Forecasting 65+ Travel: An Integration of Cohort Analysis and Travel Demand Modeling

by

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Abstract

Over the next 30 years, the Boomers will double the 65+ population in the United States and comprise a new generation of older Americans. This study forecasts the aging Boomers' travel. Previous efforts to forecast 65+ travel are lacking in key two respects: they have failed to incorporate generation differences and have forecasted only broad travel characteristics (e.g. vehicle miles traveled). Drawing on the theory of generations, this study investigates empirically whether cohort differences in travel exist between the Boomers and the current 65+ population. It incorporates theoretically motivated cohort variables related to the historical processes of motorization, proxied by registered automobiles per person, and gender role evolution, proxied by labor force participation rates of women. The resulting forecast predicts the aging Boomers' travel demand with respect to activities requiring travel, person miles traveled, usage of transit and non-motorized modes, and trip chaining propensity. Data extracted from the 1977, 1983, 1990, and 1995 National Personal Transportation Surveys (NPTS) are used to estimate discrete and joint discrete/continuous demand models. Multiple imputation is used to impute missing survey data. Iterative proportional fitting is used to simulate future populations for forecasting purposes. Although 65+ travel is predicted to increase across all the modeled travel indicators, the results indicate that the current national forecast of 65+ travel prepared for the National Highway Traffic Safety Administration and the U. S. Department of Health and Human Services may overestimate future demand. The forecasts also suggest that investment in transit could increase 65+ transit usage propensities; opportunities for increasing transit viability are identified. Finally, in the estimated models, the cohort variables are significant, and with the exception of forecasted person-miles, cohort variable inclusion increases forecasted travel. The implication for transportation modeling is that historical location and generation membership affects transportation behavior. The implication for planners is that in preparing for future 65+ transportation needs, studying the current 65+ population is not adequate. The Boomers will comprise a new generation of 65+ with different associated travel needs.

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Contents

Figures

Tables

1. Introduction

We have succeeded in adding years to life; we are only beginning to turn to the task of adding life to years.

Philip M. Hauser[1]

Aging policy in the United States tends to focus on health and financial security, areas that are both data rich and supported by well-documented forecasts. These predictions support policymakers in deciding how best to allocate future public resources to meet the needs of an aging society. In contrast, aging transportation policy does not currently benefit from such a context of analytically informed decision making. Yet transportation provides necessary links between activities that support healthy living and hence healthy aging.

The United States Department of Transportation (2001) recently released a draft national agenda on safe mobility for an aging society predicting a "pending crisis" in the provision of these transportation links. The draft paints the crisis in terms of escalating health care costs related to mobility loss and dramatic increases in highway-related deaths. The draft concludes: "Continued neglect of [elderly transportation] needs could cause the number of older people killed in crashes to possibly triple and leave many more stranded in distant suburban homes" (p. 1).

The possibility of dramatic increases in fatalities and social isolation demands that careful analyses be done to prepare for the transportation demands of the next wave of retirees. The contribution of this study is a forecast of future 65+ travel rooted in the acknowledgement that the Boomers will comprise a new generation of people 65+, differing from the current generation in both their transportation needs and mobility expectations.

Demographics and Generation Differences

The Boomers are the 78 million people in the United States born between 1946 and 1965. As they move into old age, they will square the age pyramid and double the current number of senior citizens (Census, 1996). The Boomers will not only increase the numbers of people 65+, their lifestyles and associated travel behavior are expected to differ from those of the Matures. The Matures, as defined by Smith & Clurman (1997), are the generation preceding the Boomers who were born between 1909 and 1945 and comprise much of the current 65+ population. When compared to the Matures, the Boomers are expected to carry with them into old age a higher propensity for auto

[1] Hauser, P. M. (1953). Facing the Implications of an Aging Population. *Social Review,* 26, p.162.

ownership and use, increased female independence, as well as higher levels of education, increased economic stability, and improved health.

Automobility

Sociologists have long identified as formative in human development the years in which young adults are old enough to experience their historical environment, but "not old enough to have become committed to an occupation, a residence, a family of procreation or a way of life" (Ryder, 1965, p. 848). During these years, the Matures inhabited an America in which on average there were only 3 cars for every 10 people. In contrast, when the Boomers were making that same transition, constructing their lifestyles and future expectations, there were 6 cars for every 10 people in the U.S. Thus, the historical transportation-related experiences of these generations are different. Furthermore, it has been hypothesized that as auto ownership and use spread through the population, successive generations developed lifestyles increasingly dependent on the automobile (Kostyniuk & Kitamura, 1987). Therefore, one would expect Boomers, who were socialized in a considerably more automobile oriented society, as they age, to have increased demand for travel when compared to the Matures.

Female Lifestyles

Over the last century, women have been entering the paid labor force in increasing numbers and have both expanded and redefined traditional gender roles. As they have transitioned into the work force, women have extended the spatial sphere in which they operate from one centered on the household to one encompassing both the home and the workplace. This enlarged sphere has translated to increases in both the numbers of trips and distances that U.S. women travel each day. The evolution in female lifestyles is illustrated by differences between women of the Boomer and the Mature generations. Of Boomer women, 26% have college degrees compared to only 14% of Matures. Boomer women exhibit significantly higher labor force participation rates when compared to the Matures at comparable ages (Fullerton, 1999). Furthermore, in 1995 Boomer women took more trips each day than Boomer men; in contrast, Mature women made fewer trips than their male counterparts (Spain, 1997). Therefore, one would expect Boomer women, as they age, to have increased demand for travel when compared to the female Matures.

Educational Attainment, Economic Security, and Health

With respect to completion of both high school and higher education degrees, the Boomers are better educated than the Matures. In addition, the aging Boomers are likely to enjoy improved health when compared to the Matures. Manton (1997) suggests that disability rates among the 65+ may either be static or on the decline. Finally, Boomers have higher real incomes and greater accumulated wealth than the Matures at comparable ages (Costa, 1998). As educational attainment, health, and income are all positively correlated with travel, one would expect the Boomers, as they age, to have increased demand for travel.

Thus, the Matures and the Boomers are generations with different lifestyles, and associated expectations, experiences, and attitudes regarding travel. As noted by Riley (1985), "members of every cohort currently alive already have a past history, about which much is known or can be learned, and this history can be used to anticipate the future lives of these cohort members and their contributions to the future state of society" (p. 267). The differences in the past histories of the Boomers and the Matures would cause one to expect that the Boomers, when they comprise the 65+ population, will travel more than the Matures of today.

Implications of Increased Travel

The possibility that the aging Boomers will have increased travel demand (e.g. when compared to that of the current 65+ population) has personal, public safety, and policy implications.

Personal Health & Well-Being

According to Rosenbloom (1999), "for the last two decades, every auto-related travel indicator for the elderly has gone resolutely up including: vehicle miles traveled, licensing, daily trips, daily miles traveled, and time spent driving. Concurrently, use of alternative modes has gone resolutely down" (p. 16). However, with aging, people experience physical, financial, emotional, and mental barriers to driving, and most people eventually have to stop driving. Seniors are resistant both to planning for post-driving life and to driving cessation itself. As noted by Villeneuve (1994):

> Many seniors [refuse] to discuss a future without a car. Others [can] not conceive of such a future, and some [confess] they would rather die than quit driving. . . [those] clearly unfit to drive . . . [deny] their functional status and [continue] to drive in defiance of their families because independent mobility [is] central to their definition of self. (p. 3)

When seniors can no longer drive, maintaining mobility becomes a health issue. Seniors who remain active and mobile live longer (Eno Foundation, 1999; Suen, 1999). There is a significant correlation between mobility and well-being; holding demographic, psycho-social, and medical factors constant, mobility loss has been shown to be significantly related to declines in activity levels as well as substantial increases in depression (Marottoli et al., 1997). Therefore, as increasing numbers of Boomers with higher mobility expectations face the reality of post-driving life, the associated personal cost may be high.

Public Safety

"Many older persons . . . cling stubbornly to their cars [posing] a risk both to themselves and to society" (Eno Foundation, 1999, p. 8). Perhaps this contributes to drivers over 75 having one of the highest accident rates. For people over the age of 75, fatal crash involvement rates per VMT is over two times the national average; for people over the age of 85, the fatal crash involvement rates are almost four times the national average

(Cerrelli, 1998). Hence, larger numbers of people 75+ and 85+ on the road may increase the safety risk posed by older drivers to themselves and others.

Public Policy

Currently the U.S. government spends more on specialized transportation services for those 65+ than it does for direct aid to public transportation (Eno Foundation, 1999, p. 8). With the number of people 65+ growing, the cost of special transportation provision could also burgeon. Furthermore, the Boomers have become accustomed to being the center of public policy; as children they caused the physical expansion of communities, and as adults they have driven social and market change (Coughlin, 1999). When they move into retirement, baby boomers will expect public policy to address their transportation needs. However, forecasts to inform policy decisions with respect to anticipating these needs are currently nonexistent. The irony of this impoverishment is that transportation solutions (guided by data and forecasts) involve intensive resource investment. It takes years for product development and deployment of technological change in automobiles. Similarly, changes in infrastructure and related services require decades for financing, planning and construction.

Statement of Purpose and Contributions

Over the next twenty years, the Boomers will dramatically increase the number of people in the United States over the age of 65. Furthermore, when compared to the current generation of 65+, the Boomers are expected to carry with them into old age a higher propensity for auto ownership and use, increased female independence, as well as higher levels of education, economic stability, and health. As a result, increases in 65+ travel demand are anticipated which will have personal, safety, and policy implications. Yet surprisingly little work has been done to forecast this demand

Wachs (1979) made the last substantive contribution in this research area. His analysis accounted for diversity in elderly lifestyles and used captured differences to explain the trip-making propensity of Los Angeles County residents. However, his forecast, and all subsequent forecasting efforts (Burkhardt et al., 1998; COMSIS & JHK, 1986; Hartgen, 1977; Hopkins, 1981), have projected current 65+ travel onto future generations. The fact that twenty or thirty years from now, those who are 65+ today will be replaced by a completely different generation of people, has been disregarded. Furthermore, current forecasts of aging Boomer travel are limited in that they involve aggregation of the entire current 65+ population into an average male and female (see Burkhardt et al.,1998). Finally, forecasts of 65+ travel have only predicted vehicle miles traveled (VMT) or person trips, thus providing little insight into the nature of future demand (e.g. not just how many miles but what types of trips and where).

Thus, previous demand models of 65+ travel are lacking in two key respects. They have failed to incorporate generation differences and have forecasted only broad travel characteristics (e.g. VMT). Drawing on the theory of generations and previous work modeling cohort (or generation) effects, this study ameliorates these problems. First, it investigates empirically whether generation differences exist in travel between the

Boomers and Matures. In particular, it incorporates theoretically motivated cohort variables related to the historical processes of motorization and gender role evolution over the last century. Second, the study provides a forecast of the aging Boomers' travel demand with respect to activities requiring travel, person miles traveled, usage of transit and non-motorized modes, and trip chaining propensity.

In the estimated travel demand models presented in this thesis, the theoretically motivated cohort variables are statistically significant and impact the forecasted travel indicators. The use of disaggregate methodologies results in a forecast of 65+ miles that is dramatically lower than the current forecast being used to guide 65+ transportation policy. Finally, the inclusion of multiple travel indicators provides a more fine grained picture of future 65+ travel. The forecasts indicate that over the next 30 years not only will 65+ travel increase, but also 65+ trip chaining, transit usage, and non-motorized mode usage propensities. Furthermore, the estimated models facilitate evaluation of how policy changes might impact future 65+ travel.

The structure of the subsequent chapters will be as follows. First, the literature providing foundation for this work will be summarized. Second, the data and methodologies used in model estimation and forecasting are described. Third, the results are presented. Finally, the findings are connected to the foundation literature, conclusions are drawn, and recommendations made.

2. Literature Review

I used to tell my students that the difference between economics and sociology is very simple. Economics is all about how people make choices. Sociology is all about why they don't have any choices to make.

James S. Duesenberry[2]

At its heart, transportation is an interdisciplinary endeavor. It lies at the juncture of behavioral science, economics, engineering, politics, and planning. Therefore, the problem of accurately modeling 65+ travel could be likened to the proverbial blind men touching different parts of an elephant. There are several veins of literature through which to approach the elephant, each providing only a partial picture of the whole. The most relevant avenues will be described here. However, given the complexity of the behavior under investigation, the existing literatures perhaps amount to only a description of the elephant's tail, trunk and ear. I will first review the broader field of transportation demand modeling; then work that has been done in modeling 65+ travel; the theory of cohorts or generations; models incorporating cohort differences; and finally I will discuss briefly the confluence of these fields and their application to the problem of modeling 65+ travel.

Travel Demand Modeling

Since their inception in the 1950s, travel demand models have evolved through what Mannheim (1976) characterized as three generations. The first generation of models were developed along with the conventional four-stage transportation planning models. These first generation models typically employed regression or categorical analysis to estimate the number of trips made of different purposes by household. Furthermore, they focused on statistical associations rather than behavioral relationships and used demographic explanatory variables almost exclusively. Historically these models were estimated using aggregate data (Wachs, 1979); however, more recent trip generation models have been specified using disaggregate data (Goulias & Kitamura, 1991). While they ignored underlying behavioral mechanisms and failed to account for the existence of linkages both between trips and between trips and their associated activity participation, first generation models were simple and parsimonious and are still the mainstay of transportation planning practice.

Development of second generation models was motivated in part by theoretical shortcomings associated with aggregate models. These disaggregate models (often discrete choice) emphasized sampling, model estimation, and prediction (Ben-Akiva &

[2] Duesenberry, J. S. (1960). Comment. In National Bureau of Economic Research (Ed.), *Demographic and Economic Change in Developed Countries*, p. 233. Princeton, NJ: Princeton University Press.

Lerman, 1985). The discrete choice models employed the economic theory of utility maximization and thus provided a behavioral foundation. However, they still modeled travel as individual trips, ignored the fact that travel is a derived demand, and have been criticized for inattention to behavioral context (Pas, 1990).

More recent transportation demand methodologies (e.g. third generation models) have focused on sequences or patterns of behavior rather than discrete trips, and explicitly treat travel as a derived demand; a demand derived from the desire to participate in activities away from home. There are currently two primary approaches being developed in activity-based demand: a discrete choice approach, see (Bowman & Ben-Akiva, 2001); and a continuous demand approach, see (Kockelman, 2001). Activity-based models are broader, more holistic, and theoretically complete than their predecessors; and because they are behaviorally or causally based, the models are also more likely to be stable over time. However, while microeconomically rigorous, these methods are relatively new, computationally and data intensive, and few practical applications exist in the literature.

65+ Travel Forecasts

While the discipline of transportation demand modeling is relatively young, interest in modeling travel behavior of people 65+ developed even more recently. The most notable models of 65+ travel have employed clustering techniques (e.g. cluster analysis and/or factor analysis) to segment the 65+ population into lifestyle groups and have used the resulting groups to explain differences in travel. Wachs (1979) applied segmentation analysis in a trip generation model using data aggregated at the census tract level. More recently, Hildebrand (1998) used disaggregate data in an activity-based approach; however, his work did not culminate in a forecast, or address future 65+ generational changes.

Additional studies related to 65+ transportation are limited in that they treat the entire 65+ population as a homogeneous group (Burkhardt, 1998; COMSIS Corp., 1986); amalgamate the 65+ with the disabled into a single target population (Hartgen, Howe, & Pasko, 1977); or describe broad travel characteristics void of causal relationships (Rosenbloom, 1999; Spain, 1997). Therefore, in the area of 65+ travel demand, there is a dearth of significant work. There are no current comprehensive national travel demand models specified for the 65+ population; only limited research has been generated examining the general travel patterns of the 65+; and little is known about their underlying needs and desires for travel.

Cohort Theory

Historically, indicators of an individual's previous socialization, education for example, have been included in travel demand models and have explained differences in travel behavior. The question addressed in this study is whether, beyond individual characteristics or attributes, differences in the historic socialization of cohorts (or generations) could also be used to explain differences in travel behavior.

The sociologist Riley (1985) defined a cohort as a group of people born (or entering a particular system) during the same period of time. In his seminal work on generations, Mannheim (1952) argued:

> The fact of belonging to the same class, and that of belonging to the same generation or age group, have this in common, that both endow the individuals sharing in them with a common location in the social and historical process, and thereby limit them to a specific range of potential experience, predisposing them for a certain characteristic mode of thought and experience and a characteristic type of historically relevant action. (p. 291)

Social scientists have a long tradition of asserting that formative experiences (e.g. of cohorts) in late adolescence and early adulthood are important, even decisive, in distinguishing one cohort from another. If effects of historical conditions in late adolescence and early adulthood persist throughout a cohort's life span, a cohort effect is said to exist. Therefore, the theory of cohorts rests on two arguments: first, that individual behavior is influenced by historic socialization in late adolescence/early adulthood causing differentiation between cohorts of individuals; and second, that these cohort differences persist throughout the life course.

Erikson's (1963) well known theory of psychosocial development portrays young adulthood as a search for something to be faithful to. In this search, young adults intellectually question and restructure their attitudes and behaviors. As this search intersects with family, peers, public figures, and social events, Erikson argued that socio-historic events play a central role in late adolescent identity formation. These socio-historic influences have greater impact on younger adults than older adults, because for older adults, newer influences compete on unequal terms with previous influences which have already been assimilated into an individual's lifestyle (Botwinick, 1973; Glenn, 1974; Mannheim, 1952). As argued by Stinchombe (1984), historical events "have a teaching impact . . . especially on those with less to unlearn" (p. 8). Those in late adolescence/early adulthood have not only less to unlearn, they also have fewer constraints impeding their capacity for change. Ryder (1965) argued that historical events are felt most by those who have yet to make significant life choices committing them "to an occupation, a residence, a family of procreation, or a way of life" (p. 848).

Empirical studies suggesting that early socialization carries greater weight than later socialization exist in the literature related to age effects on memory and on consumer preference formation. People of all ages disproportionately recall historical events from late adolescence/early adulthood (Lang, Lang, Kepplinger, & Ehmig, 1993; Roberts, 1986; Roberts & Lang, 1985; Schuman, Akiyama, & Knäuper, 1998; Schuman & Rieger, 1992; Schuman & Scott, 1989; Scott & Zac, 1993). In addition, when people recall memories of personal life events, there is a well documented "reminiscence bump" associated with late adolescence/early adulthood (Fitgerald & Lawrence, 1984; Rubin, Wetzler, & Nebes, 1986). Therefore, Rubin (1998) in his review of a large number of studies concluded "adolescence and early adulthood are special times for memory encoding" (p. 3). Finally, Holbrook and Schindler have reported a late adolescent/early adulthood preference peak associated with popular music (Holbrook & Schindler, 1989);

fashion models (Schindler & Holbrook, 1993); and photographs of movie stars (Holbrook & Schindler, 1994).

The second component of cohort theory is that cohort differences caused by historic socialization in late adolescence/early adulthood persist throughout the life course. Arguably the most widely accepted evidence supporting the effects of early socialization on later behavior is related to education. In their intensive analysis of the effects of education Hyman and Wright (1979) conclude:

> Many measurements on thousands of adults aged twenty-five to seventy-two drawn from thirty-eight national sample surveys conducted from 1949 to 1975 . . . establish that education produces large and lasting good effects in the realm of values. . . . despite aging the contrasts persist. No matter which birth cohort or generation was examined, we found that the more educated preserved almost all their distinctive and attractive values . . . even advanced age cannot ravage the relatively attractive profile of the more educated. (p. 60)

There is a large body of literature in political science supporting the "aging-stability thesis" arguing that with increasing age people become less likely to change. Alwin (1991) found that people form political orientations in late adolescence/early adulthood, which remain stable over the life course. Numerous other studies also identify continuity in political attitudes and behaviors (e.g. voting behavior) throughout the aging process (Bengston & Black, 1973; Carlsson & Karlesson, 1970; Cutler & Bengston, 1974; Firebaugh & Chen, 1995; Glenn, 1974, 1980; Hudson & Binstock, 1976; Wood & Ng, 1980). Additional studies offering support to this thesis include Maas and Kuyper's (1974) 40-year follow-up of subjects from the Berkeley growth study, which found that how one ages is influenced by lifestyles at earlier ages. Elder (1974, 1979, 1993) found that the lasting effects of living through the Depression varied from one cohort to another and were most consequential for those who experienced the Depression during their late adolescent/early adult years. Finally, researchers have found that, controlling for current socioeconomic effects, indicators of previous adolescent socialization explain variance in current behavioral and attitudinal variables (Cutler, 1982; Glenn & Hill, 1977).

Yet despite the intuitive appeal of cohort theory, there is no consensus on how prevalent or important cohort effects are. Skeptics argue that people are malleable and open to developmental change throughout the life course. In particular, they argue that people maintain attitudinal flexibility throughout life span (Lerner, 1984); that consequences of early childhood are continually transformed by later experience (Brim & Kagan, 1980); and that the adult life course should be characterized by perpetual openness to change instead of increasing stability and resistance to change (Gergen, 1980). Furthermore, the empirical work supporting adolescent impressionability can be criticized in that it does not necessarily follow that remembered events are formative, or that stated consumer preferences would be reflected in actual behavior. With respect to lasting effects of adolescent socialization, the effects that have been controlled for in the literature (e.g. education) are often particular to an individual; whereas this study is more concerned with broader historical influences affecting a cohort as a whole. Nevertheless, even skeptics have granted that "the general observation that there are sensitive periods in development during which there is an enhanced sensitivity to particular environmental stimuli remains valid" (Emde & Harmon, 1984, p 60).

Cohort Analysis

In part, the controversy over the existence of cohort effects persists due to an estimation problem. In conventional cohort analysis, cohort effects are defined to be time-invariant inter-cohort differences attributable to common historical "imprinting" of cohort members; period effects are fluctuations in data due to circumstances occurring at particular points in time; and age effects are long-term patterns associated with moving through the life cycle. The goal of cohort analysis is to assess the extent to which variation in a variable (e.g. person trips) observed over time is attributable to period, age, and cohort effects. However, because these three effects are linearly dependent, it is not possible to separate cohort, age, and period effects in a linear model. In particular, there is an exact equality as illustrated in Equation (1), where C denotes the time of system entry, P denotes system time, and A denotes duration in the system (Mason & Feinberg, 1985).

$$C = P - A \tag{1}$$

Cohort methods differ in how they address this identification problem. One approach involves plotting profiles of the dependent variable(s) of interest for each cohort as they age over time (Gallez, 1994; Wachs, 1979). Another similar method applies three-way analysis of variance to assess which effects (cohort, period, and/or age) can best explain variance in data (Kostyniuk & Kitamura, 1987; Pennington-Gray, 1999). Although both of these methods can be informative in determining the presence of cohort, age, and period effects, neither addresses the identification problem. Using these methods, any empirical pattern could be statistically explained by innumerable combinations of age, period and cohort effects.

Another method involves regression analysis in which A - 1 age indicators (or dummy variables)[3], P - 1 period indicators, and C - 1 cohort indicators are included as explanatory variables (where A, P, and C are the number of age groups, periods, and cohorts respectively)[4]; and constraints are introduced for identification (Berndt, Griliches, & Rappaport, 1995; Madre, Bussiere, & Armoogum, 1995; Rentz & Reynolds, 1991). With multiple cross-sections of data collected at different points in time, at least one constraint is needed for identification. If only one cross-section is available, then cohort and age effects are confounded and only one effect (cohort or age) can be identified. In the literature, theoretical bases for estimation constraints are rarely, if ever provided; and in some cases the justifications offered for the constraints are highly suspect. For example, Madre (1995) constrained period effects to be zero claiming the period effects can be neglected since their "stability tends to be fragile in projection" (p. 289). However, if period effects exist (and Madre, et al. acknowledge their existence), constraining the period parameters to equal zero results in biased estimates of both the

[3] The excluded age indicator represents the reference age category.
[4] In price indexes literature, these are also known as T-A-V (time, age, vintage) models.

age and cohort parameters. Therefore, these methods of arbitrarily constraining one of the period, age, or cohort effects to equal zero, or subsets of any of these parameters to equal zero are widely criticized in the literature (Glenn, 1976; Rodgers, 1982; Wilmoth, 1990).

A final method for solving the identification problem involves replacing one of the cohort, age, or period indicators with a continuous variable (Gourinchas & Parker, 1999; O'Brien, Stockard & Isaacson, 1999; Sakai, Brown & Mak, 2000; Venti & Wise, 1990). For example, O'Brien (1999) hypothesizes that youth homicide rates are associated with two cohort characteristics theoretically linked to criminality: relative cohort size and percentage of cohort members born to unwed mothers. Instead of including age, period, and cohort indicator variables in his analysis, he replaces the cohort indicators with the two previously described theoretically motivated continuous cohort variables. This approach recognizes that the age, period, and cohort "dummies" are only indicators of concepts like biological or intellectual development; concurrent economic and/or political conditions; or the prevailing environment during critical life cycle periods of persons born in particular years. When more direct measures of these theoretical concepts (that are continuous instead of discrete in nature) are used to replace one of the indicator variables (whether age, period, or cohort), then the identification problem is solved.

This final method of including one or more continuous variables is superior to the ad hoc method of constraining parameters to equal zero; because at a minimum, it requires an a priori assumption about the underlying cause of the cohort, period, or age effect being replaced. However, as a cautionary note, estimates of the other effects (included as dummy variables) will be sensitive to the validity of the underlying a priori assumption.

In citing examples of the first two methodological approaches to cohort analysis (e.g. cohort plotting and/or analysis of variance as well as inclusion of age, period, and cohort indicators), the transportation literature has been referenced. However, with respect to the final approach involving replacement of one or more of the age, period, or cohort indicators with theoretically motivated variables, the author is unaware of any travel demand studies in which this method has been applied.

