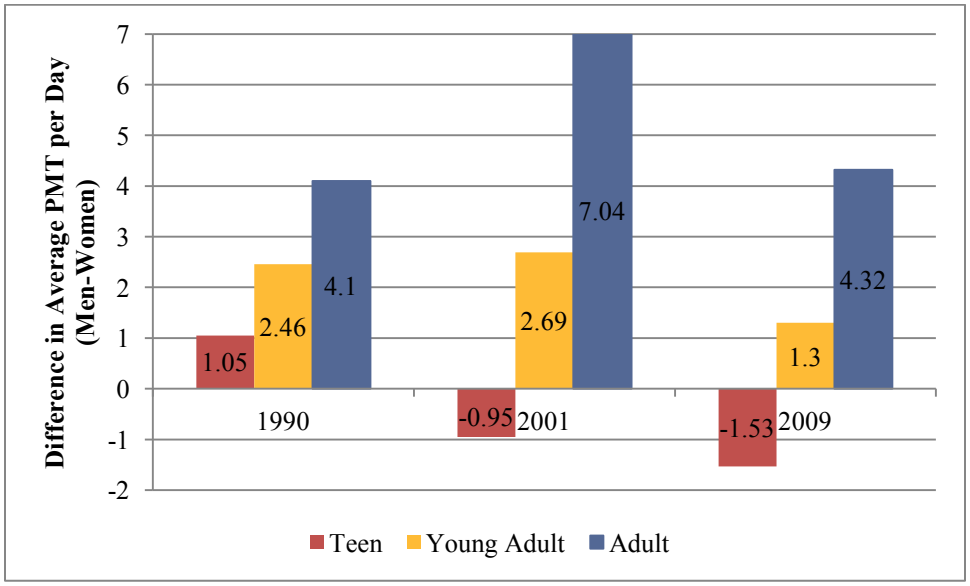
Table 14: PMT by Employment and Age (2009)

	Teen (15–18)	Young Adult (19–26)	Adult (27–61)
Not Worker	17.3	21.3	20.6
Work Full Time	20.7	31.7	33.0
Work Part Time	24.0	28.0	26.2
Average	*19.0*	*27.6*	*29.7*

Sex Differences: There is a well-established literature on the relationship between gender and travel. With respect to PMT, for example, Rosenbloom (2006) analyzes NHTS data and finds that women travel less distance than men do—on average 63 percent less in 2001. Gender differences in travel differ by age and appear to widen over time; Rosenbloom (2006) reports that women aged 16 to 24 travel 82 percent as far on average as men of the same age. Sex differences persist when controlling for other factors such as age, number of children, income, and employment (Giuliano 2003).

Figure 14 presents the average sex differences in PMT by age group and year between 1990 and 2009. Consistent with most previous studies, we find that men do indeed travel farther than women, and this gap tends to widen through adulthood. For teens in 2001 and 2009, however, we find that women actually travel farther on average than men. Whether this is a cohort or life-cycle effect remains to be seen; given that this trend of greater PMT by teen girls/women than teen boys/men appears to be growing over time suggests that this may be a cohort effect that could persist.

Figure 14: Sex Differences in PMT by Age and Year (1990, 2001, and 2009)



Web Use: As Table 15 shows, people who use the internet daily have higher average PMT than people who use the web less frequently, and the gap is larger for older age groups than for younger age groups. This finding suggests that web use is not a substitute for travel, as many individuals have hoped. However, daily web use is correlated with income, which is also a strong predictor of PMT. The apparent relationship between web use and PMT may thus actually reflect the effect of income on both web use and travel.

Table 15: PMT by Web Use and Age (2009)

	Teen (15–18)	Young Adult (19–26)	Adult (27–61)
Does not use the web daily	16.3	25.5	24.5
Uses the web daily	18.6	28.2	32.0
% Difference (Uses Daily/Not Use Daily)	87.4%	90.5%	76.6%

Living With Parents: The late teen and early 20s years are periods of considerable transition for most people. Some transition into college, and others into the workforce; some move out to form their own households, some stay at home, and some "boomerang" back home after living independently for a time. The effects of these various transitions are complex and difficult to characterize. Table 16 shows that young people living with their parents have higher average PMT than young people who do not live with their parents across all three survey years; however, this gap is decreasing over time.

Table 16: PMT by Year and Boomerang Status of Young Adults 19–26 (1990, 2001, and 2009)

	1990	2001	2009
Does not Live with Parents	21.1	24.7	28.9
Lives With Parents	27.3	27.9	31.3
% Difference (Does not Live with Parents/Lives with Parents)	*77.0%*	*88.4%*	*92.1%*

D. Cross-Sectional Models and Model Results

Table 17 and Table 18 present our multivariate statistical analyses of PMT that attempt to simultaneously account for the independent effects of the factors discussed above, as well as other control variable factors known to influence travel behavior. We first examine the results presented in Table 17, which show the models that include a "driver" variable, but no licensing regime data. In the conclusion, we discuss the second set of models presented in Table 18, which exclude the driver status variable and include graduated driver's license regulations data.

The most consistent and substantial effects on PMT across age groups and survey years are whether the respondent is employed and whether s/he drives.[15] In all of the models, employment is consistently and positively related to PMT for all age groups in all years. Moreover, the magnitude of the effect appears to be increasing for all age groups over time. Second, driver status has a positive effect on PMT for all age groups, and the effect has increased in magnitude for all groups since 1990. The magnitude of the effect is smaller for teens and young adults than for adults, but this youth/adult gap has diminished over time.

The coefficients for household income in our models can be interpreted as elasticities. For example, the coefficient of +0.14 for adults in 2009 signifies that as household income doubles, personal miles traveled increases by 14 percent. Even after controlling for a wide variety of other factors, household income is positively associated with PMT for adults; however, household income is not significantly related to personal travel for teens.[16]

Income is powerfully and positively associated with travel in the literature, so why do our models show that income is unrelated to the travel behavior of teens? Income is highly correlated with both being employed and owning an automobile. Similarly, being employed increases the probability that one will own a car and, conversely, access to autos increases the likelihood of being employed (Baum, 2009; Gurley and Bruce, 2005; Ong, 2002). Because we include employment and driver status variables, the relatively muted observed effects of income on PMT are not surprising. Not surprisingly, people living in households with higher levels of auto access tend to travel more. Individuals living in households with more automobiles per adult tend to have higher PMT than individuals with fewer automobiles per adult. In contrast to the household income effect, the effect of auto access is larger for teens and young adults than it is for adults.[17] This suggests that older adults are more likely to have "first call" on household autos, such that increasing the autos-to-adults ratio has a disproportionate effect on youth auto access, driving, and PMT.

Consistent with the descriptive statistics presented above, we find no evidence that daily web use is a substitute for personal travel, among teens, young adults, or adults. With just one exception, the relationship between daily web use and PMT is not statistically significant in the models for all age groups and years. The one exception we observe is that the relationship between web use and PMT is significant and positive for adults in 2009, indicating that, all else equal, PMT is *higher* for people who use the internet daily than for people who do not use the

[15] See Table 50 in the Appendix for the standardized coefficients for these models.

[16] Other specifications of the model also support this finding.

[17] The magnitude of the effect appears to be decreasing over time for adults.

internet daily. In the models focusing on the stringency of licensing regimes, we again find web use is not a substitute to travel for all three age groups in 2009.

Household structure affects travel patterns differently by age group. In 2001 and 2009, for each additional adult in the household, teens report an increase in PMT. Conversely, for adults the addition of another adult in the household had a negative relationship with PMT in 1990, suggesting that more adults were dividing a relatively fixed amount of household-serving travel. The addition of another child in the household increases personal travel for adults, perhaps due to increased chauffeuring and other household-serving travel responsibilities associated with children. Conversely, and perhaps logically, additional children are associated with decreased personal travel for teens and young adults in 1990, but this observed effect is not statistically significant in the two more recent surveys. Finally, and contrary to our expectations, we find that living with one's parents has no significant effect, either positive or negative, on PMT among young adults.

The geographic variables analyzed are associated with personal travel in much the same way for all age groups. We use a log-transformed value to represent density so the coefficient can be interpreted as an elasticity. The coefficient of -0.17 for youth in 2001 indicates that doubling the population density is associated with a 17 percent decrease in PMT. Without exception, population density is negatively related to PMT. The hypothesized effect here is two-fold: first, higher densities place trip origins and destinations closer together, which shorten the distances needed to travel to desired destinations; second, higher densities are associated with more traffic congestion and limited and expensive parking, both of which discourage automobile use. In contrast to the observed effects of population density, the dummy (1 = yes, 0 = no) variable for individuals in a metropolitan area with over 3 million people does not generally contribute to our understanding of PMT.

There are some surprising results with respect to a few of the other control variables in our models. In most cases, we find little evidence of a relationship between sex and PMT, after controlling for a wide array of other factors. There are two exceptions, which together suggest that sex influences travel differently depending on individuals' stage of life. In 2009, female teens had higher average PMT than otherwise similar male teens. Among adults, however, being female tends to be negatively associated with PMT, although only statistically significant in 2001. Whether this is a life-cycle effect—meaning that we can expect that women will typically travel more than men in their teens and less than men at retirement—or a cohort effect—meaning that the era of greater male PMT is waning, and an era of greater PMT by women is waxing—remains to be seen, though the fragmentary evidence presented here suggests that this may be a cohort effect.

The observed effects of race/ethnicity on PMT in 2009 point to possible changes to patterns of race/ethnicity and travel observed historically (Doyle and Taylor, 2000; Taylor and Ong, 1995).

The race/ethnicity variables are dummy (1 = yes, 0 = no) variables and should be interpreted as a group. The joint effect of the race/ethnicity variables on PMT were statistically significant for adults in 1990 and 2009 and for young adults in 2001, but were never significantly related to PMT for teens.

The results suggest that the relationship between race/ethnicity and PMT for adults has changed dramatically between 1990 and 2009. In 1990, and consistent with the literature, both Hispanics and Blacks had lower PMT (all else being equal) compared with Non-Hispanic Whites (who serve as the omitted, or base, case in the models). This suggests that, even after controlling for the lower average household incomes and lower levels of auto access in Hispanic and Black households, personal travel was still lower compared with non-Hispanic Whites. In 2009, however, we observe precisely the opposite effect: after controlling for a wide variety of factors thought to influence personal travel, Hispanic and Black respondents in 2009 had *higher* PMT than comparable Non-Hispanic Whites.[18]

Given our descriptive statistics show that PMT increases with age into late middle-age, our model results for age, particularly for teens, are also counterintuitive. According to the model, older teens travel less far than younger teens, everything else held equal. This surprising finding may be because age is highly correlated with employment, web use, and driver status, which are all included in the model.

Finally, we present the results of the license stringency model in Table 18. We do not find the strictness of state licensing regulations to be statistically significantly related to PMT for teens in 1990, 2001, or 2009. To be sure that we were not somehow missing the effect of regulations on teen travel, we examined each age separately. Doing so uncovered a statistically significant relationship between licensing regulations and PMT for 16 year olds in 2001 only.[19] This single exception notwithstanding, stricter licensing regimes—at least as we have measured them here—do not appear to substantially hinder the personal mobility of American teens.

If driving and auto access are so strongly and positively associated with personal travel, how can making it tougher for teens to get licenses and drive not affect their PMT? One answer may lie with our data. While the particulars of the licensing restrictions vary substantially from state to state, most have for the most part been moving toward tougher licensing regulations in

---

[18] We found that the coefficients for race are sensitive to model specification, particularly the inclusion of population density.

[19] In this single case, respondents in states with tougher licensing regulations had substantially lower PMT than respondents with less stringent licensing restrictions. For example, 16 year olds in states with high stringency restrictions (Good) traveled 48 percent fewer miles than respondents in states with the lowest stringency (Poor) restrictions, after controlling for the other variables in the model. Given the magnitude of this single observed effect, the lack of observed effect of license restrictions on PMT for other years and ages is surprising.

concert with one another. But for licensing restrictions to explain any of the variation in PMT in our models, the state licensing restrictions themselves must vary sufficiently from one another. But in 1990 and 2009 there is very little variation in the license ranking across states. In 1990, most states (42) had the lowest stringency regulations (Poor); by 2009, a majority of states (30) had high stringency regulations (Good). The year 2001 represents a transitional period in which there was substantial variation in licensing restrictions across the states.

Moreover, just because a law is on the books does not guarantee compliance. For example, in a study of young drivers in North Carolina, Goodwin and Fost (2004) find that although knowledge of license restrictions is widespread, teenagers frequently violate license restrictions, particularly passenger restrictions, and that enforcement is typically a low priority for police officers. It is possible that young drivers are not dissuaded from getting a drivers license and/or are not reducing the number of miles they drive because the ostensibly tight restrictions are simply poorly enforced. Finally, it is possible that the regulations have little effect on PMT in metropolitan areas where individuals may be able to travel relatively more readily by other modes such as carpool and public transit. If this is the case, we might expect driver's licensing regulations to influence mode choice—the subject of Chapters 8 and 9 of this report.

Finally, and contrary to expectations, the licensing variable is significantly related to the PMT of young adults and adults in some survey years. This suggests that the licensing variable may not only capture the strength of licensing, but also some other unknown statewide effect that influences the travel behavior of people beyond the teenage years.

Table 17: Driver Model of PMT, Excluding Licensing (1990, 2001, and 2009)

	Teen			Young Adult			Adult		
	1990	**2001**	**2009**	**1990**	**2001**	**2009**	**1990**	**2001**	**2009**
Individual Characteristics									
Age	-0.39***	-0.05	-0.58***	-0.02	-0.01	0.03	-0.01***	-0.01***	0.00
Female	-0.06	-0.08	0.21*	-0.02	0.01	0.13	0.03	-0.15***	0.06
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.02	0.08	0.17	-0.49*	0.13	0.37**	-0.20*	-0.01	0.20**
NH Asian	*no data*	0.06	-0.32	*no data*	-0.01	0.16	*no data*	-0.17	0.08
Hispanic	-0.11	-0.26	0.21	-0.39	-0.18	0.26*	-0.19*	-0.15	0.20***
NH Other	-0.07	-0.18	-0.02	-0.37	-0.03	0.31	0.00*	0.19***	-0.28*
Employed	0.60***	0.63***	0.85***	0.97***	0.98***	1.20**	0.95***	0.94***	1.06***
Web Use Daily	*no data*	0.09	0.19	*no data*	0.03	0.16	*no data*	-0.01	0.19***
Driver	0.35*	0.60***	0.82***	0.40*	1.54***	1.17**	1.08***	1.22***	1.67***
Less than High School	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
High School Graduate	-0.37	0.53	0.74	0.18	0.24	0.22	0.19*	0.21**	0.28**
Some College	-0.31	0.61	0.64	0.15	0.43	0.29	0.53***	0.43***	0.37***
College Graduate	-0.66*	0.76*	0.84*	0.22	0.66**	0.42	0.49***	0.54***	0.49***
Grad or Prof. Degree	-0.35	0.76*	0.92*	0.50*	0.68**	0.47	0.61***	0.55***	0.47***
Young Adult Lives with Parents				-0.24	-0.03	-0.02			
Household Characteristics									
Household Income (ln)	0.08	-0.05	-0.01	0.11	-0.05	-0.01	0.12***	0.18***	0.14***
Number of Adults	-0.09	0.19***	0.16**	-0.01	0.04	-0.09	-0.11**	-0.01	-0.02
Number of Children	-0.13*	-0.09	-0.10	-0.11*	0.01	0.03	0.02	0.08***	0.11***
Autos Per Adult	0.59***	0.13	0.24**	0.47***	0.38***	0.46**	0.22***	0.18***	0.19***
Geographic Characteristics									
Population Density (ln)	0.04	-0.17***	-0.10**	-0.06	-0.06**	-0.08*	-0.09***	-0.08***	-0.05***
MSA > 3 million	0.03	-0.19	0.03	0.08	-0.21**	0.18	0.08	0.04	-0.02
Constant	7.39***	1.84	9.31***	-0.01	0.33	-1.09	-0.76*	-1.68***	-2.64***
Model N	1252	5514	9464	3185	7565	9003	13167	56269	104289
Adjusted R2	0.09	0.09	0.11	0.10	0.12	0.10	0.11	0.09	0.12

KEY:

Statistically Significant

Statistically Significant Over Time (across all the years for which data were available)

Table 18: Licensing Model of PMT, Excluding Driver Status (1990, 2001, and 2009)

	Teen			Young Adult			Adult		
	1990	2001	2009	1990	2001	2009	1990	2001	2009
Individual Characteristics									
Age	-0.10	0.06	-0.45***	-0.02	0.00	0.04	-0.01***	-0.01**	0.00*
Female	-0.05	-0.09	0.21*	-0.02	-0.01	0.15	0.01	-0.16***	0.04
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0.00	0.05	0.11	-0.52**	0.09	0.38**	-0.24**	-0.02	0.18**
NH Asian	*no data*	-0.06	-0.45	*no data*	-0.10	0.18	*no data*	-0.19*	0.04
Hispanic	-0.23	-0.26	0.13	-0.38	-0.33	0.30*	-0.28**	-0.16	0.19***
NH Other	-0.14	-0.20	-0.13	-0.38	-0.13	0.32	-0.45**	0.20***	-0.30*
Employed	0.70***	0.69***	0.99***	0.99***	1.12***	1.29***	1.00***	1.04***	1.23***
Web Use Daily	*no data*	0.07	0.26*	*no data*	0.07	0.28*	*no data*	0.00	0.26***
Less than High School	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
High School Graduate	-0.14	0.51	0.68	0.21	0.33	0.36	0.27**	0.32***	0.45***
Some College	-0.11	0.64	0.59	0.17	0.59**	0.50	0.63***	0.56***	0.60***
College Graduate	-0.38	0.80*	0.80*	0.24	0.86***	0.64	0.60***	0.68***	0.72***
Grad or Prof. Degree	-0.15	0.83*	0.92**	0.53*	0.86***	0.69	0.71***	0.69***	0.69***
Young Adult Lives with Parents	*omitted*	*omitted*	*omitted*	-0.27*	-0.14	-0.08***	*omitted*	*omitted*	*omitted*
Household Characteristics									
Household Income (ln)	0.10	-0.01	0.05	0.11	-0.03	0.00**	0.15***	0.23***	0.18***
Number of Adults	-0.08	0.18**	0.16**	-0.01	0.02	-0.08***	-0.10**	-0.03	-0.02
Number of Children	-0.17**	-0.11*	-0.12*	-0.12*	0.00	0.02	0.02	0.09***	0.13***
Autos Per Adult	0.66***	0.25*	0.31***	0.55***	0.72***	0.74***	0.33***	0.27***	0.35***
State Licensing Regulations									
Stringency: Lowest	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*		*omitted*	*omitted*	
Stringency: Low	-0.30	0.11		0.15	-0.04	*omitted*	-0.15**	0.11*	*omitted*
Stringency: Medium		0.22	0.48		-0.04	-0.14***		0.06	-0.12
Stringency: High		-0.08	0.44		0.30*	-0.14***		0.16***	-0.12
Geographic Characteristics									
Population Density (ln)	0.06	-0.18***	-0.09**	-0.07	-0.09***	-0.09**	-0.10***	-0.10***	-0.06***
MSA > 3 million	0.04	-0.20	-0.08	0.04	-0.28***	0.16	0.10	0.03	-0.01
Constant	2.17	-0.24	6.59***	0.23	0.82	-0.86***	-0.24	-1.36***	-1.94***
Model N	1324	5460	9514	3188	7499	9013	13176	55645	104294
Adjusted R2	0.07	0.08	0.09	0.10	0.09	0.09	0.10	0.07	0.10

KEY:

Statistically Significant

Statistically Significant Over Time (across all the years for which data were available)

E. Quasi-Cohort Model Results

A central focus of this research is to examine whether the underlying factors influencing travel are changing over time – whether the next generation, or cohort, of American adults will travel differently than current or previous generations. The preceding analysis has been cross-sectional; that is, we have examined the constellation of factors that explain PMT in a given year for a given category of traveler and have reflected on how these appear to differ from year to year. To investigate this question via another method, we constructed models that consider the independent effects of cohorts of travelers by birth decade. Table 19 and Figure 15 show the

results of this age cohort model. Many of the control variables operate as they did in the cross-sectional models above. One exception are the race/ethnicity variables; these showed mixed effects (positive, negative, statistically significant, and not) on PMT in the cross–sectional models, but in this cohort model we see some apparently counter-intuitive and statistically significant results. While non-Hispanic Whites tend to travel more and farther than non-Hispanic Blacks or Hispanics, income differences between these groups apparently explain much of the observed travel differences. Controlling for income, and a host of other factors, we see that being Black or Hispanic is associated *more* travel between 1990 and 2009. This is likely due to significant growth in auto access and use among Blacks and Hispanics during the 1990s and 2000s relative to non-Hispanic Whites (Pisarski 2006).

The year variable accounts for period effects (such as the economic boom of the 1990s and the economic collapse of the late 2000s) not captured by any of the other independent variables (for example, by income or employment status). Neither of these variables—for 2001 and 2009—are significantly different from 1990 (the base year), which suggests that period effects have been accounted for by the individual-level effects associated with these periods (e.g. employment status).

The model suggests that being born in a more recent decade – the 1980s and, in particular, the 1990s – is associated with lower PMT than those born in earlier decades, after controlling for a wide variety of other factors known to influence travel. One should keep in mind that those born in the 1980s and 1990s were still relatively young in the most recent data year, so these findings concern only the travel of teens and young adults. Specifically, the 1980s birth cohort compares 15 to 21 year-olds to similarly aged-cohorts born in the 1970s and 1990s, and 20 to 29 year-olds to similarly aged cohorts born in the 1960s and 1970s. The 1990s birth cohort compares only the travel of 15 to 19 year olds in 2009 to the 2001 travel of similarly aged people born in the 1980s and the 1990 travel of similarly aged people born in the 1970s. We present the independent effect of birth decade on PMT graphically in Figure 15. This figure suggests a strong and almost linear negative trend in the relationship between birth decade in the 1960s, 1970s, 1980s, and 1990s and PMT – again, after controlling for the other factors known to influence travel. This suggests that we may well be observing a gradual shift away from the sorts of generational increases in PMT that were coincident with rising wealth and auto ownership that defined much of the 20th century. But, again, these results, particularly for the youngest (1990s) birth cohort, concern only the travel of teens and only in comparison to teens born in the 1970s and 1980s.

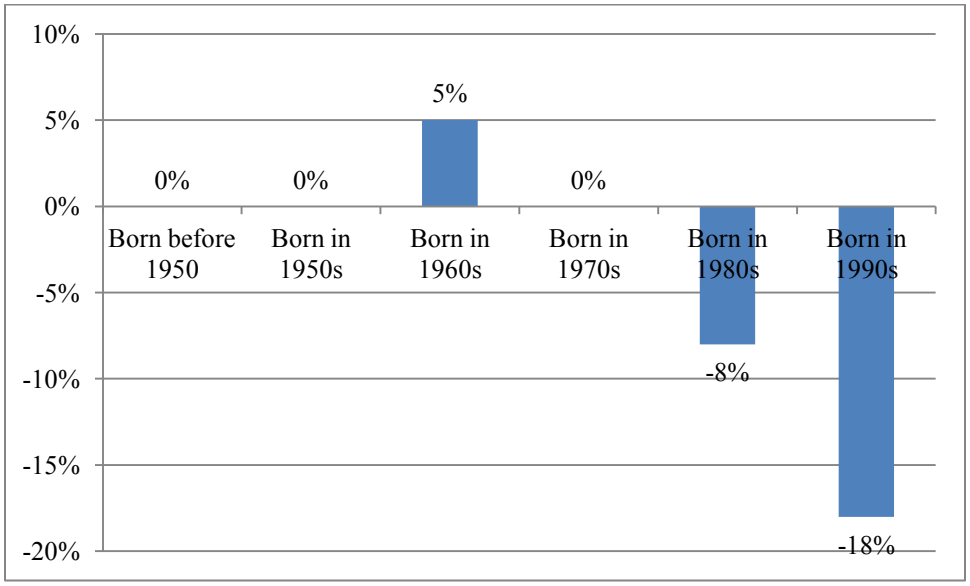
Table 19: Quasi-Cohort Model of Log-Transformed PMT (1990, 2001, and 2009 combined)

	Coefficient	Sig.	t-Statistic
Individual Characteristics			
Female	-0.044	***	-7.06

Age	-0.013	***	-3.67
Age Squared	<0.001	***	3.15
Race / Ethnicity (omitted category: Non-Hispanic White)			
Non-Hispanic Black	0.109	***	11.03
Non-Hispanic Asian (2009 Only)	0.006		0.33
Non-Hispanic Other	-0.041	**	-2.14
Hispanic	0.077	***	7.92
Education (omitted category: No HS Diploma)			
For Youth: Highest Degree Achieved in Household			
High School Diploma	0.248	***	9.98
Some College	0.306	***	12.84
Bachelor's Degree	0.346	***	13.81
Graduate Degree	0.312	***	11.45
For Adults: Highest Degree Personally Achieved			
High School Diploma	0.145	***	7.56
Some College	0.245	***	12.94
Bachelor's Degree	0.310	***	15.79
Graduate Degree	0.327	***	16.06
Reports Working	0.567	***	71.71
Uses Web Daily	0.094	***	11.02
Reports Driving	0.767	***	66.11
Household Characteristics			
Income (ln)	0.110	***	26.45
Number of Adults in HH	-0.010	***	-2.58
Number of Children in HH	0.035	***	12.42
Youth, Lives with Parents	-0.071	***	-4.73
Ratio of Cars to Adults in HH	0.171	***	24.41
Geographic Characteristics			
Population Density (ln)	-0.094	***	-44.67
In MSA with > 3M Population	0.024	***	3.64
Year			
Year: 2001 (base: 1990)	-0.120		-0.29
Year: 2009 (base: 1990)	-0.256		-0.62
Cohorts (base: Born before 1950)			
Born in 1950s	0.002		0.1
Born in 1960s	0.053	**	2.04
Born in 1970s	-0.001		-0.03
Born in 1980s	-0.077	*	-1.75
Born in 1990s	-0.170	***	-3.19
Constant	0.467		1.1

N	235,380
Adjusted R-Square	0.114
Key: Statistically Significant	

Figure 15: Independent Effect of Cohort on PMT, Controlling for Other Variables



F. Conclusion: What Explains PMT among Teens, Young Adults, and Adults?

These descriptive statistics and multivariate models paint an interesting and nuanced picture of teen and young adult travel, both in comparison with adults and over time. Personal travel, measured here as personal miles of travel, generally increases as one moves from teenage, to young adulthood, and into middle age. But personal travel is highly correlated with economic factors, such as employment and income. Indeed, we observe a substantial drop in metropolitan personal travel nationwide between 2001 and the deep economic downturn of 2009 across all age groups examined, though the largest drop (-23%) was among teens.

