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UNDERSTANDING THE GROWTH IN NON-WORK VMT

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Research Report SWUTC/02/167802-1

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February 2002

ABSTRACT

If the anecdotal evidence is to be believed, Americans are driving more than ever - and not just for commute trips. Americans don't seem entirely happy about this trend, at least some of this increase in driving appears to be a matter of choice rather than necessity. Either way, the trend has important social, economic, and environmental implications. An understanding of the forces behind this trend might lead to policy responses that reduce how much households drive – or at least how much they have to drive. This report presents a preliminary effort to understand the apparent increase in non-work vehicle-miles-traveled (VMT) at the household level. The first step was to review available data on travel trends to confirm that non-work VMT is in fact increasing. While available data sources provide convincing evidence of this trend, they are far from conclusive. The second step was to explore factors associated with households themselves – the demand side – and with the choices available to households – the supply side. This exploration included an assessment of the trend in each factor and the development of hypotheses about its effect on non-work travel. The final step in this preliminary study was to summarize the findings from existing models of non-work travel behavior on what variables significantly impact non-work travel and in what direction. The report concludes with a discussion of what questions remain and what research approaches may prove fruitful in answering them.

EXECUTIVE SUMMARY

If the anecdotal evidence is to be believed, Americans are driving more than ever - and not just for commute trips. "Soccer moms" spend their days driving kids to school, from school, to soccer practice, to violin lessons, to play dates, to the fast food place, to home again, and so on. Used vehicles with 10,000 miles per year are considered relatively low-mileage. Traffic jams occur not just during the usual morning and evening commutes but at lunch hours and on weekends. Surveys regularly show congestion to be the number one concern of residents of metropolitan areas. Cars are getting bigger and more luxurious and provide more options than ever that enable drivers and passengers to use driving time for other activities – making phone calls, watching TV, checking email. Although Americans don't seem entirely happy about this trend, at least some of this increase in driving appears to be a matter of choice rather than necessity. Either way, the trend has important social, economic, and environmental implications. An understanding of the forces behind this trend might lead to policy responses that reduce how much households drive – or at least how much they have to drive.

This report summarizes a preliminary effort to understand the apparent increase in non-work vehicle-miles-traveled (VMT) at the household level. The first step was to review available data on travel trends to confirm that non-work VMT is in fact increasing. While available data sources provide convincing evidence of this trend, they are far from conclusive. The second step was to explore factors associated with households themselves – the demand side – and with the choices available to households – the supply side. This exploration included an assessment of the trend in each factor and the development of hypotheses about its effect on non-work travel. The final step in this preliminary study was to summarize the findings from existing models of non-work travel behavior on what variables significantly impact non-work travel and in what direction. Although these models do not directly provide an estimate of how a change over time in a particular factor leads to a change in non-work travel, they can be used to

infer this impact. Still, even the best models leave much of the variation in travel behavior unexplained.

VMT TRENDS

Available data support the pervasive belief that Americans are driving more than ever. Total miles of vehicle travel on roads in the U.S., as reported by the Federal Highway Administration (FHWA 1986; BTS 1996), has been increasing at an average rate of 4.9 percent per year since at least 1970. Over the same period of time, population has been growing at a rate of only 1.1 percent per year. Together these trends imply an increase in VMT per person of 2.8 percent per year, from 5,400 to 9,700 VMT per person per year - nearly a doubling of the total miles of vehicle travel for every person in the U.S. These statistics include household travel for work and non-work purposes as well as commercial travel, such as freight movement and deliveries, however.

Data from the Nationwide Personal Transportation Survey (NPTS) provide a means of examining trends in household travel by trip purpose. According to the NPTS data as analyzed by Hu and Young (1999), American households are making more trips and traveling more miles than they were 30 years ago. Daily VMT per household for all trip purposes increased 21.8 percent over the same period, from 34.0 to 41.4 vehicle miles per day. The trend in VMT reflects trends in both the number of vehicle trips per household and the average length of those vehicle trips. According to the NPTS data, vehicle trips per household increased from 3.83 per day in 1969 to 4.66 per day in 1990, an increase of almost 22 percent. The average length of a trip, however, increased only slightly, from 8.9 to 9.0 miles. Thus, the overall growth in VMT seems to be driven by an increase in the frequency of trips rather than the length of trips.

Further analysis of the NPTS data suggests that travel for both work and non-work trips is increasing. VMT for work trips increased by 37.2 percent from 1983 to 1990 and by 33.8 percent from 1990 to 1995, due to increases in both the average number of work trips per household and the average commute distance. But VMT for non-work purposes also increased, by 27.5 percent from 1983 to 1990 and by just under 1 percent

from 1990 to 1995. For non-work trips, however, the average trip length actually declined between 1983 and 1995. The growth in non-work VMT was thus due entirely to increases in the frequency of these trips. As of 1995, non-work travel accounted for over half of total VMT and two-thirds of total trips.

DEMAND-SIDE FACTORS

The apparent growth in non-work travel may be explained, in part, by demographic and social changes that influence household demand for activities and thus the choices that households make about travel. Some of the important demographic trends that may have increased non-work travel include rising incomes, declines in household size, changes in household composition, and the aging of the baby boom generation. Social trends, such as changes in employment, changes in the use of time, leisure preferences, household responsibilities, eating habits, and the use of on-line alternatives, may also have had an important impact on non-work travel. Important trends and their possible implications for travel include:

- **Income:** Incomes continue to rise, although the increases are not evenly distributed over time or income level. Increasing incomes are associated with greater participation in out-of-home activities and thus may increase non-work travel, both frequency of trips and travel distances.

- **Household Size and Composition:** Average household size has decreased significantly, and the share of single-person households has increased. These trends may lead to an increase in non-work travel.

- **Age:** The median age of the U.S. population has increased as the baby-boom generation ages. Because persons of retirement age tend to travel less, this trend should lead to a decrease in non-work travel. However, the elderly are traveling more on average over time.

- **Auto Ownership:** Auto ownership rates have continued to rise, and auto ownership is clearly associated with higher levels of vehicle-miles-traveled. But the increase has slowed considerably since the 1970s and ownership levels appear to be reaching a saturation point. Auto ownership is unlikely to drive future increases in non-work travel.

- **Employment:** Labor force participation has increased over time, particularly for women, although this trend has been slowing. Because employment is linked to income, this trend may lead to increased non-work travel. However, workers are more constrained in their ability to participate in non-work activities and thus travel less for non-work purposes.

- **Availability of Leisure Time:** Whether Americans have more or less leisure now than twenty or thirty years ago has become an issue of some contention, although surveys suggest that Americans perceive that their leisure time has become more constrained. This perception may lead both to decreases and increases in non-work travel, and the increase in non-work travel may be contributing to the perceived decline in leisure time.

- **Approach to Leisure:** According to several observers, Americans have an especially active approach to leisure, which likely contributes to more trips for recreational purposes.

- **Household Responsibilities:** Changes in the division of household responsibilities and the emergence of new responsibilities may be contributing to increases in non-work travel. Children may also be generating more trips than in the past through a national trend toward kids' greater involvement in organized activities.

- **Eating Habits:** Changes in time availability appear to be associated with changes in eating habits as well. Dining out and purchases of prepared food at supermarkets has increased and may be contributing to an increase in non-work trips.

- **Use of On-Line Alternatives:** Internet sales of consumer goods currently account for a small fraction of all consumer activity in the U.S. Still, the Internet is likely to play an increasingly significant role in daily life in the future, and the array of services offered over the Internet is large and growing. The Internet may reduce travel either directly by eliminating the need for trips or indirectly by changing lifestyles, but it also has the potential to generate new travel.

SUPPLY-SIDE FACTORS

Supply-side factors that may impact trends in non-work travel include those relating to the geographic distribution of activities and those relating to the transportation system that provides links to those activities. Trends in the former are perhaps less obvious than those in the latter. However, a few words about transportation factors are warranted. The two most important transportation factors in explaining VMT are probably travel times to potential destinations and the availability of different transportation modes. Increases in the time it takes to get to destinations would presumably reduce the average trip distance and perhaps the frequency of trips. Although it often feels like travel times are increasing, the evidence is mixed. Congestion is certainly going up: the 1999 Annual Mobility Report showed that average annual delay per driver for 68 metropolitan areas in the U.S. increased by 29 percent from 1992 to 1997 (Schrank and Lomax 1999). However, average travel speeds, at least for actual commute trips made, have apparently increased, according to the NPTS (Hu and Young 1999). The availability of modes other than driving could also impact VMT by reducing vehicle travel as a share of total travel. Although the transportation system is overwhelming geared towards the private car, the availability of alternative modes may now be on the rise, with recent investments in light rail and other rail systems and with

renewed attention to non-motorized modes. The “supply” of these modes is hard to measure, however.

A variety of trends in the distributions of retail businesses, personal and household services, and social and recreation activities may have important implications for non-work travel. Changes in the geography of the retail industry are better documented than changes for other types of businesses. Three retail trends are discussed here: highway orientation, concentration, and homogenization.

- **Highway Orientation:** The practice of concentrating major retail centers at freeway interchanges has made it easier for consumers to travel longer distances to do their shopping. One study showed that when consumers have easy access via the freeway system to multiple shopping centers, they often choose more distant centers and make more trips to all centers (Handy 1996), thereby adding to overall VMT for non-work purposes.

- **Concentration:** Another notable trend in the retail industry has been the shift towards increased concentration in terms both of the size of individual establishments and shopping centers and the breadth of goods and services provided within individual establishments or centers. "Big-box" stores offer the potential for fewer shopping trips, but the available evidence shows that shopping trips have increased over time.

- **Homogenization:** One of the most visible trends in retail geography has been the proliferation of national chains, resulting in a homogenization of retail options. By reducing the range of choices available to consumers, homogenization may lead to a reduction in both travel distances and trip frequency.

EVIDENCE FROM MODELS

Multivariate models of travel behavior provide a statistical assessment of the contribution of factors like those discussed above to variations in travel. However,

existing studies provide only limited evidence on the question of trends in non-work travel, for a variety of reasons. First, the vast majority of these studies have focused on commute travel rather than non-work travel. Second, these studies are almost always cross-sectional, modeling differences in travel choices as explained by differences in demand and supply variables for a sample of individuals or households at one point in time. Factors explaining trends in travel behavior can only be inferred from these models. In addition, generalizing across these studies is made difficult by differences in the choice of dependent variable and the choice and definition of the independent variables, however. Nevertheless, past studies of non-work travel behavior studies provide statistical evidence of the factors that may be contributing to growing levels of vehicle-miles-traveled (VMT). The most consistent findings from a sample of seven studies include: higher incomes mean more non-work trips; employment means fewer non-work trips; auto ownership means more non-work trips; higher travel costs mean fewer non-work trips. Factors such as age, children, and household size had mixed effects on non-work trips.