Theoretically Motivated Cohort Variables

Once cohort differences have been said to exist, the challenge is explaining why they occur. Cohorts are theorized to be more sharply differentiated in historical times of rapid change (Elder, 1974). Therefore, one approach is to view historical periods of rapid change as producing opportunity structures, differentially impacting those cohorts in late adolescence/early adulthood, providing both opportunities and constraints for cohort members (Elder, 1996). Two opportunity structures, with theoretical links in the literature to travel, are derived from automobile availability and opportunity for female labor force participation.

Motorization

One historical event discussed in transportation literature as having had the potential to differentiate cohorts is the process of motorization. The use of the automobile as a form of transportation is a recent phenomenon. In the last one hundred years, the ownership and use of automobiles has spread through American society influencing not only the way we move from place to place, but also how we build our cities, and structure our lives. With respect to motorization, as a cohort, the Boomers came of age and developed lifestyles in an historical environment very different from that experienced by the Matures. Many of the Matures never learned to drive, never obtained drivers licenses, and were without much driving experience; in contrast, a large portion of the Boomers have lifestyles centered around the automobile. Therefore, it has been hypothesized that travel differences might exist between these two cohorts attributable to the degree of motorization that they experienced in their formative years (Kostyniuk & Kitamura, 1987). This study empirically tests the hypothesis that automobile prevalence during a cohort's late adolescence/early adulthood, proxied by registered automobiles per person, affects a cohort's propensity for travel in later stages of the life cycle.

Female Lifestyles

Wachs has examined effects of historic gender socialization on differences in travel behavior between men and women (Wachs, 1987, 1996). In particular, he noted that with the advent of industrialization and urbanization, men and women came to exist in what social historians and theoreticians have called "separate spheres". Men's arena was defined as economic production and public life, both pursued outside the home; whereas women's sphere was one of caring for children, family, and the home. Over the last century, as women have in increasing numbers entered the workforce, they have maintained primary responsibility for home maintenance. Thus, their spheres of activity have expanded to encompass both the home and the workplace.

According to Muller (1986), "the main structures of the life courses of men and women are outcomes of the ways a society divides labor and organizes its social institutions. The allocation of time to duties and expectations of different roles required by the institutional affiliations of individuals defines their life conditions and the course of their lives" (p. 43). Researcher have found work experience expands female sex-role attitudes (Dowdall, 1974; Egge & Meyer, 1970; Kim, 1996; Mason, Czajka, & Arber, 1976; Stolzenberg & Waite, 1977; Thornton, Alwin, & Camburn, 1983; Waite & Stolzenberg, 1976); that labor force participation in later life stages is affected by labor force participation during late adolescence/early adulthood (Mincer & Polachek, 1974; Waite, 1980); and that during late adolescence/early adulthood, the decision of women to participate in the labor force is affected by the opportunities available to a particular cohort of women to be employed in non-family-tied occupations (Muller, 1986).

Researchers have found additional evidence of the opportunity structure for participation in adolescence affecting female behavior in later stages of the life cycle. Firebaugh (1995) found that cohorts of women who during adolescence were exposed to voting disenfranchisement exhibited gender differences in voting behavior later in life. In contrast, those gender differences disappeared for cohorts whose adolescence coincided with or followed the 1920 amendment granting women the right to vote. Furthermore, Goldin and Katz (2002) have argued that the availability of oral contraceptives to cohorts of young women (e.g. opportunity) "coincided with, and is analytically related to, the increase in the age at first marriage and with the increase in women in professional degree programs" (p. 767).

Therefore, female entrance into the labor force has been hypothesized to correspond to enlarged spheres of activity participation. Furthermore, labor force participation has been shown to be correlated with expanded sex-role attitudes. Finally, current labor force participation is correlated with previous labor force participation in late adolescence/early adulthood and opportunities for participation during this same period. This study tests the hypothesis that female opportunity for labor force participation during late adolescence/early adulthood, proxied by labor force participation rates of women during that period, affects the propensity for female travel at later ages.

Summary

Travel demand methodologies have evolved through three generations from simple, parsimonious trip generation models to more complex, behaviorally-based activity models. Extant forecasts of 65+ travel have employed first generation methodologies to forecast person-trips or VMT. And though many researchers have noted that cohort differences with respect to 65+ travel are likely to exist between the Boomers and Matures, no work has yet been done to empirically model or quantify these differences. The theory of generation differentiation, particularly with respect to a critical period of socialization in late adolescence/early adulthood, is well established. However, its application to forecasting is a recent development, and very few models in the literature (in any field) have actually incorporated theoretically motivated cohort variables. In this study, the cohort variables hypothesized to have differentiated the Boomers and the Matures with respect to travel propensity are related to the historic processes of motorization and evolving gender roles.

Thus, the primary contributions of this study involve the following: incorporation of theoretically motivated cohort variables into a model of 65+ travel demand; empirical quantification of cohort differences in travel between the Boomers and the Matures; and development of a national forecast of 65+ travel demand. In this study well-developed methodologies are applied using extant survey data; second generation regression and logit models are estimated using disaggregate national travel survey data.

Mannheim (1952) in his seminal treatise on generations noted the following:

> Discoverers often tend to be over-enthusiastic about phenomena they are the first to see. Innumerable theories of history manifest this one-sidedness . . . but it may be said to their credit that they bring at least one partial factor into sharp focus and also direct attention to the general problem of the structural factors shaping history. (p. 312)

This study aims to bring into sharp focus the cohort-related differences in travel behavior between the Boomers and Matures. It does not seek to be one-sided, presuming that cohort effects associated with late adolescence/early adulthood are the sole determinants of later travel behavior; however, it does seek to highlight these cohort differences and determine whether, and if so, the extent to which, they affect travel behavior.

3. Methodology

Not everything that counts can be counted, and not everything that can be counted counts.

Albert Einstein[5]

As an undergraduate enrolled in a steel design class, when my interest in the textbook lagged, I would visit a particular steel railroad bridge. The geometry of its design and its physical construction would rekindle my motivation. This thesis is akin to that railroad bridge. The introduction is the view from the bridge deck and its purpose. The literature review is the concrete foundation. This section describes the steel members, bolts, and welded joints of which the structure is built. All of the identified methods are both well established and documented in previously published work. However, the choice of each methodology is detailed here. Estimation of cohort, age, and period effects involves specific data requirements not usually considered in more conventional travel demand models. Therefore, the choice of data is addressed and the data described prior to subsequent discussions of model specification and estimation, and forecasting methods.

Travel Data

Although most life cycle patterns (of consumption, for example) are developed using cross-sectional data, with only one cross-section, the relative effects of age and cohort are unidentifiable. This is the case even if one includes a continuous variable representing cohort effects. For with a cross-section, one has essentially only a single observation of any particular cohort; and with only one observation of each cohort (all of its members being the same age), it is then impossible to untangle whether changes in the dependent variable are attributable to cohort membership or to the age category corresponding to that particular cohort. In contrast, with more than one observation of a particular cohort, at different points in time, the relative effects of age and cohort become distinguishable.

Therefore, the most important restriction on possible data sets for estimating cohort effects is the need for comparable data sets from at least two different points in time. Acquiring comparable transportation data sets that satisfy this requirement is difficult. Regional data sets are often not maintained over time. For example, in the San Francisco Bay Area, transportation survey data from as recent as 1990 are inaccessible; in Portland, Oregon while 1995 data is readily available, data from their 1984 survey would require extensive processing. Furthermore, survey methodology has evolved substantially in the last decade such that transportation data collected in the 1980s are often not compatible with data collected in the 1990s.

[5] Sign hanging in Einstein's office at Princeton.

The National Personal Transportation Survey (NPTS) is a national survey collected by the Federal Highway Administration. The surveys were administrated in 1969, 1977, 1983, 1990, 1995, and most recently in 2001. Despite methodological changes in the 1995 NPTS survey, the first four surveys (conducted in 1969, 1977, 1983, and 1990) are comparable (Liss, Undated). With an average of 28,000 households surveyed in each survey year, the large number of NPTS observations alleviates the estimation problem posed by few 65+ observations in most regional data sets. Furthermore, because the data sets are national in scope, they do not suffer from the external validity problem besetting regional data sets.

The data from the 1969 NPTS survey is available. However, both the variable definitions and the scope of variables collected changed significantly between 1969 and 1977. Therefore, the benefit from adding an additional observation point in time would not have offset the cost of reducing the number of available dependent and explanatory variables. The 2001 NPTS data is still unavailable to researchers. Therefore, the 1969 and 2001 NPTS data sets were excluded from the analysis

Of the remaining data sets, the 1983 data is the smallest of the included data sets (10,375 observations compared to the 43,600 average of the other three surveys). According to Susan Liss (Undated), the NPTS Project Manager, the 1983 sample was so small that interviewers never became proficient. Yet despite this peculiarity, the 1983 data set collection techniques are comparable to those of 1977 and 1990. The NPTS national travel survey updated its survey methodology in 1995. Improvements over the 1990 methodology included a monetary incentive to participate, confirmation of zero trips, and proxy from travel-diary instead of proxy from memory recall. These innovations resulted in significant increases in reported trip rates.

Given the evolution in NPTS data collection between 1969 and 1995, a tradeoff had to be made between maintaining comparability and accessing additional data sets for estimating the expected cohort effects. While it is theoretically possible to estimate cohort effects with only two data sets, in trying to untangle age, period, and cohort effects (all related to time), additional points of observation in time are preferable. Therefore, despite the resulting issues from differences in comparability, the 1983 and 1995 data sets were included in model estimation. For each period (e.g. each data set or point in time), dummy variables were included in the models. Because period effects are by definition fluctuations in data due to circumstances occurring at particular points in time, the survey methodology changes are expected to confound the estimation of actual period effects. However, the survey methodology changes are not expected to confound the estimation of cohort effects.

A summary comparison of the four included surveys is provided in Table 3-1 on the following page. All of the surveys contain data related to household structure, individual household role, capabilities, activity commitments, mobility, and travel behavior. Extracting the relevant variables from each of the four surveys and ensuring comparability across surveys required considerable effort. The details of that process are outlined in the Data Appendix. Furthermore, the Data Appendix details the idiosyncrasies

Table 3-1 1977, 1983, 1990, and 1995 NPTS Comparison

	1977 NPTS	1983 NTPS	1990 NPTS	1995 NPTS
Sample Size [1]	18,000	6,500	22,300	42,000
Method	Recall; In-home Interview	Recall; In-home Interview	Recall; CATI [2]	Travel Diary with Telephone Retrieval
Conducted By	Bureau of Census	Bureau of Census	Research Triangle Institute	Research Triangle Institute
Sample Design	Stratified Multistage Cluster	Stratified Multistage Cluster	Stratified Random Digit Dialing	Stratified Random Digit Dialing
Response Rate	85%	93%	84%	55.3% [3]

[1] Households
[2] Computer Aided Telephone Interview
[3] Response rate includes telephone screening to identify residential households as well as household survey completion.
Source: Liss, S. *Effects of Survey Methodology Changes in the NPTS*. Washington, DC: FHWA.

of individual surveys and how those idiosyncrasies were addressed in constructing a single data set of comparable variables from the discrete NPTS surveys.

Missing Data

As with many travel surveys, the NPTS is prone to non-response. For example, in the 1995 NPTS survey, 17 percent of respondents provided no information on their household income. Multiple imputation was used to address this problem. In contrast to single imputation (e.g. hot decking, mean imputation, and regression imputation), multiple imputation accounts for the uncertainty attributable to missing data in the estimated variances. Furthermore, multiple imputation does not suffer from the inconsistency and inefficiency that besets simple case deletion of incomplete observations. Finally, multiple imputation is relatively simple to implement when compared to full maximum likelihood estimation. Under full maximum likelihood estimation, the missing data values and model parameters are estimated simultaneously. In addition, full maximum likelihood estimation requires special implementation for each model type (as well as for each iteration of a particular model specification). Thus, full maximum likelihood estimation would have required a prohibitive amount of computation time for implementation. In contrast, once imputed, one set of multiple imputations may be used for a variety of analyses. See Little & Rubin's (1987) seminal work for further discussion and comparison of missing data techniques.

The primary drawback of multiple imputation is the limited flexibility in variable distribution assumptions, particularly when using canned software packages for implementation. However, for the application reported in this study, the variable distributions for all the variables with missing information rates greater than 5 percent fit the distribution assumptions of the multiple imputation software. Furthermore, Han & Polak (2001) imputed travel data with variable distributions similar to the NPTS variables, using even more restrictive software distribution assumptions, and reported satisfactory results.

The multiple imputations of the missing data were produced using the Missing Data Library of S-PLUS Statistical software. Schafer (1997) details the multiple imputation algorithm. The multiple imputation methodology is described in more detail in the Data Appendix.

Models

Both the quality and availability of variables in the NPTS data sets shaped the resulting models reported in this study. The data impacted not only the choice of dependent variables, but also model specification, structure, and estimation.

Dependent Variables

The choice of dependent variables was influenced by the desire to explore not only numbers of miles traveled, but also the character of those miles (e.g. the number and types of activities creating demand for miles, prevalence of trip chaining and mode choice). For a list of dependent variables, see Table 3-2. As the aim of this study was to

Table 3-2 Dependent Variables and Model Estimation Methodologies

Variable	Description	Methodology
Total Number of Sojourns	--	Joint Discrete / Continuous
Total Person Miles Traveled	--	Joint Discrete / Continuous
Number of Sojourns by Type	Activity type: Personal Business	Joint Discrete / Continuous
Sojourning by Activity Type	Activity types: Recreation, Work, Education/Religious, Medical Alternatives: Yes or No	Binary Logit
Trip Chaining on Travel Day	Alternatives: Yes or No	Binary Logit
Transit Usage on Travel Day	Alternatives: Yes or No	Binary Logit
Biking/Walking Mode Usage on Travel Day	Alternatives: Yes or No	Binary Logit

provide a national (e.g. macro-level) forecast of 65+ travel, dependent variables often modeled in local travel demand models (e.g. travel times, time of day, origin and destination) are of less interest.

The NPTS was designed to collect information on individual trips, not daily activities or activity tours. However, operationalizing a dependent variable as gross number of trips did not facilitate investigating the types of activities being engaged in. Therefore, a variable defined as number of "sojourns", or the number of trip ends outside the home, was used. This particular operationalization allowed modeling of not only the total number of sojourns but also the number of reported personal business sojourns, recreation sojourns, etc.

Finally, because there were spikes in the distribution of the total miles variable at five and ten mile increments, the variable was collapsed. Individuals who reported traveling between one and five miles were assigned a value of one; individuals who reported traveling between six and ten miles were assigned a value of two; etc. The total miles variable was then scaled by one, and the natural log of the resulting value was used in model estimation. This particular transformation was chosen because it both preserves the zero minimum value (for those who did not report any travel) and, in reducing the right-tail skew, more closely approximates a normal distribution. After model estimation, the untransformed predicted values were estimated using a normal theory estimate (exponentiating the sum of the predicted value and half the mean squared error) and then expanded by a factor of five.

Model Specification

Trip generation models or even activity-based models are most often estimated using households instead of individuals as the unit of observation (Goulias, Pendyala, & Kitamura, 1990; Kitamura & Kostyniuk, 1986). Theoretically this makes sense as individual behavior is both constrained and influenced by the overall household composition and the needs of other household members. However, the focus of this study concerned more the travel behavior of particular individuals (e.g. the baby boomers and their mature counterparts age 65+) than the behavior of the households in which they reside. Therefore models were estimated using individuals instead of households. In doing so, as recommended by Bowman (1998), care was taken to include explanatory variables controlling for household composition and the household roles of the respective individuals.

With respect to specification, it is an art that accommodates the data, the a priori assumptions brought to the data and the prolonged engagement between the data and the modeler. In particular, a balance is struck between manipulating the independent variables to explain as much of the variation as possible vs. including only those variables expected, a priori, to influence the observed behavior. In the specifications presented here, three precautions were taken against over-fitting the data.

First, aside from the cohort variables, only those explanatory variables were included with precedence in previously published demand models (Bowman, 1998; Golob &

McNally, 1997; Lleras et al., 2003; Lu & Pas, 1997). For the cohort variables, a priori reasoning and theory were directly addressed in the Literature Review Chapter.

Second, instead of allowing the specification of explanatory variables for each model to vary among the dependent variables, the specification was kept uniform across models. Underlying this decision was the assumption that all the dependent variables are indicators of travel behavior. Therefore, one would expect that a variable explaining variation in travel behavior should be significant across several of the dependent variables. In the exploratory analysis, those variables with the most important effects were identified. Furthermore, in any particular model, variables were retained even if, in that particular model, they were not statistically significant at 95% confidence level. The resulting explanatory variables are listed in Table 3-3 on the following page.

Finally, as yet another safeguard against over-fitting the data, the data was partitioned into two random sub-sections and specification searches were conducted on only the first sub-section. After specifications searches were completed, the final specification was applied to the hold-out sample. The model estimates for both the specification and hold-out samples are provided in the Hold-Out Sample Appendix as well as a table summarizing changes in the R-squared values estimated using the hold-out and specification samples.

Model Structure

The choice of model structure was determined by the dependent variable distributions. For the dependent variables of sojourns and miles, a significant number of people reported no sojourns (or miles). Therefore, estimation using OLS would have produced a downward bias in estimated parameters. Joint discrete/continuous models were used in estimation to address this concern.

As outlined in Train (1986), within the joint discrete/continuous framework, the continuous model is the demand function for sojourns (or miles), conditioned upon reporting one or more sojourns. The resulting predicted value for total sojourns (denoted as S in this discussion) is the estimated probability of reporting a sojourn (from the discrete model) multiplied by the estimated number of reported sojourns, conditioned upon reporting one or more sojourns (from the continuous model):

$$S = \text{Prob}(S > 0) * E(S \mid S > 0) \qquad (2)$$

A correction factor is included in the continuous model to adjust for coefficient bias resulting from estimating the continuous model using only those observations for which the reported number of sojourns is greater than zero. The correction factor is a function of the estimated choice probability from the discrete choice model. When using both the continuous and discrete models for prediction purposes, the correction factor is included (Train & Strebel, 1987). As a final note, in estimating the joint discrete/continuous model, the estimated explanatory variables were not constrained to be equal across the discrete and continuous models (e.g. a switching model structure was used instead of a tobit structure).

Table 3-3 Explanatory Variable Definitions

Category	Variable		Variable Definition
Cohort	Female labor force participation	LNFLFP	natural log of female labor force participation rate, averaged over the years the individual aged from 15-24 years old, for females (0 for males)
	Motorization	LNMOTOR	natural log of per capita U.S. vehicle registration, averaged over the years the individual aged from 15 - 24 years old
Age	Age (piece-wise linear)	AGE25TO34 (ETC.)	piece-wise linear variable, 10 year break points
Period	Period (categorical)	YEAR83	1 if observation year = 1983, 0 otherwise
		YEAR90	1 if observation year = 1990, 0 otherwise
		YEAR95	1 if observation year = 1995, 0 otherwise
Household Structure and Household Role	Household size	HHSIZE	number of individuals in household
	Children	CH0TO4	1 if household has children 0-4, 0 otherwise
		HH_0TO17	number of children 0-17 in household
	Family	FAMILY	1 if at least one household member is related to the household head, 0 otherwise
	Gender	FEMALE	1 if female, 0 otherwise
	Gender-interaction	FE0TO12	1 for female adult in household with children 0-12, 0 otherwise
Ethnicity	Black	BLACK	1 if individual (or 1990/1995 household) is Black
Capabilities & Commitments	Per capita income	LNINCOME	natural log of household annual income divided by household size
	Education	HIGHED	1 if individual's highest level of educational attainment is high school graduation, 0 otherwise
		COLLED	1 if individual's highest level of educational attainment is college graduation, 0 otherwise
		GRADED	1 if individual completed some graduate schooling, 0 otherwise
	Employment status	WORKER	1 if worker, 0 otherwise
Mobility & Accessibility	Vehicle availability	VEHSATUR	1 if household has 1 or more vehicles per person 18 years or older, 0 otherwise
	Driver-vehicle interaction	LICVEH	1 if individual is a licensed driver in a household with 1 or more vehicles, 0 otherwise
	Urban	URBAN	1 if residential location is in an urban area, 0 otherwise
	Public transportation proximity	PTFOURTH	1 if residential location is within 1/4 mile of public transportation, 0 otherwise
		PTONE	1 if residential location is between 1/2 to 1 mile from public transportation, 0 otherwise
Other	Weekend travel day	TRAVWKND	1 if assigned travel date is Saturday or Sunday, 0 otherwise
	Proxy status	PROXY	1 if person or travel data was reported by another household member, 0 otherwise
	Correction factor	CORRECT	Correction factor for joint continuous/discrete models

The sojourns of types 'personal business' were modeled similarly. However, the sojourns of type 'recreation', 'work', 'medical', and 'education/religious' were modeled as binary choice; this is due to the fact that in each of these sub-categories, less than 10% of the observations had more than one sojourn of that particular type. The remaining dependent variables were modeled as discrete (binary) choice models because they constituted dependent variables with two alternatives (e.g. used transit on travel day or not). The trip chaining, transit usage, and bike/walk models were estimated using only those people who reported making a trip (e.g. the transit model estimates the probability that an individual used transit on their travel day, given that they reported travel on their travel day).

The discrete models were estimated using a binary logit structure and maximum likelihood estimation. The joint continuous/discrete models were estimated sequentially. First, the discrete portion was estimated using maximum likelihood estimation. Second, the correction factor was calculated using the predicted probability. Finally, the continuous portion of the joint discrete/continuous models was estimated using OLS. All of the models were estimated using the STATA statistical package.

Survey Design in Estimation

All of the respondents in the respective NPTS surveys were assigned weights. The weights indicate the number of people in the United States (e.g. the entire sample frame) that the sampled individual represents. In other words, the weights are proportional to the inverse of the individual's probability of being sampled.

Including survey weights in model estimation is influenced by whether one adopts a statistical or an econometric view of regression (e.g. whether one considers regression a descriptive device conditioning the mean of one variable upon the mean of a vector of other variables or, alternatively, a behavioral model of determination) (Deaton, 1997). In the first case, using weights in estimation removes the dependence of the parameter estimates on the sample design. The resulting estimated parameters are population-weighted averages that summarize the characteristics of the (presumably heterogeneous) population.

Alternatively, when using an econometric approach, differences in parameter values are a feature of the population, not the sample design. In the extreme, if a population is homogeneous in parameters, both the weighted and unweighted estimators will be consistent, but the OLS estimates will be preferable (e.g. more efficient) by the Gauss-Markov theorem. When the parameters are not homogeneous across the population, both the weighted and unweighted estimators are inconsistent, which again negates the argument for weighting.

Because theoretically, the behavioral or econometric argument is superior, results estimated without survey weights are reported in the Results Chapter. In the Weighting Appendix, models estimated both with and without weights are reported along with Hausman statistics testing the null hypothesis that differences in the estimated coefficients are not significant.

Table 3-4 Iterative Proportional Fitting Marginals

			1995	2000	2010	2020	2030
Females	Population	(1000s)	19866	20364	22522	29443	37661
	Age	% 65-74	52.5	48.9	50.2	56.4	51.9
		% 75-84	34.4	36.2	32.5	29.0	33.7
		% 85+	13.2	14.9	17.3	14.7	14.4
	Education	% Elementary	35.9	30.5	28.2	19.0	14.2
		% High School	54.1	58.1	57.7	61.6	63.3
		% College	6.9	7.8	8.0	11.2	14.2
		% Graduate	3.1	3.6	6.0	8.2	8.4
	Worker	% Non-workers	91.2	90.6	88.9	87.4	88.3
		% Workers	8.8	9.4	11.1	12.6	11.7
	Race	% Non-Black	91.6	91.3	90.8	89.9	89.1
		% Black	8.4	8.7	9.2	10.1	10.9
Males	Population	(1000s)	13678	14346	16887	23776	31718
	Age	% 65-74	61.0	57.0	57.8	62.2	56.4
		% 75-84	31.6	34.4	31.8	28.8	34.1
		% 85+	7.4	8.6	10.5	9.0	9.5
	Education	% Elementary	36.5	30.4	28.5	19.0	15.3
		% High School	46.3	48.2	49.2	53.5	57.6
		% College	10.1	12.1	11.2	14.1	15.3
		% Graduate	7.1	9.3	11.1	13.4	11.8
	Worker	% Non-workers	83.2	82.5	80.5	79.0	80.4
		% Workers	16.8	17.5	19.5	21.0	19.6
	Race	% Non-Black	92.3	92.2	92.0	91.6	91.1
		% Black	7.7	7.8	8.0	8.4	8.9

Sources: Day, Jennifer Cheeseman, *Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050*, U.S. Bureau of the Census, Current Population Reports, P25-1130, U.S. Government Printing Office, Washington, D.C., 1996.; Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2002-03 Edition. Available: http://www.bls.gov/oco/.; Kominski, R. & Adams, A., *Educational Attainment in the United States: March 1991 and 1990*, U.S. Bureau of the Census, Current Population Reports, Series P20-462, U.S. Government Printing Office, Washington, D.C., 1992.

Forecast

The forecasts of 65+ travel demand were produced through generation of synthetic future populations. The primary advantage of the synthetic population approach (which falls under the broad category of sample enumeration) derives from being a disaggregate approach (Ben-Akiva & Lerman, 1985). Unlike aggregate methods (e.g. average individual and classification), the synthetic population approach easily accommodates differential sampling rates in the initial sample population, and it facilitates disaggregation of final population-level forecasts. Furthermore, it is preferable to statistical differentiation and explicit integration, because it does not assume the distributions of attributes across populations.