In this analysis, we have been particularly motivated to examine how recent, dramatic trends may be affecting the lives and travel of youth: the recession and associated unemployment, the increasing number of young adults who live with their parents, the meteoric rise in the use of information and communications technologies, and increasingly strict driver's licensing regulations in many states. These are substantial breaks with the past, and each could be expected to dramatically alter the travel behavior—and in this case personal miles of travel—of young people. Thus, perhaps our most significant finding from this analysis is, with the exception of employment and the economic downturn, how *little* these trends appear to be influencing the personal miles of travel of teens and young adults.

The effect of economic factors on the travel of teens and young adults (measured here in terms of employment), and for that matter middle-age adults, is substantial and unambiguous—but the effect of employment on PMT is stronger for young adults than for teens, and stronger still for middle-aged adults than for young adults or teens. While being employed is highly correlated with PMT, the effect of "boomeranging" young adults living at home is ambiguous at best; we observe no effect of living with parents on the PMT of young adults in our primary "Driver's Status" model.[20] And far from acting as a substitute for travel, our models suggest that of daily web use either has no effect on travel or, in the most recent 2009 survey and our quasi-cohort model, is actually associated with *increased* PMT across all age categories; this is likely because web use, auto access, and PMT are all positively associated with education and income. Finally, although licensing requirements for teens have increased dramatically in states across the country, we find no consistent relationship between license regulations and PMT. These findings are summarized in Table 20 below.

Table 20: Summary Table: PMT and Variables of Interest (1990, 2001, and 2009)

	Teen (15–18)			Young Adult (19–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+	+	+	+
Young Adult Living at Home	*(Not Included)*			0	0	0	*(Not Included)*		
Technology (Web Use)	*n/a*	0	+	*n/a*	0	+	*n/a*	0	+
License Stringency	0	0	0	0	0	+	0	+	0

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship

One of the most significant findings of this analysis is how consistent the observed effects on travel are across the three age categories: teens, young adults, and adults. Education (or parents' education), employment, auto access, and being a driver are all positively associated with PMT across almost all age categories and survey years. Likewise, population density is negatively associated with PMT across nearly all age categories and years. There are a few exceptions to this pattern, but not many. Among adults (but not teens or young adults) income (apart from employment) and the presence of children in the household are also associated with greater personal travel. And in the most recent survey year (2009), female teens are traveling more than male teens, which constitutes a break from the past.

[20] Our models that include licensing regime but not driver's status suggest a negative effect of boomerang status on the PMT of young adults in 1990 and 2009, but not 2001. But given the lack of consistency of this finding across model specifications, we are reluctant to call this finding out as significant.

One other possible break with the past may be revealed by our quasi-cohort model. This model suggests that being born in a more recent decade – the 1980s and, in particular, the 1990s – is associated with lower PMT than those born in earlier decades, after controlling for a wide variety of other factors known to influence travel. Such a finding suggests that we may well be observing a gradual shift away from generational increases in PMT long associated with rising wealth and auto ownership. However, because we only have data on those born in the 1990s for *one* of the three data years, these results should be viewed as suggestive rather than conclusive.

It is important to note that we are attempting in these models to predict travel choices and behaviors using categorical variables like sex, race/ethnicity, education, employment status, daily web use, and so on. But whether a particular respondent walked to school, drove to the store, or took the subway to visit a friend on the survey day depended largely on whether that person was a student and it was a school day, whether her household needed groceries, or whether there was a subway nearby that connected the respondent to her friends—and not on whether she was a she, Asian-American, college educated, unemployed, or a web user. Thus, this analysis tells us whether people with such characteristics *tend* to travel differently from others, but not whether such individuals are likely to take a particular trip. As such, the fit, or explanatory power, of these sorts of models tends to be relatively low—on the order of 10 percent of the variance is explained.

Accordingly, Table 21 presents a summary of model fit by age group and year. Without exception the first set of models discussed (the so-called Driver's Status models) have higher adjusted R^2 values than the second set (or Licensing Regime) models. Collectively, these models consistently explain about 7–10 percent of the variation in PMT, and we observe no clear pattern between model year and model fit.

Table 21: Assessing Model Fit: PMT Models (1990, 2001, 2009 and Cohort)

	Teen (15–18)			Young Adult (19–26)			Adult (27–61)			Cohort
	1990	2001	2009	1990	2001	2009	1990	2001	2009	1990, 2001, & 2009
Driver Model										
Model N	1,252	5,514	9,464	3,185	7,565	9,003	13,167	56,269	104,289	214,116
Adjusted R^2	0.086	0.089	0.105	0.099	0.118	0.104	0.111	0.086	0.123	0.114
License Model										
Model N	1,324	5,460	9,514	3,188	7,499	9,013	13,176	55,645	104,294	n/a
Adjusted R^2	0.071	0.081	0.088	0.097	0.087	0.086	0.101	0.075	0.102	n/a

Chapter VI. Activities/Trips

A. Introduction

Except for walks in the park and cruising on a Saturday night, travel is a means to an end. Economists describe the demand for travel as "derived" because people travel in order to *access* other things—work, shops, restaurants, friends, and so on. One stands on a crowded subway each morning not for the thrill of the ride, but to get to work on time; one searches for a parking space at the grocery store not for the joy of finding an open space, but to stock one's house with food. Transportation is often a critical link to education, paid work, recreation, health care, culture, and many other aspects of quality living. While PMT is an excellent measure of *mobility*, it does not tell us much about access, or the utility of personal travel. To examine travel utility or access, we must turn our attention to the purpose of trips.

Trip-making is an excellent, albeit indirect and understudied window on activity participation. People's work habits, shopping behavior, recreational preferences, and so on are revealed by the stated purpose of their travel in surveys like the NPTS and NHTS.

However, all things are rarely equal. There are but 24 hours in a day and more time spent stuck in freeway traffic or waiting a long time for a bus or train reduces the number of activities that can be enjoyed at the ends of trips. A few long or expensive trips tend to reduce the total number of trips one can make in a day. Conversely, physical proximity to destinations and access to information and communications technologies can reduce the time spent traveling or the need to make trips at all. In a compact, mixed-use area, a drive to the store can be replaced by a short walk, or travel to a meeting with colleagues can be replaced by Skype. But do such opportunities affect the number, type, and mix of trips people make? If so, will such changes in trip-making patterns be more apparent among teens and young adults than among older adults? These questions motivate the analysis that follows.

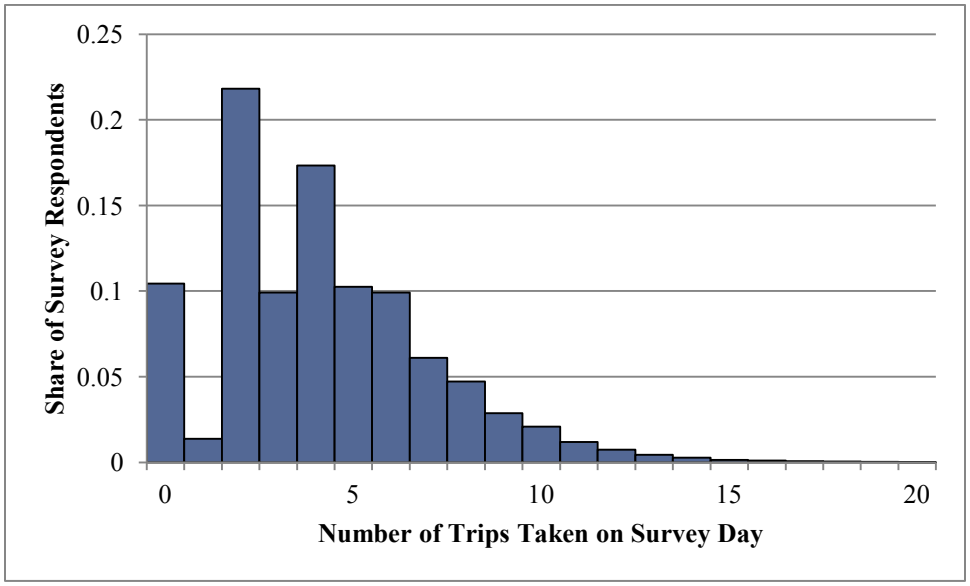
B. Methodology

To analyze patterns and trends of trip-making among teens and young adults, we again rely on the 1990 Nationwide Personal Transportation Survey and the 2001 and 2009 National Household Travel Surveys of metropolitan residents making trips of less than 75 miles on the survey day. Our variable of interest is the number of activities in which teens and young adults participated per day across all three survey years. Unlike the PMT analysis, where we split youth into two categories (teens and young adults) and ran three separate models for all three

years, this analysis compares two groups of travelers: youth (ages 15–26) and adults (ages 27–61).

Because the number of trips made by individuals is considerably right-skewed (Figure 16), with a small number of individuals making a large number of daily trips, we use a log-transformed version of the variable in our models. A sizeable share of respondents (roughly 10 percent in each of the datasets) did not make any trips during the survey day. Because the log(0) is not defined, we also add a trivial amount to the variable before log transforming it.

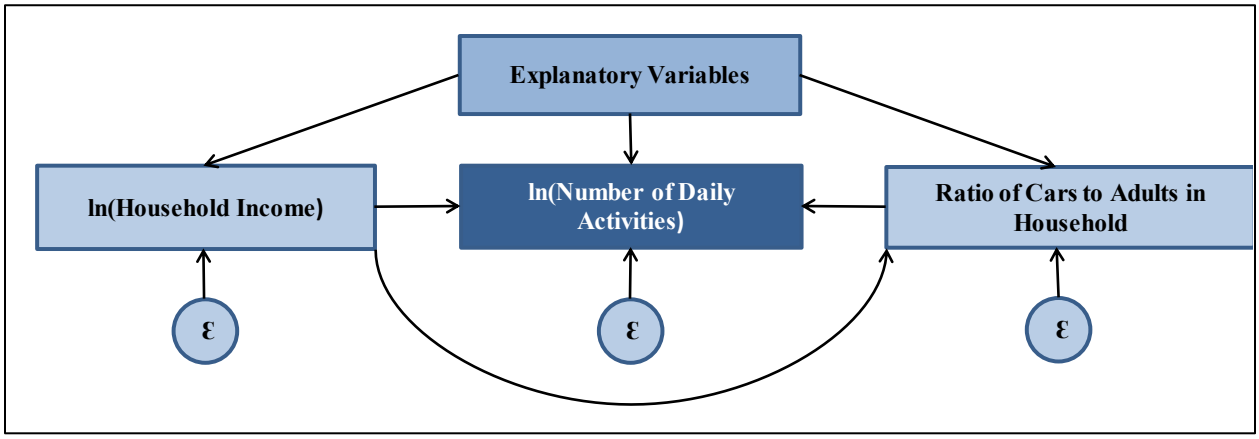
Figure 16: Number of Daily Trips (2009)



Following Lu and Pas (1999), we employ a structural equation model (SEM) as described by Bollen (1989). Structural equation models employ a maximum-likelihood technique for estimating model parameters, though they differ from other models in one important way. Unlike more common linear regression models employed in the previous chapter that posit a relatively simple linear causality, SEM allows the researcher to hypothesize complex causal relationships that involve multiple intermediary processes, which are simultaneously specified. SEMs effectively allow us to specify sub-models that then relate to one another in a larger modeling context.

Many SEMs incorporate elements of factor analysis to explore the influence of latent (unmeasured and unmeasureable) variables on variables of interest. While this is a very common component of structural equation models, we do not employ it here, as our hypothesized causal pathways do not suppose latent variables, but rather rely on more direct and measureable relationships (such as the relationship between income and car ownership).

Figure 17: Simplified Overview of Structure Equation Models (SEMs)



We estimate our SEMs using the Stata 12.1 statistical software package. Figure 17 presents a simplified overview of the model's structure. The SEM procedure estimates three sub-models: first, a model of household income estimated using a set of explanatory variables that include race/ethnicity, education, worker status, whether the respondent has a medical condition, the respondent's neighborhood residential density, and whether the respondent is a single parent or the child of a single parent. This model of income feeds into a model of car ownership (to the far right of the diagram). Here, the ratio of cars to adults in the household is modeled as a function of household income (sub-model 1), as well as a number of other explanatory variables (race/ethnicity, household size, and the neighborhood residential density). Both of these sub-models then feed into the model of daily activity participation, to which we add additional explanatory variables. These additional explanatory variables include those used in the previous sub-models, as well as the respondent's age, sex, foreign-born status, web usage, and commute duration. The advantage of such a nested, structured approach to modeling daily activity participation is that the researcher hypothesizes and then specifies the specific causal pathways thought to influence a particular outcome. SEM, then, is a way to estimate empirically the relative weight and robustness of these pathways.

We then constructed the same set of related SEM sub-models—to predict auto access (ratio of autos to adults), income, and activities—in a multi-survey-year format similar to the quasi-cohort model in the PMT analysis above. For each model, we include records from all three survey years for the usual array of explanatory variables, as well as both a variable noting the survey year, and in the auto access and activities models we also included variables for the decade of birth of each respondent.

C. Descriptive Statistics

As with our discussion of PMT, people tend to make more trips as they age. As Figure 18 illustrates, using the 2009 NHTS, the mean number of trips made per day varies considerably

by age. The youngest individuals in our sample (age 15) made an average of just over three trips per day in 2009, while individuals in their mid-40s made almost 1.5 times as many trips (4.5).

Figure 18: Mean Number of Trips by Age (2009)

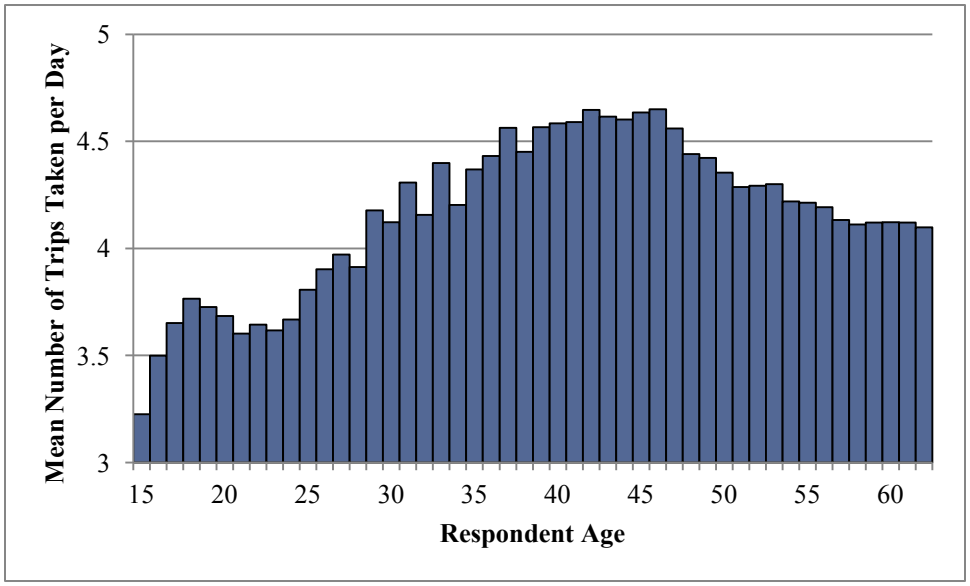


Figure 19 shows that there have been significant changes over time in the activity participation patterns of various age groups. While older individuals in the 1990 survey report making more trips in the 2001 survey, and more trips again in the 2009 survey, the story for teens and young adults is very different. In 2009, teens and young adults reported making *fewer* trips than in 2001.[21]

[21] The 1990 dataset may systematically underreport trips for all age groups. In particular, many walking trips are likely missing from the 1990 data, thus pulling down the number of trips made for all groups. However, even when we examine non-walking trips, the 1990 dataset reports fewer trips for older individuals than for younger individuals.

Figure 19: Mean Number of Daily Trips by Age and Year (1990, 2001, and 2009)

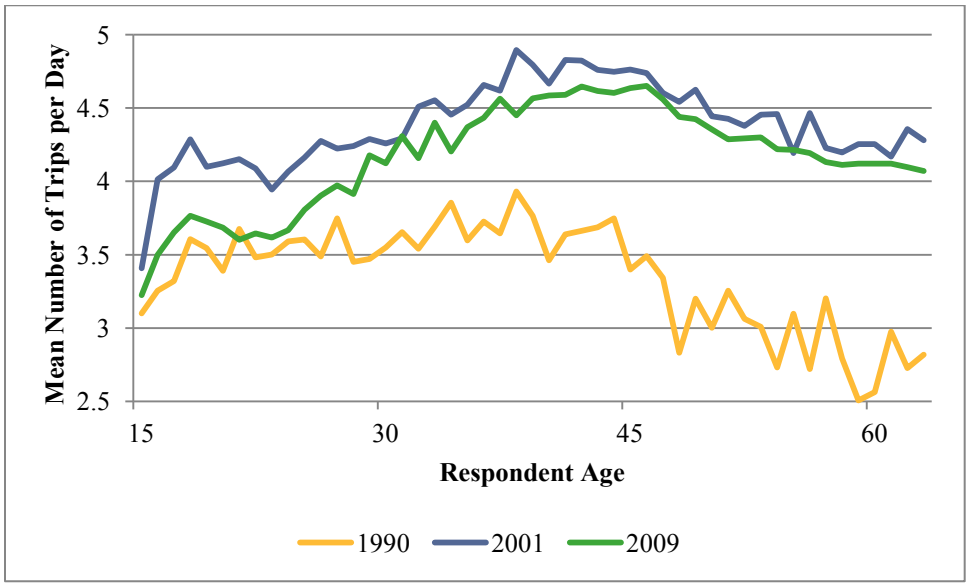


Figure 20 shows the mean number of trips taken by our two age groups of interest for the three data years. This figure illustrates that both adults' and youths' trip-making decreased from 2001 to 2009, but that the decrease was considerably more pronounced for youth than for adults.

Figure 20: Mean Number of Daily Trips by Age and Year (1990, 2001, and 2009)

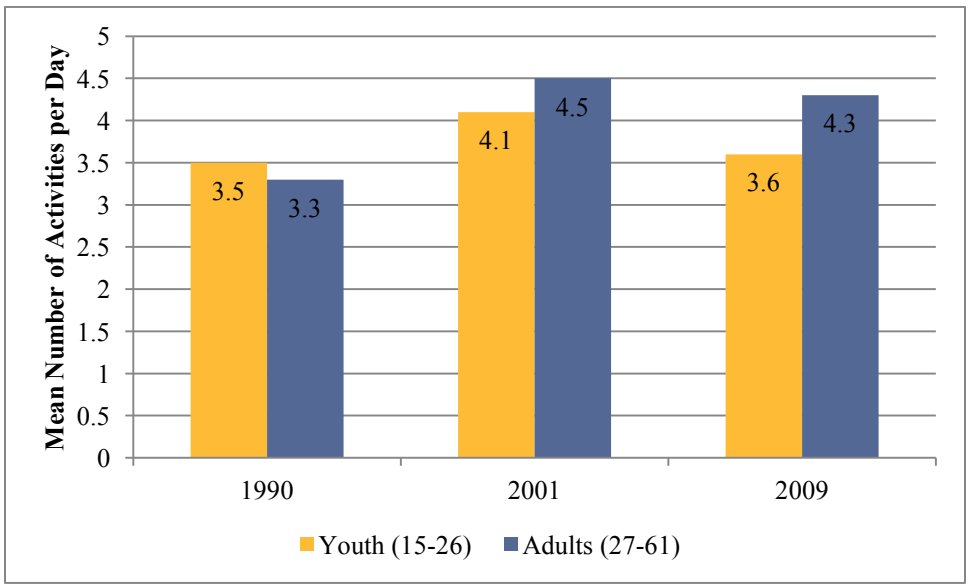


Figure 21 shows the difference between 2001 and 2009 trip-making rates. The graph shows considerable variation, though a trend is apparent—the greatest decline in trip-making has

occurred among young people. In fact, those in their late teens were, on average, making 0.5 fewer trips per day in 2009 than the same age group did in 2001.

Figure 21: Difference in Trip-Making by Age (2001 to 2009)

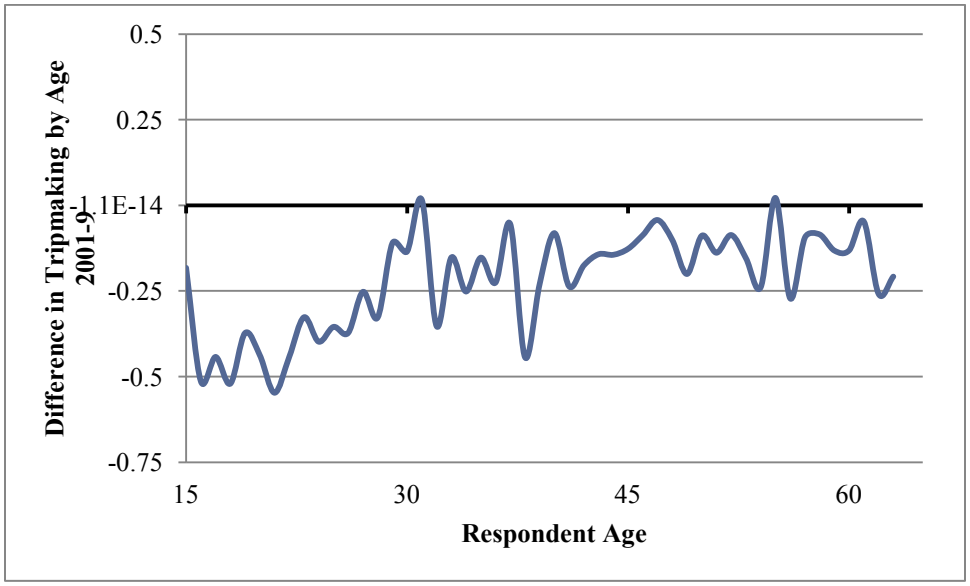
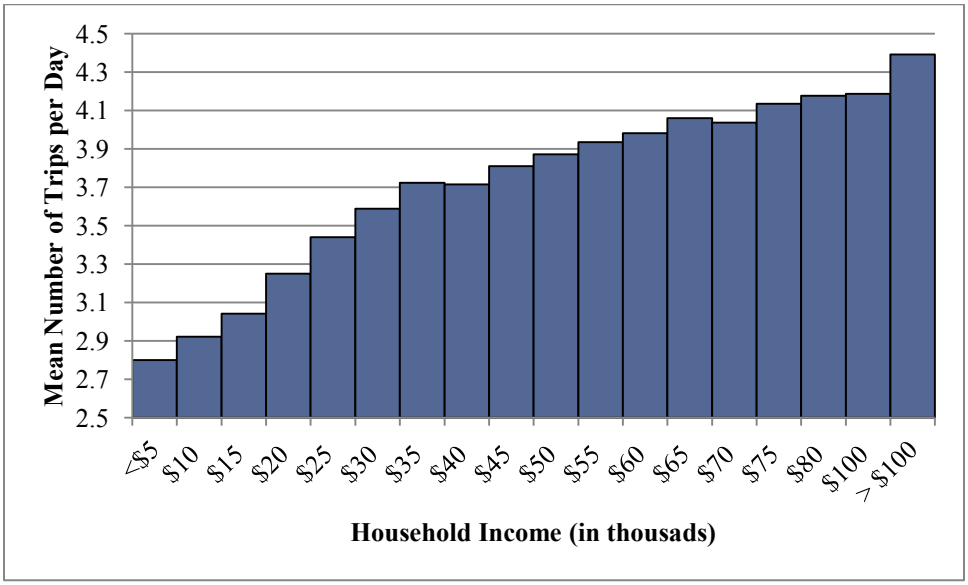


Figure 22 shows the relationship between household income and trip-making. At the lower end of the income distribution, an increase in household income is associated with rapid gains in trip-making. For instance, while those making $5,000 to $10,000 per year make, on average, just 2.9 trips per day, those earning more than $10,000 per year make 3.25 trips on average—an increase of 12 percent.

On the higher end of the income spectrum, more income is still associated with higher levels of trip-making, but the effect is milder. Why? First, income is an enabler of activities, many of which (e.g., shopping and other recreational activities) have a monetary cost associated with them.

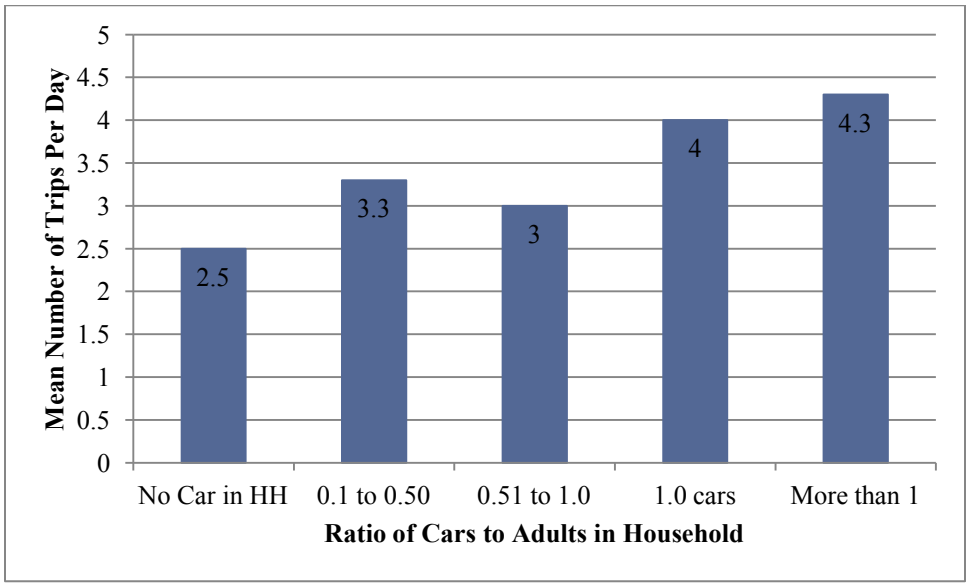
Figure 22: Household Income and Trip-Making (2009)



Second, and more importantly, our analysis of personal travel shows that automobile access is a strong predictor of PMT. Because income enables car ownership and use, we would expect that those with incomes sufficient to pay for cars would tend to travel more miles, and indeed that is the case. But once one has access to a private vehicle for travel, additional income (and more auto access) is less likely to stimulate additional travel because one can only drive one car at a time. As with personal travel, we expect that greater access to automobiles will be associated with more trips. In most places in the United States, the automobile is the most convenient mode of transportation for accessing activity sites, particularly those offering abundant free parking. As such, we anticipate that those households with less than one car per adult will make, on average, fewer trips than will households with one or more cars per adult.

Figure 23 shows the relationship between auto availability and trip-making. While the relationship between auto availability and trip-making does not progress monotonically according to our expectations, in general, those with one or more cars per adult make considerably more trips (3.5 trips or greater) than those with fewer cars; those with no car make, on average, one trip less per day (2.5 trips) than those with one car per adult.

Figure 23: Auto Availability and Trip-Making (2009)



D. Cross-Sectional Model and Model Results

Table 22 shows the results of six structural equation models of activity participation for youth and adults across the three (1990, 2001, and 2009) datasets. The control variables largely conform to expectations drawn from the extensive travel behavior literature. This section describes the sub-models, and the following section describes the results for our relationships of interest.