CONCLUSIONS

This review – of trends in non-work travel, trends in factors that might be linked to trends in non-work travel, and models of travel behavior that might reveal the significance of these factors – suggests that researchers mostly don't understand the growth in non-work VMT and maybe don't even understand the extent of that growth. Data limitations, particularly the reliance on cross-sectional data and the lack of lifestyle and attitudinal data, explain the gaps in understanding to some extent. The complexity of the relationships between potential explanatory factors and travel behavior - and between the factors themselves - also help to explain the gaps in understanding. The review has only touched the surface of the list of possible explanatory factors as well as the structure of these complex relationships.

Two directions seem especially promising for making further progress towards understanding the growth in non-work VMT. First, analysis of the Puget Sound

Transportation Panel Survey or other panel surveys that provide data on household travel for a fixed set of households over a period of time, could directly test the relative importance of socio-demographic factors in explaining trends in non-work travel. Second, a qualitative research approach might shed additional light on lifestyle and attitudinal factors that have contributed to increases in non-work VMT. The motivation for continued research on this topic has two dimensions: growth in non-work VMT generates significant social, economic, and environmental costs; and understanding this growth provides a basis for developing appropriate policy responses.

This is not to say that all growth in non-work VMT is bad. To the degree that this growth reflects the desires of U.S. households and increases their welfare as consumers, it is arguably good. But there's a significant possibility that U.S. households are driving more for reasons not entirely of their own choosing. In this case, policies that reduce the need for households to drive benefit both households and society at large. Planners may have an opportunity to intervene on the supply-side of the equation to ensure that households have the choice not to drive so much.

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CHAPTER 1. INTRODUCTION

If the anecdotal evidence is to be believed, Americans are driving more than ever - and not just for commute trips. "Soccer moms" spend their days driving kids to school, from school, to soccer practice, to violin lessons, to play dates, to the fast food place, to home again, and so on. Used vehicles with 10,000 miles per year are considered relatively low-mileage. Traffic jams occur not just during the usual morning and evening commutes but at lunch hours and on weekends. Surveys regularly show congestion to be the number one concern of residents of metropolitan areas. Cars are getting bigger and more luxurious and provide more options than ever that enable drivers and passengers to use driving time for other activities – making phone calls, watching TV, checking email. Although Americans don't seem entirely happy about this trend, at least some of this increase in driving appears to be a matter of choice rather than necessity. Either way, the trend has important social, economic, and environmental implications. An understanding of the forces behind this trend might lead to policy responses that reduce how much households drive – or at least how much they have to drive.

This report summarizes a preliminary effort to understand the apparent increase in non-work vehicle-miles-traveled (VMT) at the household level. The first step was to review available data on travel trends to confirm that non-work VMT is in fact increasing. While available data sources provide convincing evidence of this trend, they are far from conclusive. The second step was to explore factors associated with households themselves – the demand side – and with the choices available to households – the supply side. This exploration included an assessment of the trend in each factor and the development of hypotheses about its effect on non-work travel. The final step in this preliminary study was to summarize the findings from existing models of non-work travel behavior on what variables significantly impact non-work travel and in what direction. Although these models do not directly provide an estimate of how a change over time in a particular factor leads to a change in non-work travel, they can be used to infer this impact. Still, even the best models leave much of the variation in travel

behavior unexplained. The report concludes with a discussion of what questions remain and what research approaches may prove fruitful in answering them.

CHAPTER 2. VMT TRENDS

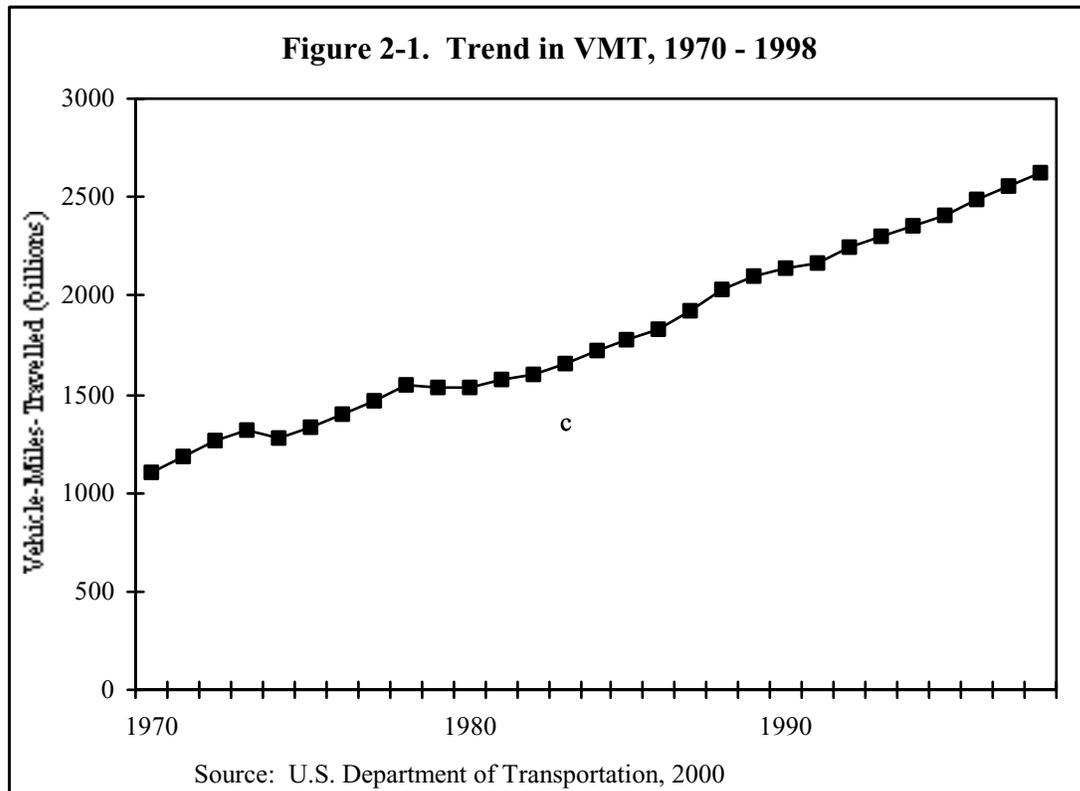
Available data support the pervasive belief that Americans are driving more than ever. Total miles of vehicle travel on roads in the U.S., as reported by the Federal Highway Administration (FHWA 1986; BTS 1996), has been increasing at an average rate of 4.9 percent per year since at least 1970 (Figure 2-1). Over the same period of time, population has been growing at a rate of only 1.1 percent per year. Together these trends imply an increase in VMT per person of 2.8 percent per year, from 5,400 to 9,700 VMT per person per year - nearly a doubling of the total miles of vehicle travel for every person in the U.S. (Figure 2-2). These statistics include household travel for work and non-work purposes as well as commercial travel, such as freight movement and deliveries, however.

Data from the Nationwide Personal Transportation Survey (NPTS) provide a means of examining trends in household travel by trip purpose. The U.S. Department of Transportation conducts the NPTS every five to seven years to gather information about the travel of U.S. households. Data are collected for daily trips of the civilian, non-institutionalized population aged 5 and older and for socio-economic characteristics at the individual and household levels. Survey results from 1969, 1977, 1983, 1990 and 1995 provide a useful resource for examining travel trends in the U.S.¹

According to the NPTS data as analyzed by Hu and Young (1999), American households are making more trips and traveling more miles than they were 30 years ago. Daily VMT per household for all trip purposes increased 21.8 percent over the same period, from 34.0 to 41.4 vehicle miles per day. The trend in VMT reflects trends in both the number of vehicle trips per household and the average length of those vehicle trips.

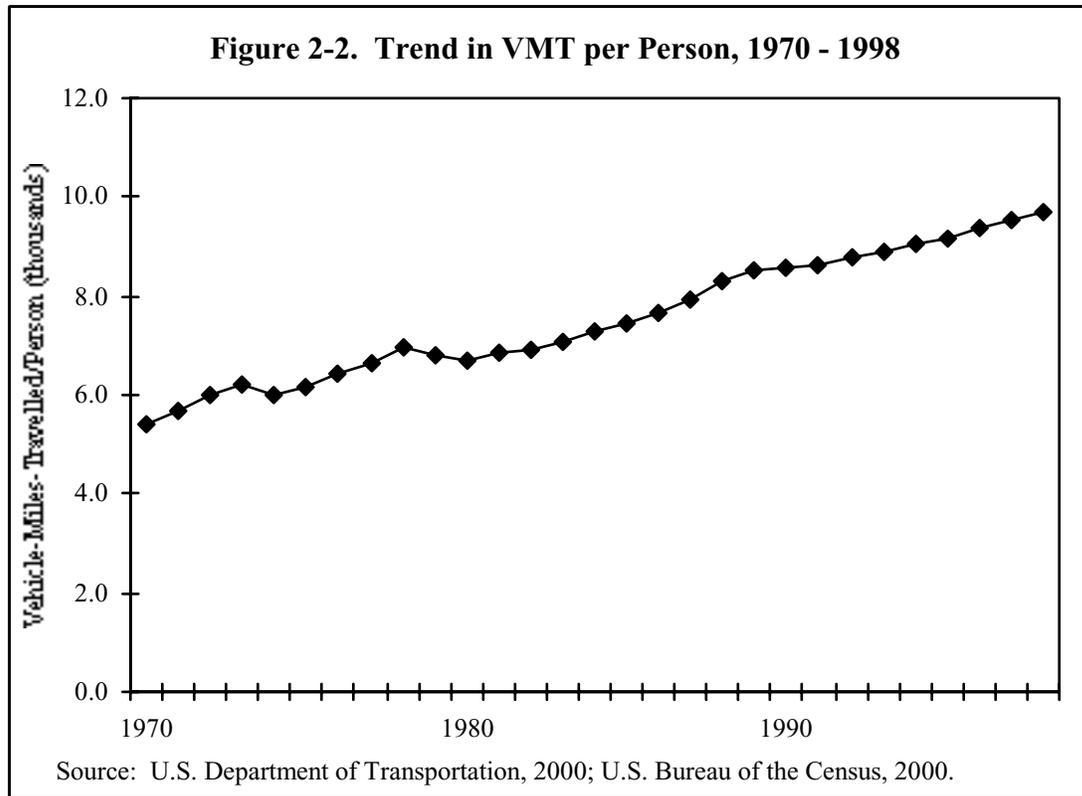
¹The NPTS made changes in their survey in 1995 that impact the reporting of trips. For this reason, the 1995 survey cannot be directly compared to the data from previous years. In Table 1, the 1990 data have been adjusted to reflect those changes made in 1995 and can be compared to the 1995 data. Throughout this document when comparisons are made with 1995 data, the adjustments to 1990 will be noted. In all other cases, the data are unadjusted or adjustments are not necessary for direct comparison. See the Appendix 1 in Hu and Young (1999) or the NPTS data documentation for a complete explanation of the changes to the 1995 data and adjustments made to 1990 for comparison.