Generating a synthetic population involved altering the sample weights for the current (in this case 1995) population. Marginals for a multi-way demographic table for each forecast year were obtained from U.S. Census and Bureau of Labor Statistics projections.

The marginals are reported in Table 3-4 on the previous page. The most notable increases, aside from population growth, are the increases in educational attainment. A 106% increase in college educated women and a 170% increase in women with graduate education is projected. For men, college graduates will increase by 51% and those with graduate schooling will increase by 66%.

The proportions for each cell of the multi-way table were estimated using iterative proportional fitting. Finally, the synthetic (future) population was created by adjusting the individual weights associated with the 1995 NPTS data set to match the estimated (future) population proportions. The synthetic populations were then used with the estimated models to obtain future predicted values for each individual in the synthetic population. For a more detailed treatment of recent studies generating synthetic populations, see (Barrett, 2002; Beckman, Baggerly, & McKay, 1996).

The marginals detailed in Table 3-4 were used because they were readily available from a government source. Those variables not incorporated in the marginals include: household role and structure (household size, children, family, gender-children interaction), per capita income, mobility (vehicle availability and driver-vehicle interaction), and accessibility (urban location and public transportation proximity) measures. Of these excluded variables, income's correlation with education mitigates its exclusion. Marginals for the remaining variables could be incorporated for sensitivity analyses. Results from such an analysis, using the transit proximity variables, are reported.

Summary

This chapter has described the data, model structures, estimation techniques, and forecasting methods employed in this study. Returning to the steel bridge analogy that began this chapter, when I first started the building process, I could not imagine how the final structure would emerge. Many of the decisions regarding individual members were made after construction commenced. In the following chapter, I will turn to describing the resulting structure.

4. Results

. . . has written a paper of tremendous scope. In doing it, he had a great struggle with the data. He won a few points, the data won a few points, and I gather they are both exhausted.

William Nordhaus[6]

Picasso was once filmed allowing viewers to watch him paint onto a blank projection screen. The film consisted of simple brushstrokes on a canvas illuminated by light. The model results presented here are also brushstrokes, using the seemingly simple medium of numbers, numbers distilled from a single day of travel reported by thousands of people over the last 20 years. The illuminating factor behind these models is the hypothesis that motivated their creation; namely, that my 50-year-old mother would, as she aged, have different travel patterns than my 80-year-old grandmother has now. Without the theory backing that idea, along with the accompanying data and methods used in estimation, the model results are merely a collection of numbers. This chapter will report the results from model estimation and compare, in particular, models estimated with and without cohort variable inclusion. In addition, forecast results for the years 2000, 2010, 2020, and 2030 will also be presented and discussed.

Model Estimation Results

The estimated models for total sojourns and total miles, with the cohort variables included and excluded (constrained to zero), are presented in Tables 4-1 and 4-2 respectively. The models for sojourn types (e.g. personal business, recreation, work, medical, and education/religious) are in Tables 4-3, 4-4, and 4-5. The models for transit usage, and usage of a non-motorized travel mode (e.g. biking or walking) are provided in Table 4-6. The model for trip chaining in Table 4-7. The total sojourns, total miles, and personal business sojourns are modeled using the joint discrete/continuous methodology. In the discrete portion, the choice is between zero sojourns (or miles) and one or more sojourns (or miles). The explanatory variables are defined in Table 3-3 on page 27 of the previous chapter. The goodness of fit measures provided in the tables are rho-squared for the discrete models and R-squared for the continuous models. The goodness of fit measures are not corrected for the number of parameters. Finally, for the discrete models, log-likelihood values are reported as well as log-likelihood values for the corresponding constant-only models. Similarly, for the continuous models, the sum of squared errors [SSE] and total sum of squares [SST] are also reported.

[6] Nordhaus, W. (1975). Comment. *Brookings Papers on Economic Activity*, 2, p.400.

Table 4-1 Estimation Results for Total Sojourns

Total Sojourns		Cohort Included				Cohort Excluded			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.105	1.70	0.343	5.81	--	--	--	--
	lnmotor	0.0716	1.74	0.0740	1.15	--	--	--	--
Age	a25to34	-0.0156	-3.13	-7.29E-03	-1.91	-0.0179	-3.67	-0.0107	-2.92
	a35to44	-6.55E-03	-1.67	6.44E-03	2.02	-8.90E-03	-2.36	2.62E-03	0.94
	a45to54	-6.62E-03	-1.65	-0.0159	-4.43	-9.22E-03	-2.42	-0.0197	-6.45
	a55to64	-5.81E-04	-0.14	8.75E-03	2.23	-3.42E-03	-0.88	4.72E-03	1.33
	a65to74	-5.71E-03	-1.38	-9.93E-03	-2.15	-8.50E-03	-2.15	-0.0144	-3.40
	a75plus	-0.0550	-11.26	-0.0386	-5.88	-0.0606	-14.96	-0.0431	-7.03
Period	year83	0.0759	2.52	0.119	3.93	0.0961	3.37	0.144	5.15
	year90	0.281	9.90	0.112	3.62	0.322	15.25	0.163	7.43
	year95	0.966	29.86	1.01	25.74	1.02	50.70	1.07	34.92
Household	family	0.133	5.45	4.30E-03	0.20	0.137	5.64	0.0101	0.48
Role &	ch0to4	-0.233	-8.57	-0.228	-10.65	-0.236	-8.73	-0.230	-10.78
Structure	hh_0to17	0.168	11.90	0.231	17.78	0.167	11.88	0.223	17.25
	hhsize	-0.103	-9.85	-0.0890	-8.79	-0.104	-9.92	-0.0863	-8.54
	black	-0.113	-4.20	-0.0865	-3.44	-0.112	-4.15	-0.0806	-3.21
	female	-0.0197	-0.29	0.324	5.59	-0.131	-7.439	-8.72E-04	-0.06
	fe0to12	0.113	3.65	0.313	12.79	0.131	4.53	0.358	15.48
Capabilities &	lnincome	0.0670	5.68	0.104	9.54	0.0671	5.69	0.103	9.51
Commitments	highed	0.174	8.98	0.319	14.90	0.174	8.98	0.308	14.45
	colled	0.280	9.73	0.480	17.67	0.280	9.73	0.469	17.34
	graded	0.398	11.85	0.615	20.83	0.398	11.86	0.603	20.49
	worker	0.940	48.80	0.102	3.35	0.938	48.79	0.0762	2.57
Mobility &	vehsatur	0.0820	4.26	0.0352	2.06	0.0808	4.20	0.0311	1.82
Accessibility	licveh	0.726	31.04	0.687	18.52	0.732	31.52	0.675	18.30
	urban	0.0811	4.22	0.0169	1.05	0.0812	4.23	0.0147	0.92
	ptfourth	0.0998	4.84	0.0339	1.90	0.100	4.86	0.0318	1.79
	ptone	0.142	5.99	0.0288	1.52	0.142	6.00	0.0254	1.34
Other	travwknd	-0.433	-26.40	-0.291	-16.01	-0.433	-26.38	-0.279	-15.56
	proxy	-0.800	-39.12	-0.665	-24.06	-0.801	-39.15	-0.646	-23.80
	correct	--	--	-0.350	-4.70	--	--	-0.273	-3.79
	constant	-2.45E-03	-0.01	0.702	4.05	0.0133	0.07	0.844	4.92
Number of observations		141,203		113,348		141,203		113,348	
Rho-squared [R-squared]		0.152		0.0920		0.152		0.0917	
Log likelihood (C) [SST]		-70120		534564		-70120		534564	
Log likelihood (β) [SSE]		-59432		485385		-59435		485526	

Table 4-2 Estimation Results for Log of Total Miles

Log of Total Miles		Cohort Included				Cohort Excluded			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.0919	1.46	-1.45E-03	-0.06	--	--	--	--
	lnmotor	0.0506	1.24	-0.0262	-1.07	--	--	--	--
Age	a25to34	-0.0172	-3.33	-7.05E-03	-4.80	-0.0190	-3.76	-6.65E-03	-4.72
	a35to44	-7.44E-03	-1.86	-6.51E-03	-5.29	-9.22E-03	-2.40	-5.91E-03	-5.44
	a45to54	-7.11E-03	-1.76	-5.24E-03	-3.80	-9.05E-03	-2.35	-4.49E-03	-3.80
	a55to64	-1.05E-03	-0.26	-5.09E-03	-3.41	-3.24E-03	-0.83	-4.43E-03	-3.29
	a65to74	-7.64E-03	-1.84	-0.0117	-6.66	-9.76E-03	-2.47	-0.0109	-6.76
	a75plus	-0.0554	-11.37	-0.0222	-8.48	-0.0595	-14.77	-0.0211	-8.73
Period	year83	0.0713	2.31	0.0182	1.58	0.0865	2.97	0.0137	1.28
	year90	0.274	9.57	0.0795	6.76	0.305	14.28	0.0707	8.48
	year95	0.977	30.04	0.324	21.75	1.02	49.89	0.313	27.48
Household	family	0.142	5.74	0.0517	6.35	0.145	5.91	0.0519	6.38
Role &	ch0to4	-0.236	-8.53	-0.0478	-5.83	-0.239	-8.67	-0.0482	-5.89
Structure	hh_0to17	0.167	11.64	0.0214	4.32	0.166	11.62	0.0216	4.39
	hhsize	-0.102	-9.55	0.0232	5.85	-0.102	-9.61	0.0230	5.82
	black	-0.133	-4.87	-0.0235	-2.39	-0.132	-4.83	-0.0238	-2.43
	female	-0.0512	-0.74	-0.132	-5.95	-0.149	-8.34	-0.132	-22.06
	fe0to12	0.118	3.75	-0.0266	-2.87	0.134	4.56	-0.0265	-3.01
Capabilities &	lnincome	0.0795	6.53	0.0993	23.08	0.0796	6.54	0.0994	23.08
Commitments	highed	0.181	9.20	0.0987	11.78	0.180	9.19	0.0990	11.86
	colled	0.287	9.77	0.162	15.66	0.287	9.76	0.163	15.76
	graded	0.414	12.06	0.160	13.80	0.414	12.06	0.161	13.89
	worker	0.959	49.27	0.155	13.56	0.958	49.30	0.157	14.06
Mobility &	vehsatur	0.0965	4.96	0.106	16.05	0.0955	4.91	0.107	16.10
Accessibility	licveh	0.733	30.53	0.312	21.89	0.738	31.01	0.314	22.16
	urban	0.0779	4.02	-0.125	-20.10	0.0780	4.02	-0.125	-20.08
	ptfourth	0.0988	4.76	-0.144	-20.32	0.0991	4.77	-0.144	-20.32
	ptone	0.144	6.00	-0.0822	-11.39	0.144	6.01	-0.0819	-11.36
Other	travwknd	-0.407	-24.16	-4.53E-03	-0.67	-0.407	-24.15	-5.24E-03	-0.78
	proxy	-0.806	-38.95	-0.103	-9.90	-0.807	-38.99	-0.104	-10.20
	correct	--	--	-0.251	-8.92	--	--	-0.257	-9.41
	constant	-0.0625	-0.34	0.465	6.87	-0.0458	-0.25	0.465	6.94
Number of observations		141,203		114,169		141,203		114,169	
Rho-squared [R-squared]		0.158		0.114		0.157		0.114	
Log likelihood (C) [SST]		-68953		81539		-68953		81539	
Log likelihood (β) [SSE]		-58093		72236		-58094		72239	

Table 4-3 Estimation Results for Personal Business Sojourns

Pers. Business Sojourns		**Cohort Included**				**Cohort Excluded**			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.607	12.01	1.15	13.77	--	--	--	--
	lnmotor	0.0721	1.49	0.203	3.03	--	--	--	--
Age	a25to34	0.0112	3.18	0.0181	4.52	5.08E-03	1.50	5.56E-03	1.50
	a35to44	9.77E-03	3.40	0.0260	7.67	4.23E-03	1.62	0.0131	4.78
	a45to54	-9.64E-03	-3.05	-0.0184	-5.08	-0.0150	-5.30	-0.0310	-9.06
	a55to64	0.0163	4.79	0.0265	6.11	0.0101	3.24	0.0138	3.86
	a65to74	-1.43E-03	-0.37	-8.97E-03	-2.02	-8.48E-03	-2.36	-0.0239	-5.82
	a75plus	-0.0468	-9.57	-0.0929	-12.22	-0.0580	-13.83	-0.119	-14.27
Period	year83	0.250	9.56	0.639	14.81	0.291	11.96	0.741	16.08
	year90	0.457	17.61	1.10	19.62	0.545	31.00	1.31	20.54
	year95	1.05	35.08	2.45	22.90	1.17	72.95	2.76	22.73
Household	family	0.0896	4.70	0.165	7.38	0.108	5.72	0.201	8.74
Role &	ch0to4	-0.092	-4.71	-0.265	-11.94	-0.108	-5.58	-0.296	-12.97
Structure	hh_0to17	0.158	14.36	0.380	18.94	0.150	13.70	0.370	18.99
	hhsize	-0.102	-11.75	-0.195	-13.31	-0.103	-11.89	-0.200	-13.59
	black	-0.0695	-3.11	-0.0650	-2.51	-0.0636	-2.85	-0.0566	-2.20
	female	0.678	13.18	1.32	15.04	0.0815	5.98	0.209	12.60
	fe0to12	0.243	10.55	0.556	17.27	0.334	15.48	0.734	19.72
Capabilities &	lnincome	0.0456	4.54	0.116	8.53	0.0465	4.64	0.119	8.71
Commitments	highed	0.203	11.88	0.505	16.42	0.199	11.59	0.503	16.47
	colled	0.304	13.45	0.712	17.15	0.303	13.39	0.720	17.31
	graded	0.380	15.37	0.840	17.57	0.380	15.38	0.852	17.78
	worker	-0.205	-13.54	-0.447	-17.41	-0.206	-13.58	-0.455	-17.67
Mobility &	vehsatur	-0.0207	-1.34	-0.0769	-4.44	-0.0258	-1.67	-0.0868	-4.98
Accessibility	licveh	0.723	33.73	1.54	18.52	0.752	35.31	1.62	18.85
	urban	0.0280	1.90	0.0295	1.75	0.0283	1.92	0.0308	1.83
	ptfourth	0.0712	4.57	0.125	6.38	0.0728	4.68	0.129	6.59
	ptone	0.0847	4.77	0.132	6.39	0.0850	4.79	0.135	6.50
Other	travwknd	-0.174	-13.58	-0.491	-22.25	-0.173	-13.55	-0.497	-22.51
	proxy	-0.704	-42.62	-1.34	-18.25	-0.708	-42.85	-1.37	-18.57
	correct	--	--	-2.26	-14.81	--	--	-2.31	-15.15
	constant	-1.92	-13.89	-5.38	-12.32	-1.81	-13.30	-5.33	-12.38
Number of observations		141,203		72,439		141,203		72,439	
Rho-squared [R-squared]		0.0770		0.0833		0.0762		0.0830	
Log likelihood (C) [SST]		-97827		203082		-97827		203082	
Log likelihood (β) [SSE]		-90296		186169		-90369		186218	

Table 4-4 Estimation Results for Recreation & Work Sojourns

		Recreation Sojourns				Work Sojourns			
		Cohort Included		Cohort Excluded		Cohort Included		Cohort Excluded	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.226	4.24	--	--	-0.0893	-1.10	--	--
	lnmotor	0.268	4.59	--	--	0.350	2.35	--	--
Age	a25to34	-0.0202	-5.46	-0.0265	-7.54	-0.0143	-2.92	-0.0194	-4.60
	a35to44	-0.0109	-3.58	-0.0187	-6.85	8.14E-03	1.72	6.51E-04	0.21
	a45to54	2.91E-03	0.83	-5.97E-03	-2.00	-3.04E-03	-0.54	-0.0129	-3.70
	a55to64	0.0125	3.40	3.97E-03	1.18	-0.0175	-2.95	-0.0255	-5.43
	a65to74	3.71E-03	0.88	-5.67E-03	-1.51	-0.0325	-3.56	-0.0426	-5.47
	a75plus	-0.0341	-6.39	-0.0497	-10.85	-0.0397	-2.41	-0.0563	-3.71
Period	year83	0.108	3.78	0.168	6.40	-0.142	-3.34	-0.0869	-2.51
	year90	0.0240	0.82	0.145	7.60	-0.0782	-1.37	0.0340	1.42
	year95	0.390	11.47	0.550	32.58	0.117	1.63	0.265	12.31
Household Role & Structure	family	-0.0603	-3.02	-0.0537	-2.70	0.0212	0.78	0.0205	0.76
	ch0to4	-0.221	-10.98	-0.226	-11.29	-0.0702	-2.93	-0.0677	-2.84
	hh_0to17	0.112	9.52	0.110	9.40	0.0226	1.57	0.0244	1.70
	hhsize	-0.0776	-8.24	-0.0788	-8.37	-0.0179	-1.56	-0.0189	-1.65
	black	-0.301	-12.04	-0.298	-11.92	0.0308	1.04	0.0312	1.05
	female	0.134	2.50	-0.0852	-6.02	-0.328	-4.30	-0.247	-13.15
	fe0to12	0.0268	1.15	0.0610	2.77	-0.236	-8.04	-0.245	-8.76
Capabilities & Commitments	lnincome	0.115	11.60	0.116	11.63	4.97E-03	0.37	4.72E-03	0.35
	highed	0.173	9.03	0.173	9.07	0.0786	3.04	0.0821	3.18
	colled	0.243	10.00	0.244	10.06	0.0646	2.01	0.0666	2.08
	graded	0.354	13.59	0.357	13.71	0.0710	2.07	0.0744	2.17
	worker	-0.326	-20.80	-0.327	-20.89	4.02	122.45	4.01	122.52
Mobility & Accessibility	vehsatur	0.100	6.20	0.0979	6.07	0.0552	2.60	0.0552	2.60
	licveh	0.454	19.28	0.469	20.02	0.200	5.87	0.200	5.88
	urban	0.0249	1.67	0.0249	1.67	0.0774	3.99	0.0772	3.99
	ptfourth	0.0493	3.06	0.0500	3.10	0.0145	0.70	0.0145	0.70
	ptone	0.0398	2.24	0.0397	2.23	0.0169	0.69	0.0167	0.68
Other	travwknd	0.631	48.66	0.631	48.64	-2.27	-126.03	-2.27	-126.01
	proxy	-0.276	-15.72	-0.276	-15.71	-0.196	-9.06	-0.195	-9.03
	constant	-1.42	-10.50	-1.45	-10.81	-2.53	-14.27	-2.64	-15.28
Number of observations		141,203		141,203		141,203		141,203	
Rho-squared		0.0450		0.0448		0.406		0.406	
Log likelihood (C)		-89298		-89298		-94097		-94097	
Log likelihood (β)		-85280		-85299		-55856		-55860	

Table 4-5 Estimation Results for Medical & Education/Religious Sojourns

		Medical Sojourns				Education/Religious Sojourns			
		Cohort Included		Cohort Excluded		Cohort Included		Cohort Excluded	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.891	6.71	--	--	-0.0240	-0.26	--	--
	lnmotor	0.370	3.08	--	--	0.141	1.74	--	--
Age	a25to34	0.0441	4.21	0.0296	2.91	-0.0293	-4.56	-0.0316	-5.12
	a35to44	0.0307	3.87	0.0142	1.95	7.27E-03	1.38	4.19E-03	0.87
	a45to54	0.0177	2.10	1.40E-03	0.18	8.60E-03	1.47	4.66E-03	0.87
	a55to64	0.0236	2.76	6.56E-03	0.84	0.0125	1.97	9.08E-03	1.54
	a65to74	0.0265	2.99	8.54E-03	1.07	0.0238	3.52	0.0203	3.22
	a75plus	0.0151	1.47	-0.0134	-1.51	-0.0233	-2.55	-0.0316	-4.14
Period	year83	-0.185	-2.36	-0.0611	-0.82	-0.237	-5.02	-0.211	-4.77
	year90	-0.290	-3.91	-0.0344	-0.64	-0.276	-6.05	-0.226	-7.16
	year95	0.265	3.29	0.608	13.74	-0.242	-4.68	-0.177	-6.38
Household	family	0.0713	1.43	0.0996	2.01	0.0929	2.58	0.0916	2.55
Role &	ch0to4	0.0247	0.46	-2.05E-03	-0.04	-0.305	-8.75	-0.305	-8.75
Structure	hh_0to17	0.0396	1.29	0.0279	0.91	0.129	6.44	0.130	6.53
	hhsize	-0.0673	-2.80	-0.0713	-2.97	0.0294	1.81	0.0286	1.76
	black	0.0294	0.51	0.0385	0.66	0.344	9.19	0.344	9.21
	female	1.18	8.38	0.270	7.56	0.238	2.50	0.262	10.27
	fe0to12	0.0878	1.48	0.226	4.08	0.0506	1.30	0.0470	1.27
Capabilities &	lnincome	-0.122	-5.24	-0.121	-5.20	-0.0497	-2.90	-0.0498	-2.91
Commitments	highed	0.184	4.07	0.181	3.99	0.377	11.12	0.380	11.19
	colled	0.265	4.45	0.264	4.42	0.610	14.39	0.612	14.43
	graded	0.318	4.96	0.318	4.95	0.853	18.89	0.855	18.94
	worker	-0.534	-14.28	-0.547	-14.60	-0.386	-13.79	-0.387	-13.85
Mobility &	vehsatur	-0.0199	-0.50	-0.0284	-0.71	0.0560	1.97	0.0558	1.97
Accessibility	licveh	0.0537	1.03	0.102	1.95	0.414	10.22	0.416	10.37
	urban	0.0462	1.23	0.0477	1.27	0.0719	2.67	0.0719	2.67
	ptfourth	0.0331	0.82	0.0358	0.89	0.0177	0.61	0.0178	0.62
	ptone	0.147	3.37	0.147	3.37	0.0110	0.35	0.0107	0.35
Other	travwknd	-1.55	-28.36	-1.55	-28.35	1.16	55.99	1.16	55.99
	proxy	-0.308	-6.53	-0.309	-6.58	-0.329	-9.64	-0.327	-9.58
	constant	-3.61	-9.55	-3.46	-9.24	-2.35	-9.60	-2.39	-9.82
Number of observations		141,203		141,203		141,203		141,203	
Rho-squared		0.0621		0.0609		0.0620		0.0620	
Log likelihood (C)		-21277		-21277		-37700		-37700	
Log likelihood (β)		-19955		-19981		-35362		-35364	

Table 4-6 Estimation Results for Transit & Non-Motorized Mode Usage

		Transit Usage Propensity				Biking/Walking Propensiy			
		Cohort Included		Cohort Excluded		Cohort Included		Cohort Excluded	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.464	3.12	--	--	0.478	5.23	--	--
	lnmotor	0.108	0.68	--	--	-0.135	-1.64	--	--
Age	a25to34	0.0107	1.11	5.29E-03	0.58	-5.16E-03	-0.82	-6.72E-03	-1.11
	a35to44	-2.82E-03	-0.32	-8.80E-03	-1.12	-7.99E-03	-1.50	-8.39E-03	-1.72
	a45to54	0.0100	1.00	4.28E-03	0.49	-0.0135	-2.25	-0.0120	-2.18
	a55to64	-0.0270	-2.47	-0.0340	-3.38	-6.70E-03	-1.02	-7.06E-03	-1.14
	a65to74	0.0113	0.87	3.59E-03	0.30	-4.66E-03	-0.65	-5.42E-03	-0.80
	a75plus	-0.0385	-2.24	-0.0501	-3.38	-0.0440	-4.33	-0.0410	-4.94
Period	year83	-0.159	-1.93	-0.116	-1.51	0.142	3.06	0.140	3.21
	year90	-0.0726	-0.87	0.0160	0.28	-0.161	-3.40	-0.160	-4.69
	year95	0.0804	0.86	0.201	4.20	-0.0591	-1.13	-0.0525	-1.81
Household	family	-0.249	-5.03	-0.240	-4.86	-0.274	-8.44	-0.262	-8.10
Role &	ch0to4	0.111	1.89	0.0984	1.68	-0.172	-4.67	-0.183	-4.98
Structure	hh_0to17	0.0117	0.38	8.39E-03	0.27	0.129	6.06	0.123	5.78
	hhsize	-0.133	-5.80	-0.134	-5.84	-0.170	-10.19	-0.171	-10.23
	black	0.725	16.17	0.728	16.26	-7.41E-03	-0.20	-2.20E-03	-0.06
	female	0.409	2.85	-0.0194	-0.48	0.344	3.78	-0.115	-4.58
	fe0to12	-0.222	-3.32	-0.168	-2.61	0.105	2.57	0.170	4.35
Capabilities &	lnincome	-0.300	-13.31	-0.299	-13.27	-0.0439	-2.88	-0.0431	-2.83
Commitments	highed	0.265	5.16	0.267	5.18	0.0979	3.04	0.0931	2.89
	colled	0.922	14.21	0.927	14.29	0.424	10.28	0.424	10.28
	graded	1.09	15.55	1.10	15.65	0.718	16.30	0.717	16.31
	worker	0.741	15.44	0.740	15.42	-0.201	-7.28	-0.201	-7.29
Mobility &	vehsatur	-1.02	-22.03	-1.02	-22.10	-0.699	-24.29	-0.703	-24.44
Accessibility	licveh	-2.05	-44.32	-2.04	-44.20	-1.35	-40.60	-1.33	-40.33
	urban	0.814	12.10	0.815	12.12	0.146	4.71	0.147	4.75
	ptfourth	1.50	24.63	1.50	24.64	0.642	21.65	0.643	21.69
	ptone	0.953	13.55	0.952	13.55	0.243	6.93	0.243	6.93
Other	travwknd	-0.850	-18.58	-0.850	-18.59	-0.211	-8.53	-0.211	-8.54
	proxy	-1.43E-03	-0.03	-3.73E-03	-0.07	-0.254	-7.06	-0.258	-7.19
	constant	-0.547	-1.56	-0.487	-1.41	0.282	1.20	0.417	1.78
Number of observations		114,212		114,212		114,212		114,212	
Rho-squared		0.316		0.315		0.120		0.120	
Log likelihood (C)		-19860		-19860		-37536		-37536	
Log likelihood (β)		-13593		-13598		-33021		-33037	

Table 4-7 Estimation Results for Trip Chaining

		Trip Chaining Propensity			
		Cohort Included		Cohort Excluded	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.133	2.14	--	--
	lnmotor	0.124	1.61	--	--
Age	a25to34	-3.02E-03	-0.75	-6.08E-03	-1.60
	a35to44	1.69E-04	0.05	-3.61E-03	-1.19
	a45to54	-8.77E-03	-2.15	-0.0131	-3.85
	a55to64	6.84E-03	1.59	2.82E-03	0.74
	a65to74	2.77E-03	0.55	-1.87E-03	-0.42
	a75plus	-0.0188	-2.78	-0.0252	-4.15
Period	year83	-8.28E-03	-0.24	0.0196	0.61
	year90	6.99E-03	0.20	0.0639	2.94
	year95	0.709	16.90	0.785	41.87
Household Role & Structure	family	-0.0436	-1.97	-0.0399	-1.81
	ch0to4	-5.91E-03	-0.26	-9.06E-03	-0.40
	hh_0to17	0.129	9.91	0.127	9.82
	hhsize	-0.0928	-8.83	-0.0932	-8.86
	black	-0.0158	-0.58	-0.0144	-0.53
	female	0.252	4.05	0.125	7.68
	fe0to12	0.194	7.43	0.212	8.73
Capabilities & Commitments	lnincome	0.121	11.32	0.121	11.34
	highed	0.283	13.24	0.282	13.21
	colled	0.405	14.95	0.406	14.95
	graded	0.527	18.32	0.528	18.35
	worker	0.0232	1.29	0.0232	1.29
Mobility & Accessibility	vehsatur	0.0273	1.53	0.0264	1.48
	licveh	0.427	15.63	0.434	15.95
	urban	-0.0112	-0.65	-0.0111	-0.65
	ptfourth	-0.0127	-0.71	-0.0124	-0.69
	ptone	6.18E-03	0.31	6.05E-03	0.30
Other	travwknd	-0.206	-13.80	-0.206	-13.81
	proxy	-0.452	-22.54	-0.453	-22.60
	constant	-1.68	-10.90	-1.69	-11.15
Number of observations		103,981		103,981	
Rho-squared		0.0515		0.0514	
Log likelihood (C)		-71954		-71954	
Log likelihood (β)		-68250		-68254	

In discussing the model results, the estimated cohort, period and age effects are discussed, summarizing the results across models. Then, the models are sequentially discussed highlighting the household role & structure, capabilities & commitments, and mobility & accessibility variables impacting the modeled behavior. The estimated models are also related to models reported in the existing literature. Finally, the estimated impact of the remaining variables is summarized.