Table 22: Structural Equation Models of Number of Daily Activities for Youth (15–26) and Adults (27–61), (1990, 2001, and 2009)

	Youth			Adult		
	1990	2001	2009	1990	2001	2009
Submodel: Ratio of Cars to Adults in HH						
Individual Characteristics						
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.22 ***	-0.18 ***	-0.13 ***	-0.14 ***	-0.11 ***	-0.08 ***
NH Asian	*n/a*	-0.14 ***	-0.04 *	*n/a*	-0.13 ***	-0.10 ***
Hispanic	-0.12 ***	-0.14 ***	-0.03 *	-0.04 **	-0.08 ***	-0.05 ***
NH Other	-0.04	-0.08 *	-0.03	-0.04	-0.05 **	0.003
Household Characteristics						
Household Income (ln)	0.21 ***	0.15 ***	0.19 ***	0.16 ***	0.14 ***	0.14 ***
Number of Adults	-0.16 ***	-0.10 ***	-0.12 ***	-0.15 ***	-0.13 ***	-0.13 ***
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
Stringency: Low	-0.13 ***	0.01	-0.18 *	-0.07 ***	0.01	-0.08 **
Stringency: Medium	*n/a*	-0.03	-0.16 *	*n/a*	0.002	-0.14 ***
Stringency: High	*n/a*	0.04 **	-0.15	*n/a*	0.07 ***	-0.12 ***
Geographic Characteristics						
Population Density (ln)	-0.06 ***	-0.08 ***	-0.07 ***	-0.06 ***	-0.08 ***	-0.06 ***
Constant	-0.70 ***	-0.29 ***	-0.60 ***	-0.23 ***	-0.14 ***	-0.03

Submodel: ln(Household Income)						
Individual Characteristics						
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.27 ***	-0.52 ***	-0.67 ***	-0.31 ***	-0.45 ***	-0.44 ***
NH Asian	*n/a*	-0.36 ***	-0.36 ***	*n/a*	-0.19 ***	-0.05 ***
Hispanic	-0.47 ***	-0.79 ***	-0.81 ***	-0.33 ***	-0.53 ***	-0.37 ***
NH Other	-0.08	-0.15 **	-0.41 ***	-0.25 ***	-0.19 ***	-0.19 ***
Employed	0.23 ***	0.09 **	-0.001	0.28 ***	0.25 ***	0.28 ***
Medical Condition	*n/a*	-0.29 ***	-0.23 **	*n/a*	-0.44 ***	-0.46 ***
Less than High School	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
High School Graduate	-0.27 ***	-0.12	-0.11 ***	0.51 ***	0.23 ***	0.71 ***
College Graduate	-0.13 **	-0.01	0.10	0.92 ***	0.60 ***	1.26 ***
Household Characteristics						
Number of Adults	0.21 ***	0.13 ***	0.10 ***	0.25 ***	0.09 ***	0.13 ***
Single Parent	-0.96 ***	-0.57 ***	-0.95 *	-0.45 ***	-0.57 ***	-0.54 ***
Child of a Single Parent	-0.10	*n/a*	-0.88	*n/a*	*n/a*	*n/a*
Constant	9.93 ***	10.41 ***	10.98 ***	9.31 ***	10.28 ***	9.87 ***

Submodel: ln(Activities on Survey Day)						
Individual Characteristics						
Age	-0.01 ***	-0.01	0.01	-0.005 ***	<0.001	0.003 ***
Female	0.07 ***	0.06 ***	0.08 ***	0.10 ***	0.04 ***	0.06 ***
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.07 **	-0.03	0.01	-0.04 **	-0.03	0.01 *
NH Asian	*n/a*	-0.001	0.003	*n/a*	-0.10 ***	-0.09 ***
Hispanic	-0.09 **	-0.09 **	0.03	-0.06 **	0.01	0.03 ***
NH Other	-0.03	0.01	0.10	-0.20 ***	-0.02	-0.03 **
Immigrant	*n/a*	-0.09 **	-0.02	*n/a*	-0.06 ***	-0.03 ***
Employed	0.12 ***	0.20 ***	0.24 ***	-0.01	0.08 ***	0.10 ***
Uses Internet Daily	*n/a*	0.03	0.02	*n/a*	0.03 ***	0.08 ***
Medical Condition	*n/a*	-0.25 ***	-0.14 **	*n/a*	-0.21 ***	-0.25 ***
Hours Spent Commuting	-0.11 ***	-0.07	-0.13 ***	-0.09 ***	-0.08 ***	-0.08 ***
Less than High School	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
High School Graduate	0.09 ***	0.21 **	-0.01	0.08 ***	0.11 ***	0.06 ***
College Graduate	0.08 *	0.10 ***	0.02	0.13 ***	0.12 ***	0.16 ***
Household Characteristics						
Household Income (ln)	-0.04 ***	-0.02	0.03 **	0.04 ***	0.06 ***	0.04 ***
Number of Adults	-0.03 **	-0.003	-0.04 ***	-0.05 ***	-0.02 **	-0.02 ***
Single Parent	0.18 *	-0.01	0.21	0.0004	0.08 ***	0.06 ***
Child of a Single Parent	0.11 **	*n/a*	0.03	*n/a*	*n/a*	*n/a*
Ratio of Children to Adults	-0.06 ***	0.00	0.01	0.04 ***	0.09 ***	0.13 ***
Autos Per Adult	0.05 **	0.08 ***	0.10 ***	0.06 ***	0.05 ***	0.03 ***
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
Stringency: Low	-0.03	0.03	-0.13	-0.06 ***	0.05 ***	-0.08
Stringency: Medium	*n/a*	0.02	-0.18	*n/a*	0.02 **	-0.13 **
Stringency: High	*n/a*	0.02	-0.13	*n/a*	0.04 **	-0.12 **
Geographic Characteristics						
Population Density (ln)	-0.001	0.000	0.01 *	0.004	0.01 **	0.02 ***
Constant	1.89 ***	1.31 ***	0.69 ***	0.97 ***	0.46 ***	0.56 ***

Variance						
Var (Ratio of Cars to Adults)	0.21	0.17	0.18	0.19	0.22	0.23
Var (ln (Household Income))	0.81	0.81	0.89	0.51	0.59	0.60
Var (ln (Activities on Survey Day)	0.30	0.40	0.39	0.27	0.42	0.42
N	4,343	12,305	20,249	11,649	59,682	115,401
R Square (Overall)	0.32	0.34	0.34	0.34	0.37	0.38

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

E. Income and Auto Availability Submodels

The broader travel behavior literature suggests that two major drivers of activity participation are income and auto ownership (Lu and Pas, 1999; Farber and Paez, 2009). We designed our models to incorporate these two variables as submodels within the larger structural equation model. We expect that greater household income and greater auto availability will increase activity participation for youth and adults; we also expect income to have an independent effect on car ownership.

The models suggest that income, in addition to having a strong direct effect on activity participation, also has an indirect effect through the mediating variable of auto ownership. However, the results do not consistently conform to our expectations. For youth in 1990 and 2001, greater household income has a negative direct effect on activity participation (trip-making), and strong positive effect on auto ownership. This means that, for youth, the effect of income on trip-making is due to the enabling of auto access, and not to the facilitation of trips in other ways (such as by providing money to spend at the trip end). Because auto ownership has a strong positive effect on trip-making, the income and auto access variables must be considered in concert with one another rather than separately. Table 23 shows these relationships.

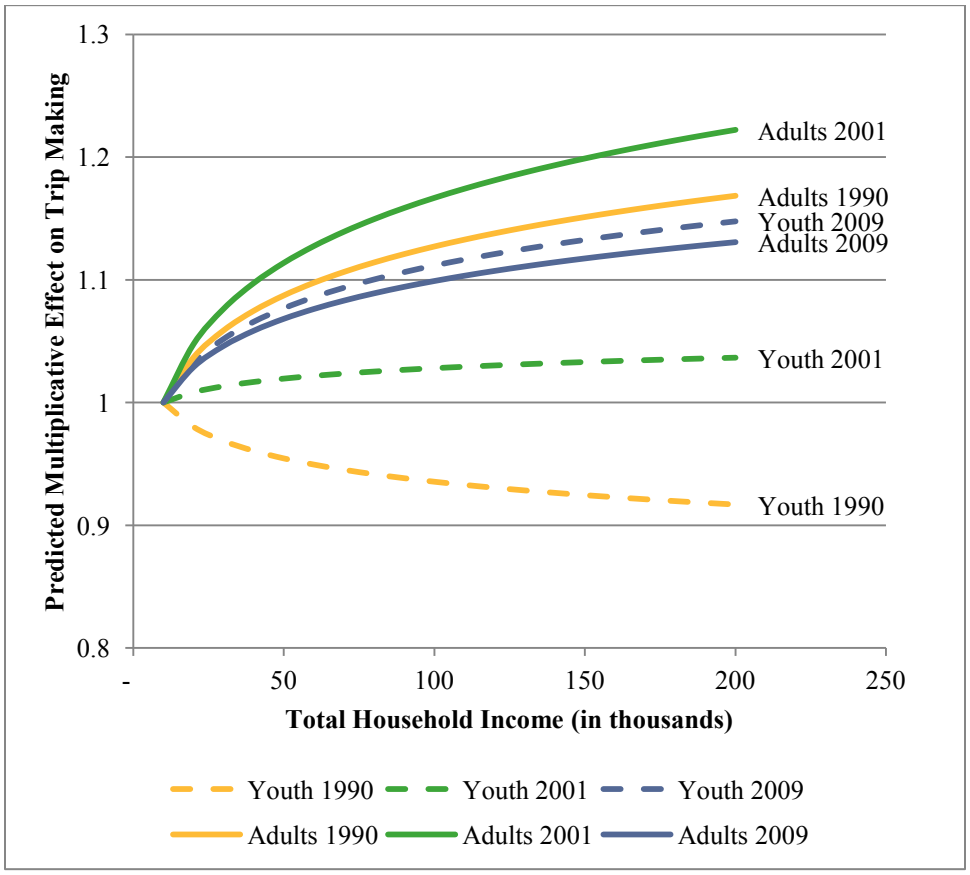
In all but the 1990 youth model, the combined effect of income on trip-making is positive. To help illuminate the magnitude of these changes, we provide an illustrative example drawing on the data presented in Table 23 on the combined direct effects of income on trip-making. An increase in income from $20,000 to $30,000, for instance, would result in a 0.41 unit change in the log-transformed income of the household. This, in turn, would result in a -0.012 (or 0.41 × -0.029) reduction in the log-transformed number of trips the model expects youth to make in 1990. This reduction means a very slight reduction in the number of actual trips—just over a one percent reduction (a multiplicative effect of 0.988, or exp(-0.012)). For adults in the same year, we would expect the same change in income to result in an increase of 2.1 percent in trip-making, slightly more than the reduction we see among youth. For all other models, we see a positive relationship between income and trip-making, though the effect is moderate.

Table 23: Direct and Indirect Effects of Income on the Log-Transformed Number of Daily Activities, Youth and Adults (1990, 2001, and 2009)

		Youth (15–26)			Adults (26–61)		
		1990	2001	2009	1990	2001	2009
a	Direct Effect of Income (ln) on Trips (ln)	-0.039	*n.s.*	0.026	0.043	0.06	0.037
b	Direct Effect of Income (ln) on Auto Availability	0.21	0.153	0.194	0.156	0.14	0.143
c	Direct Effect of Auto Availability on Trips (ln)	0.049	0.08	0.098	0.058	0.049	0.033
d	Indirect Effect of Income (ln) on Trips (ln) *(b × c)*	0.01	0.012	0.019	0.009	0.007	0.005
e	Total Effect of Income (ln) on Trips (ln) *(a + d)*	-0.029	0.012	0.046	0.052	0.067	0.041

Figure 24 provides a graphical representation of the expected effect of income on trip-making for youth and adults for all three periods. Income appears to influence adults' trip-making more than youth's trip-making. However, for the 2009 model, the difference between the youth effect and the adult effect is not meaningful, mostly due to the waxing importance of household income in predicting youth trip-making and activity participation. While the effect of income has grown in importance for youth over time, the models suggest that the effect of income declined considerably for adults between 2001 and 2009. We hypothesize that this trend reflects the effects of the recession on households whose activity patterns were constructed prior to the economic downturn. By examining Table 23, we can see that the indirect effect of income (i.e., the effect of income on auto ownership) remained relative constant across the three time periods for adults, while its direct effect declined sharply. This, combined with a weakened effect of auto availability on trip-making, suggests that while income continued to play a large role in determining auto access, the other effects of income on trip-making are waxing for youth and waning for adults.

Figure 24: Overview of Expected Effect of Income on Trip-Making, Youth and Adults, Household Income of $10,000 Base (=1.0) (1990, 2001, and 2009)



Automobile availability, independent of income effects, also has a significant positive influence on trip-making. Our model suggests that, for a two-adult household, an increase from one car (0.5 cars per adult) to two cars (1.0 cars per adult) would result in an increase of log-transformed trip-making of 0.025 for youth in 1990, and nearly 0.05 for 2009. This means that the availability of cars led youth to make over 2.5 percent (exp(0.025)) more trips in 1990, and over 5 percent more trips in 2009—a relatively strong effect. Further, our models show that, for youth, the importance of auto availability in determining trip-making has grown over time, while the effect has diminished for adults over the same period.

Worker Status. Being employed is, of course, highly correlated with income. But beyond the income effects of working, the models collectively suggest that employed people consistently take significantly more trips per day than non-working individuals, and this is particularly true for youth. While the adult models suggest a moderate direct influence of being employed on trip-making (no effect in 1990, roughly 8 percent more trips in 2001, and 10 percent more trips in 2009), the effect on youth is considerably stronger, growing from roughly 12 percent (exp(0.121)) more trips in 1990 to nearly 27 percent (exp(0.239)) more trips in 2009. At the

same time, working youth's contribution to overall household income has diminished substantially, from a strong effect in 1990 (a 26 percent increase in household income) to having no statistically significant effect on household income in 2009; this may be due to the fact that youth employment has declined the most in lower income households where their employment has the largest effect on overall household income. For adults, worker status is a strong and significant determinant of total household income across all three periods.

While being a worker has a positive influence on trip-making, as expected, the duration of one's commute has a countervailing effect. For youth, we observe a roughly 12 percent decrease in the number of trips taken for each additional hour of commuting in 1990 and 2009; for 2001, the model finds no effect. Commute duration appears to influence adults' activity patterns as well, but to a lesser degree. In all three adult models, we find a roughly 8–9 percent decrease in daily activities for each additional hour spent commuting. The data suggest that adults' days consist of more shopping trips and fewer social/recreational trips. Thus, it is likely that adults' trips are less discretionary, making it harder for adults to omit a trip when their commutes are long.

Web Use. Similar to our analysis of PMT, the SEM trip-making models presented here do not provide any strong evidence that internet usage has an influence—either positive or negative—on trip-making. In the 2001 and 2009 models (web usage is not available in the 1990 dataset, but we can presume that it was near zero for most people), daily internet usage has no statistically significant influence on the number of trips that youth make. For adults, only the 2009 model suggests a relationship, though a positive one. Specifically, the model suggests that adults who use the internet daily take, on average, 8 percent (exp(0.078)) more trips per day than do those adults who do not use the internet daily, controlling for other factors. This, too, is congruent with the findings in our PMT analysis, and suggests that any effect that web use has as a substitution for travel is more than offset by the fact that those who access the web daily are inclined to engage in more activities than those who do not. This weak substitution effect is consistent with the literature on information and communications technologies and travel more broadly (Kwan 2006; Taylor 2011).

Licensing Restrictions. Similarly, the models suggest that the increasingly strict drivers' licensing laws in the United States have had a modest influence at best on youth activity participation. All three models for the youth age group find no evidence of a direct relationship between licensing restrictions and the number of activities per day. Although the models may point to a dampening effect on the number of automobiles a household purchases, these coefficients are not consistent across the three model years. At most, the models predict a reduction of less than 0.20 cars per adult in the household when licensing restrictions become stricter. However, these coefficients are only marginally significant for 2009, and the 2001 model shows a countervailing effect—suggesting that, in 2001, stricter licensing regimes were associated with more, and not less, trip-making.

Why, given that auto access is so strongly associated with trip-making, do stricter teen licensing requirements appear not to be depressing youth activity participation? The possible explanations are many, and beyond the scope of this analysis to carefully scrutinize. However, we hypothesize that possible explanations might include that youth are simply traveling more via other modes, being chauffeured more by parents and friends, or ignoring driving restrictions. We discuss this issue further in the conclusion of this report.

Control Variables of Note. The effect of race/ethnicity on trip-making patterns appears to be diminishing over time. In general, we observe that people of color make fewer trips than their white counterparts do, although the effect has diminished considerably. This finding is consistent with the literature on race/ethnicity and travel generally (Farber and Paez, 2009). Our models suggest that race and ethnicity play a larger direct role in determining adults' trip-making than youth's trip-making. However, for youth and adults alike, race/ethnicity plays a role in determining income, which in turn influences trip-making. In the 2009 models, race/ethnicity plays no statistically significant direct role in determining youth's trip-making rates, and the influence of race/ethnicity on income has diminished considerably over the 19-year period analyzed in our models. Similarly, for adults we see that the magnitude of the direct effect of race/ethnicity on trip-making has diminished considerably over time, as has the effect of race/ethnicity on income. However, this diminishing pattern does not hold for Hispanic adults across all three models.

F. Quasi-Cohort Models and Model Results

Table 23 shows the results from the same set of related SEM submodels using a multi-survey-year format similar to the cohort PMT model discussed in the previous chapter. As with the PMT cohort model, our goal with this portion of the analysis was to test for evidence that generations of travelers may be traveling differently from one another, beyond any effects associated with their current life stage or the other predictors of travel.

In the submodel predicting the cars to household adults ratio, all of the standard independent variables perform as expected. Respondents in 2001 and 2009 were substantially more likely to have access to autos than respondents in 1990, *ceteris paribus*. Respondents born in the 1950s, 1960s, and 1980s tended to have higher levels of auto access than those born before 1950, and those born in the 1990s tended to reside in households with *much* higher levels of auto access than those born before 1950. The exception were for those born in the 1970s (and whose ages ranged from 15 to 39 over the 19 year period modeled), who tended to have lower levels of auto access than those born in the 1950s, all things equal. As auto access has a positive effect on trip-making, this component of the model suggests that particularly those born in the 1990s have an increased propensity to make trips, all else equal. However, as we shall see in the

activities sub-model, this auto availability effect is more than offset by a *negative* direct effect for trips associated with being born in the 1990s.

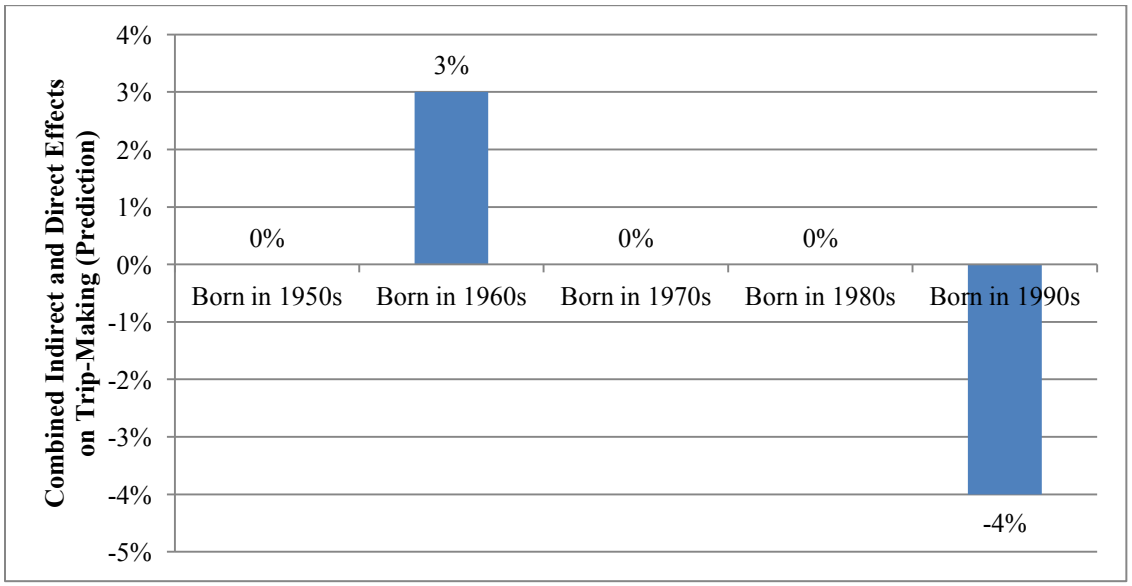
The submodel of income suggests that those born in the 1990s in particular live in households with particularly high incomes, given their age. This suggests that today's youths who are *not* unemployed are, on average, making more money than were people their current age in prior decades. We hypothesize that this may indicate that those youths (who have a maximum age of 19 in the 2009 dataset) who today are employed represent a particularly high-skilled and high-pay subset of youths. An alternate (or supplementary) explanation would simply be that those households with children born in the 1990s have fared better through the current economic recession than have other households, such as those too young to have children in their teens. In any case, as household income has a strong positive effect on trip-making, this submodel contributes considerably to the overall predicted trip-making of those born in the 1990s. However, the positive income effect associated with being born in the 1990s is more than offset by a negative direct effect on trip-making.

The direct-effect submodel on trip making produces results that are for the most part consistent with the cross-sectional models presented above. Women make more trips than men; Hispanics make more trips than Whites, who in turn make more trips than Blacks, Asians, and others. Education, being employed, household income, and access to autos are all positively associated with trip-making; and living in more densely populated areas is associated with more trips. With respect to our variables of interest, daily web use increases, rather than depresses, trips and young adults living with their parents tend to make fewer trips, all things equal. Age, controlling for other factors, has a small but meaningful influence on trip-making. As Figure 25 shows, the model suggests that trip-making increases until age 40, at which point it begins declining.

Figure 25: Estimated Independent Effect of Age on Trip-Making (age 15=0)

Independent of age, income effects, and auto ownership effects, one's birth cohorts appears to have little *direct* influence trip-making, though there is an effect for two cohorts. Relative to those born before 1950, those born in the 1960s make more trips, while those born in the 1990s make fewer trips.

Figure 26: Combined Direct and Indirect Effects on Trip-Making of Birth Cohort



The combined indirect and direct effects of one's birth cohort, however, are shown in Figure 26. These combined coefficients suggest that, while living in households that have more automobiles on average than did previous cohorts at the same stage in their lives, those born in the 1990s are making *fewer* trips on average that all previous cohorts. Again, as above, we urge caution in interpreting these results, as the short window (1990-2009) of our analysis does not allow for true comparisons with all previous cohorts. Including the survey years as dummy variables in the models should account for period effects (such as an economic downturn in 1990 and depressed trip-making after 9/11 in 2001) on trip-making, and indeed trip rates in both 2001 and 2009 are statistically significantly lower than in 1990.

Table 24: SEM Quasi-Cohort Model of the Log-Transformed Number of Activities Per Day

Sub-Model: Ratio of Cars to Adults	Coefficient	Sig.	t-Statistic	p-Value
Individual Characteristics				
Race / Ethnicity (omitted category: Non-Hispanic White)				
Non-Hispanic Black	-0.122	***	-28.47	<0.001
Non-Hispanic Asian (2009 Only)	-0.103	***	-17.27	<0.001
Non-Hispanic Other	-0.040	***	-3.77	<0.001
Hispanic	-0.064	***	-17.03	<0.001
Household Characteristics				
Number of Adults in HH	-0.130	***	-99.54	<0.001
Income (ln)	0.145	***	125.88	<0.001
Geographic Characteristics				
Population Density (ln)	-0.063	***	-102.55	<0.001
Year (base:1990)				
Year: 2001	0.230	***	56.10	<0.001
Year: 2009	0.242	***	60.94	<0.001
Cohorts (base: Born before 1950)				
Born in 1950s	0.023	***	7.35	<0.001
Born in 1960s	0.010	***	3.15	0.003
Born in 1970s	-0.039	***	-11.04	<0.001
Born in 1980s	0.034	***	7.85	<0.001
Born in 1990s	0.118	***	20.76	<0.001
Constant	-0.423	***	-31.40	<0.001
Sub-Model: Income (ln)				
Individual Characteristics				
Race / Ethnicity (omitted category: Non-Hispanic White)				
Non-Hispanic Black	-0.419	***	-61.34	<0.001

Sub-Model: Number of Activities (ln)	Coefficient	Sig.	t-Statistic	p-Value
Individual Characteristics				
Female	0.068	***	24.28	<0.001
Age	0.006	***	3.79	<0.001
Age Squared	<0.001	***	-4.73	<0.001
Race / Ethnicity (omitted category: Non-Hispanic White)				
Non-Hispanic Black	-0.020	***	-6.55	0.001
Non-Hispanic Asian (2009 Only)	-0.111	***	-13.16	<0.001
Non-Hispanic Other	-0.046	***	-5.95	<0.001
Hispanic	0.025	***	2.87	<0.001
Education (omitted category: No HS Diploma)				
For Youth: Highest Degree Achieved in Household				
High School Diploma	0.072	***	5.26	<0.001
Some College	0.134	***	10.47	<0.001
Bachelor's Degree	0.139	***	10.48	<0.001
Graduate Degree	0.165	***	11.25	<0.001
For Adults: Highest Degree Personally Achieved				
High School Diploma	0.030	*	3.14	0.002
Some College	0.099	***	10.67	<0.001
Bachelor's Degree	0.158	***	16.54	<0.001
Graduate Degree	0.209	***	21.30	<0.001
Reports Working	0.118	***	34.21	<0.001
Uses Web Daily	0.064	***	19.25	<0.001
Household Characteristics				
Income (ln)	0.034	***	17.47	<0.001
Number of Adults in HH	-0.037	***	-19.62	<0.001

Non-Hispanic Asian (2009 Only)	-0.140	***	-14.57	<0.001
Non-Hispanic Other	-0.201	***	-19.49	<0.001
Hispanic	-0.334	***	-54.93	<0.001
Education (omitted category: No HS Diploma)				
For Youth: Highest Degree Achieved in Household				
High School Diploma	0.368	***	40.12	<0.001
Some College	0.567	***	70.69	<0.001
Bachelor's Degree	1.045	***	110.59	<0.001
Graduate Degree	1.363	***	129.37	<0.001
For Adults: Highest Degree Personally Achieved				
High School Diploma	0.591	***	62.05	<0.001
Some College	0.903	***	96.08	<0.001
Bachelor's Degree	1.318	***	137.76	<0.001
Graduate Degree	1.597	***	164.04	<0.001
Reports Working	0.281	***	57.07	<0.001
Household Characteristics				
Number of Adults in HH	0.125	***	58.70	<0.001
Youth, Lives with Parents	-0.192	***	-2.78	0.005
Year (base: 1990)				
Year: 2001	-0.110	***	-16.24	<0.001
Year: 2009	-0.175	***	-25.33	<0.001
Cohorts (base: Born before 1950)				
Born in 1950s	0.009	*	1.75	0.081
Born in 1960s	0.028	***	5.25	<0.001
Born in 1970s	-0.055	***	-8.91	<0.001
Born in 1980s	-0.045	***	-4.75	<0.001
Born in 1990s	0.350	***	28.05	<0.001
Constant	9.811	***	847.77	<0.001

Youth, Lives with Parents	-0.054	***	-6.30	<0.001
Ratio of Cars to Adults in HH	0.057	***	18.80	<0.001
Geographic Characteristics				
Population Density (ln)	0.017	***	19.89	<0.001
Year (base: 1990)				
Year: 2001 (base: 1990)	-0.037	***	-4.97	<0.001
Year: 2009 (base: 1990)	-0.107	***	-10.82	<0.001
Cohorts (base: Born before 1950)				
Born in 1950s	0.005		0.74	0.458
Born in 1960s	0.032	***	3.18	0.001
Born in 1970s	-0.011		-0.78	0.437
Born in 1980s	-0.024		-1.29	0.198
Born in 1990s	-0.058	**	-2.49	0.013
Constant	0.424	***	23.84	<0.001
Variance				
Var (Ratio of Cars to Adults)	0.213			
Var (Income (ln))	0.560			
Var (Number of Activities (ln))	0.414			
N	265,543			
R2 (Overall)	0.409			
Key: Statistically Significant				

G. Conclusion: Youth, Activities, and Trips

The demand for travel is derived. That is, people travel in order to access opportunities to do, acquire, or sell. With the exceptions of long walks on the beach or cruising the boulevard on a Saturday night, people—as members of households or employees of firms—travel in order to do other things. Thus trips, as opposed to traveling, act as a proxy for activity participation; the more trips one completes, the more activities in which s/he participates. Up to a point, therefore, more trips mean more activities and access to a higher quality of life.[22] Likewise, more time and money spent traveling to a fewer number of destinations means fewer trips and lower levels of personal access, in spite of high levels of mobility. Accordingly, this analysis focuses on trip-making and trip purpose in order to examine the access, or utility that people derive from their trips.