According to the NPTS data, vehicle trips per household increased from 3.83 per day in 1969 to 4.66 per day in 1990, an increase of almost 22 percent. The average length of a trip, however, increased only slightly, from 8.9 to 9.0 miles. Thus, the overall growth in VMT seems to be driven by an increase in the frequency of trips rather than the length of trips.



Further analysis of the NPTS data suggests that travel for both work and non-work trips is increasing (Table 2-1). VMT for work trips increased by 37.2 percent from 1983 to 1990 and by 33.8 percent from 1990 to 1995, due to increases in both the average number of work trips per household and the average commute distance. But VMT for non-work purposes also increased, by 27.5 percent from 1983 to 1990 and by just under 1 percent from 1990 to 1995. For non-work trips, however, the average trip length actually declined between 1983 and 1995. The growth in non-work VMT was thus due entirely to

increases in the frequency of these trips. As of 1995, non-work travel accounted for over half of total VMT and two-thirds of total trips.



The trends for different types of non-work trips, however, reveal some interesting and potentially important differences (Table 2-1). VMT for shopping² increased during both periods, as did the number of vehicle trips for shopping. But average trip length appeared to decrease between 1983 and 1990 while it grew by 10.6 percent between 1990 and 1995, to 5.6 miles. VMT for other family and personal business (labeled “Other HH” in Table 1 and defined as the purchase of services³) increased a dramatic 66 percent between 1983 and 1990 but by only 1.3 percent between 1990 and 1995. Average trip

² Shopping is a subcategory of Family and Personal Business and includes “window shopping” and the purchase commodities such as groceries, furniture, clothing, etc.

³ Other Family and Personal Business includes trips for purchase of services such as cleaning garments, servicing an automobile, haircuts, legal services, etc.

length increased between 1983 and 1990 but declined between 1990 and 1995, to 6.9 miles. VMT for social/recreation trips increased between 1983 and 1990 but declined between 1990 and 1995, due to decreases in both the frequency and the average length of these trips. Even so, social/recreation trips accounted for 40 percent of non-work VMT and were twice the length of shopping trips on average.

Table 2-1. Household Travel by Trip Purpose, 1983, 1990, and 1995

Trip Purpose		1983	1990	Percent Change 1983-90	Adjusted 1990	1995	Percent Change 1990-95
Average Annual VMT per HH	All Purposes	11,739	15,100	28.6%	18,161	20,895	15.1%
	Work	3,538	4,853	37.2%	4,853	6,492	33.8%
	Non-Work:	6,917	8,817	27.5%	11,787	11,878	0.8%
	Shopping	1,567	1,743	11.2%	2,178	2,807	28.9%
	Other HH	1,816	3,014	66.0%	4,250	4,307	1.3%
	Social/Rec.	3,534	4,060	14.9%	5,359	4,764	-11.1%
Average Annual Veh. Trips per HH	All Purposes	1,483	1,702	14.8%	2,077	2,321	11.7%
	Work	414	448	8.2%	448	553	23.4%
	Non-Work:	904	1,105	22.2%	1,470	1,554	5.7%
	Shopping	297	345	16.2%	431	501	16.2%
	Other HH	272	411	51.1%	579	626	8.1%
	Social/Rec.	335	349	4.2%	460	427	-7.2%
Average Trip Length	All Purposes	7.9	9.0	13.7%	8.9	9.1	2.4%
	Work	8.6	11.0	28.3%	11.0	11.8	7.6%
	Non-Work:	7.7	8.0	4.3%	8.0	7.6	-4.7%
	Shopping	5.3	5.1	-3.4%	5.1	5.6	10.6%
	Other HH	6.7	7.4	11.2%	7.4	6.9	-6.7%
	Social/Rec.	10.6	11.8	11.8%	11.8	11.2	-4.7%

Source: Hu and Young (1999).

For the most part, increases in vehicle travel have outpaced increases in person travel, thanks to growth in the share of trips made by car and declines in the average occupancy of vehicles. In 1990, 87.1 percent of trips were made by personal motor vehicle, while by 1995 the share had increased to 89.3 percent (Pickrell and Schimek 1998). Vehicle occupancy rates have declined steadily for all trip purposes (Table 2-2). Non-work travel tends to have higher vehicle occupancy rates than work travel but the rate for shopping and social/recreational trips is declining more rapidly.

Table 2-2. Vehicle Occupancy by Trip Purpose, 1977 - 1995

	1977	1983	1990	1995	Percent Change 1977 - 1995
All Purposes	1.9	1.8	1.6	1.6	-16.3%
Work	1.3	1.3	1.1	1.1	-12.3%
Shopping	2.1	1.8	1.7	1.7	-17.1%
Other Family or Personal Business	2.0	1.8	1.8	1.8	-11.0%
Social/Recreational	2.4	2.1	2.1	2.0	-15.0%

Source: Hu and Young, 1999.

Unfortunately, the evidence on VMT trends is not entirely conclusive. Changes in the techniques used to implement the NPTS reduce the validity of comparisons between the results for different years. This problem seems to have been addressed for the 1990 and 1995 surveys, but that leaves only two data points on which to analyze trends, at least for now. Some of the extreme fluctuations between the 1983 to 1990 and 1990 to 1995 trends described above may result from changes in survey techniques. Lave (1996) has questioned the rate of VMT growth reported from the NPTS and has criticized the NPTS process for switching from in-person to telephone interviews, over-sampling higher income population, and using self-reported travel data. He found a VMT growth rate half of that reported from NPTS when using other data sources based on odometer readings. Nonetheless, Lave still reports overall growth in VMT.

However, analysis by Pickerell and Schmick (1998) showed a decline in the VMT per driver from 1990 to 1995, the first time in the history of the NPTS. The authors explored the possible factors that influenced the overall growth in VMT while at the same time contributing to the decline per driver. VMT was dissected as the average number of annual miles driven per licensed driver multiplied by the number of licensed drivers. Although VMT per licensed driver decreased 4.5 percent over the period 1990 to 1995, the number of licensed drivers increased 8.4 percent. They further dissected VMT per

driver into VMT per vehicle and the number vehicles per driver. Both declined from 1990 to 1995, at 2.0 percent and 1.7 percent, respectively. They concluded that the increase in total driving can be attributed entirely to the increase in the number of drivers and thus the number of people of driving age.

CHAPTER 3. DEMAND-SIDE TRENDS

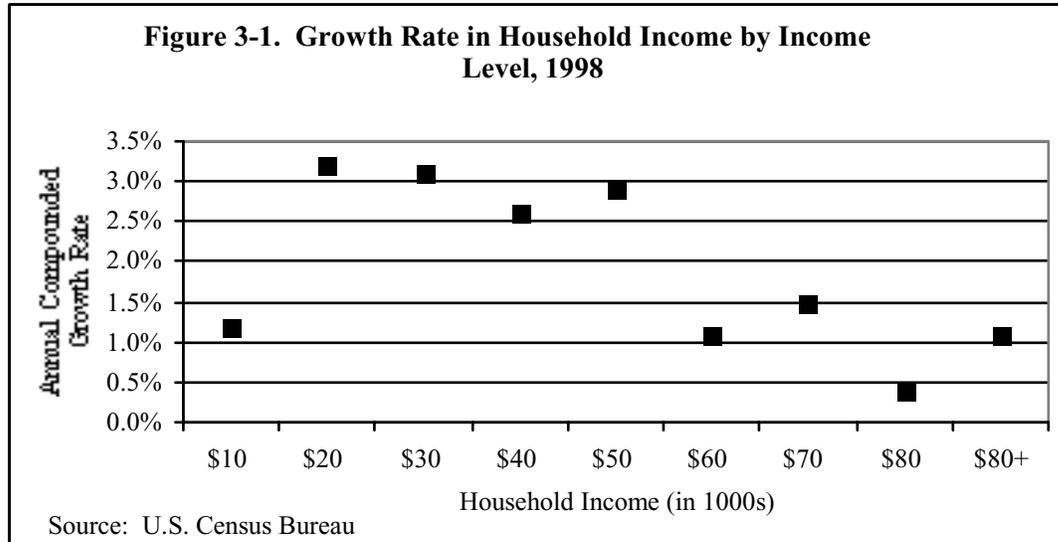
The apparent growth in non-work travel may be explained, in part, by demographic and social changes that influence household demand for activities and thus the choices that households make about travel. Some of the important demographic trends that may have increased non-work travel include rising incomes, declines in household size, changes in household composition, and the aging of the baby boom generation. Social trends, such as changes in employment, changes in the use of time, leisure preferences, household responsibilities, eating habits, and the use of on-line alternatives, may also have had an important impact on non-work travel. This section provides evidence on the trends in each of these interrelated factors and discusses the probable implications for non-work travel.

INCOME

Between 1969 and 1996, per capita income in the U.S. rose 51 percent counting only cash income (from \$11,975 to \$18,136), and rose by 62 with non-cash benefits included (McNeil 1998). Higher incomes generally give households more opportunity to participate in non-work activities outside of the home, from shopping to attending concerts to eating in restaurants. In fact, estimates of average consumption per person have risen even more than income over the past two decades, as Americans spend more and save less of their income. According to one estimate, per capita disposable income grew by 62 percent between 1969 and 1996 while per capita personal consumption grew by 67 percent (McNeil 1998).

However, the overall increase in income has not been evenly spread across time or across income levels (Figure 3-1). For example, the peak achieved in median income in 1989 was not regained until 1998 because of a long dip initiated by the 1990-91 recession. The widening gap between the median and mean incomes is an indication of the much greater gains made by those with high incomes than those at the low end of the spectrum. Median household income rose by 12 percent from \$34,706 in 1969 (in 1998

dollars) to \$38,885 in 1998, while average household income rose 31.3 percent (US Bureau of the Census 1999b).



The connection between income and travel has been documented both at the aggregate level and at the household level. Festin (1996) found a strong positive relationship between the Gross Domestic Product (GDP) and amount of travel per capita in the US from 1970 to 1995. Zmud and Arce (1999) discuss the correlation between the rise in non-work travel and the rise in consumer culture, defined as the increase in consumer spending. They argue that two trends closely track each other – the increasing demand for consumer goods and the growing demand for travel for consumer purposes. These increases are not solely attributable to the rising incomes of the more affluent, they argue. Citing evidence from the Consumer Expenditure Survey, they show that consumer spending has increased at the highest rate among the lowest income groups. As a result, travel may be increasing faster than incomes. The effect of increases in income may be to increase both trip frequency and trip distances, by loosening financial constraints on travel.