Cohort, Age, and Period Coefficients

The two primary hypotheses of this thesis are the following: (1) that automobile prevalence during a cohort's late adolescence/early adulthood, proxied by registered automobiles per person, affects a cohort's propensity for travel in later stages of the life cycle; and (2) that female opportunity for labor force participation during late adolescence/early adulthood, proxied by labor force participation rates of women during that period, affect propensity for female travel at later ages.

Using the natural log of the cohort variables in estimation resulted in increased t-statistics. Thus, in the observed data, changes in female labor force participation and motorization rates have the highest impact when penetration is low (e.g. an increase in motorization from 10 to 20% has a greater impact on travel behavior than an increase from 60 to 70%). The impact decreases as the penetration rates approach saturation.

The female labor force participation coefficient is significant at the 95% confidence level in 8 of the 13 estimated models. (Note: each joint discrete/continuous model comprises two models of the 13 model total referred to here). The motorization variable is significant at the 95% confidence level in 4 of the 13 models. The F-statistics for testing the null hypothesis that both cohort coefficients jointly are equal to zero are listed in Table 4-8 on the following page. The null hypothesis can be rejected in 9 of the 13 models. These statistical measures indicate the presence of cohort effects in the observed NPTS data. The significance of the cohort variables in the sojourns by type discrete models (e.g. personal business, recreation, and medical), and their insignificance in the total sojourns discrete model, also suggest that the cohort variables' importance decreases in aggregation.

Of the two cohort variables, female labor force participation and motorization, the female labor force participation variable is more statistically significant across the modeled travel indicators. It positively impacts total sojourns, personal business, recreation and medical sojourning, and biking/walking propensity. This result would seem to indicate that the movement of women into the workplace has had more impact on cohort differentiation in travel than the spread of the automobile ownership in the United States.

All of the age, cohort, and period variables are associated with changes attributable to time-related processes (generational, aging, and historical change). The significance of the cohort, age, and period coefficients, or rather lack thereof, would be impacted by the correlation between these variables. Furthermore, in excluding the cohort variables, one would expect the resulting estimated period and age coefficients to absorb the excluded

Table 4-8 Cohort $\chi2$ & F-Statistics

Model	χ^2-Statistic	F-Statistic
Total Sojourns (Discrete)	5.28	
Total Sojourns (Continuous)		16.45
Log of Total Miles (Discrete)	3.31	
Log of Total Miles (Continuous)		2.34
Personal Business Sojourns (Discrete)	146.80	
Personal Business Sojourns (Continuous)		9.69
Recreation Sojourns (Discrete)	38.59	
Work Sojourns (Discrete)	7.77	
Medical Sojourns (Discrete)	51.90	
Education/Religious Sojourns (Discrete)	3.48	
Transit Propensity (Discrete)	9.99	
Biking/Walking Propensity (Discrete)	32.73	
Trip Chaining Propensity (Discrete)	6.95	
Critical Values at 5% significance level	5.99	3.00
Critical Values at 1% significance level	9.21	4.61

cohort effects. As anticipated, in models with significant cohort coefficients, when they are constrained to zero, both period and age effects are magnified.

When the female labor force participation coefficient is significant, if constrained to zero, the other affected coefficient is associated with the female dummy variable. The female labor force participation variable has negative values associated with all females and zero values associated with all males, therefore, when it is included in the models, the intercept term for females adjusts upward.

Neither cohort variable is very significant in the total miles, work and education/religious sojourning, and trip chaining models. One possible explanation for the estimated negative motorization coefficients in the total miles model is increasing female influence on household decisions. This hypothesis will be further discussed in the following chapter. The cohort coefficients' insignificance in the work sojourning model is probably due to the inclusion of employment status in the model. Its associated coefficient has an estimated t-statistic of 122. With its inclusion, the cohort variable coefficients (along with the majority of the other included variable coefficients) are insignificant. If the employment variable were excluded, the female labor force participation variable, in particular, might predict work sojourning behavior.

Age is specified in the estimated models in piecewise linear segments. In general, with increasing age, the slopes do not become significantly negative until 75+. None of the age variables are systematically significant across all models, however, the 75+ age is generally the most significant.

The period effects in the estimated models capture both period effects (e.g. fluctuations in data due to circumstances occurring at particular points in time) and also increases in reported travel attributable to survey methodology changes. In 1995, the NPTS upgraded its surveying methodologies to include travel diaries, monetary incentives and zero trip confirmation. These changes should be reflected in the estimated 1995 period variable coefficient. As expected, with few exceptions, the estimated coefficients are highly significant and at least twice the magnitude of the other estimated period coefficients.

Household Role & Structure, Capabilities & Commitments, Mobility & Accessibility Coefficients

This next section highlights the impact of the household role & structure, capabilities & commitments and mobility & accessibility variables in the estimated models. First, the variables that are systematically important across all the models are identified and then the most significant variables in each model are described and related to previously published work.

Of the household role & structure, capabilities & commitments, and mobility & accessibility variables, in each category one or two variables are systematically important in explaining travel behavior. Among the household role & structure variables, the household children (hh0to17), and the female - children interaction (fe0to12) variables are the most significant. Among the capabilities & commitment variables, graduate education (graded) and employment status (worker) are the most significant. Among the mobility & accessibility variables, the driver-vehicle interaction variable (licveh) is the most significant. The transit proximity variables (ptfourth & ptone) are significant in the total miles and alternative mode usage models.

In the total sojourns models, the most significant variables are household children, educational attainment and driver-vehicle interaction variables. The employment variable is also significant in the discrete model portion. In modeling daily number of trips (demand derived from activity participation), Lu & Pas (1997) similarly found licensure, employment status, and number of children to positively impact the number of trips.

In the discrete portion of the total miles model, the employment status and driver-vehicle interaction variables are most significant, both increasing the probability of traveling one or more person miles. In the continuous portion, increases in income (lnincome) and educational attainment also increase person miles traveled. Urban residential location (urban) and transit proximity negatively impact total person miles.

Using 1995 NPTS data, Pickrell & Schimek (1998) estimated models of household VMT (vehicle miles traveled) and found household income to positively affect VMT and transit bus stop proximity to decrease VMT. They also found block group density of residential location to negatively impacted VMT as well as residing outside of an MSA. Their results agree with those reported here with one exception: MSA status (residing inside or outside an MSA) was not found to be statistically significant in the estimated models.

In the estimated joint discrete/continuous personal business models, number of household children and female gender increase personal business sojourns as well as educational attainment and licensure with vehicle availability. The results would indicate that households with children have more maintenance activities and that the larger share is undertaken by women. As mentioned previously, work sojourning probability is affected predominantly (and almost exclusively) by employment status. Employment also negatively impacts the probability of making recreation sojourns, medical sojourns, and education/religious sojourns, which may be related to time budget constraints. Educational attainment positively impacts both recreation sojourning and education/religious sojourning. Being female positively impacts medical sojourning probability. Finally, licensure with vehicle access positively impacts recreation sojourning probability.

Lu & Pas (1997) as well as Golob & McNally (1997) estimated similar models of individual activity participation. They estimated models for work/subsistence, maintenance, and discretionary/recreation activities. The estimated coefficients of the significant variables noted previously correspond with those estimated by Lu & Pas and Golob & McNally with few exceptions. Lu & Pas found a negative correlation between household children and maintenance activity participation. This study supports instead the positive relationship estimated by Golob & McNally. Neither Lu & Pas, in their study of the effects of socio-demographics on activity participation and travel behavior, nor Golob & McNally, in their study of travel interactions between household heads, incorporated educational attainment variables. The estimated models here indicate that education impacts activity participation choices and could improve the explanatory power of activity participation models.

The most significant variables in the transit usage & biking/walking propensity models are the vehicle availability (vehsatur) and driver-vehicle interaction variables (both with negative coefficients) and quarter mile proximity to public transportation (positive coefficient). Again, these results are similar to those reported by others (Bowman, 1998; Lu & Pas, 1997).

Remaining Coefficients

The estimated weekend travel (travwknd) coefficients are all negative except for those in the recreation and education/religious sojourning models. The proxy coefficients are consistently negative, indicating that respondents whose travel was reported by proxy reported less travel than self-reporting respondents. The estimated correction terms in the continuous portions of the joint discrete/continuous models were also consistently negative. These negative signs indicate a positive correlation between the error terms in the discrete and continuous models (e.g. the unobservable factors that cause high reported sojourns also increase the utility of reporting one or more sojourns).

Several variables, not available in one or more of the NPTS data sets, were reported as significantly impacting travel behavior in the referenced literature. These include indicators of disability, housing ownership and tenure, rural residential location, and measures of transit service (indicating, for example, if one lived within one fourth mile of transit service, whether the associated headways were of 4 minutes or 4 hours). Possible methodologies for addressing their absence in one or more of the NPTS data sets will be discussed in the following chapter.

In summary, the estimated models advance the existing literature in their incorporation and estimation of cohort effects on the modeled travel indicators. They are also unusual in that many different indicators of travel behavior were modeled. Furthermore, the models were estimated using several national data sets and over one hundred thousand observations, resulting in narrow confidence intervals. The use of several data sets allowed quantification of the effect of the NPTS survey methodology changes, though the estimated effects are confounded with period effects. The most significant estimated coefficients generally correspond with previously reported estimates. Finally, the models indicate that educational attainment is a strong candidate for inclusion in models of travel behavior.

Travel Projections: 1995 to 2030

The estimated models were applied to simulated future 65+ populations for the years 2000, 2010, 2020 and 2030. The simulated population statistics are provided in Table 4-9 on the following page. In addition to increases in educational attainment, the cohort variables both increase in value: the average motorization value more than doubles while the average female labor force participation value increases by 62%. Also note that in the simulated 65+ population, the percentage of persons licensed with household vehicle availability increases from 74 to 78 percent. This slight increase will be further discussed in the following chapter.

The forecasts indicate increases in travel across every indicator except male propensity for biking or walking. The results are illustrated in Figures 4-1 through 4-24, provided on subsequent pages. The impact of the cohort variables on forecasted travel is illustrated graphically in the figures. Forecasts are shown applying both the "cohort included" and "cohort excluded" models to the simulated populations. The only difference between the "cohort included" and "cohort excluded" models is the constraint of the cohort parameters to zero in the "cohort excluded" models.

Table 4-9 Simulated Population Summary Statistics

	1995	2000	2010	2020	2030
Average value of female labor force participation variable, for females	29.2%	31.5%	35.8%	40.9%	47.3%
Average value of motorization variable	24.7%	28.4%	37.1%	49.7%	61.7%
Average age	74.4	74.6	74.9	74.2	74.6
Percent living in "family" household	64.9%	64.9%	64.6%	65.7%	65.2%
Average # of household children under age of 17	0.0743	0.0730	0.0709	0.0693	0.0678
Average household size	1.92	1.91	1.91	1.91	1.90
Percent African-American	7.97%	8.03%	8.56%	9.29%	10.0%
Percent female	59.1%	58.5%	57.4%	55.4%	54.4%
Average household per-capita income	13373	13712	14323	15249	15321
Percent with high school education	52.1%	52.8%	55.0%	58.7%	61.2%
Percent with college education	8.23%	9.15%	9.43%	12.4%	14.5%
Percent with graduate education	4.87%	5.78%	8.40%	10.7%	10.2%
Percent employed	11.7%	12.0%	14.1%	15.6%	14.5%
Percent living in household with # vehicles >= # adults	58.2%	58.5%	58.9%	61.3%	61.3%
Percent licensed living in household with vehicle available	73.6%	73.9%	74.2%	77.4%	77.6%
Percent living in urban area	62.6%	63.0%	63.8%	64.8%	65.3%
Percent living within 1/4 mile of public transportation	35.9%	35.9%	36.0%	36.0%	36.3%
Percent living within 1 mile of public transportation	16.4%	16.6%	17.1%	17.8%	18.0%