Drawing on the literature, we hypothesize that adults make more trips than youth, and that higher incomes and greater private vehicle access are associated with higher levels of trip-making and, hence, activity participation—and indeed we find these to be the case. In general, trip-making increases year to year as people age from the early teens through late middle-age, and then it declines gradually thereafter. Trip-making is highly correlated with economic activity, as we observe that trips per person increased between 1990 and 2001, but declined between 2001 and the recession of 2009. Unemployment in 2009 was substantially higher among youth than adults, and the drop in trip-making between 2001 and 2009 was greater for youth than for adults. And at a more micro level, our analysis shows that both income and employment are associated with greater trip-making.

To examine the independent effects of income, auto access, employment, information and communications technologies use, and driver's licensing regimes on trip-making of both youth and adults, we constructed a set of structural equation models (SEMs). We find in these models that income is a powerful predictor of trip-making among adults, and its importance in predicting youth trips increased substantially between 1990 and 2009 and is now on par with that of adults. The most important effect of income is increased automobile access, which in turn encourages more trips. While income and working are strongly associated with increased trip-making among both adults and, increasingly, youth, time spent commuting to and from work – because it reflects the opportunity cost of time – tends to depress trip-making.

---

[22] While a few more trips at the margin are assumed to be a positive measure of accessibility, a very large number of trips in a given day is obviously excessive and burdensome. Accordingly, as we explained above, we have log-transformed our trips measure to mute the effect of large numbers of trips in our analysis.

Table 25: Summary Table: Number of Trips and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+
Young Adult Living at Home	*(Not included in the model)*					
Technology (Web Use)	*n/a*	0	0	*n/a*	+	+
License Stringency	-	+	-	-	+	-

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

While the effects of the economy, income, auto access, and working are all positively associated with trip-making among both adults and youth, internet access appears to have no effect on youth trip-making, and may actually be associated with a slight increase in adult trip-making in 2009. Likewise, and remarkably, increasingly strict licensing regimes for teens appear to have little, if any, effect on youth trip-making. Finally, we note in these models that the independent effects of race/ethnicity on trip-making appear to be waning over time, especially among youth.

We also constructed a quasi-cohort model of auto access (measured as autos per adult), income, and activities (measured as daily trips). In the submodel predicting the ratio of cars to household adults, respondents in 2001 and 2009 were substantially more likely to have access to autos than respondents in 1990, *ceteris paribus*, and those born in the 1990s in particular have remarkably high automobile access. Similarly, today's teens are living in households that have considerably higher incomes than was the case for prior generations, after controlling for the period effect of the current economic recession. Taken together, though, the negative direct effect of being born in the 1990s on trip-making overwhelms the positive effect of income and auto ownership, and those born in the 1990s are estimated to make roughly four percent fewer trips than previous cohorts did at the same age in their lives, all else equal.

Chapter VII. Trip Purpose

The purpose of a trip—for example, traveling to work or visiting friends—greatly influences travel behavior and mode choice. This brief chapter discusses trip purpose, which provides the background for the two chapters on mode choice that follow.

All three versions of the national travel surveys that we analyze in this report ask respondents about the purpose of their trips. The 2001 and 2009 NHTS ask the respondent to select from one of thirty-seven options, including highly specific purposes like "meals: coffee/ice cream/snacks."[23] Respondents may also choose multiple purposes for a trip.

However, the 1990 NPTS is much less precise. First, it only gives respondents ten options for trip purpose, and also asks respondents for the main purpose of their trips. If a person travels to work and runs several errands along the way, the trip is recorded as a work trip only. Moreover, the 1990 survey classifies trip purpose based on the destination outside the home, regardless of origin or destination. For example, a person's trip home from work is recorded as a work trip—again, even if the person ran several errands as well on the trip.

While the 1990 trip purpose data omit useful information, the data remain useful for comparing travel behavior over time. The 2001 and 2009 NHTS data files contain a recoded trip purpose variable compatible with the trip purpose variable in the 1990 NPTS. If a trip has multiple purposes listed, the place where the person spent the most time (e.g., the office) determines the purpose that appears in the recoded variable.

For purposes of our analysis, we designed four major trip purpose categories relevant for youth: family-related, shopping, work, and social. Table 26 lists the trip purposes used in the 1990 NPTS and our classification for each.

[23] Respondents may have also failed to provide a trip purpose.

Table 26: Major Trip Purpose Categories

1990 Trip Purpose	Reclassified Trip Purpose
To/From Work	Work
Work-Related Business	Work
Shopping	Shopping
Other Family/Personal Business	Family
School/Church	Family
Medical/Dental	Family
Visit Friends/Relatives	Social
Other Social/Recreational	Social
Vacation	Not used in the analysis
Other	Not used in the analysis
N/A or Refused	Not used in the analysis

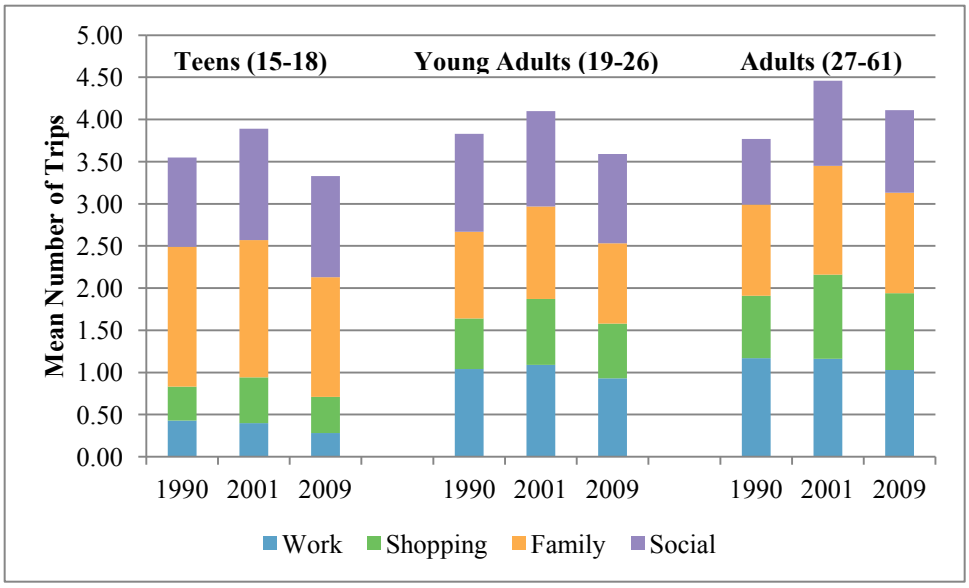
Some trips may fall into more than one major category. If a teenager travels to the mall and spends time with friends, for example, the trip will be a "shopping" trip despite the obvious social component. Likewise, some trips to school and church may be social trips if a teenager is participating in a group activity. Unfortunately, the limitations of the survey data make these analytical issues impossible to resolve. Table 27 and Figure 27 below illustrate average daily trips by age group classified by trip purpose. Family-related trips account for the largest share—roughly 50 percent of all trips for children and teenagers and 30 percent for others. Social travel is another important category—roughly 20 percent of all trips for adults and 30 percent for others. Work trips account for 25–30 percent of trips among young adults and adults and 10 percent of trips for teenagers and seniors. Finally, roughly 15–20 percent of trips are shopping trips, although that number rises to 30 percent for seniors.

While the number of trips has changed over the years—both due to changes in the economy and changes in the survey methodology—the relative share of trips for each category has remained remarkably stable over time. The main exception is the share of work trips for adults, which has declined from 31 percent in 1990 to 25 percent in 2009, in part because the share of social trips increased from 21 to 24 percent. Social trips have also increased from 30 percent to 36 percent for children.

Table 27: Average Daily Trips by Age Group (1990, 2001, and 2009)

	Work		Shopping		Family		Social	
Teen (15–18)								
1990	0.43	12%	0.40	11%	1.66	47%	1.06	30%
2001	0.40	10%	0.54	14%	1.63	42%	1.32	34%
2009	0.28	8%	0.43	13%	1.42	43%	1.20	36%
Young Adult (19–26)								
1990	1.04	27%	0.60	16%	1.03	27%	1.16	30%
2001	1.09	27%	0.78	19%	1.10	27%	1.13	28%
2009	0.93	26%	0.65	18%	0.95	26%	1.06	30%
Adult (26–61)								
1990	1.17	31%	0.74	20%	1.08	29%	0.78	21%
2001	1.16	26%	1.00	22%	1.29	29%	1.01	23%
2009	1.03	25%	0.91	22%	1.19	29%	0.98	24%

Figure 27: Average Daily Trips by Age Group (1990, 2001, and 2009)



Chapter VIII. Commute Mode Choice

The above trip purpose data reveal that work trips account for only part of people's daily travel. Given the importance of working in people's lives and that commute trips tend to be the most temporally structured and spatially expansive of trip purposes, transportation analysts have long focused considerable attention on journey-to-work, or commute, trips. Commuting contributes disproportionately to metropolitan traffic congestion, and a disproportionate share of trips on public transit. Accordingly, how people select their means of travel to and from work is a central concern of transportation planners and policy analysts. Given the policy relevance of commuting and the focus of our work on how economic conditions and factors affect youth travel behavior, this next chapter examines commute mode choice for both youth and adults between 1990 and 2009.

In this chapter of the report, we first explain our methodology for analyzing commute mode of youth and adult workers through discrete choice modeling. We then describe employment and commute mode trends over time. Finally, we discuss the model findings with an eye toward our variables of interest—economic factors, including young adults living with parents, world wide web use, and state licensing regimes—as well as key differences between youth and adult workers in terms of transit use and carpooling.

A. Methodology

To analyze mode choice in the journey to and from work, we compare the commute mode choices of teens and young adults (ages 15–26) to that of middle-aged and older adults (ages 27-61) in 1990, 2001, and 2009. We use discrete choice modeling; specifically, multinomial logistic regression analysis, a statistical approach that is well-suited to analyzing discrete outcomes like travel mode. The model predicts the likelihood of selecting a particular alternative relative to a "base" case. In our model, the dependent variable is the individual's choice of travel mode for a given trip, with the outcomes of interest being the choice to use an alternative travel mode (carpool, transit, and walking/biking) instead of driving alone (the "base" choice). The model takes the following form:

$$\text{logit}(p) \equiv \ln \frac{p}{1-p} \equiv \alpha + \beta_1 X + \beta_2 Y + \beta_3 Z + e$$

In this model, p is the probability that the event M (for mode choice) occurs (p(M)=1), $p/(1\text{-}p)$ is the odds, $\ln[p/(1\text{-}p)]$ is the log odds, and X is a vector of person-level variables thought to be determinants of mode choice, Y a vector of household-level determinants of mode choice, Z a vector of geographic determinants of mode choice. The model determines coefficients α and $\beta_{1\ldots3}$ using maximum-likelihood estimation. The modeled choice outcomes are single-occupant

vehicle (the base against which each of the models is estimated), carpool (all auto trips with more than one occupant), public transportation (or "transit"), and the two main non-motorized modes: walking and bicycling.

To test for systematic differences in the factors influencing mode choice between our two age groups, we developed separate models for youth and adult workers.

Since the unit of analysis in all three surveys is trips, and not individuals or households, we determined each worker's commute mode by identifying the longest (in terms of time) leg of their journey to work. For instance, a commuter might walk to the bus stop, ride the bus downtown, and walk a few blocks to her workplace—a journey to work that contains three separate modal segments. Since the bus ride is the longest leg of the commute, we would designate "transit" as this worker's commute mode.

As noted in previous chapters, our analysis also includes a set of control variables that account for personal, household, trip, and geographic characteristics thought to influence mode choice. Previous studies find that socio-demographic characteristics of individuals, such as race/ethnicity, sex, and immigration status vary systematically with travel behavior generally, and mode choice in particular. Previous scholarship also suggests that people of color, women, and immigrants are more likely to use alternative transportation modes than their white, male, and native-born counterparts (Blumenberg and Smart, 2010; Crane, 2007; Pas, 1984; Pisarski, 2006; Pucher and Renne, 2003). Individuals' economic characteristics also greatly influence mode choices, and we expect more solo driving from those with more income, educational attainment, and cars per adult in the household[24] (Pisarski, 2006; Pucher and Renne, 2003). Likewise, previous research has shown that geographic characteristics, such as population density and metropolitan area size, affect commute mode choice. Public transit use in particular is strongly and positively associated with metropolitan area size and population density (Chatman, 2009; Crane, 2000; Pisarski, 2006).

Table 28 below shows the sample size and the mean values or percent of whole of all the variables tested in our analysis across the three survey years, including variables that were subsequently dropped from our models.

[24] It is important to note here that due to high levels of multicollinearity between income and both educational attainment and cars per adult in a household, we had to exclude the latter two variables from our final commute mode choice model.

Table 28: Variables in Commute Mode Models (1990, 2001, and 2009)

Control Variables	1990		2001		2009	
	Frequency	Mean or Percent	Frequency	Mean or Percent	Frequency	Mean or Percent
Individual Characteristics						
Non-Hispanic White	22,342	77.8%	50,706	69.2%	124,891	65.5%
Non-Hispanic Black	3,088	10.8%	9,224	12.6%	23,918	12.5%
Non-Hispanic Asian	*n/a*	*n/a*	2,018	2.8%	6,686	3.5%
Hispanic	2,322	8.1%	9,252	12.6%	30,975	16.2%
Non-Hispanic Other	984	3.4%	2,118	2.9%	4,262	22.3%
Immigrant	*n/a*	*n/a*	7,657	13.4%	25,703	15.6%
Age	28,863	43.21	73,318	34.07	190,732	38.57
Female	14,674	50.9%	36,745	50.1%	95,842	50.3%
Young Adult Lives with Parents	1,286	4.5%	2,178	3.0%	11,099	5.8%
Daily Web	*n/a*	*n/a*	23,162	39.8%	105,405	55.3%
Medical Condition	*n/a*	*n/a*	3,247	5.7%	11,857	7.2%
*Driver**	*21,751*	*91.4%*	*55,075*	*88.8%*	*151,514*	*90.4%*
< High School*	7,136	25.9%	7,002	12.2%	12,547	7.9%
High School Diploma*	8,157	29.6%	16,075	28.1%	41,746	26.2%
Some College*	5,985	21.7%	16,260	28.4%	46,560	29.2%
College Graduate*	3,976	14.4%	11,673	20.4%	34,454	21.6%
Professional Degree*	2,305	8.4%	6,243	10.9%	24,145	15.1%
Household Characteristics						
Family Income (log)	22,019	10.44	73,318	10.79	190,732	10.95
Single Family HH	*n/a*	*n/a*	51,626	70.4%	135,919	71.3%
Number of Children	28,863	1.12	73,318	1.22	190,732	1.03
Autos Per Adult*	28,731	1.01	73,318	1.02	190,732	1.00
Trip Characteristics						
Distance to Work (log)	*n/a*	*n/a*	34,833	1.98	83,355	2.01
Peak Period Travel	*n/a*	*n/a*	73,318	0.17	190,732	0.13
Geographic Characteristics						
Population Density (log)	28,863	0.44	73,305	0.83	190,617	0.73
MSA > 3 million	11,253	39.0%	32,898	44.9%	85,680	44.9%
New York Area	2,692	9.3%	5,829	8.0%	16,398	8.6%
State Licensing Characteristics*						
License Stringency: Lowest	21,539	74.6%	25,607	23.0%	*n/a*	*n/a*
License Stringency: Low	7,324	25.4%	20,911	18.8%	7,970	4.2%
License Stringency: Med	*n/a*	*n/a*	44,913	40.4%	59,321	31.1%
License Stringency: High	*n/a*	*n/a*	19,822	17.8%	123,441	64.7%

As in the previous analytical chapters, we estimated a quasi-cohort model of mode choice for the journey to work. For this model, we estimated a binary logit choice model of the choice to

drive alone to work, rather than use any other mode of transportation. We chose this modeling form due to computational limitations of estimating a multinomial mode choice model with a very large (three data years, combined) dataset. While the use of a binary logit model may obscure many of the trade-offs made between the various non-SOV modes of transportation, the model included in this chapter provides insight into the choice to drive alone to work.

B. Who are Youth Workers and How Do They Travel?

Our commute mode analysis includes only workers, and therefore uses a different sample than the previous PMT and trip-making analyses. We begin by describing worker status—employment rates and demographic composition of the workforce—and how this has changed over time. We conclude this subsection by describing differences between commute modes of youth and adult workers across all three time periods.

Employment Status. Table 29 shows that about three-fifths of respondents to the NPTS/NHTS are workers—a proportion that is consistent over all three surveys that we analyzed.

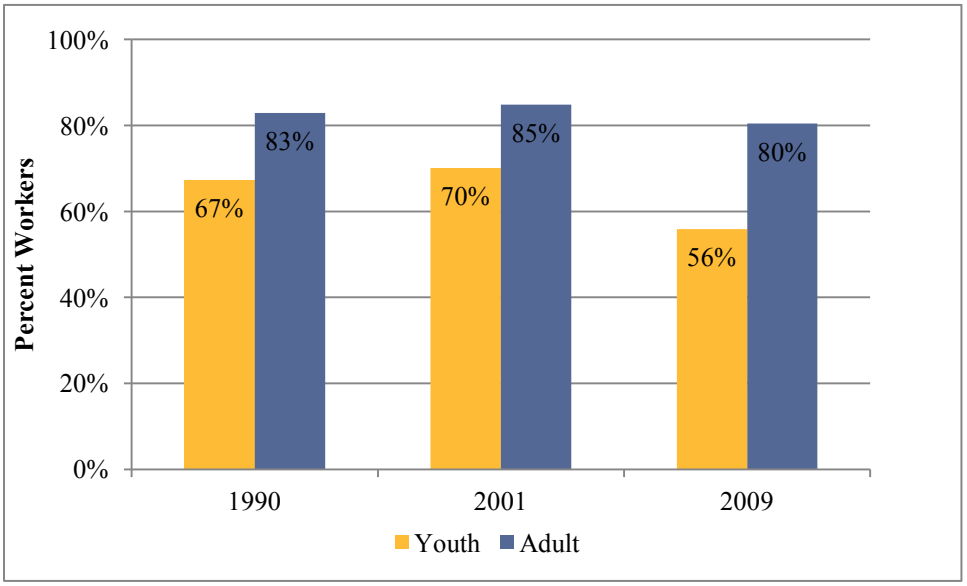
Table 29: Worker Status of Respondents (1990, 2001, and 2009)

	1990	2001	2009
Worker	61.0%	56.6%	58.2%
Non-worker	39.0%	43.4%	41.8%
Total[25]	28,626	73,318	190,732

As we mentioned in the introduction to this report, we see considerably more fluctuation in employment status across the three periods for youth than the population overall. Since working youth have less education and work experience than middle-aged and older adults, fluctuations in economic conditions affect employment patterns of youth far more than that of their older counterparts. In fact, each of the three survey years reflects very different economic circumstances. According to the Bureau of Labor Statistics, unemployment among workers over 15 was 5.6 percent in 1990, just before the U.S. economy slid into a recession in the early 1990s. In 2001, the unemployment rate stood at 4.7 percent, as the U.S. was at the tail end of one of the most sustained economic booms in its history. In 2009, the unemployment rate had nearly doubled from 2001 to 9.3 percent, the highest rate since 1983 (U.S. Department of Labor, 2012). As Figure 28 below shows, the proportion of working youth correspondingly dropped sharply from 70 percent in 2001 to 56 percent in 2009.

[25] For our commute mode analysis over time, we derive our sample from those who reported a commute mode—which is a smaller pool than all workers in this table—resulting in sample sizes of 7,438 youth and adult workers in 1990, 16,195 in 2001, and 35,003 in 2009.

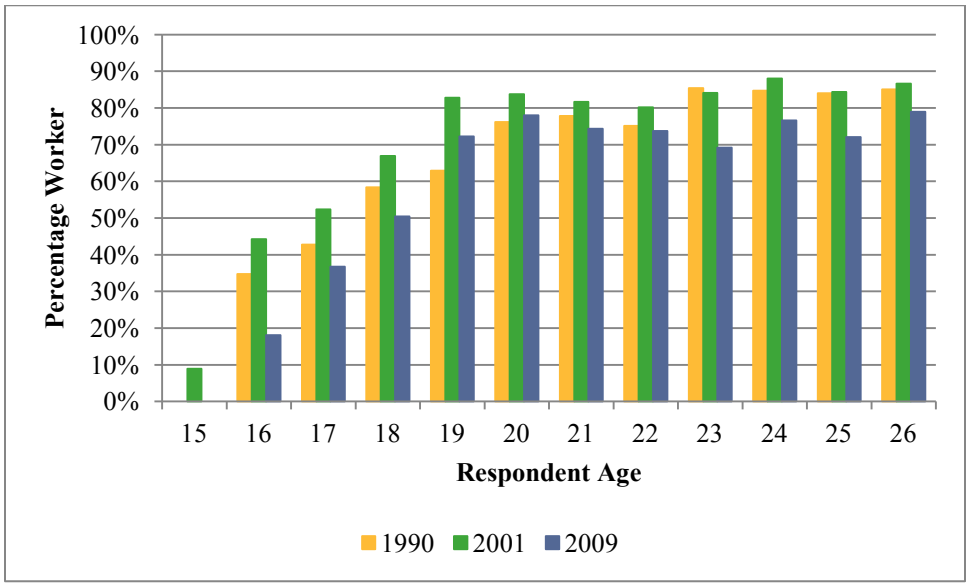
Figure 28: Worker Status by Age and Year (1990, 2001, and 2009)



Employment trends for adults, in contrast, do not vary much over time. As Figure 28 shows, approximately 80 percent of adults identified as workers over the three time periods—a much higher proportion than youth. Across all three periods, there is about a 15-percentage point gap between working youth and adults—supporting our assertion that adult workers weather fluctuations in the economy better than youth workers.

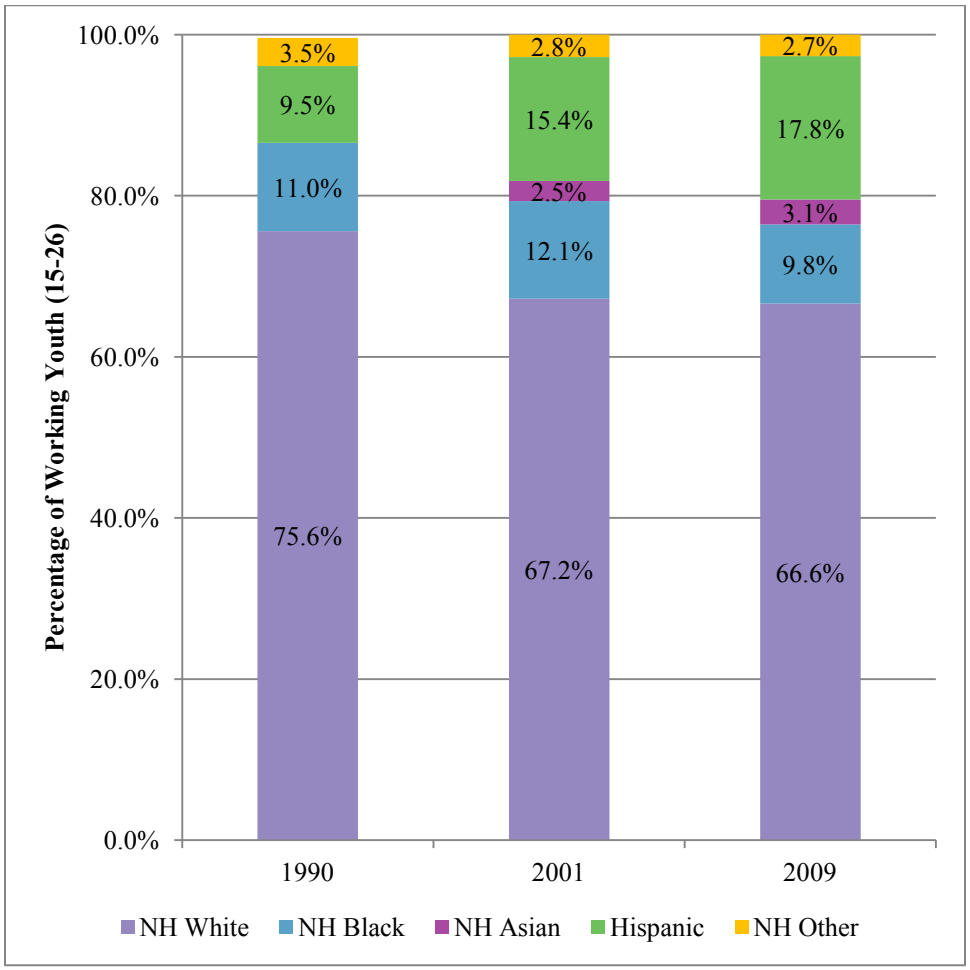
Figure 29 below shows that within the youth age group, there are stark differences in employment patterns between teens (ages 15–18) and young adults (ages 19–26). For teens, employment rates rise sharply with age in all three times periods. For young adults, employment rates do not vary much, hovering around 80 percent across all three periods. Figure 29 also shows that the proportion of working teens and adults has fallen since 2001. In fact, 2009 marks the period with the lowest proportion of working youth compared to both 1990 and 2001.