HOUSEHOLD SIZE AND COMPOSITION

The difference between changes in per capita income and household income is largely due to changes in household structure. Average household size has decreased dramatically over the past several decades, from 3.10 persons per household in 1970 (US Bureau of the Census 1973) to 2.74 in 1980, (US Bureau of the Census 1983a), to an estimated 2.61 in 1998 (US Bureau of the Census 1999c). Single person households have also increased, from 17 percent of all households in 1969 (McNeil 1989) to 22.6 percent in 1980 (Bureau of the Census 1983a) and 25.4 percent in 1997 (US Department of Housing and Urban Development and Bureau of the Census 1999). Likewise, a much smaller percentage of households are composed of married couples with kids—26 percent in 1996 versus 41 percent in 1969. Eleven percent of householders in 1996 had children but no spouse present, versus 6 percent in 1969 (McNeil 1989).

These trends toward smaller household sizes may have contributed to an increase in non-work travel in two ways. First, adults who live alone may be more likely to make trips simply for the sake of social contact, whether the trip is ostensibly for a social purpose or not. Adults who live with other adults may be somewhat less likely to make trips for social reasons. Second, multi-person households have opportunities to consolidate trips for shopping and other household maintenance activities, while similar consolidation is unlikely or impossible for single person households. However, data on the number of non-work person trips made by women living in different types of households shows little difference between households with a single adult and those with two or more adults (Table 3-1).

Table 3-1. Daily Non-Work Person Trips by Women by Life Cycle Stage

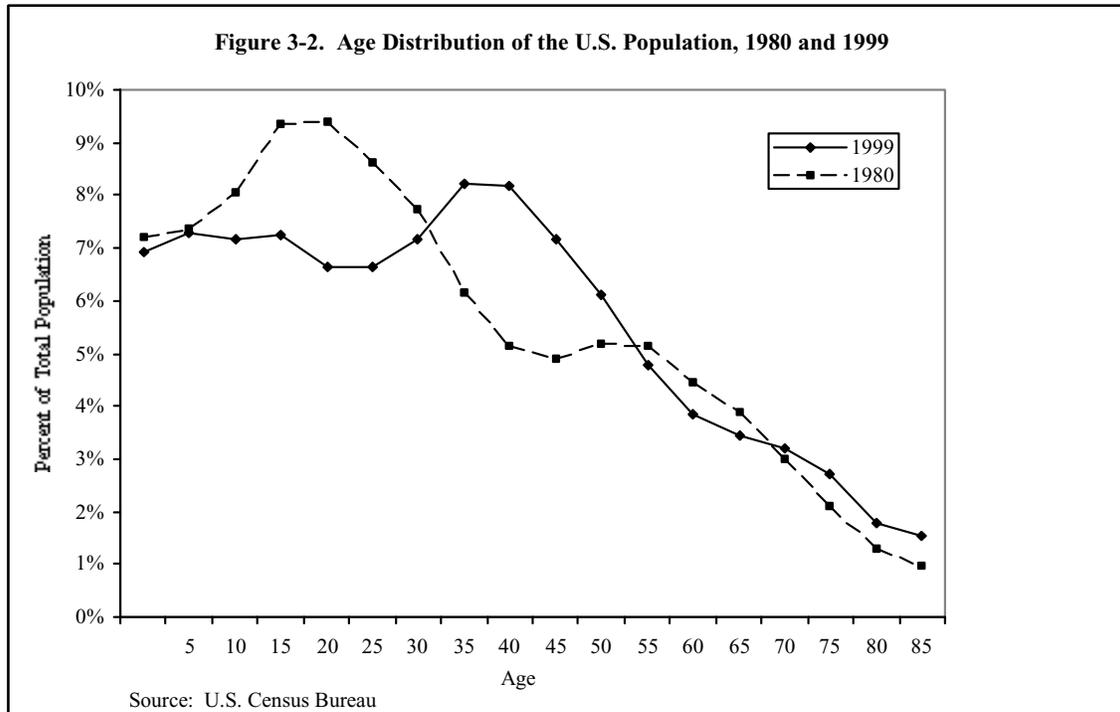
	1983	1990	1990*	1995
All	2.4	2.7	3.4	3.7
No children				
Single	2.0	2.5	3.3	3.1
2+ adults	2.1	2.4	3.2	3.1
Child <6				
Single	2.4	3.1	4.0	4.2
2+ adults	3.0	3.0	3.9	4.2
Child 6-15				
Single	3.2	3.6	4.6	4.7
2+ adults	3.1	3.3	4.3	4.6
Child 16-21				
Single	1.8	2.7	3.5	3.5
2+ adults	2.0	2.6	3.3	3.6
Retired				
Single	1.5	1.8	2.3	3.0
2+ adults	1.7	2.0	2.5	3.2

* 1990 data adjusted for comparison to 1995

Source: Hu and Young, 1999.

AGE

As the baby-boom generation has aged, so has the overall age distribution of the U.S. population. The median age in 1980 was 30.0 years (Bureau of the Census 1983b), but by the end of 1999 it was 35.6 years (Bureau of the Census 1999a), reflecting the baby boomers' progression into the 35 to 55 year age bracket. This progression is quite obvious in a comparison of the age distribution of the population in 1980 to 1999 (Figure 3-2). Also noticeable in the 1999 age distribution is the more muted bulge of the "echo boom," from about 5 to 20 years old—the children of the baby boom generation.



This age distribution has several possible implications for non-work travel. Data from the Nationwide Personal Transportation Survey show that people between 30 and 49 years old generally make more vehicle trips per day and travel farther per day than people of any other age, regardless of income (Spain 1999b).⁴ Furthermore, as shown by the bulge of the "echo boom," this age group is most likely to have children who are involved in many activities but can not drive themselves, as discussed below, at the same time that the parents are in the height of their careers and perhaps most likely to be involved in other activities. The movement of the baby boom generation into these middle years has probably augmented other trends contributing to rising non-work travel.

As the baby boom continues to age into retirement years, their contribution to the growth in non-work travel will likely decline given that trip rates and travel distances in general decline at this age. However, several effects may mute this decline. The children of baby-boomers will then enter their high travel years, partially replacing their parents'

⁴ The exception is men between 50 and 64, who make more vehicle trips per day than men 30 to 39.

high rates of travel. In addition, baby boomers may not decrease their travel as much or as soon as previous generations. One researcher has noted that women in the baby boom are much more likely to have driver's licenses than their mothers, and they are therefore more likely to follow their fathers' driving patterns than their mothers'. This will likely lead to higher travel rates among future retirees than is currently observed (Spain 1997).

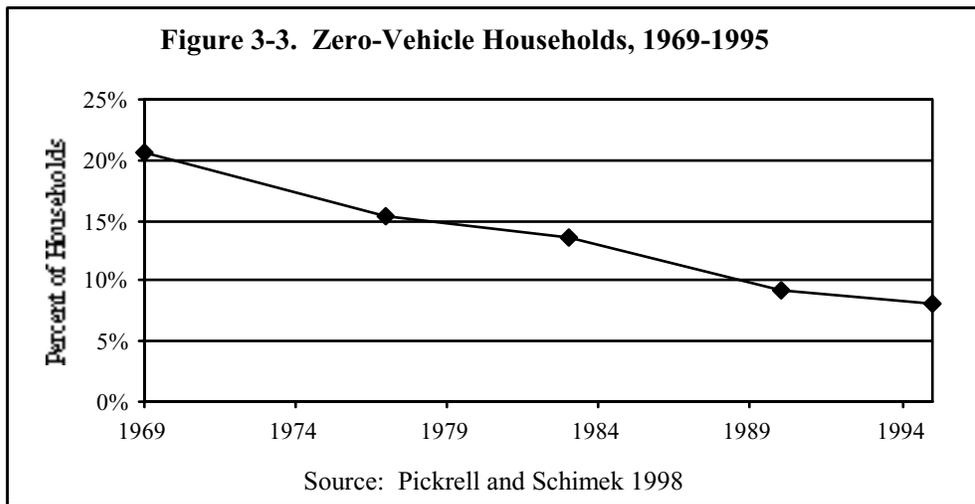
Hu and Young (1999) show that the number of non-work trips by the elderly is on the rise, increasing from 1.5 daily trips per driver in 1983 to 1.7 in 1990. However, between 1990 and 1995, non-work trips by persons 65 and older declined as a percentage of total travel, perhaps because more of the elderly are still working than in the past. Trips of all purposes made by elderly drivers increased during this period from 2.3 daily trips per driver in 1990 (adjusted) to 2.9 in 1995. The increase in daily person trips made by retired women was especially dramatic (Table 3-1). The longer life-expectancy of women combined with increases in the share of retired women with drivers licenses may be contributing to this trend. Women in all stages of life, however, were making significantly more person trips per day in 1995 than in 1983.

AUTO OWNERSHIP

Auto ownership rates have continued to rise, but the increase has slowed considerably since the 1970s. The NPTS data from 1969 through 1995 shows that the number of vehicles has increased faster than any other demographic indicator, at an annual rate of almost 1.5 times the growth in the total population. The numbers of vehicles per licensed driver, vehicles per worker, and vehicles per household all increased over this time, despite the decline in average household size. In 1969, roughly half of American households owned one car and approximately 30 percent owned two or more vehicles. By 1995, the percentage of households with two or more vehicles increased to nearly 60 percent while the number of one-vehicle households declined to roughly 32 percent.

However, the growth in vehicle ownership appears to be reaching a saturation point, where the number of vehicles per household (1.78 in 1995) just about matches the

number of licensed drivers per household (2.01 in 1995); the ratio of vehicles per household member 16 or older was stable between 1990 and 1995 at 0.89. Trends in other measures of auto ownership also indicate a slowing of growth (Pickrell and Schimek 1998; Figure 3-3). Thus, while increases in vehicle ownership may have contributed to increases in vehicle travel before 1990, their role in more recent travel increases is probably limited. As auto ownership rates stabilize at nearly one vehicle per licensed driver, they are unlikely to contribute to future increases in vehicle travel.



EMPLOYMENT

The entrance of many more women into the workforce over the past three decades has been the most noticeable trend in employment. The higher rate of employment among adults has contributed to the rise in household income and thus may have contributed to an associated rise in non-work travel. On the other hand, the increased level of employment may have cut into the time available for non-work activities in many households. This time crunch may have had several effects on travel behavior. Some non-work trips have probably shifted to morning, noon (lunch), and evening periods or weekends. Trip chaining may combine multiple activities into one tour, resulting in more efficient trip-making. Another possibility is that new trips are generated through the use

of time-saving services, such as laundry services,⁵ or participation in new activities, such as day-care.