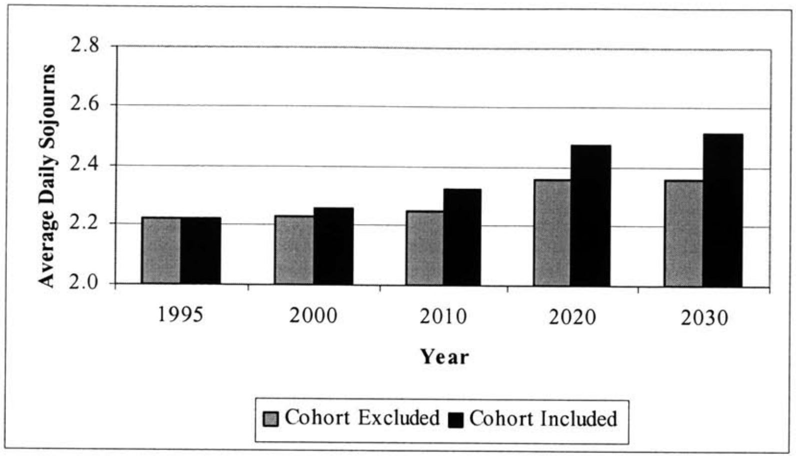

Figure 4-1 Average 65+ Daily Sojourns, by Year

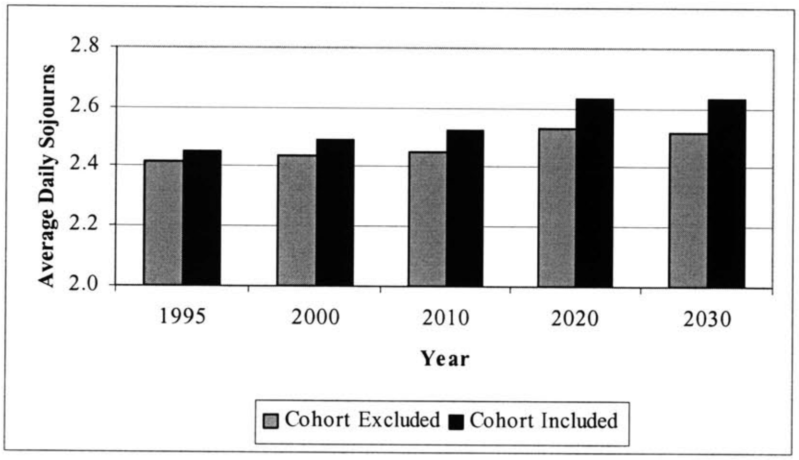

Figure 4-2 Average Male 65+ Daily Sojourns, by Year

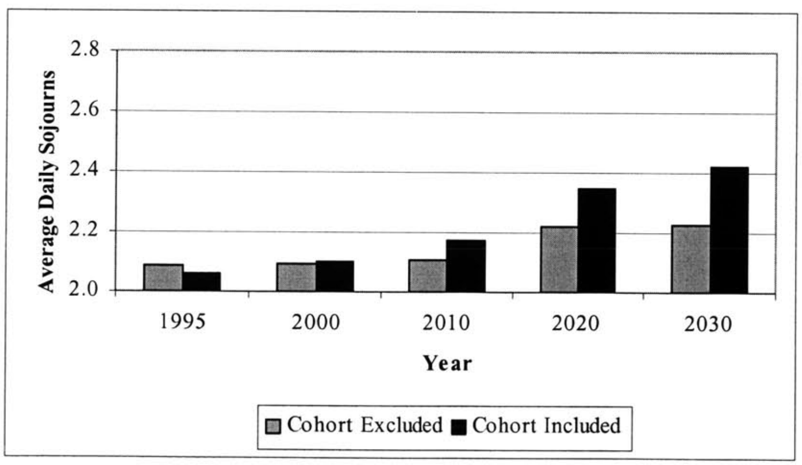

Figure 4-3 Average Female 65+ Daily Sojourns, by Year

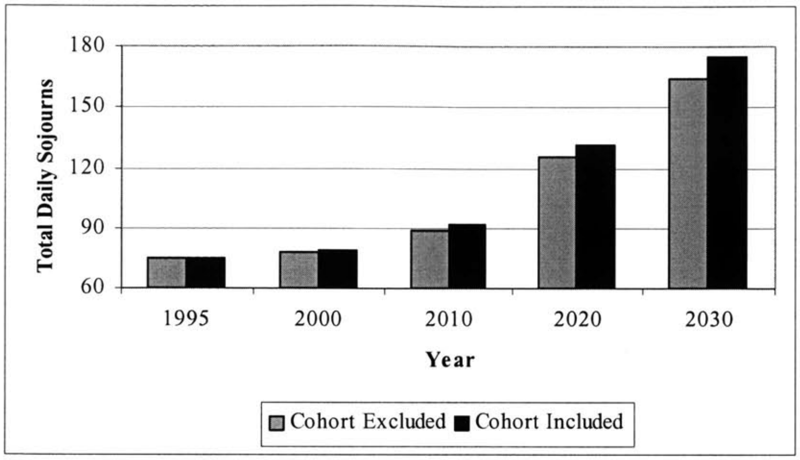

Figure 4-4 Total Daily Sojourns (millions), by Year

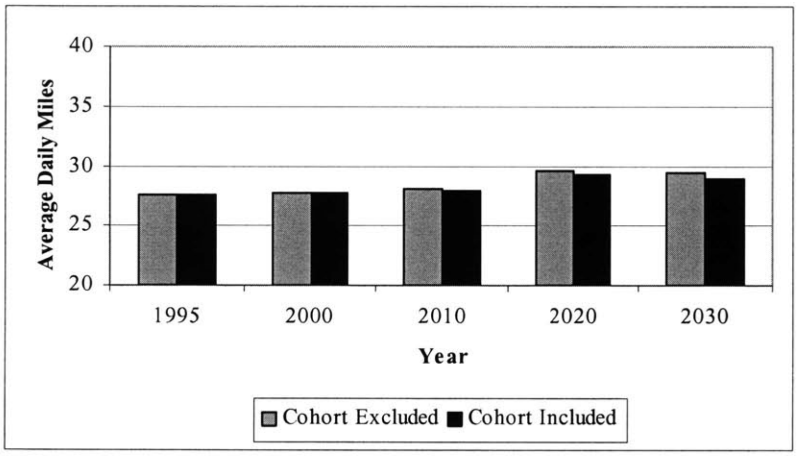

Figure 4-5 Average 65+ Daily Miles, by Year

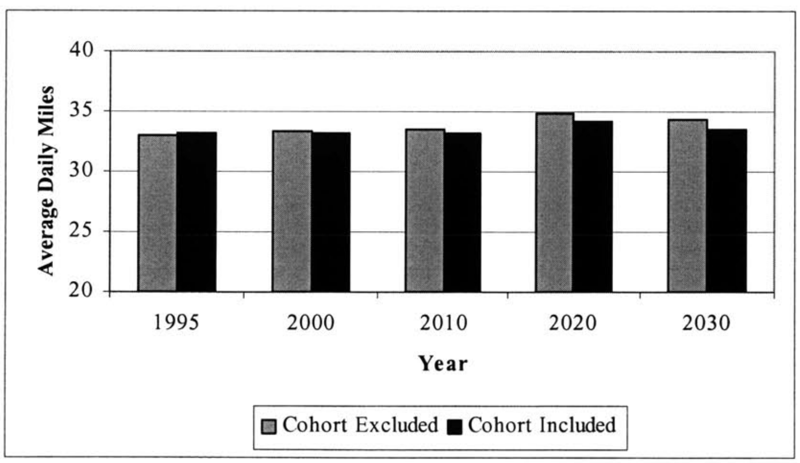

Figure 4-6 Average Male 65+ Daily Miles, by Year

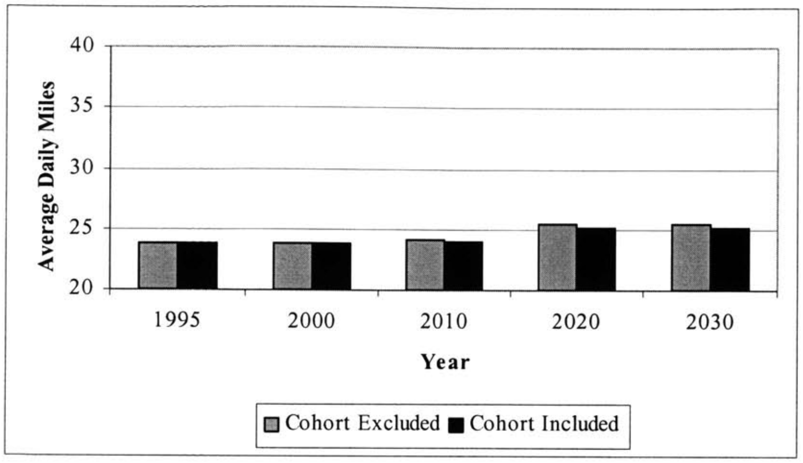

Figure 4-7 Average Female 65+ Daily Miles, by Year

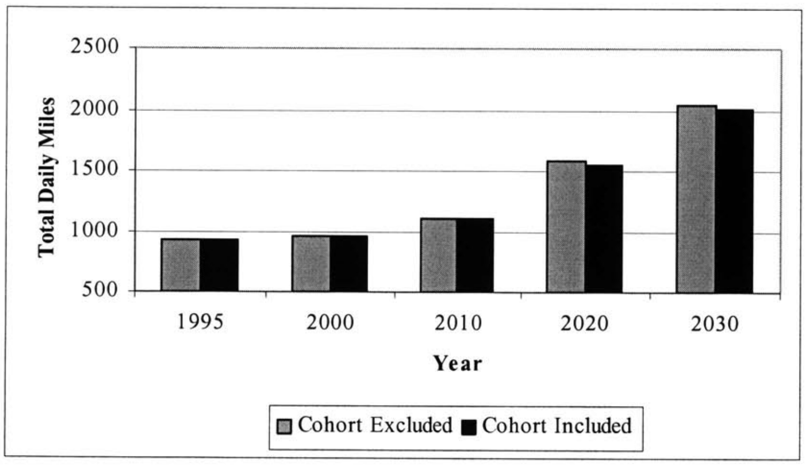

Figure 4-8 Total 65+ Daily Miles (millions), by Year

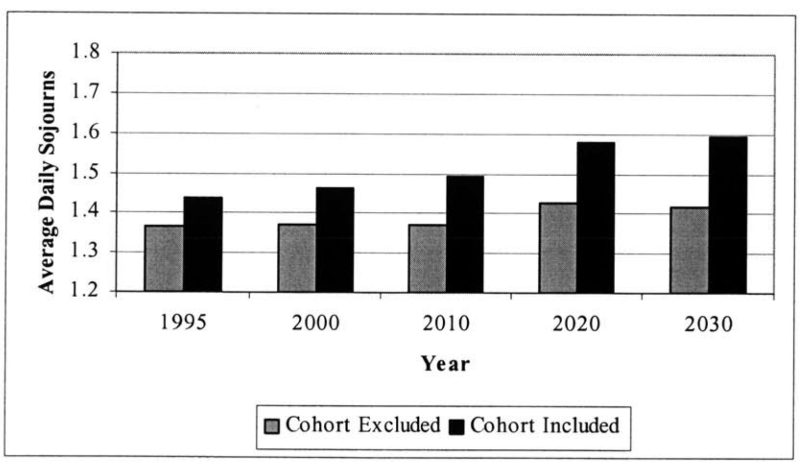

Figure 4-9 Average Male 65+ Personal Business Sojourns, by Year

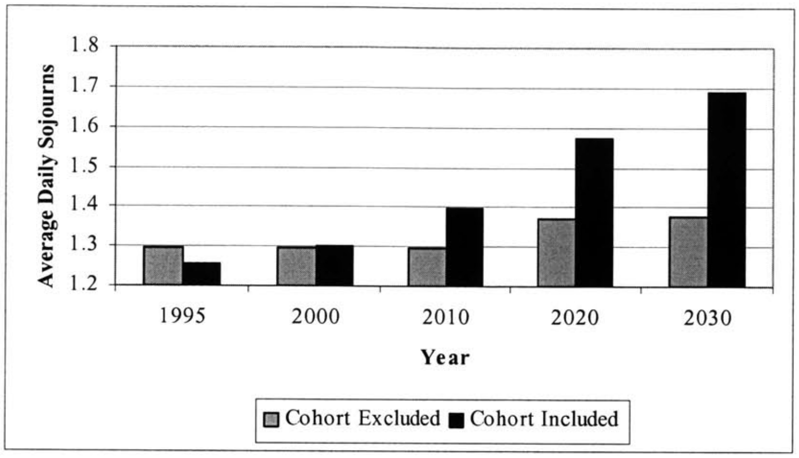

Figure 4-10 Average Female 65+ Personal Business Sojourns, by Year

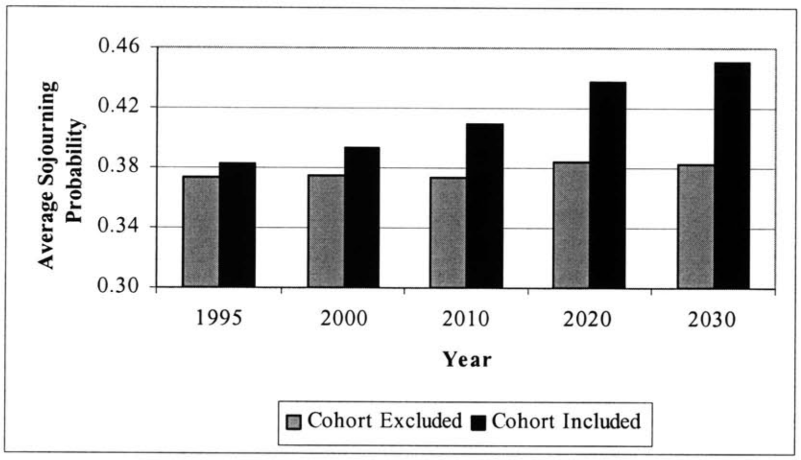

Figure 4-11 Average Male 65+ Recreation Sojourning Probability, by Year

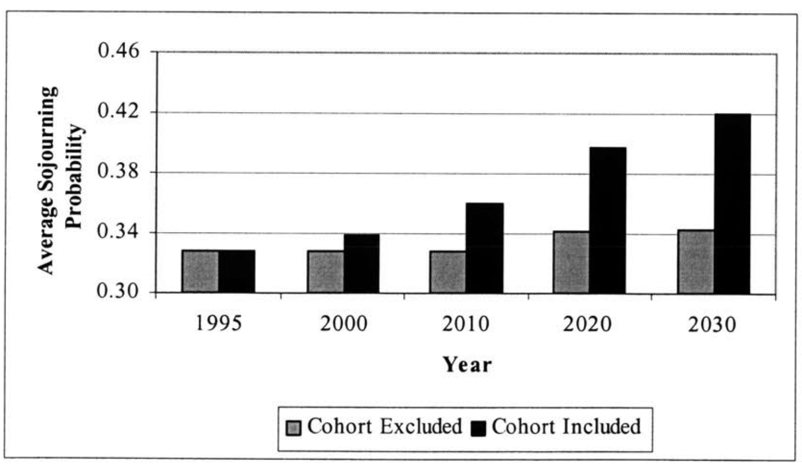

Figure 4-12 Average Female 65+ Recreation Sojourning Probability, by Year

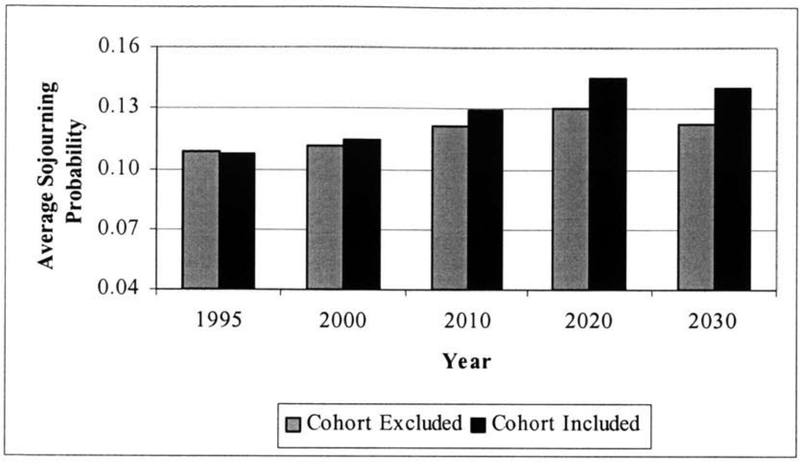

Figure 4-13 Average Male 65+ Work Sojourning Probability, by Year

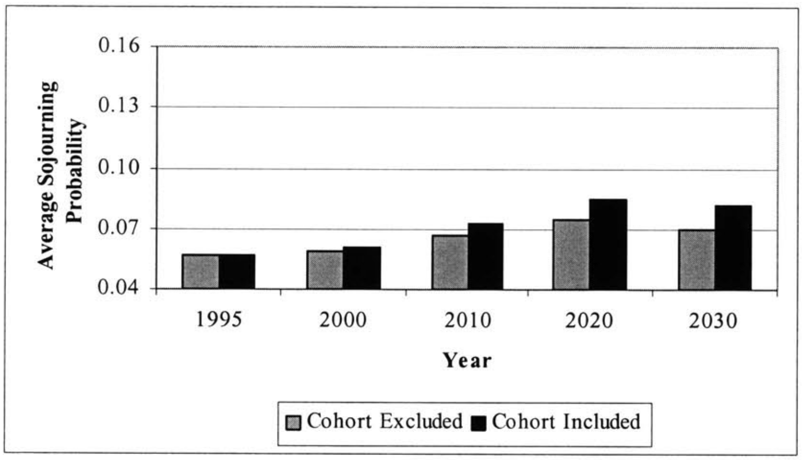

Figure 4-14 Average Female 65+ Work Sojourning Probability, by Year

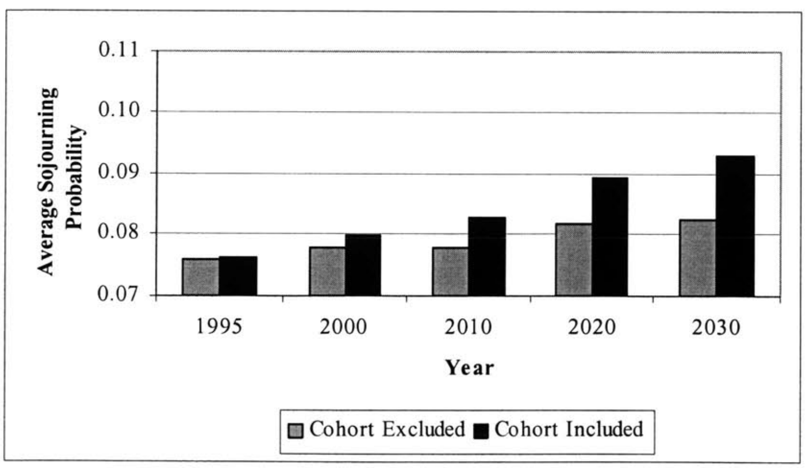

Figure 4-15 Average Male 65+ Education/Religious Sojourning Probability, by Year

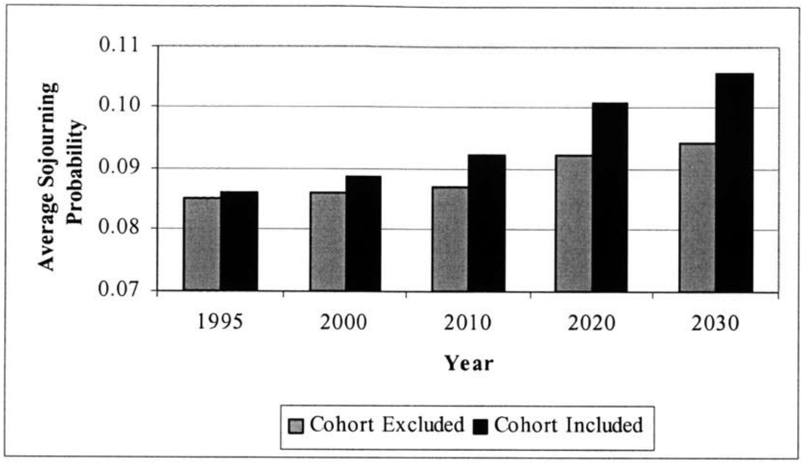

Figure 4-16 Average Female 65+ Education/Religious Sojourning Probability, by Year

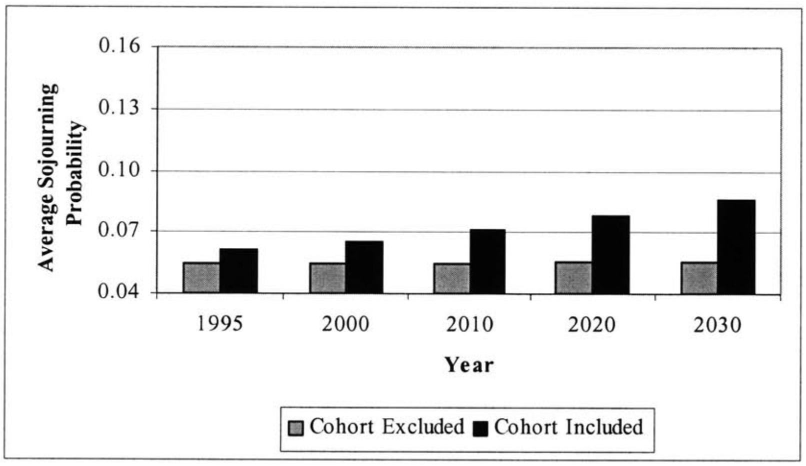

Figure 4-17 Average Male 65+ Medical Sojourning Probability, by Year

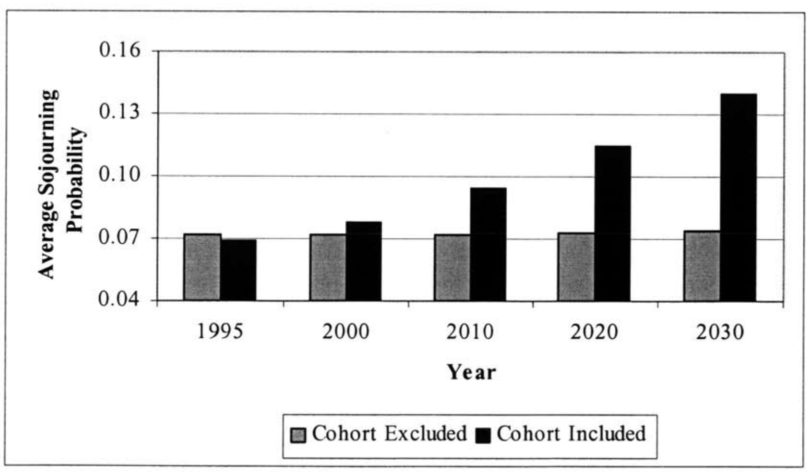

Figure 4-18 Average Female 65+ Medical Sojourning Probability, by Year

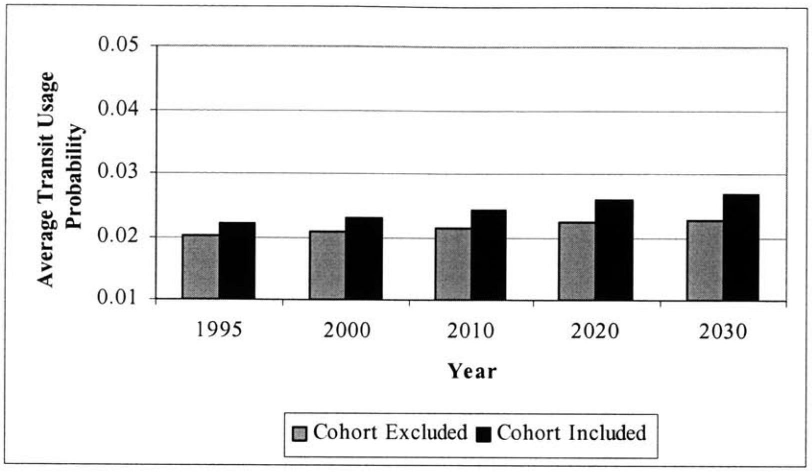

Figure 4-19 Average Male 65+ Daily Propensity for Transit Usage, by Year

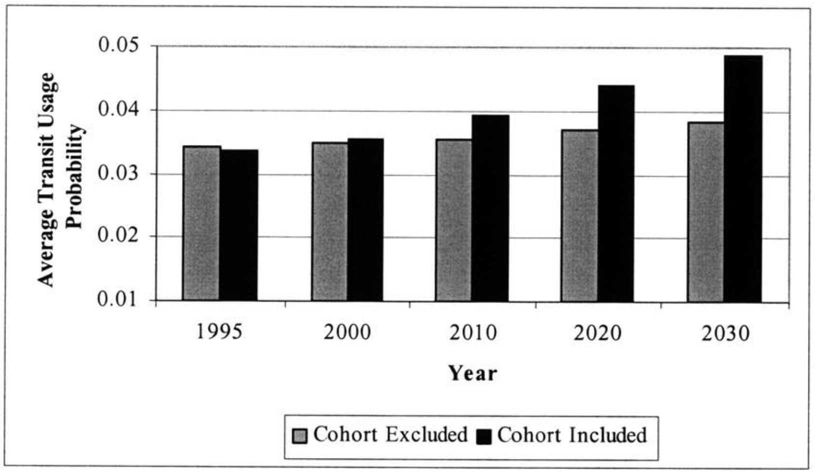

Figure 4-20 Average Female 65+ Daily Propensity for Transit Usage, by Year

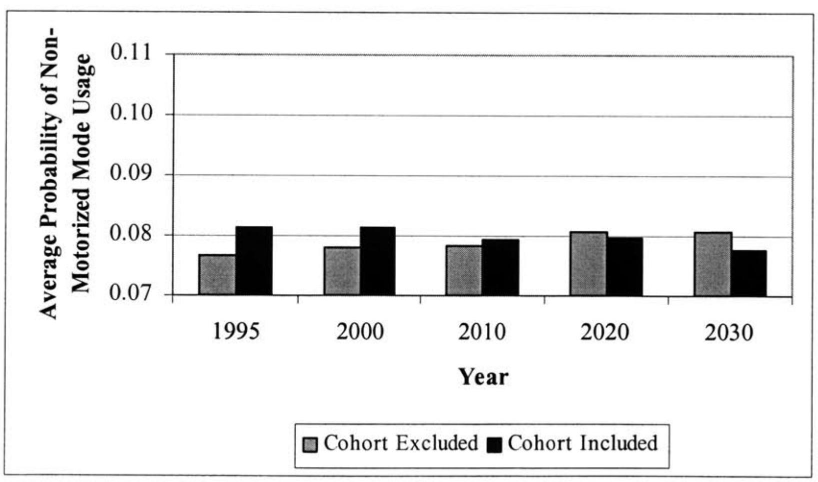

Figure 4-21 Average Male 65+ Probability of Non-Motorized Mode Usage, by Year

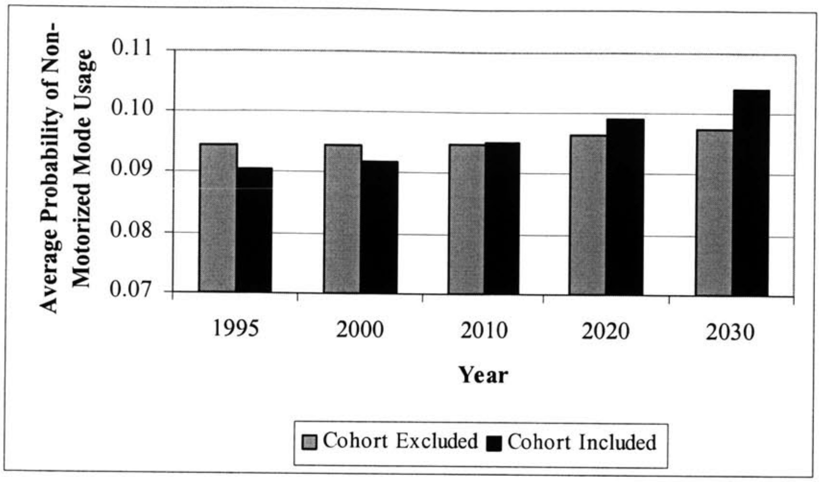

Figure 4-22 Average Female 65+ Probability of Non-Motorized Mode Usage, by Year

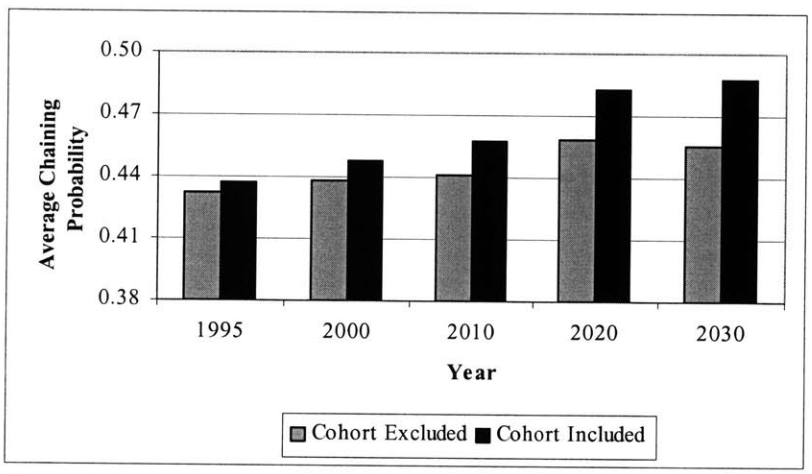

Figure 4-23 Average Male 65+ Daily Chaining Propensity, by Year

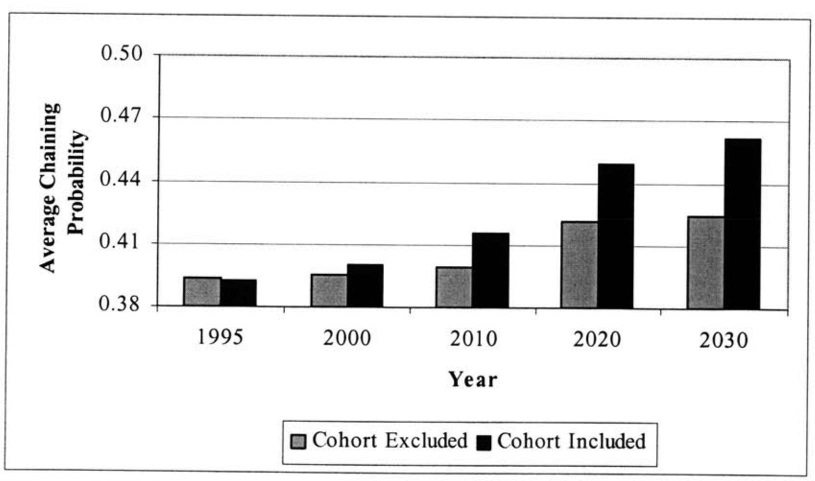

Figure 4-24 Average Female 65+ Daily Chaining Propensity, by Year

The average numbers of sojourns for women are expected to increase 17%, and for men, 7%. The average number of person miles is projected to increase 1% and 5% for men and women respectively. The total number of daily 65+ sojourns is projected to increase by 134%. The projected increase in total number of daily person miles is 117%. Most of these increases in total travel are attributable to population increases rather than average individual increases. Between 1995 and 2030, the census projects a 107% increase in the number of 65+ persons in the U.S. The average daily person miles are projected to decrease between 2020 and 2030. This is due in part to projected changes in the population age distribution: between 2020 and 2030, the projected share of people who are 75+ increases. Other notable increases include a 35% increase in average daily female personal business sojourns, a 75% increase in medical sojourns, as well as a 46% increase in female transit usage propensity.

In assessing forecast error, three sources were considered: sample errors in the estimated coefficients, sample errors in the simulated forecast population, and errors associated with the input assumptions used to generate the simulated future 65+ populations.

The forecast errors from sample error in the estimated coefficients were estimated using a jackknife methodology (Miller, 1974). First, the estimation sample was divided into 20 subsections and model coefficients were estimated for each subsection. Second, each subset of model coefficients was applied to the entire sample to produce forecast estimates. Finally, these 20 forecast estimates were then used to estimate the jackknifed standard errors as detailed by Miller (1974). The resulting standard errors for average total sojourns and miles are reported in the "Estimated Coefficient" column of Table 4-10.

The forecast errors from sample error in the simulated forecast population were also estimated using a jackknife methodology. First, the simulated forecast population was divided into 20 subsections. Second, the coefficients estimated using the complete estimation sample were applied to each of the 20 simulated population subsets to produce forecast estimates. Finally, these 20 forecast estimates were then used to estimate the jackknifed standard errors. The resulting standard errors for total sojourns and miles are reported in the "Simulated Population" column of Table 4-10.

Table 4-10 Jackknifed Sample Errors

	Estimated Coefficient Sample Errors				**Simulated Population Sample Errors**			
	Avg. Daily Sojourns		Avg. Daily Miles		Avg. Daily Sojourns		Avg. Daily Miles	
	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error
1995	2.22	0.0174	27.6	0.285	2.22	0.0094	27.6	0.149
2000	2.26	0.0201	27.7	0.345	2.26	0.0098	27.7	0.146
2010	2.32	0.0299	27.9	0.511	2.32	0.0108	27.9	0.162
2020	2.47	0.0425	29.2	0.726	2.48	0.0103	29.2	0.162
2030	2.52	0.0542	28.9	0.907	2.52	0.0107	29.0	0.170

N=20

Table 4-11 Input Error Scenarios

Input Scenario	Description
Population Low	Census Low Series Population Projections
Population High	Census High Series Population Projections
Education High	25% of Boomer women and 10% of Boomer men increase their educational attainment when compared to the Base Scenario[1]
Work Low	65+ working percentages are half those of the Base Scenario
Work High	65+ working percentages are double those of the Base Scenario
High	Combination of Population High, Education High, and Work High Scenarios
Low	Combination of Population Low and Work Low Scenarios

[1] 25% of women without a high school education complete a GED, 25% of women with high school education complete college education, etc. when compared to the base scenario.

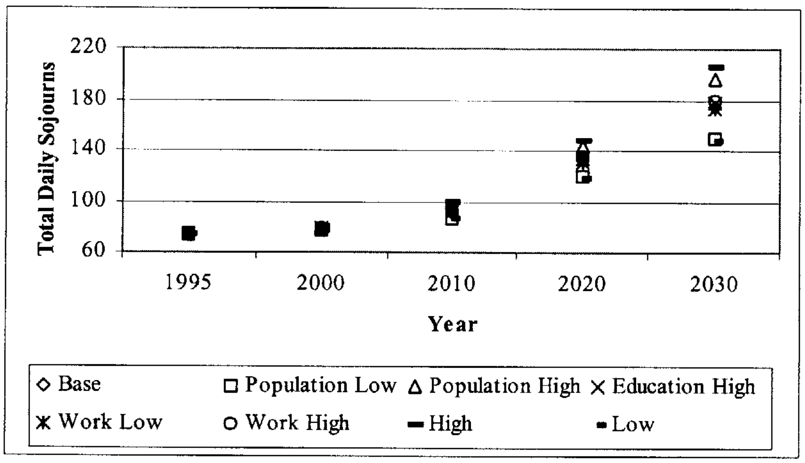

Figure 4-25 Input Scenario Predictions for Total Daily Sojourns, by Year

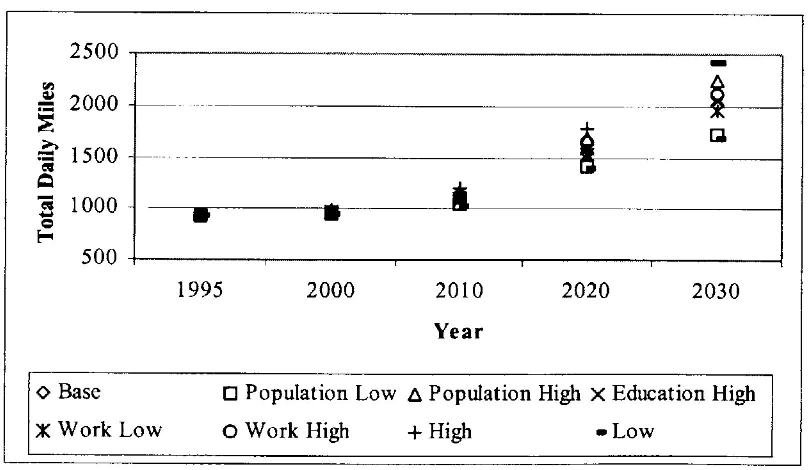

Figure 4-26 Input Scenario Predictions for Total Daily Miles, by Year

The forecast errors associated with the input assumptions were explored by generating the alternative scenarios described in Table 4-11 on the previous page. The associated forecast estimates for total sojourns and total miles are illustrated in Figure 4-25 and Figure 4-26, also on the previous page. The high and low estimates are intended to provide an interval estimate of the error associated with input assumptions. With respect to the magnitude of the resulting input error, the previously mentioned intervals are approximately equivalent to plus or minus 16% of the base prediction for total sojourns, and plus or minus 18% of the base prediction for total miles. Tables of the forecast errors (including sample and input assumption errors) for all of the modeled travel indicators are provided in the Forecast Error Appendix.