Figure 29: Percentage of Youth Working by Age and Year (1990, 2001, and 2009)



In 2009, two-thirds of working youth were non-Hispanic white (hereafter, "white"), nearly one-fifth were Hispanic, one-tenth were non-Hispanic Black ("Black"), and the remaining six percent were split evenly between NH Asian ("Asian") and NH persons of other races ("persons of other races"). Since 1990, the proportion of Black, Asian, and persons of other races has remained steady over time. However, there have been substantial changes in unemployment rates among white and Hispanic youth (Figure 30). Since 1990, the proportion of white youth workers has decreased from over three-quarters of all working youth in 1990 to two-thirds in 2009, while the proportion of Hispanic working youth has nearly doubled from 9.5 percent in 1990 to about 18 percent in 2009—partially reflecting the increasing ethnic diversity of the nation as a whole.

Figure 30: Percentage of Working Youth by Race/Ethnicity and Year (1990, 2001, and 2009)



As Figure 30 shows, most of the change in the racial and ethnic composition of working youth occurred between 1990 and 2001. Despite continuing demographic shifts, youth of color have been particularly hard-hit by the recession beginning at the end of 2007 (NBER, 2008). Certainly, the proportion of youth workers overall rises and falls substantially with changes in economic conditions. As Table 30 shows, youth employment rates climbed between 1990 and the economic boom ending in 2001, and fell between 2001 and the recession starting in 2007.

As Table 30 also shows, however, there are substantial differences between employment rates *within* different racial and ethnic groups. In particular, employment rates are highest among white youth workers across all three years, while employment rates are lowest among Black, Asian and Hispanic youth workers. This trend reflects persistent disparities in employment rates and income among white youth and youth of color in U.S. metropolitan areas, and helps explain why the proportion of young white workers has remained relatively stable between 2001 and 2009. Interestingly, despite the major differences, it is important to note that within

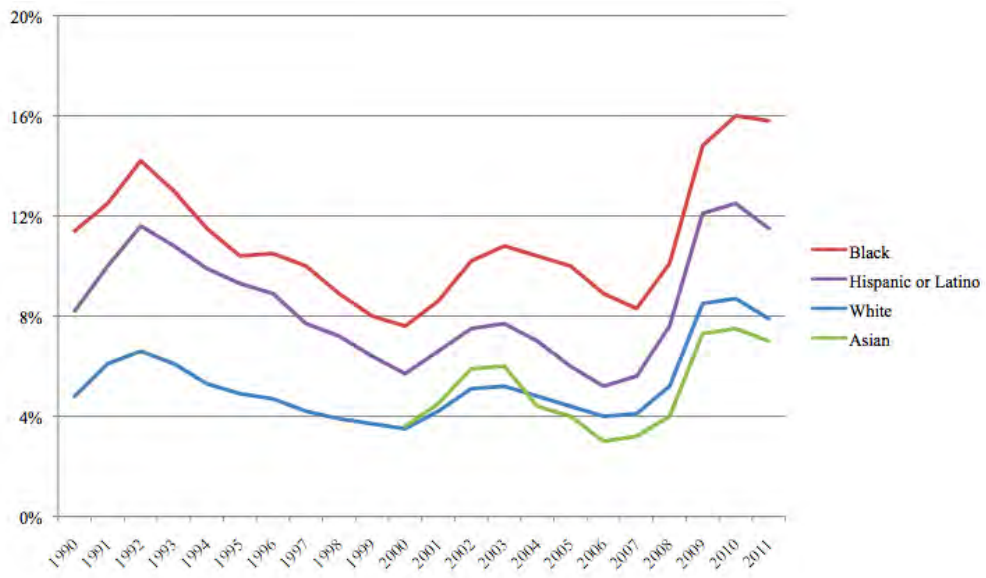
each racial group, employment rates have fallen at consistent rates across different racial groups (see far right column of Table 26 below).

Table 30: Percent Working Within Each Racial/Ethnic Group by Year (1990, 2001, and 2009)

	1990	2001	2009	2009 as a % of 2001
NH White	69.8%	73.1%	59.2%	80.9%
NH Black	57.7%	61.3%	45.8%	74.7%
NH Asian	*n/a*	57.6%	46.3%	80.4%
Hispanic	63.6%	68.0%	53.1%	78.1%
NH Other	60.2%	72.4%	57.0%	78.7%
Sample N	3,200	6.073	9,539	

Nonetheless, the current profound economic downturn has hit communities of color the hardest. As Figure 31 below shows, the unemployment gap between white workers and Hispanic/Latino and Black workers has widened during the current recession. These differences—over time and across racial/ethnic groups—are reflected in our models of commute mode choice detailed in the next section of this chapter.

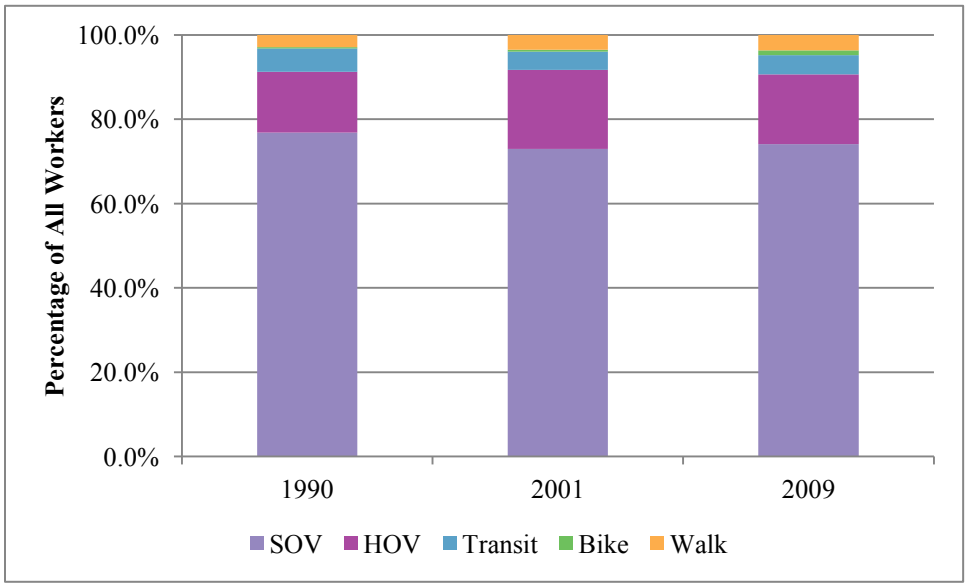
Figure 31: Unemployment by Race/Ethnicity, 1990-2011 (U.S. Department of Labor)



Commute Mode. How are people living in American metropolitan areas getting to work? Figure 32 below shows that private vehicle travel dominates commuting in U.S. metropolitan areas; across all three periods, more than 9 out of 10 workers traveled to and from their jobs by private vehicle—either alone or in a carpool. Further, despite substantial fluctuations in economic conditions, variations in real fuel prices in the midst of substantial public investments in transit systems, and the promulgation of programs to encourage carpooling,

walking, and biking over the past two decades, the mode split among U.S. workers has remained remarkably stable. Bicycle commuting increased most dramatically in relative terms over the three survey periods, but by 2009 still accounted for only about one percent of all commute trips. Walking to work also increased across all three periods to nearly 4 percent in 2009—only slightly below the share of commuters carried by public transit, which fell from about 5.6 percent in 1990 to 4.6 percent in 2009.

Figure 32: Commute Mode for All Workers (1990, 2001, and 2009)



In all three periods, nearly twice as many workers carpooled to work as the combined number who biked, walked, and rode public transit. Carpooling to work increased from about 14 percent in 1990 to about 17 percent in 2001, but then dipped slightly to about 16.5 percent in 2009. Finally, and most significantly, in all three periods the vast majority of commuters—77 percent in 1990 and 74 percent in 2001 and 2009—drove alone to work.

We expected that commute mode choices would differ between youth and adults, and they do—but not by much. Private vehicle commuting predominates among youth commuters, as with adults, accounting for approximately 90 percent of commute trips. Overall, travel by means other than private vehicles among youth workers is only about two percentage points higher than for adults.

Among private vehicle commuters, Figure 33 and Figure 34 show that there are much higher rates of carpooling to work among youth (nearly 23%) than that of adults (about 15%) in 2009, which has generally increased yet not changed dramatically over time. While the percentage of drive-alone commuters is much higher among adults than youth, this gap has closed slightly over time. As expected, use of non-motorized modes is higher among youth than among adults.

Interestingly, however, between 2001 and 2009, we observe a decrease in bicycling among youth but an increase among adults.

Figure 33: Commute Mode for Youth (1990, 2001, and 2009)

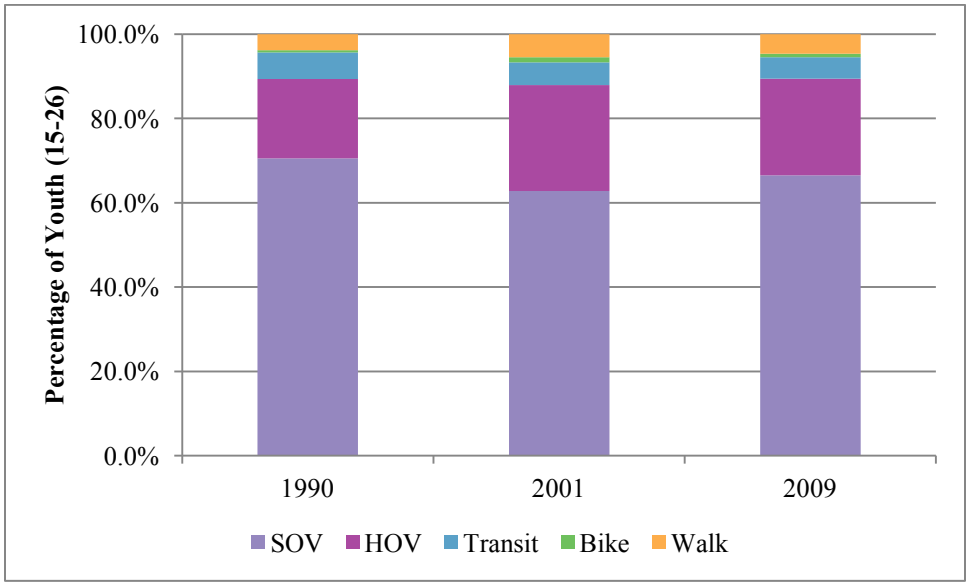
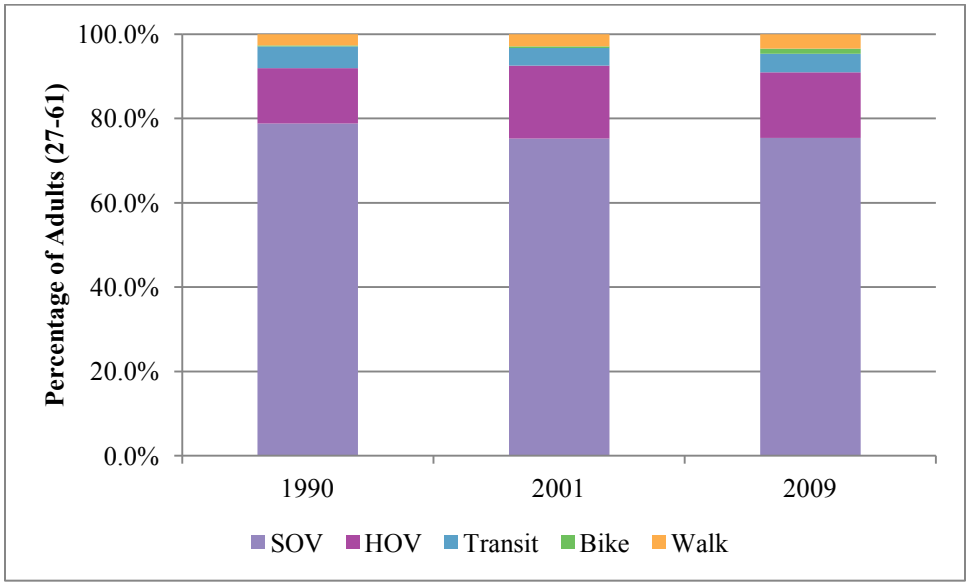


Figure 34: Commute Mode for Adults (1990, 2001, and 2009)



C. Cross-Sectional Commute Mode Model Results[26]

Tables 27-30 at the end of this section present our discrete choice (multinomial logistic regression) model results, which estimate the likelihood of commuting by carpool, public transit, bicycle, and walking relative to solo driving. In this section, we first explore the relationship between our variables of interest—employment, being a young adult living with parents, frequency of web use, and level of restriction of state licensing regimes—and youth commute mode choice. Then, we compare youth workers to adult workers by examining other important factors in the commute mode choice models, specifically focusing on carpooling and using transit relative to driving alone over time.

D. Variables of Interest

Young Adult Living with Parents: We find that being a young adult (ages 19-26) and living with one's parents influences commute mode choice for youth. In 1990, holding a wide array of personal, household, trip, and geographic attributes constant, we find that young adults living with parents are more likely to drive alone to work than carpool. On the other hand, in both 2001 and 2009, young adults living with parents are more likely to take public transit to work than drive alone, all things equal.

Daily Web Use:[27] We find that, for youth, using the web on a daily basis is *negatively* associated with choosing carpooling over driving alone to work in both 2001 and 2009. In other words, controlling for all other variables, use of the internet decreases the likelihood that a youth worker will carpool to work rather than drive alone. On the other hand, we observe a positive relationship between daily web use and commuting by transit for both youth and adults in 2001; note that we observe this effect after controlling for income. However, we see no statistically significant relationship between transit use and daily web use in 2009. We suspect this is because web use is much more common and widespread in 2009, compared to 2001, which suggests its use by a wider cross-section of society than in 2001.

Additionally, daily web use is negatively associated with commuting by bike in 2009 and positively associated with walking to work in 2001, but it is only statistically significant for adult workers.

State Licensing Regimes: Given data showing a substantial drop in driver's licensing rates among teens in recent years, we initially hypothesized that increased strictness of a given states'

---

[26] Unless otherwise noted, all results that we discuss in this section are statistically significant at the .01 (denoted by "***"), .05("**"), or .10("*") levels.

[27] As noted above, there is no daily web use for 1990, so compare web use between 2001 and 2009.

licensing regime would increase the likelihood that a teen or young adult would either carpool, ride transit or use a non-motorized form of transportation instead of driving alone to work. Indeed, state licensing regimes influence workers' choice to commute by transit instead of driving alone, but do not appear to affect the choice to carpool. Specifically, for youth workers across all three time periods, increased strictness of licensing regimes greatly increases the likelihood that youth workers choose to commute by transit instead of driving alone—holding all things equal. The same applies to adult commuters in 1990 and 2001, but to a lesser degree.

In terms of transit use, the 2009 model shows a different trend than the other two years: while increased strictness of licensing regimes increases the likelihood of a youth worker commuting by transit, the opposite applies to adults. In particular, a youth worker living in a state with strict licensing laws is far more likely to use transit than a youth living in a state with less strict laws, while an adult worker in a more strict state is much *less* likely to use transit than an adult in a less strict state.

For non-motorized modes, licensing regimes have some significant but disparate effects. We find that the stricter a state's licensing regime, the more likely adults are to bike to work in 2001 and 2009; the same goes for youth, but only in 2009. Moreover, increased strictness in licensing regimes is positively associated with walking for both youth and adults, but only in 1990. That teen driver's licensing restrictions appear to influence adult commute mode choices raises question of whether some other factor or effect may separately influence both the likelihood of a state adopting stricter licensing rules and traveling by other modes. For example, more urbanized states may be more likely to restrict teen driving and may offer commuters of all ages more options for getting to work. Unfortunately, time and resources did not allow us to explore this question further.

E. Cross-Sectional Results by Commute Mode

Carpool*:* In the adult commute mode model, we find a statistically significant increase in the likelihood of carpooling among women, immigrants, and Latino workers across all three time periods—findings congruent with previous research (Blumenberg and Smart, 2010; Cline et al. 2009; Pisarski 2006; Rosenbloom and Burns, 1994). However, in our commute mode choice analysis, this only applies to adult workers; we do not observe this trend for youth workers (except for immigrant youth in 2001, who are more likely to carpool to work than their native-born counterparts are). This finding reveals some striking differences between commute patterns of youth and adult workers over all three periods.

While it is tempting to think of carpools as being comprised of two people who work at the same job site, in fact most journey-to-work carpools include people who live together (McGuckin and Srinivasan, 2005). In fact, as we mentioned in the literature review at the beginning of this report, previous research has shown that middle-aged women do far more

"chauffeuring" of immediate and extended family members than do either middle-aged men or younger women, including on the commute journey (Descartes et al., 2007). Therefore, the difference we observe in carpooling between younger and older women is likely due to these differences in chauffeuring rates. As evidence of this, we find a statistically significant relationship between the number of children in the household and carpooling for all three years. For both youth and adult workers, an increase in the number of children in the household increases the odds of carpooling over driving alone to work.

Besides our finding that being a Latino adult worker increases the likelihood that one will carpool instead of drive alone to work, we find inconsistency among the effects of race/ethnicity on carpooling to work. In 1990 and 2009, Black adult workers are more likely to carpool than their white counterparts are. In 2001, the same applies to Black youth. We also find that in the 2001 model, Asian youth are less likely to carpool to work than are white youth workers. Collectively, however, these findings present no clear patterns or trends.

Other variables that influence carpooling include age, distance to work, and family income. For age, we observe that young adults are less likely to carpool to work than teens in both the 1990 and 2001 models; we observe the same trend among adults in the 2001 and 2009 models.

In terms of how commute distance influences one's mode choice, we were surprised to observe that increased distance to work decreases the likelihood of carpooling for youth in the 2009 model and adults in the 2001 and 2009 models—contrary to previous studies' findings (Teal, 1987; Ferguson, 1997). Though, again, these other studies that find a positive relationship between carpooling and commute distance typically focus on workers who form non-home-based carpools, in which the share of the total commute time devoted to linking up with another worker to carpool declines with longer commutes. On the other hand, research on "fampooling" has shown that significant household chauffeuring responsibilities motivates workers, particularly women, to take jobs closer to home (Schwanen et al., 2008).

Finally, in the 1990 and 2009 youth models, we find a negative correlation between household income and carpooling; working youth living in wealthier households are less likely to carpool than those living in poorer households; the same applies for adult workers in the 1990 and 2001 models.

Public Transit: Compared with other commute mode choices, geographic characteristics appear to play a much larger role in determining transit use among both youth and adults. Population density (which we measure at the Census tract level) is positively related to transit commuting for both youth and adult workers across all three periods.

Similar to previous research, we find that the denser a person's neighborhood, the more likely that person is to commute by transit than drive alone (Crane, 2000; Pisarski, 2006; Chatman, 2009; Taylor et al., 2009). In this scenario, it is likely that both supply- and demand-side effects

influence transit use. On the supply side, densely developed areas allow the same amount of transit network coverage to serve larger numbers of potential origins and destinations within a short walk of transit stops and stations. On the demand side, the number and proportion of transit users is greater in densely developed areas, because the relative costs of driving a car are greater: traffic speeds are slower, parking is more scarce and expensive, and auto insurance is more costly than in lower density areas. These two effects are mutually reinforcing, such that higher levels of transit use warrant more service, lowering headways, making transit travel speeds faster relative to driving, and thereby encouraging more transit use. Our models show that this is as true for youth as it is for adults across all three periods.

More specifically, we find that living in the New York metropolitan area—home to about 38 percent of all U.S. transit patrons—strongly increases the likelihood that workers will choose transit over solo driving. This correlation is particularly strong for youth in the 2009 model, which shows that youth living in the New York area are much more likely to commute by transit than are their counterparts in other parts of the country.

In addition to geographic characteristics, some personal and household characteristics appear to influence transit use. In particular, race/ethnicity plays a significant role in transit use. For both the youth and adult models, Black workers are far more likely to commute by transit than are white workers, after controlling for a wide variety of socio-economic factors[28]; this finding supports decades of research on transit usage. Further, we find that the propensity for Black workers to use transit is stronger for youth than it is for adults in the 2009 model. Indeed, the descriptive statistics are extremely suggestive: in 2009, over 25 percent of Black youth used transit to commute to work, while 13 percent of Black adults used transit. While this is still much higher than the figure for white workers (only 3 percent for both youth and adults), Black youth use transit at much higher rates than any other group in our sample.

Income also greatly influences transit use. Previous research on the topic has found that, in general, income is negatively correlated with transit use, though the relationship is weaker for commute trips than for all trips. (The sole exception to this pattern is among commuter rail users, who form a very small share of overall transit ridership and who are not separately studied here.) Consistent with previous studies, we find that income has a strong and consistent negative relationship with transit use in both the youth and adult models over all three periods. Collectively, our models suggest that income has a larger effect on youth's use of transit than on adults.

Living in a single-family household is negatively related to transit commuting, but only for adults, who are less likely than youth to use transit than drive alone to work.

---

[28] This finding is statistically significant in all but the 2001 youth model.

Finally, we find that having a medical condition is a significant predictor of the use of public transportation, all else being equal. Since transit includes services like paratransit, this conforms to our expectation; this is indeed the case in both the 2001 and 2009 models (the two datasets for which we have data on peoples' medical conditions).

Table 31: Commute Mode: Carpool Relative to Drive Alone (1990, 2001, and 2009)

Commute Mode: Carpool (base Drive Alone)	Youth			Adult		
	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.09***	-0.13***	-0.03	0.01	-0.02***	-0.01**
Female	-0.08	-0.12	-0.16	0.33***	0.37***	0.44***
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0.17	0.91***	0.26	0.42***	0.19	0.46***
NH Asian	*no data*	-2.69***	0.52	*no data*	0.21	0.36
Hispanic	0.44	0.19	-0.03	0.49***	0.28**	0.61***
NH Other	-0.09	0.7	1.08*	0.26	0.26	-0.07
Immigrant	*no data*	0.72**	0.17	*no data*	0.37***	0.23*
Daily Web	*no data*	-0.69***	-0.45**	*no data*	-0.04	0.26***
Medical Condition	*no data*	0.6	1.73**	*no data*	0.83***	0.1
Young Adult Lives with Parents	-0.46**	0.3	0.24	*no data*	*no data*	*no data*
Household Characteristics						
Household Income (ln)	-0.34***	-0.11	-0.4***	-0.37***	-0.13**	-0.06
Single Family HH	*no data*	-0.03	-0.21	*no data*	-0.07	-0.02
Number of Children	0.37***	0.18*	0.31***	0.17***	0.14***	0.16***
Trip Characteristics						
Distance to Work (log)	*no data*	-0.02	-0.16*	*no data*	-0.12***	-0.21***
Peak Period Travel	*no data*	-0.18	-0.08	*no data*	0.3	-0.21*
Geographic Characteristics						
Population Density (ln)	0.10*	-0.06	0.07	0.01	0.02	-0.05
New York Area	0.28	0.23	1.02**	0.03	0.19	0.04
MSA > 3 million	0.26	-0.21	-0.09	-0.01	-0.13	-0.02
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*no data*	*omitted*	*omitted*	*no data*
Stringency: Low	-0.15	-0.12	*omitted*	0.05	-0.03	*omitted*
Stringency: Medium	*no data*	0.03	0.17	*no data*	-0.11	-0.1
Stringency: High	*no data*	-0.37	0.12	*no data*	0.03	-0.08
Constant	3.85***	3.11*	4.2***	1.33	0.24	-0.52
Sample Size	1619	3006	3239	5819	24195	31721
Pseudo R Squared	0.15	0.27	0.18	0.11	0.13	0.14

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

Table 32: Commute Mode: Transit Relative to Drive Alone (1990, 2001, and 2009)

Commute Mode: Transit (base Drive Alone)	Youth			Adult		
	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.02	0.02	-0.07	-0.01	-0.01	-0.01
Female	0.41	0.4	0.17	0.21	0.23	-0.1
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0.96**	0.62	2.3***	0.82***	0.77***	0.88***
NH Asian	*no data*	-0.56	-0.09	*no data*	0.46	0.02
Hispanic	-0.11	-0.18	-0.52	0.72***	0	-0.36
NH Other	0.84	1.51**	-1	1.04*	0.33	-0.05
Immigrant	*no data*	0.69	1.06**	*no data*	-0.01	0.24
Daily Web	*no data*	0.55*	-0.25	*no data*	0.44***	-0.05
Medical Condition	*no data*	2.43**	1.44	*no data*	1.3***	1.66***
Young Adult Lives with Parents	0.48	1.48***	0.8*	*no data*	*no data*	*no data*
Household Characteristics						
Household Income (ln)	-0.40***	-0.74***	-0.63***	-0.39***	-0.2*	-0.49***
Single Family HH	*no data*	-0.39	0.13	*no data*	-0.57***	-1.08***
Number of Children	-0.06	-0.07	0.21	-0.24***	-0.05	-0.14
Trip Characteristics						
Distance to Work (ln)	*no data*	-0.15	0.23	*no data*	0.2***	-0.04
Peak Period Travel	*no data*	2.93***	0.62	*no data*	0.77**	0.26
Geographic Characteristics						
Population Density (ln)	0.76***	1.03***	0.51***	0.61***	0.81***	0.64***
New York Area	0.61*	0.28	2.43***	1.10***	0.96***	0.81***
MSA > 3 million	0.4	0.95**	0.14	-0.06	0.95***	0.71***
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*no data*	*omitted*	*omitted*	*no data*
Stringency: Low	1.16***	1.82***	*omitted*	0.67***	0.61**	*omitted*
Stringency: Medium	*no data*	1.77***	5.7***	*no data*	0.4*	-1.42*
Stringency: High	*no data*	0.46	4.77***	*no data*	0.05	-0.82
Constant	-0.06	-0.31	-1.8	0.48	-3.43**	3.06
Sample Size	1619	3006	3239	5819	24195	31721
Pseudo R Squared	0.15	0.27	0.18	0.11	0.13	0.14

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

Table 33: Commute Mode: Bicycle Relative to Drive Alone (1990, 2001, and 2009)