In addition to the movement of women into the labor force, the nature of employment has changed for many workers. Larger numbers of workers are now employed in “non-traditional” arrangements, such as contracting, part-time, or contingent arrangements (US Bureau of Labor Statistics 1999b), although little is known about exact trends. “Contingent” workers made up an estimated 1.9 to 4.3 percent of the total workforce in 1999. The broadest definition (4.3 percent) includes all workers who did not expect their current jobs to last (US Bureau of Labor Statistics 1999b). In that year, 81.9 percent of workers worked full time, while 18.1 percent worked part-time. Full-time workers were slightly more likely than part-time workers to have traditional working arrangements: 91.8 percent of full-time workers had traditional arrangements versus 85.2 percent of part-time workers (US Bureau of Labor Statistics 1999b). The impact of these arrangements on travel is not clear. Some non-traditional arrangements may simply shift the timing of work and non-work trips. Telecommuters or independent contractors who work from home may feel a need to get out of the house, inspiring additional non-work trips. The available evidence on the travel impact of telecommuting shows that non-work travel may actually decrease slightly on average for the telecommuter and for the telecommuter’s household (Mokhtarian, et al. 1995).

AVAILABILITY OF LEISURE TIME

Whether Americans have more or less leisure now than twenty or thirty years ago has become an issue of some contention. Schor (1991) used Department of Labor statistics to argue that Americans have significantly less leisure time now than in previous decades because of many more hours spent working. Robinson and Godbey (1997), on the other hand, conducted time-use diaries in 1965, 1975, and 1985 as part of

⁵ However, according to the International Fabricare Institute, dry cleaning is on the decline because of casual dress styles and increasing use of fabrics which do not require drycleaning (Fisher 2000). Thus, "other personal business" trips have not increased because of more trips to the drycleaners!

their Americans' Use of Time study. Their data showed that Americans had more free time in 1985 than either 1965 or 1975. More recently, a study published in 1998 by the Federal Reserve Bank of Minneapolis showed that work hours per person have remained essentially stable since 1950 (Kacapyr 1998).

Whether Americans have more free time or not, the 1990s were marked by a societal sense of time shortage. In 1996, 40 percent of Americans complained about a shortage of time rather than a shortage of money. Robinson and Godbey (1997) suggest several reasons for Americans' sense of rush. They note that much of the increase in free time has come in small, disjointed chunks. They also note what they call "time deepening," people's increasing attempts to do multiple things at once as a way of increasing the productivity of time, whether for work or leisure. Driving to pick up the kids while making business calls on a cell phone would be an example of this "time deepening." They cite a theory from economist Staffan Linder's 1970 book, *The Harried Leisure Class*, that increasing productivity of work time has made people feel the need to increase the productivity of their leisure time, making people feel busy even during their "leisure time." Finally, increasing activity on Sundays may have reduced people's sense of free time. In 1961, all fifty states had "blue laws," which limited or prohibited retail activities on Sundays, but only thirteen still had blue laws in 1996 (Lagerfeld 1998).

Another reason for the sense of time scarcity may be an unequal distribution of leisure time. Some people, like retirees, have gained leisure time (through earlier retirements) while others, particularly those with children, are working longer hours (Lagerfeld 1998). The increase in women's participation in the workforce has placed greater time constraints on families with single working parents or dual wage earners. In 1970, 87 percent of families included married couples, and only 16 percent of married women worked full time, but in recent years only two-thirds of families are headed by married couples, and 38 percent of married women work full time. The resulting decline in women's at-home time may have led to a decline in entire families' free time (Spain 1999a).

The sense of time scarcity may have had conflicting effects on travel. Tighter schedules might theoretically lead to fewer, more efficient trips for purposes such as grocery shopping. Tighter schedules might, on the other hand, have resulted in more trips, if trips are seen as necessary to save time in other ways. For example, people might stop at a supermarket for a prepared meal or pick up some take-out food to avoid spending time on preparing a meal at home. A time crunch may necessitate other trips, such as to day care facilities or other child supervision activities. Finally, the sense of time crunch may be the result of participation in more activities, from shopping to kids' sports to cultural events, and the travel necessary to participate in these activities.

APPROACH TO LEISURE

According to several observers, Americans have an especially active approach to leisure, which likely contributes to more trips for recreational purposes. A writer in *The Economist* pointed to the "productivity" of American leisure; according to a market researcher with the Leisure Trends Group, Americans in the 1990's have begun "...to manage their close-to-home leisure time 'very much the way a businessman would manage a business.'" (The Economist 1997) In an article entitled "Play's new identity: big business," another researcher observes that Americans are using increasing amounts of "purchased goods and services for our fun" (Kraus 1995). He notes the rapid growth of a number of recreational businesses, including kids' play centers like Gymboree, arcades, gymnastics studios, and martial arts studios, as well as the entertainment elements being added to malls, stores, restaurants, and bars. Casinos and racetracks are adding children's activities to shape themselves as family entertainment centers (Kraus 1995). The U.S. Fish and Wildlife Service found in a survey of anglers that the same number of anglers were fishing in 1995 as in 1990, but in 1995 they spent twice as much time fishing and five times as much money on fishing equipment, suggesting that perhaps anglers were making more trips both to fish and to buy equipment (Kraus 1995). These additional activities are likely contributing to non-work trips, although Americans' leading use of free time continues to be, by far, watching TV. The American approach to

leisure might also lead to longer trip distances. The National Travel Survey conducted by the US Travel Data Center showed an increase in long distance weekend trips of 34 percent from 1984 to 1989 (Rutherford et al. undated).

HOUSEHOLD RESPONSIBILITIES

Changes in the division of household responsibilities and the emergence of new responsibilities may also be contributing to increases in non-work travel. From the NPTS data, it is clear that women are traveling more frequently over time (Hu and Young 1999). The number of trips generated per day increased for all women regardless of household composition. While increases in employment levels for women explain some of this increase, as noted above, household responsibilities clearly contributed as well. Single mothers with school age children generated the most trips per day for each point in time (Table 3-1). Women continue to make more non-work trips than men for family and personal business: more than half of women's travel is for family and personal business compared to around 40 percent for men.

Children may also be generating more trips than in the past through a national trend toward kids' greater involvement in organized activities. For children aged 12 or under, organized time per day increased by 3.5 hours between 1981 and 1997, reducing "free" time from 9.5 hours per day to 6 hours. Children spent 50 percent more time in organized sports in 1997 than in 1981 (Fishman 1999). Reaching these organized activities requires trips which might not have occurred in earlier years when children played at home or at neighbors' houses. Furthermore, as more children participate in organized activities away from home, fewer opportunities are available for children to play with friends in their neighborhood, creating a cycle which forces additional children into organized activities in order for them to have supervision (Lagerfield 1998).

EATING HABITS

Changes in time availability appear to be associated with changes in eating habits as well. According to the Food Marketing Institute (1999a), "Consumers continue to

move a larger portion of their meal dollars to prepared foods, and the trend is especially strong among younger consumers, a significant portion of whom eat their main meal of the day outside the home three or more times a week.” Supermarkets over the past decade have increasingly sold prepared foods to these busy consumers, as discussed in the next section. This habit might increase the frequency of trips to supermarkets, if consumers shop for prepared foods on a daily basis. Supermarkets and restaurants are in a battle for people’s meals and food money as people increasingly eat meals away from home.

According to the National Restaurant Association (NRA) consumer spending on food away from home as a percentage of total food spending has increased steadily over the past several decades. Their figures show consumers spending 33.6 percent of their food budget on food away from home in 1972, rising to 36 percent in 1980, 42.5 percent in 1990, and 44.3 percent in 1996 (Ebbin 1999). Spending on restaurant meals has increased (in 1999 dollars) from \$42.8 billion in 1970 to \$354 billion in 1999, an eight-fold increase (Panitz 1999). Perhaps predictably, the association expects restaurant sales to continue to account for growing shares of consumers’ food budgets; they expect an increase to 53 percent by 2010 (Mills 1999). According to the U.S. Bureau of Labor Statistics (2000), consumers spent 42 percent of their food dollars on food away from home in 1998.

Other evidence also suggests that people are increasingly “eating out.” For example, the NRA also notes that the number of restaurants in the U.S. has grown from 492,000 to 815,000 between 1972 and 1996, a 66 percent increase (Panitz 1999). The U.S. population grew by 21 percent over that same period (US Bureau of the Census 1999d), so that there is now about one restaurant for every 325 residents, up from one restaurant for every 425 people in 1972. Similarly, the association estimates that in 1997 46 percent of all adults bought something at a restaurant on an average day (Panitz 1999). Another survey showed that roughly 80 percent of consumers ate at least one lunch away from home in 1996, and a similar proportion ate at least one dinner away from home, both up from roughly 70 percent in 1990. Likewise, about 40 percent ate at

least one breakfast out per week in '96, versus less than 30 percent in 1990 (Mogelonsky 1998).

Echoing a prominent theme from the grocery industry, the National Restaurant Association cites “today’s hectic world” as a reason why “dining out is gaining in popularity.” (Panitz 1999); eating out is a short-cut which allows people not only to avoid home chores but also to socialize and be entertained. The National Restaurant Association estimates that sales volume at “limited-service restaurants” (e.g. fast food) has increased from less than half the volume at full service restaurants in 1970 to nearly equal volume in 1998 (Panitz 1999). These figures perhaps track the increase in the use of restaurants as replacements for home meals. The association also estimates that most of the growth in restaurant sales in the 1990s has come from increases in take-out sales (Mills 1998), also suggesting the replacement of home-made meals with ordering out. Both of these trends - eating in restaurants and ordering take-out - are likely to increase travel. On the other hand, the association reports that 56 percent of surveyed consumers said in 1998 that they were entertaining at home less often than two years before, perhaps indicating that some social activity has shifted to locations away from home like restaurants. Such a shift would result in a change in the destination of trips but not a significant increase in the number of trips.

Eating out at lunch time may actually be on the decline, however. The National Restaurant Association reports that a growing number of full-time workers spend their lunch hour working or doing errands rather than eating. Half of these people estimated that they were spending less time eating lunch in 1997 than they did before, with 27.3 percent spending their lunch break doing something else. In 1996, 24.4 percent had reported devoting their lunch break to activities other than eating (Smith 1999). “People are under the impression that we have less time—and so many things to do in that time—that lunch takes backstage,’ agrees Ann Clurman, a partner with the marketing-and-social-research firm Yankelovich in New York City.” The association estimates that 75 percent of full-time workers eat at least one meal per week that was not made at home.

But workers who don't eat out may be traveling even greater distances on their lunch hours to complete their errands.