Summary

This chapter, with its paintings of numbers, has presented the study results addressing in particular the a priori cohort hypotheses. The results indicate that there is evidence of cohort differentiation in travel. In particular, the female labor force participation variable is highly significant in the personal business sojourn models. Furthermore, the forecasts project increases in travel across all travel indicators. A more detailed summary and discussion of these findings are presented in the following chapter.

5. Conclusions and Recommendations

When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.

William Thomson, Lord Kelvin[7]

This study shores up, with estimated numbers, hypotheses previously postulated in the literature regarding 65+ travel. It provides a forecast of 65+ travel that incorporates theoretically motivated cohort variables, uses disaggregate estimation and forecasting techniques, forecasts multiple travel indicators, and employs multiple age groups in estimation. After briefly summarizing the previous chapters, each of these contributions is discussed and related to previous research, policy implications, and recommendations for future research.

The next 30 years will bring a doubling of the 65+ population. The Boomers, with higher propensities of auto ownership and use, increased female independence, as well as higher levels of educational attainment, will comprise that future population. While many researchers have hypothesized generational differences in travel between the current and future 65+generations, to date, the hypothesis had not been investigated empirically. This study addressed that hypothesis.

Data sources employed included the 1977, 1983, 1990 & 1995 NPTS survey data as well as female labor force participation and auto ownership rates obtained from the Statistical Abstract of the United States. Missing data were imputed using multiple imputation. Models were estimated using discrete and joint discrete/continuous methodologies. Finally, forecasts were produced by applying the estimated models to simulated future populations, generated using iterative proportion fitting techniques.

Theoretically Motivated Cohort Variables

The estimated models resolve the problem of linear dependence between age, period, and cohort effects through inclusion of theoretically motivated cohort variables. The included cohort variables were related to movement of women into the labor force (the female labor force participation variable) and the spread of automobile ownership (the motorization variable).

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[7] Kelvin, William Thomson, Baron (1891-1894). *Popular Lectures and Addresses.* London: Macmillan and Co.

The empirical significance of the coefficients associated with these two variables supports the primary hypothesis of this study, namely, that cohort (or generational) differences affect travel behavior. Furthermore, this corroborates the literature arguing that differences in historic socialization influence cohort behavior, the literature that would suggest Boomers are unique not only because they number so many, but also because they locate a particular niche in U.S. history.

The female labor force participation variable is significant, particularly in the total sojourns, personal business and medical sojourn models. The results indicate that women who came of age when female labor force participation rates were higher, all else equal, participate in more activities requiring travel, particularly personal business and medical activities, and will be more likely to use biking & walking modes in accessing those activities.

Not only are the cohort variables statistically significant in the estimated models, they also affect the forecasts. For example, the impact of excluding the cohort variables in the personal business forecast is illustrated in Figure 5-1. In particular, constraining the cohort variables to zero, as would be done in a conventional transportation demand model, has more affect on the forecast than any of the other forecast scenarios.

Spain (1997), working with NPTS data, identified an expectation that Boomer women as they age would more resemble Mature men than Mature women in their travel patterns: "middle-aged women today probably will travel more like their fathers than like their mothers when they reach their parents' age" (p. 3). The forecasted results substantiate her claim in terms of sojourn demand, but not person-mile demand. The implication is that Boomer women, as they age, will participate in more activities outside the home than

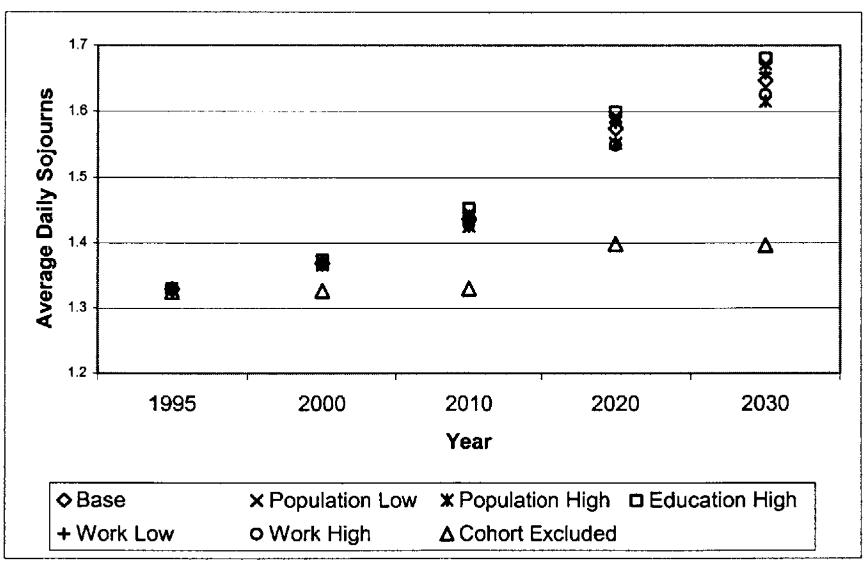

Figure 5-1 Forecast of Average Daily 65+ Personal Business Sojourns, by Year

previous generations of women; however, they will continue to traverse smaller distances to access those activities than their male counterparts. This also corroborates Wachs' (1987, 1996) concept of an enlarged female activity sphere no longer centered exclusively around the home. Yet if 65+ women are not traversing significantly more miles, enlarged may not be the appropriate descriptor. A more apt term might be an increasingly "multi-faceted" activity sphere.

Kostyniuk & Kitamura (1987) posed the hypothesis that "the age of a person during intense motorization of his environment influences his perceptions, habits, and expectations about transportation throughout his lifetime" (p. 31). Having empirically tested their hypothesis, the models with highest estimated motorization t-statistics would indicate that individuals who came of age when automobiles were more prevalent in the U.S., all else equal, participate in more personal business, recreation, and medical activities. A priori, the motorization variable was expected to be both positive and significant in the person-miles model. However, the estimated coefficients were not as expected. They were neither positive nor significant.

One possible hypothesis for why younger generations may travel fewer miles than their predecessors is the following: perhaps females of younger generations exert more influence on household decisions than their predecessors. Research suggests that women have a higher disutility for travel time costs, perhaps due to their multiple roles (e.g. mother, daughter, wife, employee), and place an even higher premium (than males) on locating activity destinations closer to home (Hanson & Pratt, 1995). Therefore, women to the degree that they influence household decisions, might also increase the disutility associated with household travel time costs, and thus reduce the number of daily miles traversed by all household members, men included.

In Rosenbloom's (1999) analysis of the 1995 NPTS, she writes: "for the last two decades, every auto-related travel indicator for the elderly has gone resolutely up including: vehicle miles traveled, licensing, daily trips, daily miles traveled, and time spent driving. Concurrently, use of alternative modes has gone resolutely down" (p. 16). Her analysis would suggest that younger generations have lower propensities for non-POV (non-privately-owned-vehicle) mode usage. However, the model results indicate the opposite for women: that generations with higher female labor force participation variable values exhibit, all else equal, higher propensities for transit usage and walking/biking on their travel day.

One possible explanation for this unexpected result might be that the environmental movement of the '60s and the energy crisis of the '70s influenced female propensity for non-POV mode usage. A second possible explanation is that the binary forecast variables identified whether or not a respondent reported any transit usage on their travel day. Therefore, females might be more inclined to use transit on any given day, with their overall transit usage still declining. Finally, despite overall declines in transit usage, a recent study found that transit usage is on the rise for non-work related trips (Schaller & Cohen, 2002). The model results might also be related to this non-work increase in transit use.

Disaggregate Estimation and Forecast

Previously published forecasts of 65+ travel have relied on aggregation. Wachs' (1979) Los Angeles county forecast, using cluster analysis, identified differences in aggregate travel behavior between census tract groupings. Burkhardt's (1998) national forecast aggregated the 65+ population to an average female and average male. In contrast, the forecasts produced in this thesis improved upon previous work by using disaggregate data both in model estimation and in forecasting technique.

Because disaggregate data was used, the estimated models could postulate causal relationships between travel behavior and individual characteristics (e.g. age, cohort, household composition, capabilities, and mobility characteristics), facilitating identification of the underlying attributes causing differentiation in travel. As a result, the forecasts could reflect differences between the Boomers and Matures, including those directly related to historical differentiation, that would contribute to growth in travel. Although Burkhart and others identified that future 65+ populations might exhibit increased travel demand, this is the first forecast to actually quantify the effects of the changing 65+ population.

For example, Spain (1997) identified that the Boomers have higher levels of educational attainment than the current 65+ generation and concluded that they would therefore make more trips and drive more miles per day than their parents do now. The forecasts substantiate her claim and quantify the differences. In the estimated models, increased educational attainment has a positive effect on all of the travel indicators, translating over the next 30 years into increases in activity participation rates, mileage, chaining propensity, and alternate mode usage. Other generational differences accounted for in the estimated models include age distribution, gender composition, and racial mix.

The current 65+ forecast, developed for the U. S. Department of Health and Human Services and the National Highway Traffic Safety Administration to guide current transportation policy, projects a 230% increase in total VMT between 1995 and 2030 (Burkhardt, 1998). In contrast, this study projects only a 117% increase in 65+ person miles. See Figure 5-2 on the following page. The difference might be related to the dependent variable discrepancy (Burkhardt forecasted VMT for 65+ drivers, whereas this study forecasts person miles, traversed using any mode, driver or non-driver). The more probable cause is the fact that Burkhardt used aggregate NPTS data from 1969 to 1995 and a simple trend-line model to predict VMT to 2030. His model did not account for changes in survey methodology, which between 1990 and 1995 significantly increased the number of reported miles (Liss, Undated). Therefore, the results would imply that the use of disaggregate data can dramatically change forecasted travel estimates. The difference in forecasts also emphasizes the importance of accounting for survey methodology changes and population composition changes.

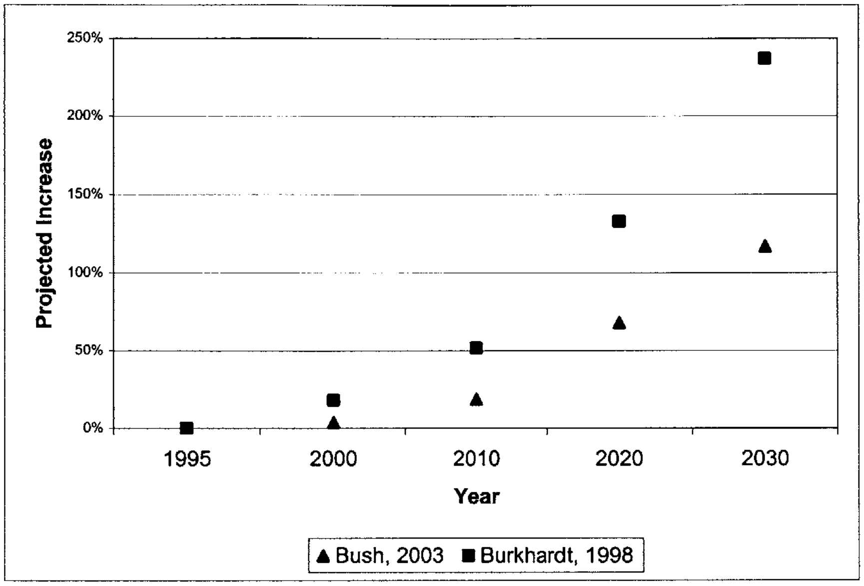

Figure 5-2 Forecast of Total Daily 65+ Miles, by Year

Multiple Travel Indicators

In their forecasts, Wachs focused on person-trips and Burkhardt on VMT; both neglected to identify the activity types generating the demand for travel, as well as the modes and chaining behavior accommodating the trips. This forecast provides a more detailed examination of travel behavior. The sojourns are broken down into sojourn types, allowing understanding not only of the growth in gross sojourn numbers but also of the activity types the growth derives from. Furthermore, the models provide indicators of trip chaining propensity, transit usage and non-motorized mode usage propensities.
The forecasts indicate particular growth for women in personal business, recreation, and medical sojourns, for men in recreation and medical sojourns. The home-destination-home trip plan is still predominant among the 65+. However, it will lose ground over the next 30 years as the percentage of the 65+ population chaining daily trips is projected to increase. Finally, daily person-miles are projected to increase slightly for both men and women, and female non-POV mode usage is also projected to increase.

To explore the impact of transit investment, the estimated models were applied to a contrived scenario in which the entire 2030 simulated 65+ population lives within 1/4 mile of public transportation. The resulting forecasted transit usage probabilities are provided in Figure 5-3 on the following page, both for urban and non-urban residents. The results indicate potential for increases in transit viability as an automobile alternative for the 65+ population.

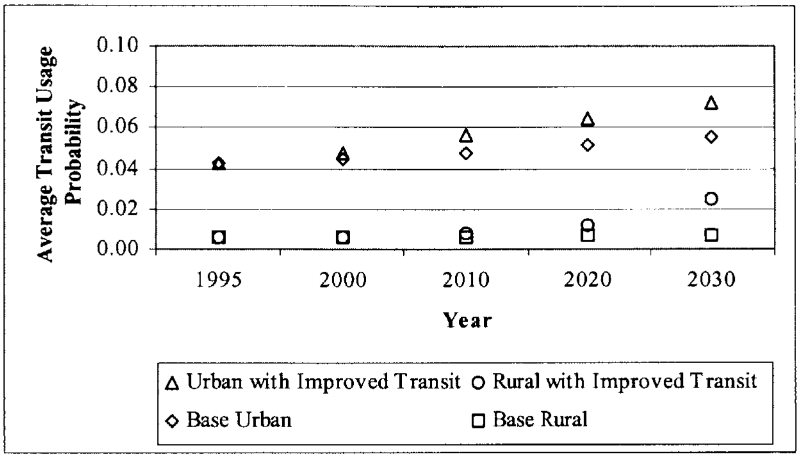

Figure 5-3 Impact of Transit Service Provision within ¼ Mile of all 65+ Residential Locations, by Year

For policy makers, the forecast results also identify opportunities for increasing the viability of alternate transportation strategies. The activity growth indicates that alternate transport systems, to meet the needs of the 65+, should connect residential locations of the 65+ to service provision centers that are loci of personal business, recreation, and medical activities. These centers are increasingly being built in the suburbs, whereas the radial spokes of most transit provision strategies are not designed to accommodate sojourns to decentralized locations. The forecast indicates increasing shares of the 65+ population will chain daily activities. This implies a premium for transport provision that allows for chaining of activities outside the home. Finally, the projected increase in non-POV usage suggests the possibility of a multi-modal response to the transportation needs of the aging boomers, a premium for designing streets to accommodate walking and bicycling, and increased viability of livable communities and sustainable development.

Multiple Age Groups

The age of 65 is referenced in government and academic publications, as well as lay conversation, as the advent of old age. The 65 age delineation was initiated in Bismarck's Germany in 1883 as the age of work incapacity. In the United States, 65 was institutionalized as the age of retirement with the formulation of social security in 1934. Dora Costa (1998), among others, has questioned 65 as an appropriate retirement age and argues that it is demand for leisure, not worsening health, that drives retirement. Furthermore, there is growing evidence that people beyond 65 are not retiring. Rather, they are retiring from the work of their middle-age and embarking on new careers (EBRI, ASEC, & Greenwald, 2002).

This is the first forecast to focus on the 65+ population, yet use the 25+ adult population in estimation. Estimating a model of 65+ travel using the entire adult population allows the 65+ to be compared with other age groups. One might expect those who are categorized as the "elderly" to exhibit travel patterns very different from the rest of the adult population. However, in the estimated models, the 65+ age slopes do not become more strongly negative than other age groups until 75+.

The descriptive language of the literature, particularly the transport literature, does not reflect the forecasted activity participation rates of the 65+. The stereotype, or synecdoche, used most often to frame the 65+ transportation policy debate is that of a sick and decrepit individual who can no longer drive. For example, quoting the U.S. Department of Transportation's (2001) draft national agenda on mobility for an aging society: "older persons develop physical limitations that restrict their ability to drive, walk, or use public transportation. Illnesses, medications, or impairments make it difficult for them to use the transportation they desire" (p. 7). Over the next 30 years, with not only the numbers, but also the composition of the 65+ changing, this synecdoche will be even less representative of the 65+ population than it is today. For transport policy, the results imply that, in crafting solutions for the 65+ population, either the marriage of "senior" with "sick and disabled" needs to be divorced, or alternatively, the entitlement age at which one becomes eligible for special "elderly" transportation services should be increased.

Recommendations for Future Research

The included cohort variables do not represent all the generational differences between the Boomers and the current cohort of 65+. A few candidates for further research are identified here. First, the positive female labor force participation cohort effects on non-POV mode usage might, as mentioned previously, have been erroneously attributed to the included cohort variables, and were instead caused by the impact of environmental and energy conservation movements. Cohort variables could be constructed to test this hypothesis. Second, the NPTS, unlike census data, does not provide any information regarding survey respondent health. The relationship between health and travel was not explored in this thesis and invites further research. Cohort variable possibilities include measures of height and/or body mass indices (BMI). See (Costa, 1998). Third, Hakamies-Blomqvist (1999) has looked at generational trends in accident data and concluded that "accident rates of older drivers have been decreasing in successive cohorts" (p. 132). Theoretically motivated variables, possibly those applied in this work, might shed additional light on Boomer accident propensity as well as the USDOT's claim of a pending crisis with respect to accident fatalities.

Recommendations for further modeling improvements include use of latent variables and developing related systems of models. The two cohort variables used in this study were highly correlated measures of concurrent socio-historic processes. Use of latent variables might resolve collinearity concerns, and also compensate for the crude measures of social change. Latent variables would also be candidates for replacing other variable groups (e.g. household role and structure). Additionally, as alluded to in the Results Chapter, only 68% of the women in the 2030 simulated 65+ population have licenses and auto availability (compared with 88% of the men). In contrast, 89% of 1995 Boomer women are licensed with auto access compared to 94% of boomer men. One related opportunity for future research lies in developing model systems that would condition daily travel decisions (e.g. sojourns and miles) on longer term mobility decisions (e.g. licensing and auto ownership) and include cohort variables in the long-term mobility models.

Additionally, the four NPTS data sets are a rich source of information regarding change in United States travel patterns over the last 40 years. However, the variables changed between survey years, and additional variables were added in each survey iteration. In constructing comparable data sets from the four survey years, much of the collected information was deleted (e.g. a variable collected in 1977 but not in 1995 was excluded from the final model specification data set). Recommendations for further research involving the NPTS data include development of latent variables or imputation techniques to allow full use of the available information.

Summary and Conclusion

The contributions of this study encompass estimation of disaggregate travel demand models that allow forecasting of multiple travel indicators (sojourns, miles, chaining behavior, and non-POV mode usage), and comparison between age groups and generations. In particular, the theoretically motivated cohort variables were found to be significantly related to the modeled travel behavior. Recommendations for future research include further development of cohort variables in models of travel demand and enhancement of the estimated models with latent variables and model systems incorporating longer-term mobility decisions. Policy recommendations include redefinition of the age one becomes an "elder" and development of a multi-modal response to the transportation needs of aging Boomers.

In conclusion, to counterweight Lord Kelvin's assertion of the paramount importance of numbers quoted at the beginning of this chapter, Deborah Stone (2002) in her book on policy paradox asserts: "the capacity to imagine a better world, . . . the capacity to continually re-envision problems and solutions are qualities that make us human and give us a fighting chance at improving our lot. For all the trouble caused by vague goals, imprecise problem definitions, and unruly policy instruments, we would be fools to trade them in for a calculator" (p. xiii). This study has provided the work of the calculator: it is the most sophisticated measure of 65+ travel to date. If a researcher's role is staking out territory in uncharted land, I have left much for future explorers. As I see it, applying the numbers calculated and documented here to the policy arena of "vague goals, imprecise problem definitions, and unruly policy instruments" is the next frontier. I anticipate a future expedition that will chart a policy analysis as rich in nuance and imagination as this analysis has been in numbers.

6. Data Appendix

Real data is messy.

Tom Stoppard[8]

Several steps were required to prepare the NPTS data for use in model estimation. First, variables were extracted from the 1977, 1983, 1990, and 1995 NPTS household, person, and travel day data files. These variables were used to construct variables comparable across all four survey years. Table 6-1 lists the resulting variables and details how they were constructed for each survey year. If any of the required information for creating a variable was missing, the new variable was also coded as missing. For example, for the 1977 survey year, the variable hh_0to4 (number of persons in household age 0 to 4) had to be constructed. If the age of any person in the household was missing, the resulting hh_0to4 variable was also coded as missing.

Second, missing values were imputed using S-Plus's multiple imputation library. The percentages of missing information for each variable are listed in Table 6-2. The need to mitigate for missing data was determined using non-response regressions. Non-response indicators were created for each variable with missing data. They were coded in the following manner: 1 if data was missing, 0 otherwise. These non-response indicators were then regressed on the remaining available variables. Estimated coefficients and t-statistics from the non-response regressions for household family income, licensed driver, and education are provided in Table 6-3. The regressions were estimated using 1977 and 1990 NPTS data. Only the most statistically significant coefficients are reported. Variables not defined in Table 3-3 (explanatory variable descriptions) are defined in Table 6-4. The large estimated t-statistics in the non-response regressions were indication that the missing data problem could not be ignored.

In imputing the missing data, the multiple imputation model assumes a distribution for each variable included in the model. The initial intent was to preserve all of the categorical variable distributions in the imputation model. However, this resulted in too many cells in the log-linear table for the imputation model to be estimable. Therefore, the number of included categorical variable distributions was reduced until estimability was achieved. Additionally, due to the large number of observations, estimation required partitioning the data sets into smaller random sub-samples (two sub-samples for 1977 and 1990, four sub-samples for 1995). The final model distribution assumptions and the variable transformations, if any, used to reduce the gap between the actual variable distribution and that assumed by the multiple imputation model are listed in Table 6-5. Post-imputation, the variables were transformed back to their original values.

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[8] Stoppard, T. (1993). *Arcadia*, p. 46. London: Faber and Faber.

In 1990 and 1995, little or no demographic information was collected for non-surveyed household members. See Note 6 for Table 6-1. In order to create the household role and structure variables, demographic information was imputed for these "missing" individuals. The missing individual models were imputed as secondary model runs, because including the missing household individuals in the primary models and imputing all of their information (including travel data) resulted in prohibitive computation requirements. The following subset of variables were included in these secondary imputation models: r_age, r_relat, worker, lic_drvr, r_sex, urban, hhvehcnt, hh_0to4, hh_hisp, hh_race, hhsize, msasize, hhfaminc, ref_age, ref_sex, educ, and ptrn_dis.

Following imputation, additional variables used in model estimation were constructed. Most of these variables were straightforward combinations or transformations of the variables listed in Table 6-1. Additional clarification for the "family" and "lnincome" variables is provided here. The "family" variable was coded 1 if any person in the household was related to the household head (or reference person); 0 otherwise. The "lnincome" variable was coded as the natural log of the midpoint value of the household family income category.