Commute Mode: Bicycle (base Drive Alone)	Youth			Adult		
	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.24	-0.05	0.22*	-0.04	-0.05**	-0.04**
Female	-0.95	-1.17	-0.82	-1.59**	-1.16**	-1.85***
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	1.62*	-20.46***	-0.6	-0.23	-2.39**	0.12
NH Asian	*no data*	-4.58**	0.18	*no data*	-0.13	-2.19***
Hispanic	-22.14***	-1.72	-0.35	0.37	-0.89	-1.67***
NH Other	-22.16***	1.19	-20.99***	-19.73***	0.2	-1.04*
Immigrant	*no data*	2.33***	0.11	*no data*	0.17	0.19
Daily Web	*no data*	-1.12	-0.45	*no data*	-0.26	-0.69*
Medical Condition	*no data*	-1.92	-20.98***	*no data*	-2.56***	-0.16
Young Adult Lives with Parents	1.97*	-0.23	-0.48	*no data*	*no data*	*no data*
Household Characteristics						
Household Income (ln)	-0.56	-0.17	0.2	-0.76***	-0.12	-0.23
Single Family HH	*no data*	-0.76	-0.36	*no data*	-0.06	0.06
Number of Children	-0.05	0.83	-0.08	-0.11	-0.53**	0.03
Trip Characteristics						
Distance to Work (ln)	*no data*	-1.07***	-0.64***	*no data*	-0.41***	-0.5***
Peak Period Travel	*no data*	0.01	0.12	*no data*	-0.33	0.15
Geographic Characteristics						
Population Density (ln)	-0.05	1.47***	0.03	0.48**	0.83***	0.28**
New York Area	-0.82	1.78	-0.56	0.31	1.25*	-1.03
MSA > 3 million	0.09	-1.73***	0.06	-1.23	-1.47***	0.04
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*no data*	*omitted*	*omitted*	*no data*
Stringency: Low	-22.78***	-0.61	*omitted*	0.69	1.96***	*omitted*
Stringency: Medium	*no data*	-1.44	1.81	*no data*	1.37**	0.33
Stringency: High	*no data*	0.84	2.6**	*no data*	2.45***	1.21**
Constant	5.58	-2.1	-11.29***	4.25	-2.71	0.86
Sample Size	1619	3006	3239	5819	24195	31721
Pseudo R Squared	0.15	0.27	0.18	0.11	0.13	0.14

KEY:

Statistically Significant

Statistically Significant Over Time (across all the years for which data were available)

Table 34: Commute Mode: Walk Relative to Drive Alone (1990, 2001, and 2009)

Commute Mode: Walk (base Drive Alone)	Youth			Adult		
	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.13	0.16	-0.01	-0.01	-0.01	0
Female	0.09	-0.89*	-0.86**	0.04	-0.08	0.08
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0	2.44***	-1.48	-0.45	0.3	0.11
NH Asian	*no data*	1.73	0.79	*no data*	-0.73	1.03***
Hispanic	0.09	0.06	-0.21	-0.2	-0.2	-0.18
NH Other	-0.29	-0.36	-0.03	0.17	-0.1	-0.08
Immigrant	*no data*	-0.24	-0.15	*no data*	0.64**	-0.29
Daily Web	*no data*	0.72	0.3	*no data*	0.77***	0.12
Medical Condition	*no data*	-1.59	3.06***	*no data*	0.86**	0.19
Young Adult Lives with Parents	-0.54	-1.05	0.73*	*no data*	*no data*	*no data*
Household Characteristics						
Household Income (ln)	-0.90***	-0.78***	-0.74***	-0.72***	-0.31**	-0.44***
Single Family HH	*no data*	-0.68	-1.21***	*no data*	-0.69***	-0.83***
Number of Children	0.21	-0.21	0.24	-0.11	-0.16	-0.07
Trip Characteristics						
Distance to Work (ln)	*no data*	-1.82***	-0.91***	*no data*	-0.74***	-0.8***
Peak Period Travel	*no data*	0.66	-0.84*	*no data*	0.23	0.1
Geographic Characteristics						
Population Density (ln)	0.54**	0.38*	0.1	0.72***	0.31**	0.31***
New York Area	0.62	0.97	1.5***	0.19	1.36***	0.94***
MSA > 3 million	0	0.33	-0.5	-0.03	-0.03	0.01
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*	*no data*	*omitted*	*omitted*	*no data*
Stringency: Low	0.78*	0.64	*omitted*	1.15***	0.36	*omitted*
Stringency: Medium	*no data*	0.33	-1.03	*no data*	0.34	-0.78
Stringency: High	*no data*	1.12	-1.04	*no data*	0.68	-0.5
Constant	7.75***	1.17	8.37***	3.29**	0.17	3.15**
Sample Size	1619	3006	3239	5819	24195	31721
Pseudo R Squared	0.15	0.27	0.18	0.11	0.13	0.14

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

F. Quasi-Cohort Model Results

Table 35 shows the results of a quasi-cohort model of commute mode choice in which we estimate the probability of driving alone to work rather than using any other mode of transportation. The coefficients on the control variables carry their expected signs and broadly conform to the findings from our cross-sectional analyses. The model suggests that women and all non-white racial and ethnic groups are less likely to drive alone than are men and whites. Education, income, and greater access to automobiles are all positively associated with driving alone to work, all else equal. The model also suggests that those living in denser and larger urban areas, as well as those commuting on the weekend, are less likely to drive alone.

Table 35: Quasi-Cohort Logit Model for SOV Use for Journey to Work

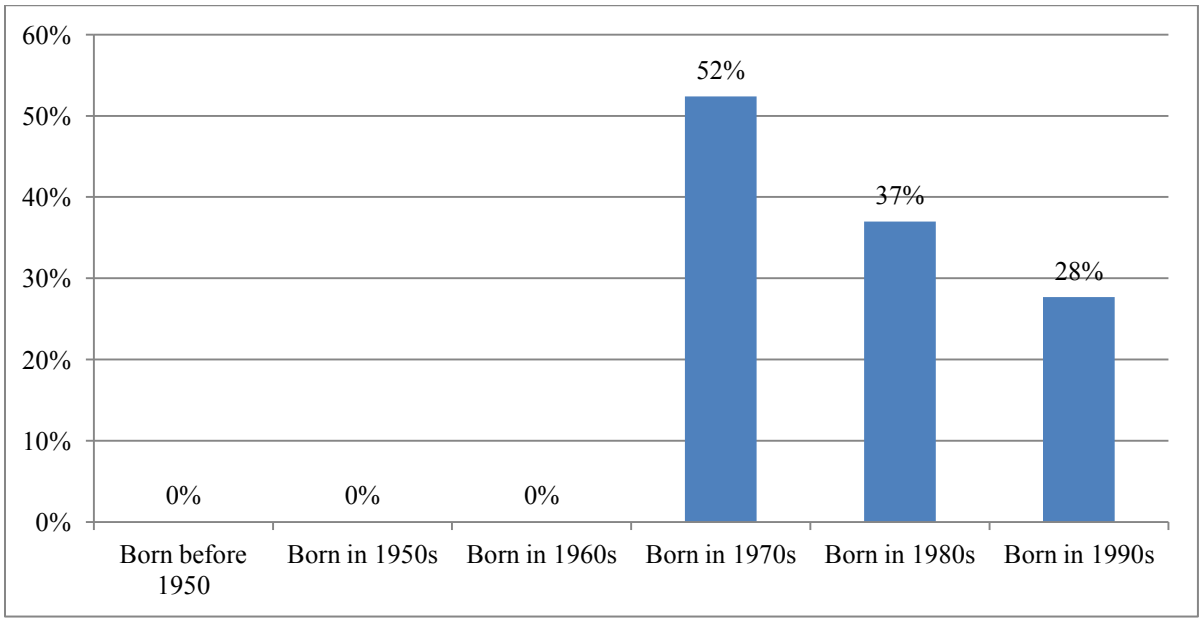
	Coefficient	Sig.	t-Statistic	p-Value
Individual Characteristics				
Female	-0.064	***	-3.42	0.001
Age	0.247	***	25.52	<0.001
Age Squared	-0.003	***	-24.59	<0.001
Race / Ethnicity (omitted category: Non-Hispanic White)				
Non-Hispanic Black	-0.290	***	-7.94	<0.001
Non-Hispanic Asian (2009 Only)	-0.114	**	-2.21	0.027
Non-Hispanic Other	-0.221	***	-3.9	<0.001
Hispanic	-0.034		-1	0.319
Uses Web Daily	0.128	***	5.67	<0.001
Education (omitted category: No HS Diploma)				
For Youth: Highest Degree Achieved in Household				
High School Diploma	0.659	***	8.12	<0.001
Some College	0.785	***	10.21	<0.001
Bachelor's Degree	0.799	***	10.01	<0.001
Graduate Degree	0.557	***	6.25	<0.001
For Adults: Highest Degree Personally Achieved				
High School Diploma	0.426	***	7.29	<0.001
Some College	0.593	***	10.19	<0.001
Bachelor's Degree	0.534	***	8.94	<0.001
Graduate Degree	0.415	***	6.75	<0.001
Household Characteristics				
Income (ln)	0.111	***	8.19	<0.001
Number of Adults in HH	0.023	*	1.92	0.055
Number of Children in HH	-0.127	***	-14.54	<0.001

Youth, Lives with Parents	0.715	***	14.02	<0.001
Ratio of Cars to Adults in HH	1.381	***	50.28	<0.001
Geographic Characteristics				
Population Density (ln)	-0.115	***	-17.68	<0.001
In MSA with > 3M Population	-0.261	***	-12.62	<0.001
Weekend	-0.376	***	-13.27	<0.001
Year				
Year: 2001 (base: 1990)	-0.505	***	-10.65	<0.001
Year: 2009 (base: 1990)	-0.653	***	-9.83	<0.001
Cohorts (base: Born before 1950)				
Born in 1950s	-0.003		-0.06	0.950
Born in 1960s	0.075		1.06	0.288
Born in 1970s	0.524	***	5.37	<0.001
Born in 1980s	0.370	***	2.93	0.003
Born in 1990s	0.277	*	1.77	0.077
Constant	-6.309		-22.92	<0.001
N	98,276			
R-Square	0.126			

Turning now to our variables of interest, we find that youth living with their parents are considerably more likely to drive alone to work, as are those who use the web daily. Over time, the model suggests a decreasing trend in single-occupant auto commutes, controlling for other variables included in the model. This finding seemingly contradicts the descriptive statistics, which show a rapid increase in drive-alone commutes during the 1990s, and a slower increase from 2001 to 2009. The model's suggestion of a negative independent effect of the 2001 and 2009 data years may suggest that the observed increase in SOV commutes are explained by other variables in the model, such as auto ownership, which also increased rapidly during our study period.

Finally, the cohort variables suggest that newer cohorts have an increased likelihood of driving alone to work than previous cohorts, but that this effect is diminishing over time. As Figure 35 indicates, the model finds that those born in the 1970s are 52 percent more likely to choose to drive alone to work than are those born before 1950, all else equal. Those born in the 1980s and 1990s have a similarly elevated but diminishing probability of driving alone, with a 37 percent and 28 percent increase in the likelihood of driving alone, *ceteris paribus*.

Figure 35: SOV Independent Effect of Cohort, Controlling for Other Variables



G. Conclusion: Commute Mode Findings

While the previous two analyses found that working has a substantial influence on both personal miles traveled and the number of daily trips, this analysis has focused specifically on the mode choices of workers. As with the previous analyses, the effects of the recession on travel behavior, particularly by youth, are substantial. While the proportion of working adults declined from 85 to 80 percent between 2001 and 2009, the number of working youth dropped precipitously, from 70 percent in 2001 to just 56 percent in 2009.

While the proportion of adult and, especially, young workers was much lower in 2009 than in 2001, the analysis in this chapter focused on how those who do work get there. We find, not surprisingly, that household income is a consistent predictor of commute mode choice for both youth and adults. In general, income is strongly and positively associated with driving alone to work; put another way, as incomes go up, the probability of commuting via carpool, public transit, bicycle, or foot all go down—for both youth and adults, and across all three survey years.

With respect to the effect of the bad economy causing a growing number of youth to "boomerang" home to live with parents, we find that young working adults living at home are less likely to carpool and more likely to use public transit than other workers. Likewise, those who use the web daily were *less* likely to carpool (2001 and 2009) and *more* likely to commute via public transit (2001 only). Last, in terms of our variables of interest, youth in places with stricter teen licensing regimes were more likely to commute to work via public transit;

however, we find that the strictness of licensing regimes has no significant effect on an individual's choice to commute via carpool.

The analysis also revealed important differences between youth and adult workers. Previous studies have consistently shown that being female, Hispanic, or foreign born increases the likelihood of commuting by carpool over driving alone. Our analysis shows that trend remains consistently strong for adults, but not for young workers. This suggests that the relationship between travel mode broad social categories, like sex, race/ethnicity, and immigration status, may be weakening over time.

Finally, the quasi-cohort model suggests that those born in more recent decades (the 1970s, 80s, and 90s) are far more reliant on the single-occupancy vehicle for their journey to work than were previous generations, though this effect appears to be diminishing over time.

Table 36: Assessing Model Fit: Commute Mode Models (1990, 2001, and 2009)

	Youth (15–26)			Adult (27–61)		
	1990	**2001**	**2009**	**1990**	**2001**	**2009**
Commute Mode						
Model N	1,619	3,006	3,239	5,819	24195	31721
Pseudo R^2	0.15	0.27	0.18	0.11	0.13	0.14

Table 37: Summary Table: Commute Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
HOV (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	-	-	*n/a*	0	+
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	+	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	+	0	*n/a*	+	0
License Stringency	+	+	+	+	+	-
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	+	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	0	-
License Stringency	-	0	+	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	0	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	0	0	+	0	0

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0): indicates no statistically-significant relationship.

Chapter IX. Social Trip Mode

A. Introduction

Understanding the factors that affect mode choice is essential for planning for the transportation needs of future generations. With respect to trip purpose, all work and no play make Jack and Jill dull children. So while policymakers and transportation analysts, perhaps understandably, tend to focus on commuter travel, other trips—including social trips—are important to quality of life as well. Developing social relations independent of familial and neighbor relationships is a central part of the teenage transition into adulthood—and social and recreational travel is central to this transition. Indeed, social and recreational trips form a larger share of teen travel than adult travel. Regardless of age, however, research on subjective well-being has consistently shown that time spent in social and recreational activities is positively associated with happiness (Dolan, Peasgood, and White 2008). Accordingly, this chapter uses data from the NHTS surveys to construct a model of mode choice for social trips.

B. Methodology

As we explained in the previous chapter, the NHTS asks respondents about the purpose of their travel, and we classify their travel as social travel if they give "visiting friends or relatives" or "other social or recreational" as reasons for making a trip. However, using the NHTS to analyze social travel in this manner has limitations. Although the respondents give the purpose of their trips, some purposes—for example, shopping—can be either social or non-social. An after work journey to a grocery store in search of food for dinner by a weary single mother is almost certainly a non-social shopping trip. But if a teenager travels to the mall and spend time with friends, the trip will be designated a "shopping" trip in the NHTS despite the obvious social component. Because our analysis includes only trips described explicitly as social trips, our analysis unavoidably omits some social and recreational trips.

As with the commute mode choice analysis above, multinomial logistic regression is the most common statistical technique used to test the relationships between various factors and mode choice. We use this technique in our analysis of social and recreational travel as well.

In addition to the variables described and used in the analyses above, the models presented here include the additional analysis-specific variables:

- The *social trips* variable refers to the number of social trips the respondent has taken on the survey day.

- The *distance* variable refers to the distance traveled for a given trip. Mode choice varies greatly by distance: for example, people become much less likely to choose non-motorized forms of transportation for longer trips; as a result, we use the natural log of distance.

- The *weekend* variable identifies whether the respondent took the trip on Saturday or Sunday. We include this variable because social trips taken on the weekend may differ in both frequency and type from social trips taken on a weekday.

As in the previous analytical sections, we estimated a quasi-cohort model of mode choice for social trips. For this model, we estimated a Poisson regression model of the share of social trips made by single-occupancy vehicle (SOV), rather than use any other mode of transportation. We chose this modeling form due to computational limitations of estimating a multinomial mode choice model with a very large (three data years, combined) dataset. While the use of the Poisson model may obscure many of the trade-offs made between the various non-SOV modes of transportation, the following model provides insight into the choice to drive alone for social purposes.

C. Descriptive Statistics

Figure 36 illustrates the average daily social trips taken by different age groups in each survey year.[29] Social trip making is relatively consistent across age categories, ranging from 0.8 to 1.3 trips per day. High school students and young adults make the highest number of social trips, and adults make the fewest. The number of social trips declined slightly from 2001 to 2009, as did the number of trips overall. As Figure 37 shows, social trips comprise a higher percentage of tripmaking among both teens and young adults than adults.

[29] The 2001 NHTS changed its methodology so that the NHTS would more accurately estimate the number of walking trips people make. As a result, one cannot directly compare trip or mode information from the 1990 NPTS with other years.

Figure 36: Average Daily Social Trips by Age Group (1990, 2001, and 2009)

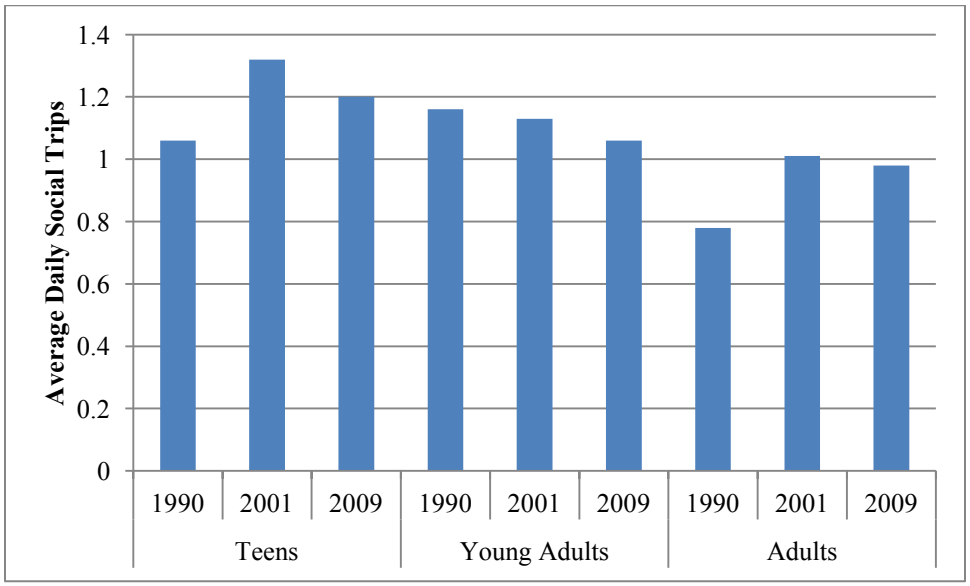


Figure 37: Percentage of Social Trips by Age Group (1990, 2001, and 2009)

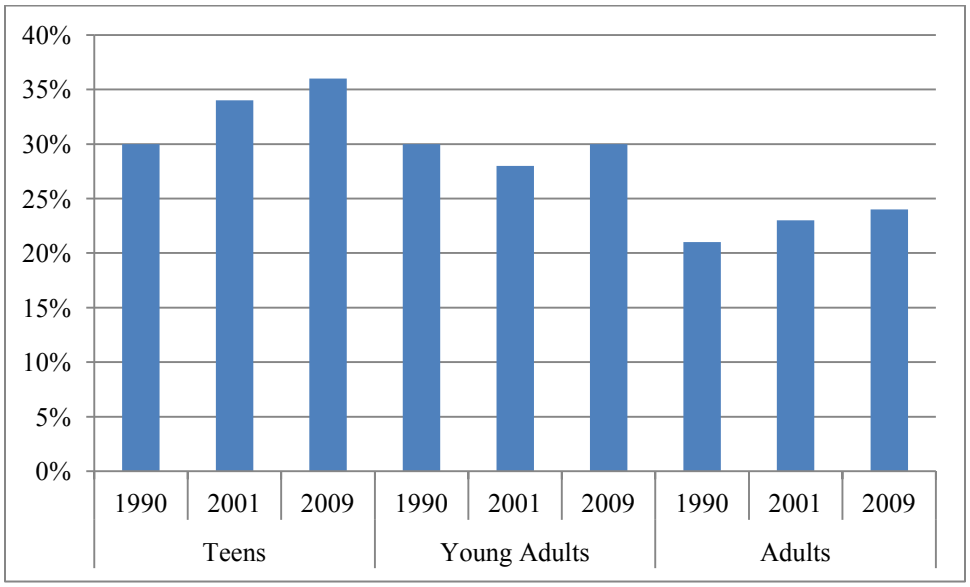
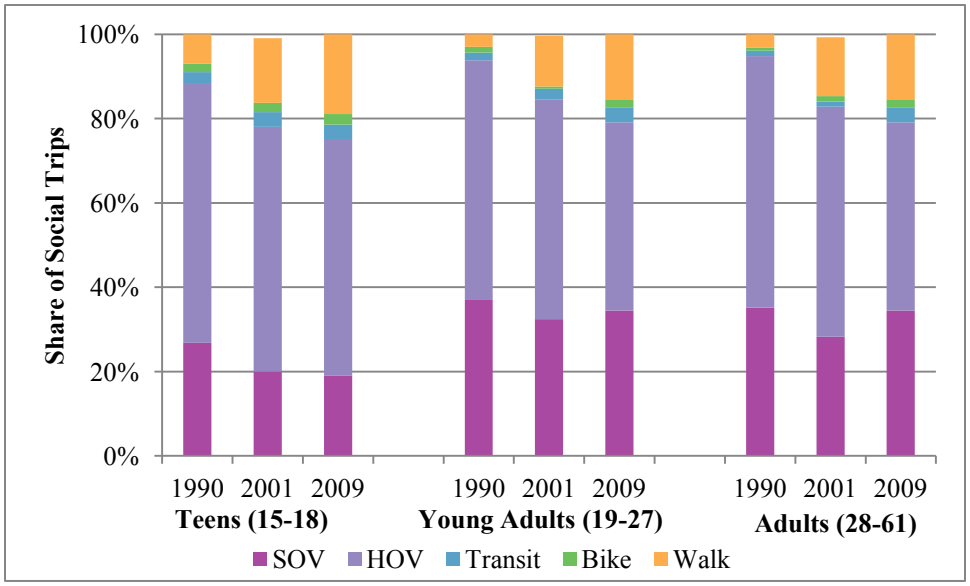


Figure 38 illustrates mode choice for different age groups across the three surveys for social trips. Automobile travel is by far the most common mode for social travel across all age groups and all years. In 2001 and 2009, automobile trips account for 70–80 percent of trips for every

age group. However, many of these trips involve multiple passengers, making them high-occupancy vehicle (HOV) trips. Every automobile trip for children age 0–14, for example, is an HOV trip.[30] As teenagers obtain drivers' licenses, however, they quickly begin making single-occupancy vehicle (SOV) trips in place of the HOV trips—roughly 20 percent of their total trips for all three years.

Figure 38: Social Trip Mode by Age Group and Year (1990, 2001, and 2009)



Walking is the next most common mode of social and recreational travel, although it represents less than 20 percent of total trips in 2001 and 2009. Young adults and adults make a smaller percentage of trips by walking than other groups for all three years. Children are the most likely to walk, followed by high school students and elderly people. We see a slight increase in walking from 2001 to 2009 across all age categories.

Public transit and bicycling trips for social and recreational purposes are comparatively rare. Children under 14 make a higher percentage of their trips by bicycle (5–7%) and public transit (1–2%) than other groups. Bicycle use quickly declines as people grow older. However, teenagers make roughly two percent of their trips by bicycle, and that percentage drops to one to two percent for the remaining population. Transit use for social and recreational trips, on the other hand, increases as people grow older—and has also increased slightly from 2001 to 2009 for all age groups—but still accounts for only one to four percent of total trips.

[30] The NHTS surveys report that children make a very small number of their social trips—less than a tenth of a percent—in single-occupancy vehicles, but we can safely assume that number is due to survey error.

D. Cross-Sectional Model Results

Table 38 to Table 41present results for the social and recreational mode choice models. The tables show results for each travel mode relative to driving alone. In Table 38, which compares the likelihood of carpooling relative to driving alone, one sees a number of expected results. Women—youth and adults—are more likely to carpool, although for adults, similar to the commute mode analysis above, many of those trips are likely chauffeuring trips for children. As other scholars find, immigrant and Hispanic adults are also more likely to carpool; carpooling is also higher in households with a greater number of children, most likely due to "fampool" and chauffeuring trips. Adults with medical conditions are more likely to carpool as well, perhaps as passengers. Both youth and adults are more likely to carpool for longer-distance trips, with an increase in the number of social trips, and on the weekend. However, in a finding that runs counter what we observed with journey-to-work mode choice, the likelihood of carpooling increases with income for adults, but has no apparent effect on youth.

With respect to our variables of interest, young adults who live with their parents are less likely to carpool. Licensing regulations generally do not have a statistically significant effect on the probability of carpooling for youth social and recreational trips. Contrary to expectations, daily web use appears to make people *less* likely to carpool relative to driving alone.

Table 38: Social Travel Mode: Carpool Relative to Drive Alone (1990, 2001, and 2009)

Social Mode: Carpool	Youth (15-26)			Adults (27-61)		
(base: driving alone)	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	0.02	0.01	-0.03**	0.01***	-0.01***	-0.02***
Female	0.23***	0.35***	0.28***	0.42***	0.45***	0.32***
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0.31**	0.57***	0	-0.50***	-0.10	-0.08
NH Asian	*no data*	-0.13	0.83***		0	0.14
Hispanic	0.34**	-0.07	0.13	0.36**	0.44***	0.27***
Other	-0.02	0.21	0.38	0.47*	0.15	0.10
Immigrant	*no data*	0.31**	-0.02	*no data*	0.18**	0.17**
Daily web use	*no data*	-0.14*	-0.31***	*no data*	-0.05	-0.09*
Medical condition	*no data*	0.52*	0.41	*no data*	0.50***	0.41***
Young Adult Lives w/ Parents	-0.66***	-0.36***	-0.39***	*omitted*	*omitted*	*omitted*
Household Characteristics						
Household Income (ln)	-0.16***	-0.16***	-0.31***	0.15***	0.16***	-0.01
Number of children	0.36***	0.37***	0.18***	0.37***	0.34***	0.22***
Trip Characteristics						
Trip Distance (ln)	0.13***	0.10***	0.07*	0.18***	0.18***	0.17***
# of social trips that day	0.04*	0.05***	0.06***	0.04**	0.04***	0.14***
Weekend	0.32***	0.58***	0.47***	0.40***	0.75***	0.70***
Geographic Characteristics						
Population density	0	0.10***	0.06**	-0.05**	-0.01	-0.01
New York	0.51***	0.12	-0.26	-0.17	0.13*	0.26***
MSA > 3 million	-0.34***	0.04	0.14	0.01	-0.10**	-0.05
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*		*omitted*	*omitted*	
Stringency: Low	-0.20*	0	*omitted*	0.11	-0.04	*omitted*
Stringency: Medium	no data	-0.12	0.04	no data	0.05	0.09
Stringency: High	no data	0.15	-0.05	no data	-0.02	-0.06
Constant	1.04*	0.98*	1.13**	-2.57***	-2.20***	-0.33*
N	4,685	11,281	14,970	8,981	54,257	101,997
Pseudo-R2	0.12	0.23	0.25	0.11	0.20	0.25

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

Table 39 illustrates the likelihood of using transit relative to driving alone. Many of the variables are relatively consistent across both age groups. African Americans tend to be more likely to use transit than non-Hispanic Whites. With one exception (youth in 1990), income is negatively related to transit use; those with higher incomes are less likely to use transit.

Individuals are more likely to use transit in denser areas and in transit-rich New York City. The probability of taking transit increases with distance for youth in all three survey years and for adults in 2001 and 2009. With one exception (youth in 2009), traveling on the weekend does not appear to have an effect on transit use for youth or for adults.