USE OF ON-LINE ALTERNATIVES

Despite the dominance of Internet-related news in the media these days, Internet sales of consumer goods currently account for a small fraction of all consumer activity in the U.S. Still, the Internet is likely to play an increasingly significant role in daily life in the future. The array of services offered over the Internet is large and growing, from on-line banking, to shopping for almost any consumer item, to getting medical advice, to ordering a pizza. However, according to an estimate by Forrester Research, Inc., only 8.7 million households, or less than 10 percent of the households in the U.S., shopped on-line in 1998 (McQuivey et al 1998, US Bureau of the Census 1999c). The company estimated fourth quarter 1999 sales to be \$9 billion, including travel and ticket purchases (\$5.5 billion without), while the Department of Commerce estimated \$5.3 billion in sales, excluding travel and tickets, less than 1 percent of total retail sales (Tessler 2000). Even after enthusiastically projecting that this number will increase to 40 million by 2003, or almost 40 percent of total U.S. households based on Census projections (Bureau of the Census 1996), Forrester Research projected that total Internet sales in that year will still account for only 6 percent of total retail sales (McQuivey et al. 1998).

The use of on-line services most likely substitutes for at least some travel for at least some users. Studies by Gould and Golob (1998) and Handy and Yantis (1997) explored the question of whether shopping at home substitutes for traveling to the store. Although direct evidence addressing this question is limited, both studies concluded that the answers are not simple or straight forward and will vary by individual and household characteristics as well as by attitudes and preferences. For example, on-line shoppers may use the time saved by not having to travel to the store to make other trips outside the home. The continued growth in non-work VMT seems to support this possibility. In addition, on-line shopping may replace catalog shopping rather than store shopping. A

Merrill Lynch report predicted that 40 percent of Internet sales in the next several years will come from former catalog sales (International Council of Shopping Centers 1999).

Another possibility is that many Internet users simply research products on-line before buying them at traditional stores. The National Retail Federation (1999) survey found that only 4 percent of consumers with access to the Internet make more than 10 purchases per year on-line while 64 percent of those consumers use the Internet to research products which they later buy in traditional, "brick and mortar" stores. In that vein, malls are trying to use the Internet to draw customers by distributing coupons and information, including whether items at mall stores are in stock (Kaggwa 1999). These findings point to the possibility that Internet use might actually increase travel by making consumers more aware of shopping opportunities. On the other hand, use of the Internet might reduce travel for the purpose of comparison shopping by enabling the consumer to find the store offering the desired product at the desired price before even leaving the house.

Some evidence, however, links computer or Internet use to increased participation in other activities. For instance, one survey found that people who used computers at home also were more likely to participate in almost all other free time activities except for gardening and TV watching than nonusers. These differences persisted at a less substantial level even after accounting for demographic factors such as age and income, but high, rather than low or moderate, levels of computer use tended to decrease participation rates (Robinson et al. 1998). More recently, a National Retail Federation (1999) survey also found that Internet shoppers have "active lifestyles," with higher participation in movie-going, gardening, volunteering, and attending concerts, plays and museums than people who do not shop on-line. These survey results hint that the convenience of shopping on-line may simply enable active people to reduce shopping trips while increasing trips for other purposes, although the causal relationships between these trends are not yet understood.

Other evidence points to the possibility that the Internet will reduce travel either directly by eliminating the need for trips or indirectly by changing lifestyles. On-line

shoppers currently are most likely between 40 and 64 years old (64 percent of on-line shoppers) and likely to be men (68 percent) (National Retail Federation 1999). They are also likely to have incomes above the national average, with 74 percent of 1998 on-line spending coming from households with annual incomes of \$50,000 or more. These consumers are projected to still represent two-thirds of on-line spending in 2003 (McQuivey et al. 1998). Since these characteristics also describe those who tend to make the most trips, the potential seems high for some trip substitution to occur. In addition, at least one study has indicated the potential for increased Internet use to decrease other activities. A recent study at Stanford showed that people who used the Internet extensively also spent less time socializing and shopping (at least off-line) and more time working (Markoff 2000). These results suggest that on-line activities may indeed result in less overall travel.

CHAPTER 4. SUPPLY-SIDE FACTORS

Supply-side factors that may impact trends in non-work travel include those relating to the geographic distribution of activities and those relating to the transportation system that provides links to those activities. Trends in the former are perhaps less obvious than those in the latter and will thus be the focus of this section. However, a few words about transportation factors are warranted. The two most important transportation factors in explaining VMT are probably travel times to potential destinations and the availability of different transportation modes. Increases in the time it takes to get to destinations would presumably reduce the average trip distance and perhaps the frequency of trips. Although it often feels like travel times are increasing, the evidence is mixed. Congestion is certainly going up: the 1999 Annual Mobility Report showed that average annual delay per driver for 68 metropolitan areas in the U.S. increased by 29 percent from 1992 to 1997 (Schrank and Lomax 1999). However, average travel speeds, at least for actual commute trips made, have apparently increased, according to the NPTS (Hu and Young 1999). The availability of modes other than driving could also impact VMT by reducing vehicle travel as a share of total travel. Although the transportation system is overwhelming geared towards the private car, the availability of alternative modes may now be on the rise, with recent investments in light rail and other rail systems and with renewed attention to non-motorized modes. The “supply” of these modes is hard to measure, however.

A variety of trends in the distributions of retail businesses, personal and household services, and social and recreation activities may have important implications for non-work travel. Trends in three factors are discussed here: highway orientation, concentration, and homogenization. These trends are in many ways interrelated, and for some of them, counter-trends seem to be occurring at the same time. These trends are also closely related to changes in consumer demand, and it is not always clear whether supply-side changes are a response to changes in consumer behavior or vice versa. Trends in retail geography are better documented than trends in the spatial distribution of other kinds of personal and household services and social and recreation activities and are

thus the focus of the discussion here. More exploration of the supply of these services and activities might reveal other important trends.⁶ The growing supply of services and activities via the Internet is another important trend. However, the use of these on-line alternatives is more directly related to travel than is the supply of these alternatives and so their use was discussed in the previous section as a demand-side factor.

HIGHWAY ORIENTATION

Although retail establishments have always gravitated to the busiest streets, the development of urban freeway systems beginning in the 1950s exaggerated this tendency. By 1985, the urban federal-aid highways system contained over ten times the mileage of the 1950 system; as of 1994, over 13,000 miles of Interstate freeway passed through urban areas – nearly 30 percent of the entire system (FHWA 1986; BTS 1996). Shopping center developers from the start favored locations within sight of freeways and expressways. According to one observer, "the location of centers with respect to the [highway] system plays a vital role in the success of centers . . . centrality implies accessibility to residences via the highway system" (Garrison, et al. 1959). Published in 1972, the *Mobile Consumer* stressed that "knowledge of the program for the interstate highway system is critical for the establishment of automobile-oriented retail sites in the U.S." and noted that easy access to the site was more important than linear distance for the customer (Claus and Hardwick 1972). The new shopping centers drew business from both the central business district and from local shopping areas at least partly because of their easy access from major arterials or freeways and their ample and free parking. These advantages have made such centers a dominant retailing form in car-dependent suburbs. The concentration of retail activity around freeway interchanges, when combined with significant office development, are one form of what Joel Garreau (1991)

⁶ One example is the growth in "magnet" schools, which draw students from throughout the school district. Not only do these schools increase the distance that students travel to get to school, they may result in networks of friends spread throughout the community rather than concentrated in one neighborhood, thereby increasing the distances that children and their parents must travel for "play dates" and other social activities.

has called "edge cities": concentrations of office and retail activity that resemble downtown in terms of sheer numbers but not physical character or physical location.

The concentration of major retail centers at freeway interchanges has made it easier for consumers to travel longer distances to do their shopping. A study in the San Francisco Bay Area showed that when consumers have easy access via the freeway system to multiple shopping centers, they often choose more distant centers and make more trips to all centers (Handy 1996), thereby adding to overall VMT for non-work purposes. Indirect evidence of this connection comes from recent studies on the issue of "induced travel" – the possibility that an increase in road capacity leads to an increase in travel. For example, Strathman, et al. (2000) estimated the relationship between road capacity and VMT using NPTS data on VMT and road capacity data from the Texas Transportation Institute. The authors conclude that VMT is both directly and indirectly (through residential and employment density) related to road capacity. In other words, increases in highway capacity may have contributed to the overall increase in VMT. This conclusion is consistent with the notion of a "travel-time budget," as posited by Zahavi (1974), whereby households are willing to devote a certain amount of time to travel each day. If travel speeds increase – due to the construction or expansion of a freeway, for example – then households can travel a greater distance within their fixed travel-time budget.

CONCENTRATION

Another notable trend in the retail industry, one related to the trend towards highway orientation, has been the shift towards increased concentration in terms both of the size of individual establishments and shopping centers and the breadth of goods and services provided within individual establishments or centers. In 1980, the *average* supermarket was 23,000 square feet and offered roughly 14,000 items (Food Marketing Institute 1981). In 1998, the *median* sized supermarket (defined as stores with \$2 million or more in annual sales) was 40,483 square feet, up from 31,000 square feet in 1990 (Food Marketing Institute 1999c), and it offered over 40,000 items (Food Marketing

Institute 1999d). In 1977, there were almost 176,000 grocery stores around the country (including 30,000 convenience stores), of which about 19 percent were considered supermarkets, with annual sales of \$1 million or more in 1977 dollars (Progressive Grocer 1978). Due to the growth of large supermarkets and small groceries' difficulty in competing, the total number of stores shrank to 126,000 in 1998, a drop of nearly 30 percent. Convenience stores made up about 45 percent of this total, and supermarkets with sales of at least \$2 million made up another 24 percent. In 1977, small stores (selling less than \$1 million of groceries annually) sold 19 percent of the nation's groceries, but in 1998 they sold only 12 percent (Progressive Grocer 1978 and 1999).

Supermarkets are also offering an ever-wider range of goods and services to cater to the demand for increased convenience. In 1980, 37 percent of supermarkets had a deli, 28 percent had a bakery, and 19 percent had a floral shop; in 1996, 95 percent of new supermarkets had a deli, 91 percent a bakery, and 89 percent a floral shop (Food Marketing Institute 1990 and 1997). Almost 84 percent of supermarkets sold prepared foods in 1998, down from 93 percent in 1997 but significantly higher than 63.1 percent in 1995 (Food Marketing Institute 1999c). In order to make these foods even more convenient, 28 percent of supermarkets had separate check-out lanes for purchases of prepared foods; 27.5 percent had sit-down eating areas, 20 percent had snack, juice, or coffee bars, and about 6 percent had separate entrances for the prepared foods area. In addition, a few stores even offered special parking spaces for these customers.

Supermarkets now have services ranging from flower shops to ATM machines to actual bank branches. The trend toward increasing diversity of services in one location should help to reduce trip making, since shoppers can accomplish several purposes with one trip.