Table 6-1 Variables Extracted from NPTS Prior to Imputation

	1977	1983
r_sex	1 if female; 0 otherwise	1 if female; 0 otherwise
r_age	Respondent's age	Respondent's age
educ	1 if years of education < 12; 2 if > 11 & < 16; 3 if == 16; 4 if > 16	1 if years of education < 12; 2 if > 11 & < 16; 3 if == 16; 4 if > 16
worker	1 if age > 15 & in previous week "worked at all; had a job, but not at work; had a job, but absent or laid off"; 0 otherwise	1 if age > 15 & in previous week "worked at all; had a job, but not at work; had a job, but absent or laid off"; 0 otherwise
retired	1 if reported retired, and not a worker; 0 otherwise	1 if reported retired, and not a worker; 0 otherwise
lic_drvr	1 if respondent is licensed driver and age > 15; 0 otherwise	1 if respondent is licensed driver and age > 15; 0 otherwise
hh_hisp	1 if respondent's origin or descent "Mexican-American, Chicano, Mexican, Mexicano, Puerto Rican, Cuban, Central or South American, other Spanish"; 0 otherwise	1 if respondent's ethnic origin "Mexican American, Mexican, Puerto Rican, Cuban, Central or South American, other Spanish"; 0 otherwise
hh_race	1 if respondent race is black; 0 otherwise	1 if respondent's race is black; 0 otherwise
r_relat	1 if "household head"; 2 if "wife"; 3 if "unmarried child"; 4 if "other relative"; 5 if "partner/other nonrelative"	1 if "reference person"; 2 if "spouse"; 3 if "child"; 4 if "parent, sibling, other relative"; 5 if "nonrelative"
hh_0to4	Number of individuals age 0 - 4 in household. [1]	Number of individuals age 0 - 4 in household. [1]
hhvehcnt	Number of vehicles available to household for use	Number of household vehicles
hhsize	Number of respondents in household	Total number of people in household
hhfaminc	15 categories.	17 categories [2]
msasize	0 if not in smsa; 1 if smsa population < 250K; 2 if smsa population >= 250K & < 500K; 3 if smsa population >= 500K & < 1M; 4 if smsa population >= 1M & < 3M; 5 if smsa population >= 3M	0 if not in smsa; 1 if smsa population < 250K; 2 if smsa population >= 250K & < 500K; 3 if smsa population >= 500K & < 1M; 4 if smsa population >= 1M & < 3M; 5 if smsa population >= 3M
urban	1 if place of residence urban area; 0 otherwise	1 if place of residence urban area; 0 otherwise
ptrn_dis	1 if distance to nearest public transit <= 0.25 miles; 2 if > 0.25 & <= 1 miles; 3 if > 1 miles or if public transit not available	1 if distance to nearest public transit <= 0.25 miles; 2 if > 0.25 & <= 1 miles; 3 if > 1 miles or if public transit not available. Assumed 12 blocks = 1 mile.
travwknd	1 if travel day was Saturday or Sunday; 0 otherwise	1 if travel day was Saturday or Sunday; 0 otherwise [4]
proxy	1 if respondent not interviewed; 0 otherwise	0 [5]
anytrips	1 if # of trips > 0; 0 otherwise	1 if # of trips > 0; 0 otherwise
sojourns	Total number of trip ends outside home.	Total number of trip ends outside home.
miles	Total miles traversed in travel day.	Total miles traversed in travel day.
avgmiles	Miles / Trips	Miles / Trips
trips	Number of reported trips	Number of reported trips
work	Number of trip ends outside home with purpose of "to work, work-related business, convention"	Number of trip ends outside home with purpose of "to or from work, work-related business"
edu_rel	Number of trip ends outside home with purpose of "civic/education/religious"	Number of trip ends outside home with purpose of "school/church"
per_bus	Number of trip ends outside home with purpose of "shopping, family or personal business"	Number of trip ends outside home with purpose of "shopping, other family or personal business"
medical	Number of trip ends outside home with purpose of "doctor or dentist"	Number of trip ends outside home with purpose of "doctor/dentist"
recrea	Number of trip ends outside home with purpose of "visit friends or relatives, pleasure driving, sighseeing, entertainment, recreation, vacation, social"	Number of trip ends outside home with purpose of "visit friends or relatives, pleasure driving, other social or recreational, vacation"
transit	1 if main mode of transportation on any day trip was "bus, train, streetcar, elevated rail or subway"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.	1 if main mode of transportation on any day trip was "bus, train, streetcar, elevated rail or subway"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.
bikewalk	1 if main mode of transportation on any day trip was "bicycle, walk"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.	1 if main mode of transportation on any day trip was "bicycle, walk"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.
chain	1 if (total # of trips) / (number of trips ending at home) > 2; 0 otherwise. Excluded from estimation if respondent did not begin and end travel day at home.	1 if (total # of trips) / (number of trips ending at home) > 2; 0 otherwise. Excluded from estimation if respondent did not begin and end travel day at home.

Table 6-1 Variables Extracted from NPTS Prior to Imputation (cont.)

	1990 [6]	1995 [6]
r_sex	1 if female; 0 otherwise	1 if female; 0 otherwise
r_age	Respondent's age [7]	Respondent's age [7]
educ	1 if years of education < 12; 2 if > 11 & < 16; 3 if == 16; 4 if > 16	1 if years of education < 12; 2 if > 11 & < 16; 3 if == 16; 4 if > 16
worker	1 if age > 15 & in previous week "worked at all; had a job, but not at work; had a job, but absent or laid off" 0 otherwise	1 if worker; 0 otherwise
retired	1 if reported retired, and not a worker; 0 otherwise	1 if reported retired, and not a worker; 0 otherwise
lic_drvr	1 if respondent is licensed driver and age > 15; 0 otherwise	1 if respondent is licensed driver and age > 15; 0 otherwise
hh_hisp	1 if household reference person is Hispanic; 0 otherwise	1 if household reference person is Hispanic; 0 otherwise
hh_race	1 if household reference person is black; 0 otherwise	1 if household reference person is black; 0 otherwise
r_relat	1 if "reference person"; 2 if "spouse"; 3 if "child"; 4 if "parent, sibling, other relative"; 5 if "nonrelative"	1 if "reference person"; 2 if "spouse"; 3 if "child"; 4 if "parent, sibling, other relative"; 5 if "unmarried partner or nonrelative"
hh_0to4	Number of persons in household age 0 - 4	Number of persons in household age 0 - 4
hhvehcnt	Number of vehicles in household	Count of all vehicles for the household
hhsize	Total number of persons in household	Total number of persons in household
hhfaminc	17 categories [2]	17 categories [2]
msasize	0 if not in smsa; 1 if smsa population < 250K; 2 if smsa population >= 250K & < 500K; 3 if smsa population >= 500K & < 1M; 4 if smsa population >= 1M & < 3M; 5 if smsa population >= 3M	0 if not in smsa; 1 if smsa population < 250K; 2 if smsa population >= 250K & < 500K; 3 if smsa population >= 500K & < 1M; 4 if smsa population >= 1M & < 3M; 5 if smsa population >= 3M
urban	1 if household in urbanized area; 0 otherwise	1 if household in urbanized area; 0 otherwise
ptrn_dis	1 if distance to nearest public transit <= 0.25 miles; 2 if > 0.25 & <= 1 miles; 3 if > 1 miles or if public transit not available	1 if distance to nearest public transit <= 0.25 miles; 2 if > 0.25 & <= 1 miles; 3 if > 1 miles or if public transit not available [3]
travwknd	1 if travel day was Saturday or Sunday; 0 otherwise	1 if travel day was Saturday or Sunday; 0 otherwise
proxy	1 if travel day data or person-level data from proxy; 0 otherwise	1 if person and trip data were collected from proxy respondent; 0 otherwise
anytrips	1 if # of trips > 0; 0 otherwise	1 if # of trips > 0; 0 otherwise
sojourns	Total number of trip ends outside home.	Total number of trip ends outside home.
miles	Total miles traversed in travel day.	Total miles traversed in travel day.
avgmiles	Miles / Trips	Miles / Trips
trips	Number of reported trips	Number of reported trips
work	Number of trip ends outside home with purpose of "to or from work, work-related business"	Number of trip ends outside home with purpose of "to work, work-related business, return to work"
edu_rel	Number of trip ends outside home with purpose of "school/church"	Number of trip ends outside home with purpose of "school, religious activity"
per_bus	Number of trip ends outside home with purpose of "shopping, other family or personal business"	Number of trip ends outside home with purpose of "shopping, other family or personal business"
medical	Number of trip ends outside home with purpose of "doctor/dentist"	Number of trip ends outside home with purpose of "medical/dental"
recrea	Number of trip ends outside home with purpose of "visit friends or relatives, pleasure driving, other social or recreational, vacation"	Number of trip ends outside home with purpose of "visit friends or relatives, pleasure driving, other social/recreational, vacation"
transit	1 if main means of transportation on any day trip was "bus, amtrak, commuter train, streetcar/trolley, elevated rail/subway"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.	1 if main means of transportation on any day trip was "bus, amtrak, commuter train, streetcar/trolley, elevated rail/subway" ; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.
bikewalk	1 if main mode of transportation on any day trip was "bicycle, walk"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.	1 if main mode of transportation on any day trip was "bicycle, walk"; 0 otherwise. Excluded from estimation if respondent did not traverse any miles on travel day.
chain	1 if (total # of trips) / (number of trips ending at home) > 2; 0 otherwise. Excluded from estimation if respondent did not begin and end travel day at home.	1 if (total # of trips) / (number of trips ending at home) > 2; 0 otherwise. Excluded from estimation if respondent did not begin and end travel day at home.

Table 6-1 Notes:

1. If age of any individual in the household was missing; hh_0to4 was coded as missing.
2. In 1983, 1990, & 1995, information on non-family income was collected. To make the income data conformable to 1977, the midpoint values of the household income & non-family income were summed. The summed value was then replaced with the corresponding original household family income category.
3. In 1995, distance to public transit was collected for the following modes: bus, streetcar, subway, train. This information was used to create a ptrn_dis variable equal to the shortest distance to a public transit mode.
4. In 1983, the travel day (of the week) was collected only for those respondents reporting trips. For all other respondents, the travel day was coded as missing (and subsequently imputed).
5. In 1983, no travel data was collected by proxy. Therefore, for individuals with no travel data (different from those reporting 0 trips), all travel data was coded as missing (and subsequently imputed).
6. In 1977 & 1983, person-level data was collected for all household members. In 1990, person-level data was not collected for all household members. In 1995, some person-level data was collected for all household members. In order to create the household interaction variables used in estimation (e.g. fe0to12, family), the following variables were imputed (if missing) for all 1990 & 1995 household members: r_age, r_relat, worker, lic_drvr, r_sex. These were imputed separately from the full data sets using the following subset of variables: r_age, r_relat, worker, lic_drvr, r_sex, urban, hhvehcnt, hh_0to4, hh_hisp, hh_race, hhsize, msasize, hhfaminc, ref_age, ref_sex, educ, ptrn_dis.
7. In 1990 & 1995, an average value was assigned to the 76-79, 80-84, and 85+ age categories. These average values were maintained and motivated the last break-point at age 75 (instead of 85) in the age piece-wise linear model specification.

Table 6-2 Missing Information Percentages for each Variable, by Year

	1977	1983	1990	1995
anytrips	0.00%	3.65%	0.00%	0.00%
avgmiles	0.31%	4.04%	1.35%	0.93%
bikewalk	0.03%	7.31%	0.18%	5.03%
chain	0.75%	5.63%	5.98%	6.96%
edu_rel	0.03%	4.59%	0.08%	0.06%
educ	1.78%	7.84%	4.96%	0.65%
hh_0to4	0.18%	0.03%	0.00%	0.00%
hh_hisp	4.48%	3.75%	0.29%	0.16%
hh_race	0.05%	0.02%	0.55%	1.08%
hhfaminc	10.68%	1.65%	27.51%	17.16%
lic_drvr	4.77%	2.40%	0.10%	0.00%
medical	0.03%	4.59%	0.08%	0.06%
miles	0.88%	5.80%	2.90%	3.65%
msasize	0.00%	5.26%	0.00%	0.00%
per_bus	0.03%	4.59%	0.08%	0.06%
ptrn_dis	6.55%	4.31%	2.09%	5.05%
r_age	0.05%	0.02%	1.03%	1.16%
r_relat	0.00%	0.02%	0.11%	0.05%
r_sex	0.45%	0.02%	0.05%	0.00%
recrea	0.03%	4.59%	0.08%	0.06%
retired	4.48%	2.38%	0.22%	0.55%
sojourns	0.03%	4.57%	0.03%	0.06%
transit	0.04%	7.60%	0.18%	6.24%
travwknd	0.00%	0.00%	0.00%	4.56%
trips	0.00%	3.65%	0.00%	0.00%
urban	0.00%	0.00%	0.00%	0.69%
work	0.03%	4.59%	0.08%	0.06%
worker	4.48%	2.38%	0.25%	0.00%

Table 6-3 Non-Response Regressions [1]

Dependent Variable	Explanatory Variable	Coef.	T-stat.
Household Family Income	motor	-0.756	12.9
	age66to70	-0.274	11.09
	age71to75	-0.292	10.9
	age76to80	-0.323	10.73
	age51to55	-0.197	10.68
	age61to65	-0.238	10.43
	age56to60	-0.209	10.23
	age46to50	-0.156	9.89
	adltchld	0.092	9.84
	age81to85	-0.327	9.83
	age36to40	-0.079	8.75
	age41to45	-0.107	8.67
	age86to90	-0.331	7.9
	age31to35	-0.047	7.35
	proxy	0.035	6.47
	hhwfpr	-0.026	4.21
	vehratio	0.015	4.21
Licensed Driver	proxy	0.100	54.39
	fulltime	-0.038	23.39
	year90	-0.038	13.09
	retired	-0.027	11.14
	flfp	0.109	8.32
	female	-0.046	8.15
	parttime	-0.019	6.1
	hh_0to17	0.005	5.57
	sojourn	-0.007	5.19
	student	-0.024	5.11
	age96to100	0.28	4.9
	per_bus	0.006	4.81
	hhwfpr	-0.010	4.74
	recrea	0.007	4.73
	fehh0to17	-0.006	4.69
	work	0.006	4.64
	graded	0.008	4.51
	edu_rel	0.007	4.19
	highed	0.006	4.15
Education	licveh	-0.033	12.66
	hisp	0.022	8.94
	proxy	0.014	7.14
	female	-0.036	6.3
	flfp	0.072	5.37
	nonmv	-0.056	5.29
	vehavail	0.018	5.23
	persmv	-0.052	5.03
	pubmv	-0.050	4.66

[1] Dependent variable = 1 if data missing, 0 otherwise

Table 6-4 Non-Response Explanatory Variable Definitions

Variable	Definition
age31to35	categorical variable, 5 year increments
adltchld	1 if individual is 18 years or older and is the child of the household head; 0 otherwise
fehh0to17	number of children 0-17, for female adult; 0 otherwise
hisp	1 if individual (or 1990 household) is Hispanic; 0 otherwise
hhwfpr	proportion of household adults, age 18-64, employed or students
fulltime	1 if full-time worker; 0 otherwise
retired	1 if retired; 0 otherwise
parttime	1 if part-time worker; 0 otherwise
student	1 if full-time student; 0 otherwise
vehratio	number of household vehicles divided by number of household adults
sojourn	number of sojourns reported on travel day
per_bus	number of personal business sojourns reported on travel day
recrea	number of recreation sojourns reported on travel day
work	number of work sojourns reported on travel day
edu_rel	number of education/religious sojourns reported on travel day
nonmv	1 if most common mode is non-motorized, 0 otherwise
persmv	1 if most common mode is personal motorized vehicle, 0 otherwise
pubmv	1 if most common mode is public motorized vehicle, 0 otherwise

Table 6-5 Multiple Imputation Transformations and Assumptions

	Variable Distribution	Transformation	Imputation Model Assumption
anytrips	binary	--	categorical
avgmiles	left-skew	natural log	multi-variate normal
bikewalk	binary	--	multi-variate normal
chain	binary	--	multi-variate normal
edu_rel	left-skew	natural log twice	multi-variate normal
educ	categorical	natural log	multi-variate normal
hh_0to4	left-skew	natural log	multi-variate normal
hh_hisp	binary	--	multi-variate normal
hh_race	binary	--	multi-variate normal
hhfaminc	categorical	--	categorical
lic_drvr	binary	--	multi-variate normal
medical	left-skew	natural log twice	multi-variate normal
miles	left-skew	natural log	multi-variate normal
msasize	quasi-normal	--	multi-variate normal
per_bus	left-skew	natural log twice	multi-variate normal
ptrn_dis	categorical	--	categorical
r_age	quasi-normal	--	multi-variate normal
r_relat[1]	categorical	--	multi-variate normal
r_sex	binary	--	multi-variate normal
recrea	left-skew	natural log twice	multi-variate normal
retired	binary	--	multi-variate normal
sojourns	left-skew	natural log	multi-variate normal
transit	binary	--	multi-variate normal
travwknd	binary	--	multi-variate normal
trips	left-skew	natural log	multi-variate normal
urban	binary	--	multi-variate normal
work	left-skew	natural log twice	multi-variate normal
worker	binary	--	multi-variate normal

[1]The r_relat variable was included in the model as 4 separate dummy variables (one variable for each category excluding the reference category). Schafer (1997) suggests this practice for categorical variables with no missing data.

7. Hold-Out Sample Appendix

The following tables compare models estimated using the specification and hold-out samples. The final table provides a summary of the R-squared values. In addition, the final table provides R-squared values resulting from constraining the hold-out sample coefficients to be those estimated using the specification sample, and alternatively, the R-squared values resulting from constraining the specification sample coefficients to be those estimated using the hold-out sample. The F-statistics test the null hypothesis that there is no statistical difference between the hold-out sample estimates and the specification sample estimates (e.g. the hold-out sample estimates are constrained to be equal to the specification sample estimates). The null hypothesis can be rejected in all but two of the models (the continuous personal business sojourns and recreation sojourns). However, with so many observations, this is not surprising.

In all but four of the models (continuous personal business, medical sojourns, education/religious sojourns, and biking/walking propensities), the R-squared values for the hold-out sample were greater than the R-squared values for the specification sample. If the model were over-fitted, one would expect the opposite. Additionally, for all the models save one (continuous log of total miles), the difference in R-squared values between the unconstrained models and their corresponding constrained models (e.g. in Table 7-8: SS/SS minus SS/HS and HS/HS minus HS/SS) is less than the difference in R-squared between the two unconstrained models (e.g. in Table 7-8: SS/SS minus HS/HS). From this assessment, there is little indication of having over-fitted the specification data sample.

Table 7-1 Total Sojourns Specification & Hold-Out Sample Estimates

Total Sojourns		Specification Sample				Hold Sample			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.208	2.39	0.365	4.32	0.0160	0.18	0.3143	3.82
	lnmotor	9.88E-03	0.17	0.0150	0.17	0.128	2.14	0.147	1.54
Age	a25to34	-0.0143	-2.06	-1.03E-02	-1.94	-0.0163	-2.31	-0.0032	-0.59
	a35to44	-6.58E-03	-1.20	2.65E-03	0.59	-6.90E-03	-1.25	1.10E-02	2.42
	a45to54	-8.14E-03	-1.45	-0.0159	-3.19	-5.16E-03	-0.91	-0.0159	-3.12
	a55to64	3.92E-03	0.69	1.16E-02	2.10	-5.06E-03	-0.89	4.98E-03	0.91
	a65to74	-1.05E-02	-1.81	-8.71E-03	-1.34	1.43E-03	0.24	-0.0084	-1.30
	a75plus	-0.0618	-9.03	-0.0408	-4.32	-0.0527	-7.71	-0.0375	-4.08
Period	year83	0.156	3.68	0.140	3.29	-0.0121	-0.29	0.100	2.31
	year90	0.324	8.19	0.108	2.47	0.237	5.89	0.110	2.47
	year95	1.003	22.29	1.00	17.89	0.93	20.17	1.01	18.40
Household Role & Structure	family	0.113	3.29	1.19E-02	0.40	0.154	4.50	-0.0030	-0.10
	ch0to4	-0.201	-5.26	-0.237	-7.95	-0.267	-7.02	-0.215	-7.07
	hh_0to17	0.179	8.94	0.238	13.04	0.157	7.95	0.223	12.43
	hhsize	-0.088	-5.90	-0.0929	-6.60	-0.114	-7.78	-0.0877	-6.19
	black	-0.114	-3.01	-0.1194	-3.35	-0.118	-3.13	-0.0534	-1.51
	female	0.0841	0.88	0.332	4.02	-0.105	-1.087	3.09E-01	3.81
	fe0to12	0.079	1.83	0.306	8.95	0.133	3.06	0.325	9.47
Capabilities & Commitments	lnincome	0.0678	4.58	0.105	7.70	0.0700	4.76	0.097	7.18
	highed	0.187	6.82	0.312	10.41	0.154	5.63	0.327	11.12
	colled	0.297	7.29	0.466	12.33	0.257	6.33	0.496	13.39
	graded	0.433	9.22	0.591	14.27	0.359	7.59	0.637	15.73
	worker	0.920	35.20	0.067	1.60	0.958	36.94	0.1360	3.16
Mobility & Accessibility	vehsatur	0.0849	3.13	0.0376	1.55	0.0918	3.42	0.0328	1.37
	licveh	0.684	20.99	0.650	12.72	0.770	23.91	0.735	13.78
	urban	0.0684	2.57	-0.0093	-0.42	0.0866	3.27	0.0486	2.19
	ptfourth	0.1041	3.68	0.0666	2.77	0.112	3.96	0.0059	0.24
	ptone	0.149	4.61	0.0577	2.19	0.146	4.51	-0.0057	-0.22
Other	travwknd	-0.424	-19.00	-0.279	-10.96	-0.448	-20.11	-0.299	-11.56
	proxy	-0.846	-29.60	-0.642	-15.86	-0.752	-26.04	-0.680	-18.24
	correct	--	--	-0.267	-2.55	--	--	-0.425	-4.12
	constant	-1.34E-01	-0.54	0.891	0.00	0.0545	0.22	0.555	2.36
Number of observations		70,558		70,558		70,650		56,696	
Rho-squared		0.151		0.0903		0.159		0.0938	
Log likelihood		-29726		--		-29049		--	

Table 7-2 Log of Total Miles Specification & Hold-Out Sample Estimates

Log of Total Miles		Specification Sample				Hold Sample			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.1857	2.11	-4.14E-03	-0.13	-0.0013	-0.01	-1.41E-03	-0.04
	lnmotor	-5.18E-03	-0.09	-0.0985	-2.95	0.099	1.69	0.027	0.77
Age	a25to34	-0.0148	-2.09	-9.23E-03	-4.53	-0.0189	-2.64	-5.03E-03	-2.45
	a35to44	-9.90E-03	-1.77	-1.03E-02	-6.09	-6.85E-03	-1.22	-3.13E-03	-1.82
	a45to54	-7.49E-03	-1.32	-6.01E-03	-3.15	-7.02E-03	-1.23	-5.31E-03	-2.75
	a55to64	3.66E-03	0.64	-5.53E-03	-2.62	-5.37E-03	-0.94	-5.59E-03	-2.68
	a65to74	-1.22E-02	-2.08	-0.0153	-6.18	-6.75E-04	-0.12	-0.0073	-2.96
	a75plus	-0.0618	-9.01	-0.0260	-7.24	-0.0536	-7.83	-0.0204	-5.81
Period	year83	0.1568	3.65	0.0223	1.37	-0.0072	-0.17	0.0170	1.04
	year90	0.324	8.10	0.0985	5.95	0.224	5.55	0.0646	3.88
	year95	1.019	22.45	0.352	16.70	0.94	20.32	0.300	14.58
Household	family	0.125	3.59	0.0456	4.04	0.163	4.70	0.0553	4.84
Role &	ch0to4	-0.206	-5.29	-0.0545	-4.78	-0.269	-6.96	-0.0393	-3.38
Structure	hh_0to17	0.178	8.78	0.0199	2.87	0.159	7.94	0.0219	3.19
	hhsize	-0.086	-5.71	0.0295	5.50	-0.115	-7.75	0.0184	3.39
	black	-0.139	-3.63	-0.0200	-1.46	-0.131	-3.44	-0.0310	-2.28
	female	0.0464	0.48	-0.133	-4.22	-0.139	-1.42	-0.134	-4.33
	fe0to12	0.077	1.75	-0.0385	-2.95	0.137	3.13	-0.0145	-1.11
Capabilities &	lnincome	0.0795	5.31	0.1047	20.06	0.0851	5.73	0.0989	18.95
Commitments	highed	0.190	6.87	0.1005	8.78	0.161	5.86	0.0932	8.27
	colled	0.294	7.12	0.150	10.43	0.273	6.62	0.167	11.74
	graded	0.455	9.47	0.155	9.82	0.363	7.55	0.157	10.15
	worker	0.942	35.55	0.137	8.68	0.978	37.25	0.167	10.24
Mobility &	vehsatur	0.0966	3.51	0.115	12.37	0.1011	3.73	0.097	10.61
Accessibility	licveh	0.695	21.20	0.310	15.99	0.779	24.06	0.313	15.43
	urban	0.0718	2.65	-0.126	-14.86	0.0819	3.04	-0.126	-14.87
	ptfourth	0.1008	3.51	-0.141	-15.30	0.1092	3.80	-0.144	-15.64
	ptone	0.146	4.44	-0.0782	-7.77	0.143	4.35	-0.0853	-8.52
Other	travwknd	-0.403	-17.79	-7.39E-03	-0.79	-0.418	-18.51	-3.37E-03	-0.36
	proxy	-0.854	-29.41	-0.095	-6.31	-0.753	-25.76	-0.106	-7.59
	correct	--	--	-0.245	-6.27	--	--	-0.247	-6.39
	constant	-0.2085	-0.83	0.444	0.00	0.0026	0.01	0.444	4.92
Number of observations		70,558		70,558		70,650		57,082	
Rho-squared		0.157		0.114		0.159		0.115	
Log likelihood		-28987		--		-29049		--	