There are a few differences between youth and adults. Age seems to make a difference even within the youth age group. As youth age from their teens to their 20s, they are less likely to use transit for social trips. Age is not significant among adults. Also, young adults who live with their parents are less likely to use transit for social trips. Youth who take a greater number of social trips in a given day are less likely to use transit, a finding that likely reflects the difficulty of coordinating multiple transit trips.

In addition, stringent licensing laws have a statistically significant effect in nearly every case for youth, but the direction of the effect varies. The laws also have a statistically significant effect on adult travel; as we mention in the chapter on commute mode, we hypothesize that the licensing variable may also reflect other characteristics of states that adopt stricter licensing regulations.

Table 39: Social Travel Mode: Transit Relative to Drive Alone (1990, 2001, and 2009)

Social Mode: Transit	Youth (15-26)			Adults (27-61)		
(base: driving alone)	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.13***	-0.11***	-0.17***	-0.03*	0	-0.01
Female	-0.25	-0.1	0.27	0.26	0.43**	0.25
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	1.52***	1.70***	1.09***	0.53	0.45**	0.48**
NH Asian	*no data*	1.16**	0.15	*no data*	1.15***	0.4
Hispanic	0.73*	-0.2	-0.3	1.32***	0.44	-0.12
Other	0.76	0.24	-0.38	0.09	0.58*	-1.19***
Immigrant	*no data*	-0.94**	-0.02	*no data*	0.29	-0.31
Daily web use	*no data*	0.56*	0.13	*no data*	-0.06	-0.14
Medical condition	*no data*	2.58***	0.51	*no data*	-0.09	1.13***
Young Adult Lives w/ Parents	-0.95***	-0.59*	-0.37	*omitted*	*omitted*	*omitted*
Household Characteristics						
Household Income (ln)	-0.19	-0.25**	-0.92***	-0.53***	-0.71***	-0.90***
Number of children	0.36***	0.36**	0.20**	0.04	0.06	0.19**
Trip Characteristics						
Trip Distance (ln)	0.26*	0.32***	0.40***	0.03	0.33***	0.27***
# of social trips that day	-0.32***	-0.21***	-0.07*	-0.16*	0.04	0.07***
Weekend	-0.33	-0.16	-0.59***	-0.03	0.06	-0.06
Geographic Characteristics						
Population density	0.52***	0.55***	0.72***	0.69***	0.69***	0.88***
New York	1.39***	1.89***	0.97**	0.21	1.21***	0.50**
MSA > 3 million	-0.34	-0.05	1.16***	0.47	0.93***	0.17
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*		*omitted*	*omitted*	
Stringency: Low	1.06***	0.7	*omitted*	1.48***	1.46***	*omitted*
Stringency: Medium	no data	0.97**	-1.58**	no data	1.68***	-1.80***
Stringency: High	no data	0.72	-1.14**	no data	0.24	-0.89
Constant	0.64	-0.27	1.97*	1.22	-0.16	-1.90***
N	4,685	11,281	14,970	8,981	54,257	101,997
Pseudo-R2	0.12	0.23	0.25	0.11	0.20	0.25

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

Table 40 illustrates the likelihood of bicycling relative to driving alone. Fewer statistically significant findings emerge from this model, probably because the data contain relatively few bicycling trips for analysis. A few expected results appear, however. People are less likely to bicycle as trip distance increases. Women are also less likely to bicycle than men; and African Americans tend to be less likely to travel by bicycle than non-Hispanic whites. Income is not

related to the likelihood of biking among youth but has a negative relationship to bicycling among adults in two of years. Being a young adult living at home and daily web use are not statistically significant. State licensing regulations are positively related to travel by bicycle for adults, and—in 1990 and 2009—are not related to bicycle travel.

Table 40: Social Travel Mode: Bicycle Relative to Drive Alone (1990, 2001, and 2009)

Social Mode: Bike	Youth (15-26)			Adults (27-61)		
(base: driving alone)	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.02	-0.13**	-0.06	-0.03**	-0.02***	0.01*
Female	-0.03	-0.48	-1.16***	-0.4	-0.61***	-1.04***
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.67	1.1	-1.54***	-3.59***	-1.56***	0.13
NH Asian	no data	-3.03***	0.18	no data	-1.04*	-0.27
Hispanic	-24.57***	0.41	-0.01	-0.26	-1.43***	-0.06
Other	1.07*	1.25**	-0.51	-20.99***	-1.25**	0.14
Immigrant	no data	-0.35	0.35	no data	0.47*	0.17
Daily web use	no data	-0.14	0.13	no data	0.13	0.16
Medical condition	no data	1.44	0.56	no data	-0.02	-0.56**
Young Adult Lives w/ Parents	-0.46	-1.05**	0.36	*omitted*	*omitted*	*omitted*
Household Characterisitcs						
Household Income (ln)	-0.01	-0.19	-0.22	-0.34*	-0.18*	-0.17
Number of children	0.42***	0.17	0.09	0.35***	0.18***	0.11*
Trip Characteristics						
Trip Distance (ln)	-0.38***	-0.58***	-0.54***	-0.43***	-0.45***	-0.44***
# of social trips that day	-0.01	-0.1	0.06**	0	0.16***	0.07***
Weekend	-0.56*	-0.15	-0.39	0.27	0.30**	-0.05
Geographic Characteristics						
Population density	0.21	0	0.08	-0.13	-0.05	0.02
New York	0.52	0.45	-1.82**	-2.37***	0.50*	-0.90***
MSA > 3 million	-0.01	0.57	0.25	-0.17	-0.04	-0.17
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*		*omitted*	*omitted*	
Stringency: Low	0.13	0.93*	*omitted*	0.02	0.35	*omitted*
Stringency: Medium	no data	0.68	-0.48	no data	0.49**	0.61**
Stringency: High	no data	1.29**	-0.3	no data	1.21***	0.63**
Constant	-2.27	0.97	-0.68	1.75	-0.66	-3.34***
N	4,685	11,281	14,970	8,981	54,257	101,997
Pseudo-R2	0.12	0.23	0.25	0.11	0.20	0.25

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

Finally, Table 41illustrates the likelihood of walking relative to driving alone. As expected, people are less likely to walk as their incomes and trip distances increases. They are, however, more likely to walk in dense urban environments. Immigrants and people living in the New York are more likely to walk for social and recreational purposes than are others. People with a medical condition are also more likely to walk, which contradicts research showing that the disabled are more likely to drive because it requires less physical exertion than walking. Finally, the driver's licensing results are mixed, suggesting once again that this state variable reflects some other characteristic of states that adopt these tough regulations.

Table 41: Social Travel Mode: Walk Relative to Drive Alone (1990, 2001, and 2009)

Social Mode: Walk	Youth (15-26)			Adults (27-61)		
(base: driving alone)	1990	2001	2009	1990	2001	2009
Individual Characteristics						
Age	-0.11***	0.02	-0.02	0	0	-0.01*
Female	-0.46**	0.03	-0.03	0.46***	0.55***	0.13**
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	0.16	0.74***	0.51*	0.23	-0.16	-0.1
NH Asian	no data	0.47	1.29***	no data	0.1	-0.1
Hispanic	-0.09	-0.62**	0.45***	-0.03	-0.27*	0.04
Other	0.84*	0.44	0.35	0.78*	0.01	-0.07
Immigrant	no data	-0.09	0.51**	no data	0.45***	0.40***
Daily web use	no data	-0.07	-0.2	no data	0.21***	0.06
Medical condition	no data	1.58***	1.68***	no data	0.43***	-0.1
Young Adult Lives w/ Parents	-0.83***	-0.26	-0.35**	*omitted*	*omitted*	*omitted*
Household Charateristics						
Household Income (ln)	-0.53***	-0.27***	-0.33***	0.11	0.18***	-0.13**
Number of children	0.30***	0.30***	0.19**	-0.11	0	-0.01
Trip Characteristics						
Trip Distance (ln)	-1.72***	-1.46***	-1.50***	-1.48***	-1.30***	-1.42***
# of social trips that day	0.05	-0.02	-0.01	0.03	0	0.07***
Weekend	0.06	0.09	0.08	-0.1	-0.01	0.03
Geographic Characteristics						
Population density	0.18**	0.35***	0.06	0.01	0.09***	0.06***
New York	-0.12	0.86***	0.53**	0.63***	0.63***	0.64***
MSA > 3 million	0.07	-0.05	0.27*	0.19	0.01	0.05
State Licensing Regulations						
Stringency: Lowest	*omitted*	*omitted*		*omitted*	*omitted*	
Stringency: Low	0.51**	0.31	*omitted*	0.32*	0.04	*omitted*
Stringency: Medium	no data	0.58***	-0.86**	no data	0.19**	0.32*
Stringency: High	no data	0.44*	-0.71*	no data	0.12	0.39**
Constant	6.53***	0.81	1.43**	-2.63**	-2.69***	-0.33
N	4,703	13,311	17,817	9,007	55,815	111,112
Pseudo-R2	0.12	0.23	0.25	0.11	0.20	0.25

KEY:
Statistically Significant
Statistically Significant Over Time (across all the years for which data were available)

E. Quasi-Cohort Model and Model Results

As in the previous analytical chapters, we estimated a quasi-cohort model of mode choice for social trips. For this model, we estimated a Poisson regression model of the share of social trips made by single-occupancy vehicle (SOV), rather than by any other mode of transportation. We chose this modeling form due to the computational challenges of estimating a multinomial logistic regression mode choice model with a very large (a combined three years of national data) dataset. While the use of the Poisson model may obscure some of the trade-offs made among the various non-SOV modes of transportation, the following model provides insight into the choice to drive alone for social purposes.

Table 42 presents the results of the social trip quasi-cohort model. The coefficients on the control variables carry their expected signs and broadly conform to the findings from our cross-sectional analyses. The model suggests, for instance, that women are less likely to drive alone to social events than men, and all non-white racial and ethnic groups are less likely to drive alone to social destinations than are whites. Education and greater access to automobiles are all positively associated with driving alone for social purposes, all else equal. However, after controlling for education and auto access, income is negatively associated with driving alone for social purposes. This finding echoes the findings in the cross-sectional models that higher-income individuals are more likely to carpool for social trips. The model also suggests that those living in denser areas (as well as those surveyed on the weekend) are less likely to drive alone.

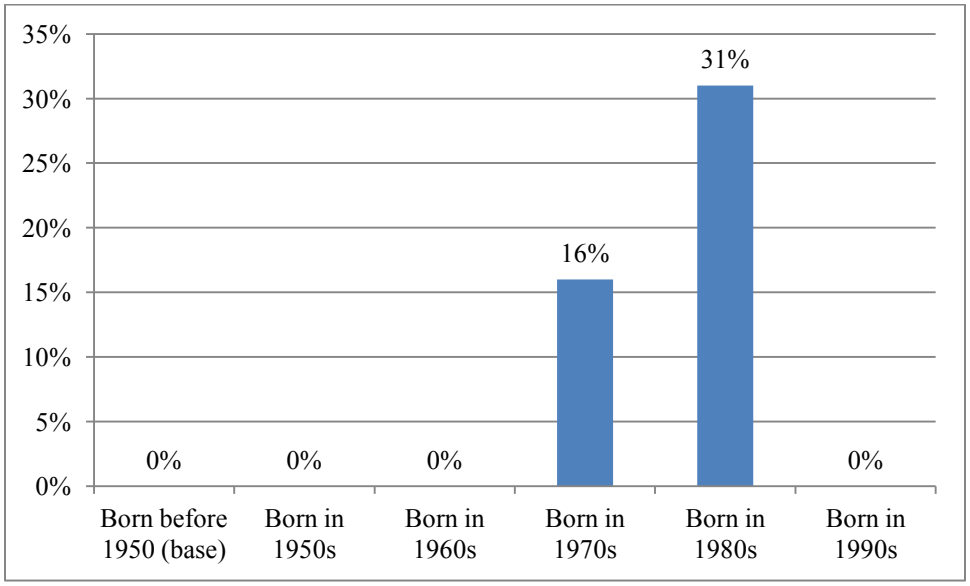
Turning to the variables of interest, the model suggests that daily internet users are more likely to drive alone for social purposes than are those who do not use the internet daily, all else equal. Similarly, youth who live with their parents are *far* more likely to drive alone for social trips than are youths who live elsewhere. And while those in 2001 and 2009 appear to make fewer solo-driving social trips than did those in 1990, the model suggests that later birth cohorts (1970s and 1980s) tend to make more of their trips by single-occupancy vehicle than do those who were born in earlier decades (see Figure 39). For those born in the 1990s, we find no conclusive evidence of a cohort effect.

Table 42: Cohort Poisson Model of the Share of Social Trips taken by SOV

	Coefficient	Sig.	t-Statistic	p-Value
Individual Characteristics				
Female	-0.107	***	-10.51	<0.001
Age	0.075	***	12.86	<0.001
Age Squared	-0.001	***	-11.34	<0.001
Race / Ethnicity (omitted category: Non-Hispanic White)				
Non-Hispanic Black	-0.023		-1.02	0.306
Non-Hispanic Asian (2009 Only)	-0.055		-1.62	0.104
Non-Hispanic Other	-0.092	***	-2.66	0.008
Hispanic	-0.085	***	-3.82	<0.001
Education (omitted category: No HS Diploma)				
For Youth: Highest Degree Achieved in Household				
High School Diploma	0.323	***	4.97	<0.001
Some College	0.407	***	6.94	<0.001
Bachelor's Degree	0.394	***	6.63	<0.001
Graduate Degree	0.396	***	6.31	<0.001
For Adults: Highest Degree Personally Achieved				
High School Diploma	0.074		1.59	0.113
Some College	0.106	**	2.31	0.021
Bachelor's Degree	0.115	**	2.48	0.013
Graduate Degree	0.112	**	2.38	0.017
Reports Working	0.245	***	18.52	<0.001
Uses Web Daily	0.051	***	4.19	<0.001
Reports Driving	4.548	***	30.54	<0.001
Household Characteristics				
Income (ln)	-0.017	**	-2.29	0.022
Number of Adults in HH	-0.044	***	-5.88	<0.001
Number of Children in HH	-0.293	***	-49.17	<0.001
Youth, Lives with Parents	0.395	***	12.84	<0.001
Ratio of Cars to Adults in HH	0.136	***	13.41	<0.001
Trip Characteristic				
Trip was on Weekend	-0.436	***	-32.68	<0.001
Geographic Characteristics				
Population Density (ln)	-0.009	***	-2.60	0.009
In MSA with > 3M Population	0.005		0.46	0.648
Year (base: 1990)				
Year: 2001	-0.219	***	-8.23	<0.001
Year: 2009	-0.299	***	-8.42	<0.001
Cohorts (base: Born before 1950)				
Born in 1950s	0.009		0.40	0.692

Born in 1960s	0.022		0.61	0.539
Born in 1970s	0.151	***	2.98	0.003
Born in 1980s	0.269	***	3.94	<0.001
Born in 1990s	0.107		1.26	0.208
Constant	-6.912	***	-31.78	<0.001
N	123,167			
R-Square	0.154			
Statistically Significant				

Figure 39: Expected Percentage Change in Share of Social Trips Made by SOV by Cohort



F. Conclusion: Social Trip Mode

Social travel has received relatively little attention from researchers compared with other types of travel—in particular, the commute to work. While the previous analyses show that the recession has had a large effect on the travel behavior of teens and young adults, our analysis presented in Chapter IX finds that the effects of the economic downturn on social travel are less clear. The total number of social trips declined slightly from 2001 to 2009, but the share of social trips relative to other types of trips actually increased slightly. This finding contradicts expectations that people are most likely to reduce discretionary travel in worsening economic circumstances.

Table 43: Summary Table: Social Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
Carpool (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	-	*(Not included)*		
Technology (Web Use)	*n/a*	-	-	*n/a*	0	-
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	0	*(Not included)*		
Technology (Web Use)	*n/a*	+	0	*n/a*	0	0
License Stringency	-	?	-	+	?	?
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	-	0	*(Not included)*		
Technology (Web Use)	*n/a*	0	0	*n/a*	0	0
License Stringency	0	+	0	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	-	*(Not included)*		
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	+	-	+	?	+

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; blue (0) indicates no statistically-significant relationship; and white (?) means no consistent effect.

While the recession may have had unexpected effects on the amount of social travel, it has more expected effects on mode choice. As seen in the previous chapter on commute mode choice, household income strongly affects commuter mode choice, increasing the likelihood of driving alone, and we observe similar results for social trip mode choice. For youth, income has a negative effect on carpooling, transit use, and walking; for adults, income has a negative effect on transit use and bicycling. However, the models suggest that higher-income adults are more likely to carpool than drive alone for social trips, an unexpected—but highly social—result.

On the other hand, trip characteristics frequently had statistically significant effects on mode choice. For example, trip distance, the number of social trips taken in the survey day, and weekend travel all had positive effects on carpooling for both youth and adults. Conversely, trip distance had a negative effect on bicycling and walking for both groups. Geographic

characteristics had less of an effect overall, but population density and living in New York both had positive effects on transit use.

As for other variables of interest, daily Internet use had almost no effect for youth and adults, and licensing had either no effect or inconsistent effects. Young adults living at home were more likely to drive alone in most of the models, including the carpooling models. This finding perhaps reflects their desire to maintain a measure of independence while living with their parents.

Our analysis further revealed some differences in social travel between youth and adults. As noted previously, studies have shown that being Hispanic or an immigrant increases the likelihood of carpooling or walking over driving alone. As with our commuting analysis, the social trips analysis shows that this trend remains consistent over time for adults, but not for youth. In other words, the relationship between socio-demographic categories and mode choice for recreational travel may be weakening as well.

Finally, the quasi-cohort model finds that being born in the 1970s and especially the 1980s is associated with more driving alone (perhaps to bowl alone) to social destinations, while being born in earlier decades or in the 1990s has no effect on driving alone on social trips. While the 1990s results compares only the social travel mode choice of 15 to 19 year olds with similar age cohorts born in the 1980s and 1970s, this finding does suggest that rates of driving alone, after controlling for a wide array of other factors, is down among the latest generation of teens.

Chapter X. Conclusion

To explore potential influences on the travel behavior of youth, we analyze data from the Nationwide Personal Transportation Survey in 1990 and the National Household Travel Surveys in 2001 and 2009. We use the data to examine how the travel behavior of youth (teens and young adults ages 15–26) compares to that of middle-aged adults (ages 27–61), whether the basic determinants of youth travel behavior are changing, and whether we see evidence that today's youth are likely to travel differently than adults. To do this we focus on five fundamental measures of travel: personal miles traveled (PMT); activity participation (number of daily trips); trip purpose; journey-to-work (or commute) mode choice; and travel mode used for social trips. With the exception of our descriptive analysis of trends in trip purpose, we employ a set of statistical models to analyze each of the four other measures of travel. These models allow us to assess the influence of life-cycle effects (changes that typically occur of the course one's life), period effects (associated with particular events like an economic downturn), and cohort effects (where the patterns of one generation differ from others) on the travel behavior of youth relative to middle-aged adults.

In a nutshell, we find that economic factors—employment status, household income, and the like—strongly influence the travel behavior of both adults and youth, the latter of which has been harder hit by our current, prolonged economic downturn. These economic effects help to explain the growth mobility, trip-making, and driving among both youth and adults during the 1990s, and the subsequent contraction of mobility, trip-making, and driving during the 2000s. When it comes to changes in teen, youth (and adult) travel behavior in recent years, the adage "It's the economy, stupid" appears to hold.

With regard to the effects of young adults "boomeranging" to live at home with parents, the explosion of information and communications technologies, and stricter driver's licensing requirements for teens, the effects are far milder, and mixed. While more young adults appear to be living at home than in years past, the effects on travel behavior are mixed at best. Likewise, despite the staggering increase in mobile phone and web access and use, the effects we were able to measure were both mild and tended to be associated with *increases* in travel. That is, when information and communications technologies affect travel, it is as a complement to travel and not a substitute for it. Finally, while teen licensing requirements have grown considerably stricter over the past two decades, and more teens are obtaining their licenses in their late teens and early twenties, the effects on overall teen mobility are surprisingly muted. Sixteen and 17-year-olds are driving less, but they appear to be (eventually) getting driver's licenses and moving about as much as earlier generations of adults.

Our quasi-cohort models suggest moderate generational effects on travel behavior. Despite (or perhaps because of) what appears to be youth's increasing reliance on the single-occupant

vehicle for the journey to work and social trips, the youngest cohorts in our datasets appear to be making somewhat fewer trips (-4%) and traveling considerably fewer miles (-18%) than was the case for previous generations at the same stage in their lives, all else equal.

Perhaps the most significant overall finding from this analysis is how little teen and youth travel behavior is deviating from that of adults, given the enormous economic, social, technological, and policy changes over the past two decades. Specifically, we see little evidence in these data that living circumstances, technological innovations, or driving regulations are dramatically altering travel behaviors. We do find that economic factors—specifically employment status, educational attainment, and household income—strongly affect the travel behaviors of teens and young adults, but these factors strongly affect the travel of older adults as well.

We summarize the principal findings of each of our four specific analyses—person travel, trip-making, commute mode choice, and social and recreational trip mode choice—in turn below.

A. What Explains PMT among Teens, Young Adults, and Adults?

The descriptive statistics and multivariate models of the factors affecting person-miles of travel paint an interesting and nuanced picture of teen and young adult travel, both in comparison with adults and over time. Personal travel, measured here as person miles of travel (or PMT), generally increases as one moves from teenage, to young adulthood, and into middle age. But person travel is highly correlated with economic factors, such as employment and income. Indeed, we observe a substantial drop in metropolitan person travel nationwide between 2001 and the recession 2009 across all age groups examined, though the largest drop (23%) was among teens.

The effect of economic factors on the travel of teens and young adults (measured here in terms of employment), and for that matter middle-age adults, is substantial and unambiguous—but the effect of employment on PMT is stronger for young adults than for teens, and stronger still for adults than for young adults or teens. But while being employed is highly correlated with PMT, the effect of "boomeranging" young adults living at home is ambiguous at best; we observe no effect of living with parents on the PMT of young adults in our primary "Driver's Status" model. And far from acting as a substitute for travel, our models suggest that of daily web use either has no effect on travel or, in the most recent 2009 survey, is actually associated with *increased* PMT across all age categories; this is likely because web use, auto access, and PMT are all positively associated with education and income. Finally, although licensing requirements have increased dramatically for teens in states across the county, we find no consistent relationship between license regulations and PMT. These findings are summarized in Table 44 below.

Table 44: Summary Table: PMT and Variables of Interest (1990, 2001, and 2009)

	Teen (15–18)			Young Adult (19–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+	+	+	+
Young Adult Living at Home	*(Not Included)*			0	0	0	*(Not Included)*		
Technology (Web Use)	*n/a*	0	+	*n/a*	0	+	*n/a*	0	+
License Stringency	0	0	0	0	0	+	0	+	0

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

One of the most significant findings of this analysis is how consistent the observed effects on travel are across the three age categories: teens, young adults, and adults. Education (or parents' education), employment, auto access, and being a driver are all positively associated with PMT across almost all age categories and survey years. Likewise, population density is negatively associated with PMT across nearly all age categories and years. There are a few exceptions to this pattern, but not many. Among adults (but not teens or young adults) income (apart from employment) and the presence of children in the household are also associated with greater personal travel. And in the most recent survey year (2009), female teens are traveling more than male teens, which constitutes a break from the past and portend future changes in the gender division of travel.

Finally, the quasi-cohort model suggests that those born in more recent decades (the 1980s and 1990s) are traveling fewer miles per day than did previous cohorts at the same stage in their lives. Such a finding suggests that we may well be observing a gradual shift away from generational increases in PMT long associated with rising wealth and auto ownership. However, because we only have data on those born in the 1990s for *one* of the three data years, these results should be viewed as suggestive rather than conclusive.

B. What Explains Patterns of Activities and Trips among Youth and Adults?

People travel in order to access opportunities to do, acquire, or sell. Thus trips, as opposed to traveling, act as a proxy for activity participation; the more trips one completes, the more activities in which s/he participates. Up to a point, therefore, more trips mean more activities and access to a higher quality of life. Likewise, more time and money spent traveling to a fewer number of destinations means fewer trips and lower levels of personal access, in spite of high levels of mobility.

We find that adults make more trips than youth, and that higher incomes and greater private vehicle access are associated with higher levels of trip-making and, hence, activity participation. In general, trip-making increases year to year as people age from the early teens through late

middle age, and then it declines gradually thereafter. Trip-making is highly correlated with economic activity, as we observe that trips per person increased between 1990 and 2001, but declined between 2001 and the recession of 2009. Unemployment in 2009 was substantially higher among youth than adults, and the drop in trip-making between 2001 and 2009 was greater for youth than for adults. And at a more micro level, our analysis shows that both income and employment are associated with greater trip-making.

We constructed a set of structural equation models (SEMs) and find that income is a powerful predictor of trip-making among adults, and its importance in predicting youth trips increased substantially between 1990 and 2009 and is now on par with that of adults. The most important effect of income is in increasing automobile access, which in turn encourages more trips. While income and working are strongly associated with increased trip-making among both adults and, increasingly, youth, time spent commuting to and from work reflects the opportunity cost of time and tends to depress trip-making.

Table 45: Summary Table: Number of Trips and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adult (27–61)		
	1990	2001	2009	1990	2001	2009
Worker Status	+	+	+	+	+	+
Young Adult Living at Home	*(Not included in the model)*					
Technology (Web Use)	*n/a*	0	0	*n/a*	+	+
License Stringency	-	+	-	-	+	-

Yellow (+) indicates a positive and statistically-significant relationship; red (-) indicates a negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

While the effects of the economy, income, auto access, and working are all positively associated with trip-making among both adults and youth, internet access appears to have no effect on youth trip-making, and may actually be associated with a slight increase in trip-making in adults in 2009. Likewise, and remarkably, increasingly strict licensing regimes for teens appear to have little, in any, effect on youth trip-making. Finally, we note in these models that the independent effects of race/ethnicity on trip-making appear to be waning over time, especially among youth.

Finally, our quasi-cohort model suggests that, despite having high levels of auto access and higher incomes than previous generations did at the same stage in their lives, the most recent cohort (those born in the 1990s) appear to be making fewer trips (roughly 4% fewer) than did previous cohorts, all else equal.

C. How Do Commute Mode Choice Patterns Compare between Youth and Adults?

While the previous two analyses found that working has a substantial influence on both person miles of travel and the number of daily trips, this analysis has focused specifically on the mode choices of workers. As with the previous analyses, the effects of the recession on travel behavior, particularly by youth, are substantial. While the proportion of working adults declined from 85 to 80 percent between 2001 and 2009, the number of working youth dropped precipitously, from 70 percent in 2001 to just 56 percent in 2009.

While the proportion of adult and, especially, young workers was much lower in 2009 than in 2001, the commute mode analysis focused on how those who do work get there. We find, not surprisingly, that household income is a consistent predictor of commute mode choice for both youth and adults. In general, income is strongly and positively associated with driving alone to work; put another way, as incomes go up, the probability of commuting via carpool, public transit, bicycle, or foot all go down—for both youth and adults, and across all three survey years.