The proliferation of convenience stores and the re-emergence of small, neighborhood drug stores represent both another example of this trend towards the concentration of a diverse mix goods and services within a single establishment but also a counter-trend towards smaller stores. Convenience stores are a fraction of the size of supermarkets, at an average size of 2,374 square feet (NACS 1996), but offer a wide range of products and services, including prepared food. Major oil companies, most of

which have already added convenience stores to their gas stations, are exploring the potential for providing an even a wider range of services, including dry-cleaning drop-off, mail services, banking services, video rentals, and florist services -- a sort of "micro-mall" that makes filling the tank less of a chore because it eliminates the need for trips to several other locations and the hassle of waiting in line at a supermarket for just a few items (Salpukas 1997). Walgreens, the nation's largest drugstore chain, favors "freestanding stores with ample parking in convenient neighborhood locations" (*Chain Store Age* 1996) and has expanded its product line to include staples such as bread and milk. These stores give residents the convenience of getting many things done in one place, without the inconveniences of the larger "all-in-one" stores, including traffic, parking, and crowds, but at higher prices and with a more limited range of choice.

Wal-Mart is perhaps the ultimate example of the concentration trend: the company's share of all retail sales in the U.S. has grown from about 1 percent in 1986 to over 6 percent in 1999 (Kaufman 2000). The growth in Wal-Mart's market share suggests that the trend towards concentration may reduce VMT by enabling one-stop shopping. Available evidence does not show a decline in the frequency of shopping trips, however. U.S. shoppers have been making more trips to the grocery store over time. On average, Americans made about 1.4 trips to the supermarket per week in 1979, with 55.6 percent of respondents shopping once a week (Burgoyne 1980). By 1998, shoppers made 2.2 trips to the supermarket per week (Food Marketing Institute 1999b). In addition, bigger stores may increase trip distances: they require a larger customer base to survive, which means that fewer big stores are viable, which means that customers are farther away on average than in a system of more small stores, which means that they travel longer distances to get there. In Seattle in 1940, there were 1,144 persons per supermarket, versus 11,028 persons per supermarket in 1990. This change resulted in an increase in average travel distance, from 0.46 miles to 0.79 miles (Yim 1990), from just under to considerably over the maximum acceptable walking distance commonly assumed by designers and planners.

HOMOGENIZATION

One of the most visible trends in retail geography has been the proliferation of national (and even international) chains, resulting in a homogenization of retail options. Starbucks, for example, can be found in every city of any size in the U.S., in airports and on airplanes, in hotels, in strip malls -- and down the street from many locally-owned and -operated coffee sellers (many of which are themselves expanding into local and regional chains, although none have yet challenged Starbucks on a national level).⁷ A handful of communities have resisted, for fear of the loss of local town character. Starbucks has responded through a strategy of making its stores look and feel different from one another, by "tying the store to local cultures" (Solomon 1996). Another visible example is the spread of Barnes & Noble bookstores (many of which include a Starbucks cafe) and its competitors, most notably Borders. Expanding from its flagship location in Manhattan, the chain can now be found in downtown as well as suburban locations throughout the U.S. and has partnered with 360 university bookstores in college towns from Austin, TX to Cambridge, MA as of 1997 (Halkias 1997).

Homogenization means that the range of choices for consumers has declined while the predictability of choices has increased (Newby 1993). With the proliferation of chains, consumers have less reason to bypass local stores, because the next closest store may be a copy of the first, and less reason to shop at more than one store, because all the stores are essentially the same. Homogenization may thus lead to a reduction in both travel distances and trip frequency. At a larger scale, the choices from one city to the next are increasingly similar. This trend may reduce the fun of traveling to other cities, at least for those visitors who like to spend their time shopping, but it may also increase the comfort visitors feel in new cities and thus potentially increase their willingness to travel.

Perhaps in response to the increase in homogenization, some retailers have turned to differentiation as a competitive strategy. For example, in the last two decades, several new types of food stores have appeared. Specialty supermarkets, for example, may draw

⁷ The proliferation of Starbucks creates an interesting symmetry with the first chain retailer in the U.S., the Atlantic and Pacific Tea Company, which had 95 stores stretching from Boston to Milwaukee by 1880 (McNair and May 1976).

customers from significant distances and may increase the number of shopping trips if trips to these stores do not replace trips to regular supermarkets. A 1979 survey showed that consumers shopped in an average of 2.2 different grocery stores per month (Burgoyne 1980), whereas a similar study in 1999 showed that they shopped at 2.6 different stores per month (Food Marketing Institute 1999a). The increase in the number of trips may be a result of poor planning on the part of today's shoppers, but it also suggests the possibility that increasing differentiation between the supermarket options has contributed to an increase in the frequency of food shopping trips. Austin's up-scale Central Market appears to have generated substantial increases in travel for food shopping by increasing both the frequency of food shopping trips and the average length of these trips (Handy and Clifton 2001).

CHAPTER 5. EVIDENCE FROM TRAVEL MODELS

Multivariate models of travel behavior provide a statistical assessment of the contribution of factors like those discussed above to variations in travel. Studies that use discrete choice theory to model travel behavior arguably provide the most reliable evidence available on travel decisions, including destination choice, mode choice, and departure time choice. However, existing studies provide only limited evidence on the question of trends in non-work travel, for a variety of reasons. First, the vast majority of these studies have focused on commute travel rather than non-work travel. Fortunately, the number of non-work studies is growing, and a few recent studies look at the connections between work and non-work trips, such as the decision to stop for shopping or other non-work activities while heading home from work. Second, these studies are almost always cross-sectional. They model differences in travel choices as explained by differences in demand and supply variables for a sample of individuals or households at one point in time. Factors explaining trends in travel behavior can only be inferred from these models. If a model shows, for example, that households with higher incomes travel more, then it is reasonable to assume that as incomes increase over time, household travel will increase.

This chapter reviews the evidence available from past studies of non-work travel behavior that use multivariate regression or discrete choice modeling techniques to quantify the effect of different factors on non-work travel behavior. These studies provide statistical evidence of the factors that may be contributing to growing levels of vehicle-miles-traveled (VMT). An extensive effort to find such studies turned up seven journal articles or conference papers spanning over three decades. Although this set of studies is almost certainly not complete, it does suggest that studies that model non-work travel are significantly more rare than studies that model work travel. This sample, though limited, provides important insights into the relationships between non-work travel and various possible explanatory factors. The seven studies are:

- Vickerman, 1972: This study explored patterns on non-work travel using the 1965 National Travel Survey for Great Britain. Regression models were estimated for frequency of shopping trips, recreational trips, social trips, and pleasure trips for four different regions of Great Britain and for non-car-owners and car-owners. The models for the number of shopping trips and for the number of recreational trips per week for car owners in Greater London are presented here.
- Vickerman, 1974: This study also explored patterns on non-work travel using the 1965 National Travel Survey for Great Britain. Regression models were estimated for the frequency of car trips and bus trips for recreation, social, and pleasure purposes for different regions of Great Britain. The model for the number of car trips per week for recreation purposes at the individual level is presented here.
- Vickerman and Barmby, 1984. This study used data from weekly shopping diaries collected in 1972 in the County of Sussex in Great Britain. The purpose of the analysis was to explore the relationship between trip making and expenditures. Separate and simultaneous models were estimated for these dependent variables. The simple model for the number of shopping trips per week at the household level is presented here.
- Agyemang-Duah, et al. 1995. This study estimated a model for shopping trip frequency using the data from the Transportation Tomorrow Survey for the Greater Toronto Area conducted in 1986. The researchers used an ordered-response formulation, treating the number of shopping trips per day measured at the household level as an ordinaly-scaled categorical variable.
- Crane and Crepeau 1998. This study explored the link between urban form and non-work travel behavior using data from the 1986 Travel Behavior Surveys conducted for the San Diego Association of Governments. These researchers also used an ordered-response formulation to estimate a model of daily household car trip frequency and car trip frequency for persons aged 16

to 74, both for non-work purposes. The model for individual trips is presented here.

- Bhat and Singh, 1998. This study focused on mode choice for work trips, evening commute stops (stops made on the way home from work), and post-home arrival stops (trips made for non-work purposes after arriving home from work). A joint model for these choices was estimated, using a logit model formulation for work mode choice and an ordered-response formulation for evening commute stops and post-home arrival stops and using data from a travel diary survey conducted in 1991 in the Boston metropolitan region. The model for the number of post-home arrival stops per day at the individual level is presented here.
- Boarnet and Sarmiento, 1998. This study tested the link between urban form and non-work travel behavior using data from a 1993 survey administered as part of the Panel Study of Southern California Commuters. The researchers used an ordered-response formulation to estimate a model for the number of non-work automobile trips over two days at the individual level.

Results from these studies point to several factors as significant predictors of the frequency of non-work trips (Table 5-1). Generalizing across these studies is made difficult by differences in the choice of dependent variable and the choice and definition of the independent variables, however. Dependent variables vary with respect to period of time (e.g. one day, two days, one week), purpose of trip (e.g. shopping, recreation), mode of travel (e.g. all modes versus car trips only), and level of analysis (e.g. household versus individual). Independent variables tested in these studies generally fall into three categories: demographic and socio-economic characteristics, transportation characteristics, and land use characteristics. All these studies tested basic demographic and socio-economic characteristics such as age, sex, household size, and income. Most tested at least one transportation characteristic and one land use characteristic, but these categories of variables are much less consistently represented. While some independent

Table 5-1. Evidence from Models on Factors Influencing Non-Work Travel

Author(s)/Year	Vickerman, R.; 1972	Vickerman, R.; 1972	Vickerman, R. W.; 1974	Vickerman, R. & T. Barmby; 1984
Data Source	1965 National Transportation Survey for Great Britain	1965 National Transportation Survey for Great Britain	1965 National Transportation Survey for Great Britain	1972 Shopping Travel Diary for Sussex County
Dependent Variable	Number of Individual Shopping Trips per Week	Number of Individual Recreational Trips per Week	Number of Individual Recreational Car Trips per Week	Number of Household Shopping Trips per Week
Demographic & Socio-Economic				
Age		Negative		
Sex	Negative for male	Positive for male		
Household Size			Negative	Positive
Children				
Income	Positive	Positive	Positive	Positive
Work status	Positive for not working			
Other Variables	Positive for older hh member Varied for occupation	Negative for older hh member Varied for occupation	Negative for older hh member Varied for occupation	
Transportation				
Number of Cars				Positive
Drivers License	Positive		Positive	
Commute Time				
Travel Cost				Negative for travel cost index
Land Use				
Population Density	Negative		Negative	
Location Specific Effect			Varied	
Other Variables	Negative for distance to downtown			Positive for shopping attraction
Goodness of Fit	R-square = 0.11	R-square = 0.06	R-square = .11	R-square = 0.06

Table 5-1. Evidence from Models on Factors Influencing Non-Work Travel: continued

Author(s)/Year	Agyemang-Duah et al; 1995	Bhat, C. R. & S. K. Singh; 1997	Crane, R. & R. Crepeau; 1998	Boarnet, M.G. & S. Sarmiento; 1998
Data Source	1986 Transportation Tomorrow Survey for Greater Toronto Region	1991 Household Activity Survey for Boston Region	1986 Travel Behavior Surveys for San Diego County	1993 Panel Study of Southern California Commuters
Dependent Variable	Number of Household Home-Based Shopping Trips per Weekday	Number of Individual Post-Home Arrival Stops per Day	Number of Individual Non-Work Car Trips per Day	Number of Individual Non-Work Car Trips per 2-Days
Demographic & Socio-Economic				
Age		Negative	Positive	
Sex			Negative for male	Positive for female
Household Size	Positive			
Children	Negative	Negative if kids <= 12; positive if kids 12-16		Positive
Income				Positive; negative for square of income
Work Status	Negative for employed	Negative for hours worked	Negative for employed	Negative for work day
Other Variables		Negative for single parent household	Negative for mean age of hh members	
Transportation				
Number of Cars	Positive			
Drivers License			Positive	
Commute Time		Negative		
Travel Cost			Negative for distance; positive for speed	
Land Use				
Population Density				
Location Specific Effect	Varied			
Other Variables			Varied for land use share	
Goodness of Fit	Pseudo R-s = 0.05	N/A	Pseudo R-sq = 0.24	N/A

variables, such as age and sex, are consistently defined across the studies, most are defined differently in each study. The effect of children, for example, has been represented by dummy variables for the presence of children twelve years old or younger (Bhat and Singh 1997), by a categorical variable for the number of children in the household (Agyemang-Duan et al. 1995), and by a continuous variable for the number of children (Boarnet and Sarmiento 1998). Several different variables related to work status have been used: unemployed (Vickerman 1972) or employed (Agyemang-Duah et al. 1995; Crane and Crepeau 1998), hours worked (Bhat and Singh 1997), and worked on the day of the survey (Boarnet and Sarmiento 1998). Several studies tested the effect of population density as a characteristic of land use, at least two included dummy variables related to specific cities or zones (Vickerman 1974; Agyemang-Duah et al. 1995), and one study used several specific variables related to land use characteristics (Crane and Crepeau 1998). Table 5-1 presents only those variables that were statistically significant in the estimated model.

The models produced by these studies differ in three important ways: which variables are significantly related to non-work trip frequency, the direction of the relationship, and the magnitude of the relationship. No one variable proved significant in all eight models summarized in Table 5-1. Income is the most consistently significant variable, showing up in five of the eight models. In four cases, higher incomes are associated with more frequent non-work trips. This finding is consistent with commonly-held assumptions and suggests that as incomes increase, non-work travel will also increase. Boarnet and Sarmiento (1998), however, found a significant positive effect for income and a significant negative effect for the square of income, pointing to a non-linear relationship between non-work trips and income. At incomes below \$10,500, non-work trips increase slightly with income, but at higher incomes, they decline slightly. At any level of income, the effects of the two variables offset each other, so that income has little net effect on non-work trips. In Bhat and Singh (1997), income proved insignificant, and in Crane and Crepeau (1998), categorical income variables proved insignificant. Agyemang-Duan, et al. (1995) apparently did not test income in their model. The lack of

significance in the most recent studies suggests that income may not play as important a role in explaining the frequency of non-work trips as it once did and that increases in income in the future may not continue to drive increases in non-work trips.

The results for other variables are even more mixed. Two studies found that non-work trips decline with age (Vickerman 1972; Bhat and Sing 1997) and one found that non-work trips increase with the age of the traveler but decrease with the mean age of household members (Crane and Crepeau 1998). These results provide some indication that non-work trips will decline as the population ages, assuming other factors such as incomes and lifestyles do not also change. The effect of children is also not clear: one study found that non-work trips decline with the number of children in the household (Agyemang-Duah, et al. 1995) and one found that they increase (Boarnet and Sarmiento 1998); another found that the presence of children under the age of 12 leads to fewer non-work trips but that the presence of children between the ages of 12 and 16 leads to more non-work trips. These results perhaps reflect the role of children both as a constraint on activities and as a generator of new activities for a household.

Results were more consistent for work status and transportation characteristics. The more cars owned by the household, the more non-work trips (Vickerman and Barmby 1984; Agyemang-Duah, et al. 1995). Individuals with drivers' licenses make more non-work trips than those without (Vickerman 1972; Vickerman 1974; Crane and Crepeau 1998). Three studies found that employed individuals make more non-work trips than unemployed individuals (Vickerman 1972; Agyemang-Duah, et al. 1995; Crane and Crepeau 1998), one found that more hours worked and more time spent commuting meant fewer non-work trips (Bhat and Singh 1997), and another found that fewer non-work trips were made on days that the individual worked (Boarnet and Sarmiento 1998). This result suggests that time spent working or getting to and from work constrains an individual's ability to participate in non-work activities. All of these findings help to explain the historic increase in non-work trips – increases in car ownership, increases in the share of population with drivers' licenses, increases in labor force participation

(especially by women). But the trends in these factors are flattening, as described in Chapter 3, so that the rate of increase in non-work trips may also decline.

The results for sex were also interesting. Two studies found that men make fewer non-work trips than women (Crane and Crepeau 1998; Boarnet and Sarmiento 1998) and one found that men make fewer shopping trips but more recreational trips than women (Vickerman 1972). These results seem to reflect traditional household roles, where women are responsible for more of the household maintenance activities. Increased participation in the labor force may have helped to reduce non-work travel for women, but as described in Chapter 3, even working women tend to handle more household duties than their male partners. Of course, it is not clear from these studies to what degree women make more non-work trips than men because they have to or because they choose to.

Surprisingly, few studies considered the role of transportation costs in explaining the frequency of non-work trips. Crane and Crepeau (1998) found a negative relationship between median car trip distance and frequency of non-work trips and a positive relationship between median car trip speed and frequency of non-work trips. In other words, as the price of travel goes up, the amount of travel goes down. In some ways, land use characteristics are also a measure of travel cost. For example, Vickerman (1972) found that individuals living farther from the town center made fewer shopping trips; distance to the town center might serve as a proxy for the average distance necessary to reach shopping areas and thus as a proxy for travel cost. Vickerman and Barmby (1984) found a positive relationship between a measure of shopping attraction and frequency of shopping trips, again suggesting that lower costs of travel are associated with higher frequencies. These results support the conclusion that centralization trends (described in Chapter 4) would tend to decrease the frequency of non-work trips and that decentralization trends would tend to increase their frequency. In addition, increasing levels of congestion, which lead to slower travel times, would tend to decrease the frequency of non-work trips.

Several limitations of these studies point to the need for further research. First, many of the potentially important factors were not tested in these models, at least not directly. The absence of factors like leisure time, eating habits, and household responsibilities in these models can be partly explained by the lack of available data on these factors. Travel diary surveys have typically focused on collecting basic socio-demographic data but not characteristics related to life styles, attitudes, and preferences. In the handful of studies in which such data have been collected, these factors have proven statistically significant in explaining travel behavior (e.g. Kitamura, et al. 1997). Some factors are at least indirectly tested through their impact on more standard variables. For example, highway orientation and homogenization impact travel time to potential destinations, and increases in travel time are associated with less travel or fewer trips. Second, these models generally explain a small fraction of the variation in travel behavior. In other words, the models suggest that many important explanatory factors have not been included. In addition, it should be noted that these studies explore just one aspect of non-work travel, namely the frequency of these trips. The length of trips and the choice of modes also determine the total amount of VMT for non-work purposes, and other characteristics of non-work travel, such as the timing of trips, might also be of interest.

CHAPTER 6. CONCLUSIONS

This review – of trends in non-work travel, trends in factors that might be linked to trends in non-work travel, and models of travel behavior that might reveal the significance of these factors – suggests that researchers mostly don't understand the growth in non-work VMT and maybe don't even understand the extent of that growth. Data limitations, particularly the reliance on cross-sectional data and the lack of lifestyle and attitudinal data, explain the gaps in understanding to some extent. The complexity of the relationships between potential explanatory factors and travel behavior - and between the factors themselves - also help to explain the gaps in understanding. The review has only touched the surface of the list of possible explanatory factors as well as the structure of these complex relationships. A summary of the points explored in this report serves as a set of hypotheses for further research (Table 6-1).

Two directions seem especially promising for making further progress towards understanding the growth in non-work VMT. First, analysis of the Puget Sound Transportation Panel Survey, which provides data on household travel for a fixed set of households over a period of time, could directly test the relative importance of socio-demographic factors in explaining trends in non-work travel. Preliminary analysis of this data set did not seem to reveal a decline in average trip frequencies, distances, or VMT for non-work trips between the beginning of the panel survey in 1989 and the last year currently available, 1997 (in fact, non-work travel seemed to decline over this period). Disaggregate analysis of changes in household travel may reveal that travel increased for some households and decreased for others but could also identify factors leading to either increases or decreases. Second, a qualitative research approach might shed additional light on lifestyle and attitudinal factors that have contributed to increases in non-work VMT. Potentially profitable techniques include focus groups and in-depth interviews. The results of these efforts could then be used to develop new survey instruments that would collect data about these kinds of factors and thus enable their inclusion in models. Qualitative research approaches might also prove helpful in untangling the structure of the relationships between explanatory factors and travel behavior.

Table 6-1. Summary of Factors, Trends, and Travel Impacts

Factor	Trend in Factor	Travel Impact?	Evidence
Income	increasing	more trips longer trips	moderate
Household size	decreasing	more trips/person	weak
Age	increasing	fewer trips but declining impact	moderate
Auto ownership	increasing	more travel but declining impact	strong
Employment	increasing for women	shifts in timing fewer trips	moderate
Leisure time	decreasing - at least perceived	fewer trips more trips	weak
Approach to leisure	more active more purchased	more trips	weak
Household responsibilities	driven by children	more trips	moderate
Eating habits	more prepared food more eating out	more trips	weak
On-line alternatives	increasing use	fewer trips more trips	moderate
Highway orientation	increasing but stabilizing	longer trips more VMT	weak
Concentration	increasing but some decentralization	fewer trips longer trips	weak
Homogenization	increasing but some differentiation	fewer trips shorter trips	weak

The motivation for continued research on this topic has two dimensions: growth in non-work VMT generates significant social, economic, and environmental costs; and understanding this growth provides a basis for developing appropriate policy responses. This is not to say that all growth in non-work VMT is bad. To the degree that this growth reflects the desires of U.S. households and increases their welfare as consumers, it is

arguably good. But there's a significant possibility that U.S. households are driving more for reasons not entirely of their own choosing. In this case, policies that reduce the need for households to drive benefit both households and society at large. Planners may have an opportunity to intervene on the supply-side of the equation to ensure that households have the choice not to drive so much.

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