With respect to the effect of the bad economy causing a growing number of youth to "boomerang" home to live with parents, we find that young working adults living at home are less likely to carpool and more likely to use public transit than other workers. Likewise, those who use the web daily were *less* likely to carpool (2001 and 2009) and *more* likely to commute via public transit (2001 only). Last, in terms of our variables of interest, youth in places with stricter teen licensing regimes were more likely to commute to work via public transit; however, we find that the strictness of licensing regimes has no significant effect on an individual's choice to commute via carpool.

The analysis also revealed important differences between youth and adult workers. Previous studies have consistently shown that being a female, Hispanic, or foreign-born increases the likelihood of commuting by carpool over driving alone. Our analysis shows that this trend remains consistently strong for adults, but not for young workers. This suggests that the relationship between travel mode broad social categories, like gender, race/ethnicity, and immigration status, may be weakening over time.

Finally, our quasi-cohort model suggests that particularly those born in more recent decades (the 1970s, 1980s, and 1990s) are far more reliant on the single-occupancy vehicle for their journey to work than were previous generations, though this effect appears to be diminishing over time.

Table 46: Summary Table: Commute Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
Carpool (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	-	-	*n/a*	0	+
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	+	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	+	0	*n/a*	+	0
License Stringency	+	+	+	+	+	-
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	+	0	0	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	0	-
License Stringency	-	0	+	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	0	+	*n/a*	*n/a*	*n/a*
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	0	0	+	0	0

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; and blue (0) indicates no statistically-significant relationship.

D. How Do Social/Recreational Mode Choice Patterns Compare Over Time?

While it appears in our previous analyses that the recession has had a large effect on the travel behavior of teens and young adults, its effects on social travel are less clear. The total number of social trips did decline slightly from 2001 to 2009, but the share of social trips relative to other types of trips actually increased slightly. This contradicts expectations that people would primarily reduce discretionary travel in worsening economic circumstances.

While the recession may have had unexpected effects on the amount of social travel, it has more expected effects on mode choice. As seen in the commute mode analysis, household income strongly affects commuter mode choice, increasing the likelihood of driving alone, and we observe similar results for social trip mode choice. For youth, income has a negative effect on carpooling, transit use, and walking; for adults, income has a negative effect on transit use and bicycling. However, the models suggest that higher-income adults are more likely to carpool than drive alone for social trips, an unexpected—but highly social—result.

On the other hand, trip characteristics frequently had statistically significant effects on mode choice. For example, trip distance, the number of social trips taken in the survey day, and weekend travel all had positive effects on carpooling for both youth and adults. Conversely, trip distance had a negative effect on bicycling and walking for both groups. Geographic characteristics had less of an effect overall, but population density and living in New York both had positive effects on transit use.

As for other variables of interest, young adults living at home were more likely to drive alone in most of the models, including the carpooling models and the quasi-cohort model. This finding perhaps reflects their desire to maintain a measure of independence while living with their parents and the fact that they are less likely to live with the peers with whom they socialize. Daily web use had mixed and generally modest effects on both youth and adult social travel mode choice, except for reducing the likelihood of carpooling for adults in the cross-sectional model and increasing the likelihood of driving alone in the cohort model. As in earlier analyses, web use has either a neutral or positive influence on travel, and in this case, driving. Finally, licensing had either no effect or mixed effects in most of the models—again, suggesting that the licensing variable captured other factors.

Our analysis did reveal some differences in social travel between youth and adults. As noted previously, studies have shown that being Hispanic or an immigrant increases the likelihood of carpooling or walking over driving alone. As with our commuting analysis, the social trips analysis shows that this trend remains consistent over time for adults, but not for youth. In other words, the relationship between socio-demographic categories and mode choice for recreational travel may be weakening as well.

Finally, the cohort model finds that being born in the 1970s and especially the 1980s is associated with more driving alone (perhaps to bowl alone) to social destinations, while being born in earlier decades or in the 1990s has no effect on driving alone on social trips. While the 1990s results compares only the social travel mode choice of 15–19 year olds with similar age cohorts born in the 1980s and 1970s, this finding does suggest that rates of driving alone, after controlling for a wide array of other factors, is down among the latest generation of teens.

Table 47: Summary Table: Social Mode and Variables of Interest (1990, 2001, and 2009)

	Youth (15–26)			Adults (27–61)		
	1990	2001	2009	1990	2001	2009
Carpool (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	-		*(Not included)*	
Technology (Web Use)	*n/a*	-	-	*n/a*	0	-
License Stringency	0	0	0	0	0	0
Transit (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	-	0		*(Not included)*	
Technology (Web Use)	*n/a*	+	0	*n/a*	0	0
License Stringency	-	?	-	+	?	?
Bicycling (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	0	-	0		*(Not included)*	
Technology (Web Use)	*n/a*	0	0	*n/a*	0	0
License Stringency	0	+	0	0	+	+
Walking (Base: driving alone)						
Employment Status	*(Not included in the model)*			*(Not included in the model)*		
Young Adult Living at Home	-	0	-		*(Not included)*	
Technology (Web Use)	*n/a*	0	0	*n/a*	+	0
License Stringency	+	+	-	+	?	+

Yellow (+) indicates positive and statistically-significant relationship; red (-) indicates negative and statistically-significant relationship; blue (0) indicates no statistically-significant relationship; and white (?) means no consistent effect.

Chapter XI. Sources

Baum, Charles L. (2009). "The effects of vehicle ownership on employment," *Journal of Urban Economics*, 66(3): 151-163.

Blumenberg and Smart (2010). "Getting by with a little help from my friends…and family: immigrants and carpooling," *Transportation*, 37: 429-446.

Bollen, K.A. (1989). *Structural Equations with Latent Variables*. Vol. 8: Wiley New York.

Booz, Allen, and Hamilton (2011). *Next Generation of Travelers. Statistical Analysis Draft Report*. Paper prepared for the U.S. Department of Transportation, Federal Highway Administration. April 25, 2011

Bungum, Timothy J., Monica Lounsbery, Sheniz Moonie and Julie Gast (2009). "Prevalence and correlates of walking and biking to school among adolescents," *Journal of Community Health*, 34(2): 129-134.

Bureau of Labor Statistics (various years). Labor Force Statistics from the Current Population Survey. http://data.bls.gov/cgi-bin/surveymost?ln

Chatman, Daniel (2009). "Residential choice, the built environment, and nonwork travel: Evidence using new data and methods," *Environment and Planning A*, 41: 1072-1089,

Clifton, Kelly (2003). "Independent mobility among teenagers: Exploration of travel to after-school activities," *Journal of the Transportation Research Board*, 1854: 74-80.

Clifton, Kelly J., Gulsah Akar, Andrea Livi Smith, and Carolyn C. Voorhees (2009). "Gender differences in adolescent travel to school: Exploring the links with physical activity and health," *Women's Issues in Transportation, Summary of the 4th International Conference*, Volume 2: Technical Papers. http://onlinepubs.trb.org/onlinepubs/conf/cp46v2.pdf

Cline, Michael E., Corey Sparks, and Karl Eschbach (2009). "Understanding carpool use by Hispanics in Texas," *Journal of the Transportation Research Board*, No. 2118: 39–46.

Contrino, Heather, Erica Interrante, and Cynthia Hatley (2010) "The Next Generation of Travel: Literature Scan," FHWA Office of Policy and Governmental Affairs, Office of Transportation Policy Studies, August 2010

Contrino, Heather and Nancy McGuckin (2006). "An exploration of the internet's effect on travel," Paper for the 2007 Transportation Research Board Conference,

http://www.travelbehavior.us/Nancy-pdfs/An_Exploration_of_the_Internet_s_Effect_on_Travel.pdf

Copperman, R., and C.R. Bhat (2011), "An Assessment of the State-of-the-Research of US Children's Time-Use and Activity-Travel Patterns," presented at the Second Workshop on Time Use Observatory (TUO 2), March 2010, and published in Time Use Observatory, Chapter 2, pp. 29-52, edited by J.A. Carrasco, S. Jara-Diaz, and M. Munizaga, Gráfica LOM, Santiago de Chile

Crane, Randall (2000). "The influence of urban form on travel: An interpretive review," *Journal of Planning Literature*, 15(1): 3-23.

Crane, Randall (2007). "Is there a quiet revolution in women's travel? Revisiting the gender gap in commuting," *Journal of the American Planning Association*, 73(3): 298-316.

Dalton, Madeline A., Meghan R. Longacre, Keith M. Drake, Lucinda Gibson, Anna M. Adachi-Mejia, Karin Swain, Haiyi Xie and Peter Owens (2011). "Built environment predictors of active travel to school among rural adolescents," *American Journal of Preventive Medicine,* 40(3): 312–319.

Descartes, Lara, Conrad P. Kottak, and Autumn Kelly (2007), "Chauffeuring and commuting. A story of work, family, class, and community," *Community, Work, and Family* 10(2): 161-178.

Di, Zhu Xiao, Yi Yang, and Xiaodong Liu (2002). "Young American Adults Living in Parental Homes," Joint Center for Housing Studies, Cambridge: Harvard University, May.

Dolan, Paul, Tessa Peasgood, and Matthew White (2008). "Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being," *Journal of Economic Psychology*, 29(1): 94–122.

Doyle, D. Gregg and Brian D. Taylor (2000). "Variation in metropolitan travel behavior by sex and ethnicity," in *Travel Patterns of People of Color: Final Report.* Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration. Pages 181-244. http://www.fhwa.dot.gov/ohim/trvpatns.pdf

Emond, Catherine R. and Susan L. Handy (2012). "Factors associated with bicycling to high school: Insights from Davis, CA," *Journal of Transport Geography*, 20(1): 71–79.

Farber, S. and A. Páez (2009). "My car, my friends, and me: A preliminary analysis of automobility and social activity participation." *Journal of Transport Geography***,** 17(3): 216-225.

Federal Highway Administration (1995). *Highway Statistics 1995*. Washington, DC: U.S. Department of Transportation.

Federal Highway Administration (2009). *Highway Statistics 2009*. Washington, DC: U.S. Department of Transportation.

Ferguson, Eric (1997). "The Rise and Fall of the American Carpool: 1970-1990," *Transportation*, 24: 349–376.

Ferrell, Christopher E. (2004). "Home-based teleshoppers and shopping travel: Do teleshoppers travel less?" *Journal of the Transportation Research Board*, 1894: 241-248.

Goodwin, Arthur H. and Foss, Robert D. (2004), "Graduated driver licensing restrictions: Awareness, compliance, and enforcement in North Carolina," *Journal of Safety Research*, 35(4): 367-74.

Guiliano, Genevieve (2003). "Travel, location and race/ethnicity," *Transportation Research Part A: Policy and Practic*e, 37(4): 351–372.

Gurin, DB (1974). "Travel patterns of suburban high school males and programs to increase their mobility," *Transportation Research Board*, 508: 1–12.

Gurley, Tami and Donald Bruce (2005). "The effects of car access on employment outcomes for welfare recipients," *Journal of Urban Economics*, 58(2): 250-272.

Greenstone, Michael and Adam Looney (2010). *The Long-Term Effects of the Great Recession for America's Youth*. The Hamilton Project. Washington, DC: The Brookings Institution. http://www.brookings.edu/opinions/2010/0903_jobs_greenstone_looney.aspx

Hedlund, Ruth A. Shults, and Richard Compton (2002). "What we know, what we don't know, and what we need to know about graduated driver licensing," *Journal of Safety Research*, 34(1): 107–115.

Hillman, Mayer, John Adams and John Whitelegg (1990). *One false move ... A Study of Children's Independent Mobility*. London: Policy Studies Institute. http://john-adams.co.uk/wp-content/uploads/2007/11/one%20false%20move.pdf

Hjorthol, Randi Johanne (2002). "The relation between daily travel and use of the home computer," *Transportation Research Part A: Policy and Practice*, 36(5): 437–452

Hubsmith, Deborah A. (2006). "Safe routes to school in the United States," *Children, Youth and Environments*, 16(1): 169-190.

Insurance Institute for Highway Safety (2012). "Young Driver's Licensing Systems in the U.S.," http://www.iihs.org/laws/graduatedLicenseIntro.aspx

Kaplan, Greg (2009). "Boomerang kids: Labor market dynamics and moving back home," Federal Reserve Bank of Minneapolis, Working Paper 675, October.

Kitamura, Ryuichi, Patricia L. Mokhtarian, and Laura Laidet (1997). "A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area," *Transportation*, 24: 125-158.

Kreider, Rose M. (2007) "Young adults living in their parents' home," Fertility and Family Statistics Branch, U.S. Census Bureau. http://www.census.gov/hhes/families/files/young-adults-in-parents-home.pdf

Kwan, Mei-Po (2002). "Time, information technologies, and the geographies of everyday life," *Urban Geography*, 23(5): 471–482.

Kwan, Mei-Po (2006). "Transport geography in the age of mobile communications," *Journal of Transport Geography*, 14(5): 384-85.

Lambert, Thomas E. and Hokey Min (2010). "Neighborhood environment and obesity in the Louisville, Kentucky area," *International Journal of Housing Markets and Analysis*, 3(2): 163-174.

Landsberg, B., S. Plachta-Danielzik, D. Much, M. Johannsen, D. Lange, and M.J. Mülle (2008). "Associations between active commuting to school, fat mass and lifestyle factors in adolescents: The Kiel Obesity Prevention Study," *European Journal of Clinical Nutrition*, 62: 739–747.

Lenhart, Amanda, Mary Madden, and Paul Hitlin (2005). *Teens and technology. Youth are leading the transition to a fully wired and mobile nation*. July 27, Washington, DC: Pew Internet and American Life Project. http://www.pewinternet.org/~/media//Files/Reports/2005/PIP_Teens_Tech_July2005web.pdf.pdf

Lu, X., and E.I. Pas (1999). "Socio-demographics, activity participation and travel behavior," *Transportation Research Part A: Policy and Practice* 33 (1):1-18.

Mans, Janine, Erica Interrante, Lewison Lem, Judy Mueller, and Michael Lawrence (forthcoming) "The Next Generation of Travel Behavior: Potential Impacts Related to Household Use of Information and Communications Technology," *Journal of the Transportation Research Board*.

Marzoughi, Reihane Marzoughi (2011). "Teen travel in the Greater Toronto Area: A descriptive analysis of trends from 1986 to 2006 and the policy implications" *Transport Policy*, 18(4): 623–630.

McCartt, Anne T., Eric R. Teoh, Michele Fields, Keli A. Braitman & Laurie A. Hellia (2010). "Graduated Licensing Laws and Fatal Crashes of Teenage Drivers: A National Study," *Traffic Injury Prevention,* 11(3): 240-248.

McCray, Talia M. and Sabina Mora (2011). "Analyzing the activity spaces of low-income teenagers: How do they perceive the spaces where activities are carried out," *Journal of Urban Affairs*, 33(5): 511–528.

McDonald, Noreen C. (2005). Children's Travel: Patterns and Influences. Dissertation, Department of City and Regional Planning, University of California, Berkeley.

McDonald, Noreen C. (2006). "Exploratory analysis of children's travel patterns" *Journal of the Transportation Research Board*, #1977: 1-7.

McDonald, Noreen C. (2008). "Household interactions and children's school travel: the effect of parental work patterns on walking and biking to school," *Journal of Transport Geography*, 16(5): 324–331.

McDonald, Noreen (2007). "Travel and the social environment: Evidence from Alameda County, California," *Transportation Research Part D: Transport and Environment,* 12(1): 53-63.

McDonald, Noreen C. (2008). "Children's mode choice for the school trip: the role of distance and school location in walking to school," *Transportation*, 35: 23-35.

McDonald, Noreen, Sally Librera, and Elizabeth Deakin (2004). "Free transit for low-income youth: Experience in San Francisco Bay Area, California," *Journal of the Transportation Research Board*, 1887: 153-160.

McGuckin, Nancy and Nandu Srinivasan. (2005). "The journey-to-work in the context of daily travel ," *TRB Census Data for Transportation Planning Conference.*

McMillan, Tracy (2007). "The relative influence of urban form on a child's travel mode to school," *Transportation Research Part A*, 44: 69–79.

McMillan, Tracy, Kristen Day, Marlon Boarnet, Mariela Alfonzo, and Craig Anderson (2006). "Johnny walks to school- does Jane? Sex differences in children's active travel to school." *Children, Youth and Environments* 16(1): 75-89.

Messineo, Melinda and Roger A. Wojkiewicz (2004). "Co-residence of adult children with parents from 1960 to 1990: Is the propensity to live at home really increasing," *Journal of Family History*, 29(1): 71-83.

Mokhtarian, Patricia L. (2000). "Telecommunications and travel," Transportation in the New Millennium, Transportation Research Board, Committee on Telecommunications and Travel Behavior, http://onlinepubs.trb.org/onlinepubs/millennium/00115.pdf

Mokhtarian, Patricia L. (2002). "Telecommunications and travel: The case for complementarity," *Journal of Industrial Ecology*, 6(2): 43–57.

Mokhtarian, P.L. and I. Salomon (2002). "Emerging travel patterns: Do telecommunications make a difference" In: *Perpetual Motion: Travel Behavior Research and Opportunities and Application Challenges*. Oxford: Elsevier. pp. 143-182.

Neff, Jack (2010). "Is digital revolution driving decline in U.S. car culture?" *Ad Age*, May 31.

NHTSA (nd*). Graduated Driver Licensing. Questions and Answers*. Insurance Institute for Highway Safety. http://www.iihs.org/brochures/pdf/gdl_brochure.pdf

Ong, Paul (2002). "Car ownership and welfare-to-work," *Journal of Policy Analysis and Management*, 21(2): 239-252.

Pas, Eric I. (1984). "The effect of selected sociodemographic characteristics on daily travel-activity behavior," *Environment and Planning A*, 16(5): 571-581.

Pew Research Center (2009). "Tech Usage Over Time." http://www.pewinternet.org/Static-Pages/Trend-Data-for-Teens/Usage-Over-Time.aspx

Pew Research Center (2010a). *The Return of the Multi-Generational Family Household*. March 18, 2010, Washington DC: Pew Research Center.

Pew Research Center (2010b). *Millennials: Confident. Connected. Open to Change*. Washington: Pew Research Center, February 24. http://pewsocialtrends.org/files/2010/10/millennials-confident-connected-open-to-change.pdf

Pisarski, Alan E. (2006). *Commuting in America III*. NCHRP Report 550, TCRP Report 110. Washington, DC: Transportation Research Board.

Pucher John and John L. Renne (2003). "Socioeconomics of urban travel: Evidence from the 2001 NHTS," *Transportation Quarterly*, 57(3): 49-77.

Rosenbloom, Sandra (2006). "Understanding women's and men's travel: The research challenge" *Research on Women's Issues in Transportation*. Washington, DC: Transportation Research Board.

Rosenbloom, Sandra and Elizabeth Burns (1994). "Why Working Women Drive Alone: Implications for Travel Reduction Programs," *Transportation Research Board,* 1459: 39-45.

Rubin, D.B. (1987). *Multiple Imputation for Nonresponse in Surveys*. Hoboken, NJ: J. Wiley and Sons.

Schafer, J. L. (1999). "Multiple imputation: A primer," *Statistical Methods in Medical Research,* 8(1):3-15.

Schlossberg, Marc, Jessica Greene, Page Paulsen Phillps, Bethany Johnson and Bob Parker (2006). "School trips: Effects of urban form and distance on travel mode," *Journal of the American Planning Association*, 72(3): 337-346.

Schwanen, Tim, Mei-Po Kwan, and Fang Ren (2008). "How fixed is fixed? Gendered rigidity of space-time constraints and geographies of everyday activities," *Geoforum*, 39(6): 2109–2121

Shope, Jean T. (2007). "Graduated driver licensing: Review of evaluation results since 2002," *Journal of Safety Research*, 38(2): 165–175.

Sims, Laurel (2012). Personal communication, February 1, 2012.

Taylor, Brian D. (2011). "Information and communications technology and travel behavior: Implications for Southern California," Report to the Southern California Association of Governments. UCLA: Institute of Transportation Studies.

Taylor, Brian D. and Paul M. Ong (1995). "Spatial mismatch or automobile mismatch? An examination of race, residence, and commuting in U.S. Metropolitan Areas," *Urban Studies*, 32(9): 1453-1473.

Taylor, Brian D., Douglas Miller, Hiroyuki Iseki, and Camille Fink (2009). "Nature and/or nurture? Analyzing the determinants of transit ridership across US urbanized areas," Transportation Research Part A: Policy and Practice, 43(1): 60–77

Teal, Roger F. (1987). "Carpooling: Who, How and Why?" *Transportation Research A*, 21(3): 203-214.

Thakuriah, Piyushiita (Vonu), Lei Tang, and Sashi Menchu (2009). "Young women's transportation and labor market experiences" *Women's Issues in Transportation, Summary*

of the 4th International Conference, Volume 2: Technical Papers. http://onlinepubs.trb.org/onlinepubs/conf/cp46v2.pdf

Troeh, Eve (2010). "Teens getting behind the wheel later," Friday, July 30, American Public Media. http://marketplace.publicradio.org/display/web/2010/07/30/mm-teens-getting-behind-the-wheel-later/?refid=0

Trowbridge, Matthew J. and Noreen C. McDonald (2008). "Urban sprawl and miles driven daily by teenagers in the United States," *American Journal of Preventive Medicine*, 34(3): 202–206.

U.S. Department of Labor (various years). Labor Force Statistics from the Current Population Survey. Washington DC: Bureau of Labor Statistics.

U.S. Department of Transportation (1992). *Driver's License Administration Requirement and Fees, 1990 and 1992*, Washington, DC: Federal Highway Administration.

Viswanathan, Krishnan and Konstadinos G. Goulias (2001). "Travel behavior implications of information and communications technology in Puget Sound Region," *Journal of the Transportation Research Board*, 1752: 157-165.

Voorhees, Carolyn C. Alice F. Yan, Kelly J. Clifton, and Min Qi Wang (2011). "Neighborhood environment, self-efficacy, and physical activity in urban adolescents," *American Journal of Health Behavior*, 35(6): 674-688.

Wiemers, Emily E. (2011). "The effect of unemployment on household composition and doubling up," National Poverty Center. Working Paper Series, #11-12., University of Michigan. http://npc.umich.edu/publications/u/working_paper11-12.pdf

Williams, A.F. and S.A. Ferguson (2002). "Rationale for graduated licensing and the risks it should address," *Injury Prevention*, 8 (Supplement II): ii9–ii16.

Yarlagadda, Amith K. and Sivaramakrishnan Srinivasan (2008). "Modeling children's school travel mode and parental escort decisions," *Transportation*, 35:201–218.

Yoon, Seo Youn, Marjorie Doudnikoff, and Konstadinos G. Goulias (2011). "Spatial analysis of propensity to escort children to school in Southern California," *Journal of the Transportation Research Board*, 2230: 132-142.

Chapter XII. Appendix

Table 48: Number and Percentage of Trips by Length and Survey Year

Survey Year	Trips < 75 miles	Trips ≥ 75 miles			
		1 trip	2 trips	3+ trips	Total: Excluded Trips
1990	32,206 (94%)	771 (2%)	983 (3%)	291 (1%)	2,045 (6%)
2001	123,998 (96%)	2,771 (2%)	1,548 (1%)	195 (.2%)	4,514 (4%)
2009	217,600 (97%)	3,946 (2%)	2,108 (1%)	239 (.1%)	6,293 (3%)

Table 49: PMT by Employment Status and Age Group (1990, 2001, and 2009)

	1990			2001			2009		
	Teens	Young Adult	Adult	Teens	Young Adult	Adult	Teens	Young Adult	Adult
Not Employed	16.3	17.5	17.3	19.9	19.5	23.6	17.3	21.3	20.6
Full Time	25.6	30.5	28.0	32.0	33.8	36.7	20.7	31.7	33.0
Part Time				27.8	27.9	30.0	24.0	28.0	26.2

Table 50: PMT Cross-Sectional Model – Standardized Coefficients

	Teen			Young Adult			Adult		
	1990	2001	2009	1990	2001	2009	1990	2001	2009
Individual Characteristics									
Age	-0.39 ***	0.01	-0.56 ***	-0.02	-0.02	0.03	-0.01 ***	-0.01 *	0.00
Female	-0.06	-0.32 ***	0.01	-0.02	0.01	0.11	0.03	-0.14 ***	0.07
NH White	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
NH Black	-0.02	-0.07	-0.17	-0.49 *	0.07	0.39 *	-0.20 *	0.02	0.21 **
NH Asian		0.39 *	-0.23		-0.02	0.17		-0.16	0.10
Hispanic	-0.11	-0.23	-0.16 *	-0.39	-0.26	0.27	-0.19 *	-0.17	0.23 ***
NH Other	-0.07	-0.34 *	-0.17	-0.37	-0.04	0.35	-0.37 *	0.05	-0.25
Employed	0.60 ***	0.29 ***	0.81 ***	0.97 ***	1.02 ***	1.19 ***	0.95 ***	0.94 ***	1.08 ***
Web Use Daily	*no data*	-0.12	0.11	*no data*	0.02	0.16	*no data*	0.01	0.21 ***
Driver	0.35 *	0.38 ***	0.48 ***	0.40 *	1.54 ***	1.20 ***	1.08 ***	1.21 ***	1.70 ***
Less than High School	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*	*omitted*
High School Graduate	-0.37	0.39	0.65 **	0.18	0.23	0.25	0.19 *	0.18	0.23
Some College	-0.31	0.57 **	0.59 **	0.15	0.43	0.32	0.53 ***	0.41 ***	0.33 **
College Graduate	-0.66 *	0.76 ***	0.71 ***	0.22	0.70 *	0.45	0.49 ***	0.49 ***	0.43 ***
Grad or Prof. Degree	-0.35	0.65 **	0.73 ***	0.50 *	0.71 *	0.51	0.61 ***	0.53 ***	0.43 ***
Young Adult Lives with Parents				-0.24	-0.03	-0.02			
Household Characteristics									
Household Income (ln)	0.08	-0.01	0.02	0.11	-0.04	-0.01	0.12 ***	0.16 ***	0.16 ***
Number of Adults	-0.09	0.31 ***	0.04	-0.01	0.04	-0.08	-0.11 **	-0.01	-0.02
Number of Children	-0.13 *	-0.11 ***	-0.07 *	-0.11 *	0.03	0.03	0.02	0.10 ***	0.12 ***
Autos Per Adult	0.59 ***	0.36 ***	0.10	0.47 ***	0.34 **	0.45 **	0.22 ***	0.21 ***	0.19 ***
Geographic Characteristics									
Population Density (ln)	0.04	-0.17 ***	-0.11 ***	-0.06	-0.05	-0.08	-0.09 ***	-0.09 ***	-0.05 **
MSA > 3 million	0.03	-0.39 ***	0.01	0.08	-0.23 *	0.16	0.08	0.08	-0.04
Constant	7.39 ***	0.61	9.69 ***	-0.01	0.32	-1.07	-0.76 *	-1.49 ***	-2.87 ***
Model N	1252	19383	31046	3185	7736	9174	13167	57061	105063
Adjusted R2	0.09	0.09	0.11	0.10	0.12	0.10	0.11	0.08	0.13