Table 7-3 Personal Business Sojourns Specification & Hold-Out Sample Estimates

Pers. Business Sojourns		**Specification Sample**				**Hold Sample**			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.678	9.56	1.27	10.37	0.5400	7.60	0.9994	9.24
	lnmotor	-0.0024	-0.04	0.067	0.79	0.156	2.17	0.35	3.32
Age	a25to34	0.0077	1.56	0.0139	2.59	1.52E-02	3.04	2.38E-02	4.05
	a35to44	1.27E-02	3.17	0.0263	5.47	7.59E-03	1.85	0.0259	5.42
	a45to54	-1.56E-02	-3.55	-0.0294	-5.77	-0.0050	-1.11	-0.0086	-1.70
	a55to64	0.0181	3.78	0.0338	5.64	0.0161	3.35	0.0197	3.23
	a65to74	-2.88E-03	-0.53	-1.30E-02	-2.16	1.41E-03	0.26	-0.0015	-0.24
	a75plus	-0.0517	-7.53	-0.0993	-8.93	-0.0447	-6.50	-0.090	-8.58
Period	year83	0.333	9.17	0.781	11.60	0.147	3.99	0.476	9.42
	year90	0.499	13.90	1.17	13.89	0.408	10.92	1.01	13.78
	year95	1.08	26.43	2.52	16.17	1.00	23.03	2.34	16.32
Household	family	0.0895	3.36	0.163	5.29	0.101	3.77	0.179	5.58
Role &	ch0to4	-0.071	-2.61	-0.231	-7.75	-0.110	-4.02	-0.291	-8.92
Structure	hh_0to17	0.161	10.38	0.387	13.76	0.157	10.17	0.369	13.13
	hhsize	-0.094	-7.64	-0.185	-9.66	-0.114	-9.42	-0.206	-9.60
	black	-0.0813	-2.58	-0.1022	-2.79	-0.0519	-1.65	-0.0210	-0.59
	female	0.719	9.95	1.39	11.08	0.6442	8.90	1.218	10.40
	fe0to12	0.234	7.38	0.528	12.28	0.243	7.63	0.570	12.66
Capabilities &	lnincome	0.0405	3.36	0.119	8.46	0.0483	4.04	0.106	7.21
Commitments	highed	0.207	8.60	0.510	11.89	0.202	8.41	0.488	11.37
	colled	0.302	9.54	0.703	12.52	0.309	9.80	0.705	12.24
	graded	0.367	10.68	0.847	13.18	0.402	11.61	0.817	11.89
	worker	-0.210	-9.81	-0.477	-13.25	-0.198	-9.31	-0.405	-11.44
Mobility &	vehsatur	0.0226	1.04	-0.0328	-1.40	-0.0553	-2.58	-0.1122	-4.52
Accessibility	licveh	0.663	22.02	1.47	13.73	0.787	26.13	1.60	12.66
	urban	0.0039	0.19	-0.0155	-0.74	0.0540	2.68	0.0774	3.42
	ptfourth	0.1101	5.08	0.201	7.34	0.0366	1.69	0.055	2.31
	ptone	0.1181	4.93	0.192	6.56	0.0421	1.76	0.066	2.56
Other	travwknd	-0.162	-9.09	-0.477	-16.20	-0.190	-10.61	-0.505	-15.38
	proxy	-0.712	-30.60	-1.35	-13.14	-0.693	-29.70	-1.29	-12.72
	correct	--	--	-2.26	-10.62	--	--	-2.21	-10.30
	constant	-1.84	-10.11	-5.36	0.00	-2.00	-10.92	-5.26	-8.52
Number of observations		70,558		70,558		70,650		36,135	
Rho-squared		0.0762		0.0846		0.0787		0.0824	
Log likelihood		-45153		--		-45100		--	

Table 7-4 Recreation & Work Sojourns Specification & Hold-Out Sample Estimates

		Recreation Sojourns				Work Sojourns			
		Specification Sample		Hold Sample		Specification Sample		Hold Sample	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.271	3.63	0.1991	2.66	-0.0364	-0.32	-0.1414	-1.24
	lnmotor	0.240	2.98	0.289	3.48	0.438	2.03	0.330	1.57
Age	a25to34	-0.0248	-4.88	-0.0150	-2.93	-0.0094	-1.37	-0.0189	-2.75
	a35to44	-0.0101	-2.36	-0.0114	-2.65	5.84E-03	0.86	1.19E-02	1.77
	a45to54	1.55E-03	0.32	3.95E-03	0.82	5.85E-03	0.72	-0.0082	-1.03
	a55to64	0.0150	2.92	9.27E-03	1.81	-0.0173	-2.04	-0.0169	-2.03
	a65to74	3.46E-03	0.59	5.30E-03	0.91	-0.0184	-1.42	-0.0376	-2.99
	a75plus	-0.0383	-5.10	-0.0307	-4.09	-0.0369	-1.71	-0.0519	-2.18
Period	year83	0.117	2.93	0.104	2.59	-0.133	-2.26	-0.1464	-2.52
	year90	0.0229	0.56	0.026	0.63	-0.1062	-1.30	-0.0675	-0.84
	year95	0.388	8.23	0.390	8.12	0.102	0.99	0.112	1.11
Household	family	-0.0506	-1.84	-0.0724	-2.62	-0.0185	-0.51	0.0449	1.24
Role &	ch0to4	-0.226	-7.97	-0.207	-7.29	-0.0413	-1.22	-0.1140	-3.38
Structure	hh_0to17	0.105	6.36	0.122	7.41	0.0363	1.84	0.0089	0.46
	hhsize	-0.0722	-5.45	-0.0855	-6.50	-0.0209	-1.31	-0.0126	-0.80
	black	-0.282	-8.06	-0.324	-9.22	0.0311	0.74	0.0262	0.63
	female	0.184	2.46	0.1019	1.35	-0.276	-2.60	-0.378	-3.56
	fe0to12	0.0045	0.14	0.0428	1.30	-0.231	-5.81	-0.237	-5.96
Capabilities &	lnincome	0.112	8.80	0.115	9.14	1.04E-02	0.62	-5.42E-03	-0.33
Commitments	highed	0.194	7.38	0.147	5.61	0.0391	1.09	0.1221	3.42
	colled	0.279	8.34	0.204	6.13	0.0405	0.93	0.0828	1.91
	graded	0.383	10.70	0.323	8.98	0.0736	1.59	0.0684	1.48
	worker	-0.323	-14.68	-0.327	-14.88	4.02	87.08	4.03	87.46
Mobility &	vehsatur	0.111	4.88	0.0935	4.14	0.0332	1.12	0.0864	2.93
Accessibility	licveh	0.394	12.00	0.518	15.61	0.254	5.41	0.154	3.28
	urban	0.0055	0.26	0.0472	2.26	0.1119	4.19	0.0405	1.52
	ptfourth	0.0619	2.76	0.0426	1.89	-0.0460	-1.60	0.0726	2.51
	ptone	0.0390	1.58	0.0469	1.91	-0.0128	-0.41	0.0545	1.74
Other	travwknd	0.633	35.24	0.629	34.87	-2.26	-89.76	-2.29	-90.56
	proxy	-0.289	-11.65	-0.262	-10.56	-0.231	-7.65	-0.172	-5.64
	constant	-1.25	-6.64	-1.59	-8.43	-2.67	-10.94	-2.34	-9.58
Number of observations		70,558		70,650		70,558		70,650	
Rho-squared		0.0447		0.0455		0.405		0.409	
Log likelihood		-42694		-42579		-27973		-27846	

Table 7-5 Medical & Education/Religious Sojourns Specification & Hold-Out Sample Estimates

		Medical Sojourns				Education/Religious Sojourns			
		Specification Sample		Hold Sample		Specification Sample		Hold Sample	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	1.067	5.75	0.6977	3.68	-0.0747	-0.57	0.0324	0.25
	lnmotor	0.318	2.02	0.430	2.31	0.014	0.13	0.270	2.33
Age	a25to34	0.0535	3.59	0.0363	2.46	-0.0236	-2.58	-0.0325	-3.63
	a35to44	0.0270	2.46	0.0350	3.08	4.09E-03	0.55	7.07E-03	0.95
	a45to54	0.0298	2.61	4.12E-03	0.34	8.21E-03	1.00	1.00E-02	1.21
	a55to64	0.0155	1.34	3.47E-02	2.80	0.0103	1.18	1.60E-02	1.82
	a65to74	0.0196	1.60	3.15E-02	2.45	0.0192	2.02	0.0293	3.07
	a75plus	0.0197	1.42	0.0085	0.58	-0.0454	-3.38	-0.0021	-0.17
Period	year83	-0.226	-2.05	-0.1443	-1.29	-0.252	-3.71	-0.246	-3.74
	year90	-0.275	-2.71	-0.3084	-2.84	-0.199	-3.11	-0.357	-5.54
	year95	0.263	2.41	0.258	2.16	-0.170	-2.35	-0.315	-4.31
Household	family	0.0880	1.28	0.0553	0.78	0.0440	0.87	0.1336	2.65
Role &	ch0to4	0.0358	0.47	2.01E-02	0.26	-0.307	-6.21	-0.308	-6.28
Structure	hh_0to17	0.1041	2.39	-0.0379	-0.88	0.136	4.90	0.114	4.14
	hhsize	-0.1231	-3.57	-0.0113	-0.35	0.0395	1.75	0.0326	1.49
	black	-0.0396	-0.48	0.0720	0.89	0.291	5.40	0.405	7.87
	female	1.35	6.89	0.980	4.92	0.180	1.33	0.303	2.29
	fe0to12	-0.0253	-0.30	0.216	2.60	0.0736	1.33	0.0181	0.33
Capabilities &	lnincome	-0.140	-4.73	-0.135	-4.46	-0.0347	-1.58	-0.0477	-2.21
Commitments	highed	0.199	3.17	0.197	3.02	0.343	7.28	0.402	8.55
	colled	0.254	3.06	0.311	3.67	0.581	9.71	0.629	10.59
	graded	0.289	3.24	0.392	4.27	0.793	12.69	0.897	14.38
	worker	-0.556	-10.69	-0.501	-9.42	-0.384	-10.34	-0.394	-10.64
Mobility &	vehsatur	-0.0343	-0.62	0.0003	0.01	0.0546	1.37	0.0658	1.69
Accessibility	licveh	0.0829	1.13	0.033	0.44	0.395	6.89	0.417	7.43
	urban	0.0410	0.79	0.0585	1.10	0.0512	1.37	0.0757	2.04
	ptfourth	0.0526	0.93	0.0126	0.22	0.0063	0.16	0.0452	1.15
	ptone	0.180	3.00	0.085	1.37	0.0291	0.67	-0.0051	-0.12
Other	travwknd	-1.63	-20.70	-1.47	-19.37	1.17	40.02	1.14	39.19
	proxy	-0.295	-4.50	-0.320	-4.74	-0.364	-7.50	-0.295	-6.23
	constant	-3.67	-6.99	-3.35	-6.46	-2.74	-8.22	-2.19	-6.70
Number of observations		70,558		70,650		70,558		70,650	
Rho-squared		0.0662		0.0594		0.0631		0.0615	
Log likelihood		-10142		-9791		-17563		-17796	

Table 7-6 Transit & Non-motorized Mode Usage Specification & Hold-Out Sample Estimates

		Transit Usage Propensity				Biking/Walking Propensiy			
		Specification Sample		Hold Sample		Specification Sample		Hold Sample	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.115	1.34	0.14	1.61	0.423	2.04	0.423	2.65
	lnmotor	-0.006	-0.06	0.30	2.37	0.394	1.50	-0.0656	-0.33
Age	a25to34	-0.0064	-1.13	1.37E-05	0.00	1.89E-02	1.40	9.67E-03	0.72
	a35to44	-4.56E-03	-0.96	6.29E-03	1.23	3.78E-03	0.31	-8.52E-03	-0.72
	a45to54	-0.0101	-1.90	-6.51E-03	-1.12	0.0194	1.37	0.0089	0.66
	a55to64	0.0076	1.31	0.0073	1.21	-1.96E-02	-1.27	-4.33E-02	-2.83
	a65to74	-0.0005	-0.07	8.28E-03	1.14	2.21E-02	1.18	1.64E-02	0.91
	a75plus	-0.0219	-2.38	-0.0238	-2.57	-0.0438	-1.86	-0.0337	-1.47
Period	year83	0.008	0.17	-0.019	-0.40	-0.203	-1.74	-0.166	-1.41
	year90	0.0631	1.34	-0.0572	-1.06	-0.262	-2.09	0.056	0.49
	year95	0.7782	14.03	0.626	9.58	-0.0820	-0.57	0.1654	1.34
Household	family	-0.040	-1.31	-0.049	-1.59	-0.174	-2.51	-0.309	-4.43
Role &	ch0to4	-0.001	-0.04	-0.0165	-0.54	0.085	1.04	0.130	1.56
Structure	hh_0to17	0.1434	7.99	1.15E-01	6.40	0.035	0.82	-0.013	-0.31
	hhsize	-0.100	-6.93	-0.090	-6.30	-0.151	-4.65	-0.111	-3.46
	black	-0.015	-0.39	0.006	0.15	8.21E-01	13.47	6.32E-01	10.08
	female	0.211	2.47	0.2700	3.16	0.364	1.82	0.492	2.42
	fe0to12	0.184	5.14	0.212	5.90	-0.178	-1.94	-0.245	-2.60
Capabilities &	lnincome	0.117	8.27	0.112	7.99	-0.2425	-8.07	-0.3468	-11.53
Commitments	highed	0.294	10.01	0.283	9.67	0.2652	3.74	0.2989	4.20
	colled	0.433	11.67	0.406	11.01	0.980	10.87	0.889	9.63
	graded	0.50	12.53	0.58	14.59	1.119	11.68	1.106	11.31
	worker	0.019	0.77	0.027	1.10	0.714	10.91	0.736	11.10
Mobility &	vehsatur	0.05	1.95	0.01	0.41	-1.082	-16.79	-0.933	-14.03
Accessibility	licveh	0.42	11.01	0.45	11.77	-1.99	-30.81	-2.16	-32.45
	urban	-0.013	-0.56	0.006	0.24	0.859	9.06	0.698	7.57
	ptfourth	-0.01	-0.32	-0.04	-1.44	1.489	17.68	1.570	18.22
	ptone	0.015	0.54	-0.016	-0.59	0.948	9.98	1.024	10.54
Other	travwknd	-0.233	-11.16	-0.193	-9.17	-0.827	-13.21	-0.891	-13.60
	proxy	-4.96E-01	-17.91	-4.20E-01	-15.24	0.085	1.20	-0.097	-1.29
	constant	-1.619	-7.73	-1.591	-7.56	-1.163	-2.39	-0.144	-0.30
Number of observations		52,018		52,006		57,116		57,107	
Rho-squared		0.052		0.053		0.312		0.321	
Log likelihood		-34124		-34107		-6919		-6662	

Table 7-7 Trip Chaining Specification & Hold-Out Sample Estimates

		Trip Chaining Propensity			
		Specification Sample		Hold Sample	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.577	4.52	0.390	3.05
	lnmotor	-0.076	-0.65	-0.228	-2.06
Age	a25to34	-3.38E-03	-0.39	-9.80E-03	-1.14
	a35to44	-1.85E-03	-0.25	-7.74E-03	-1.06
	a45to54	-7.67E-03	-0.93	-0.0252	-3.06
	a55to64	-3.22E-03	-0.36	-1.45E-02	-1.60
	a65to74	2.88E-04	0.03	-6.74E-03	-0.67
	a75plus	-0.0496	-3.54	-0.0446	-3.21
Period	year83	2.02E-01	3.13	0.0491	0.74
	year90	-1.52E-01	-2.28	-0.1660	-2.53
	year95	-0.064	-0.86	-0.035	-0.49
Household	family	-0.2724	-6.04	-0.2760	-6.08
Role &	ch0to4	-1.72E-01	-3.38	-1.76E-01	-3.38
Structure	hh_0to17	0.158	5.52	0.089	3.07
	hhsize	-0.1838	-8.08	-0.1592	-7.02
	black	0.0572	1.15	-0.0553	-1.08
	female	0.453	3.55	0.206	1.62
	fe0to12	0.126	2.21	0.087	1.49
Capabilities &	lnincome	-0.049	-2.35	-0.068	-3.28
Commitments	highed	0.106	2.36	0.110	2.43
	colled	0.416	7.19	0.471	8.15
	graded	0.777	13.14	0.682	11.24
	worker	-0.1740	-4.54	-0.2418	-6.26
Mobility &	vehsatur	-0.7350	-19.21	-0.6431	-16.63
Accessibility	licveh	-1.321	-29.44	-1.374	-30.13
	urban	0.1452	3.52	0.1844	4.44
	ptfourth	0.6579	16.23	0.6201	15.22
	ptone	2.97E-01	6.35	1.64E-01	3.43
Other	travwknd	-0.189	-5.52	-0.225	-6.40
	proxy	-0.243	-4.98	-0.267	-5.42
	constant	0.20	0.64	0.68	2.17
Number of observations		57,116		57,107	
Rho-squared		0.1233		0.1193	
Log likelihood		-16649		-16348	

Table 7-8 Specification & Hold-Out Sample R-squared Summary Table

Sample / Beta Estimation Sample:	SS* / SS*	SS* / HS**	HS** / HS**	HS** / SS*	F-Stat.
Total Sojourns (Discrete)	0.1511	0.1499	0.1548	0.1535	3.35
Total Sojourns (Continous)	0.0903	0.0893	0.0938	0.0929	1.67
Log of Total Miles (Discrete)	0.1565	0.1553	0.1595	0.1582	3.32
Log of Total Miles (Continuous)	0.1144	0.1132	0.1149	0.1138	2.34
Personal Business Sojourns (Discrete)	0.0762	0.0751	0.0787	0.0776	2.76
Personal Business Sojourns (Continuous)	0.0846	0.0834	0.0824	0.0812	1.44
Recreation Sojourns	0.0447	0.0442	0.0455	0.0451	1.15
Work Sojourns	0.4049	0.4041	0.4088	0.4080	3.00
Medical Sojourns	0.0662	0.0637	0.0594	0.0569	6.07
Education/Religious Sojourns	0.0631	0.0617	0.0615	0.0600	3.59
Transit Propensity	0.3119	0.3086	0.3206	0.3172	9.21
Biking/Walking Propensity	0.1233	0.1214	0.1193	0.1173	4.12
Trip Chaining Propensity	0.0517	0.0506	0.0526	0.0516	1.80
Critical Value at 5% significance level					1.45

* Specification Sample

** Hold-out Sample

8. Weighting Appendix

The following tables compare models estimated both with and without the sample weights. In 1977, individuals with proxied travel data were assigned a weight of zero. Inclusion of these observations exacerbates coefficient differences (the zero-weighted observations are excluded from the weighted estimation resulting in two different estimation samples). Therefore, the reported results were estimated excluding observations with zero weights.

Table 8-8 provides a summary of the Hausman statistics testing the null hypothesis that the difference in coefficients is not significant. The null hypothesis is rejected in all of the models except two (the total sojourns and medical sojourns models). However, in assessing the Hausman test statistics, note that the number of observations generally exceeds 50,000, and that critical values for χ^2 statistics are not adjusted for the number of observation. Therefore, with so many observations, it is perhaps more surprising that the Hausman test is not rejected for two of the models. For the remaining models, the Hausman statistics were not high enough to cause concern.

Table 8-1 Total Sojourns Unweighted & Weighted Estimates

Total Sojourns		Unweighted Estimation				Weighted Estimation			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.197	3.16	0.354	5.90	0.3683	4.44	0.2867	3.89
	lnmotor	1.19E-01	2.83	0.0965	1.45	0.115	2.16	0.067	1.28
Age	a25to34	-0.0130	-2.58	-6.20E-03	-1.63	-0.0201	-2.93	-0.0144	-2.72
	a35to44	-6.12E-03	-1.54	7.24E-03	2.26	-5.37E-03	-1.00	-1.11E-03	-0.27
	a45to54	-4.57E-03	-1.13	-0.0154	-4.28	-2.13E-03	-0.40	-0.0152	-3.49
	a55to64	-2.56E-04	-0.06	8.59E-03	2.19	1.72E-03	0.32	5.29E-03	1.18
	a65to74	-2.83E-03	-0.68	-8.03E-03	-1.74	-3.55E-03	-0.63	-0.0070	-1.43
	a75plus	-0.0546	-11.32	-0.0387	-5.83	-0.0504	-7.68	-0.0463	-6.50
Period	year83	-0.042	-1.37	0.104	3.37	-0.0619	-1.87	0.106	3.65
	year90	0.095	3.25	0.078	2.48	0.068	1.91	0.083	2.78
	year95	0.768	23.03	0.97	25.50	0.75	17.48	1.06	26.37
Household	family	0.113	4.60	1.48E-03	0.07	0.121	3.61	-0.0210	-0.76
Role &	ch0to4	-0.230	-8.36	-0.225	-10.51	-0.221	-5.95	-0.205	-6.54
Structure	hh_0to17	0.180	12.53	0.232	17.81	0.188	9.72	0.201	11.38
	hhsize	-0.100	-9.44	-0.0892	-8.88	-0.110	-7.63	-0.0680	-5.15
	black	-0.094	-3.47	-0.0845	-3.35	-0.104	-2.98	-0.0950	-3.01
	female	0.0721	1.05	0.334	5.71	0.319	3.432	2.88E-01	3.74
	fe0to12	0.062	1.98	0.309	12.76	0.043	1.03	0.309	9.05
Capabilities &	lnincome	0.0920	8.65	0.104	10.64	0.0785	5.45	0.125	9.91
Commitments	highed	0.187	9.57	0.325	15.13	0.174	6.72	0.326	13.70
	colled	0.297	10.19	0.487	18.05	0.239	5.92	0.508	15.58
	graded	0.433	12.72	0.621	20.92	0.452	9.62	0.680	17.69
	worker	0.920	49.04	0.093	3.00	0.932	37.28	0.1877	4.34
Mobility &	vehsatur	0.0973	5.02	0.0339	1.98	0.0705	2.67	0.0545	2.37
Accessibility	licveh	0.710	30.37	0.684	18.07	0.709	22.62	0.716	15.42
	urban	0.0781	4.10	0.0186	1.18	0.0532	2.07	-0.0192	-0.92
	ptfourth	0.1081	5.33	0.0359	2.10	0.116	4.29	0.0301	1.34
	ptone	0.154	6.60	0.0249	1.33	0.174	5.49	0.0348	1.37
Other	travwknd	-0.455	-28.56	-0.292	-15.31	-0.414	-19.04	-0.303	-12.17
	proxy	-0.603	-27.59	-0.633	-25.67	-0.597	-20.18	-0.645	-19.35
	correct	--	--	-0.338	-4.26	--	--	-0.496	-5.17
	constant	-1.50E-01	-0.84	0.718	0.00	0.1840	0.77	0.595	2.60
Number of observations		139,495		139,495		139,495		112,868	
Rho-squared (R-squared)		0.146		0.0911		0.137		0.0917	
Log likelihood		-58085		--		-2.63E+08		--	

Table 8-2 Log of Total Miles Unweighted & Weighted Estimates

Log of Total Miles		**Unweighted Estimation**				**Weighted Estimation**			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.1780	2.82	1.33E-02	0.58	0.3295	3.94	2.31E-02	0.74
	lnmotor	9.70E-02	2.33	-0.0155	-0.63	0.088	1.68	-0.063	-1.83
Age	a25to34	-0.0149	-2.89	-6.76E-03	-4.67	-0.0223	-3.19	-8.89E-03	-4.32
	a35to44	-7.61E-03	-1.88	-6.42E-03	-5.28	-7.03E-03	-1.29	-6.97E-03	-3.97
	a45to54	-5.06E-03	-1.23	-4.99E-03	-3.65	-1.55E-03	-0.29	-7.10E-03	-3.52
	a55to64	-1.06E-03	-0.26	-5.31E-03	-3.56	-1.98E-05	0.00	-8.22E-03	-3.86
	a65to74	-4.40E-03	-1.06	-0.0109	-6.20	-5.71E-03	-1.02	-0.0120	-4.89
	a75plus	-0.0551	-11.40	-0.0238	-9.43	-0.0522	-7.94	-0.0253	-7.92
Period	year83	-0.0504	-1.63	0.0055	0.46	-0.0638	-1.91	0.0109	0.83
	year90	0.083	2.82	0.0594	4.97	0.062	1.74	0.0737	4.67
	year95	0.776	23.10	0.310	21.63	0.77	17.86	0.346	16.95
Household Role & Structure	family	0.123	4.95	0.0498	6.21	0.136	4.00	0.0591	5.26
	ch0to4	-0.235	-8.40	-0.0489	-5.98	-0.226	-6.00	-0.0386	-3.38
	hh_0to17	0.181	12.43	0.0241	4.86	0.191	9.75	0.0269	3.79
	hhsize	-0.100	-9.33	0.0228	5.96	-0.113	-7.74	0.0243	4.53
	black	-0.114	-4.17	-0.0246	-2.54	-0.131	-3.72	-0.0264	-2.17
	female	0.0362	0.52	-0.121	-5.44	0.265	2.81	-0.091	-2.91
	fe0to12	0.063	1.99	-0.0300	-3.24	0.059	1.39	-0.0331	-2.58
Capabilities & Commitments	lnincome	0.1062	9.89	0.1047	27.75	0.0917	6.33	0.1105	20.27
	highed	0.192	9.72	0.1045	12.77	0.171	6.53	0.1106	10.51
	colled	0.304	10.25	0.167	16.25	0.238	5.86	0.173	12.54
	graded	0.446	12.82	0.167	14.82	0.470	9.84	0.186	11.54
	worker	0.941	49.45	0.162	13.85	0.946	37.47	0.187	10.93
Mobility & Accessibility	vehsatur	0.1096	5.58	0.107	16.26	0.0802	3.01	0.104	11.06
	licveh	0.719	30.58	0.322	22.47	0.719	22.81	0.324	16.37
	urban	0.0765	3.96	-0.125	-20.77	0.0471	1.81	-0.108	-12.44
	ptfourth	0.1052	5.11	-0.142	-21.69	0.1149	4.19	-0.133	-14.63
	ptone	0.151	6.37	-0.0802	-11.24	0.171	5.31	-0.0679	-6.57
Other	travwknd	-0.431	-26.65	-1.21E-02	-1.74	-0.379	-17.22	-3.02E-03	-0.31
	proxy	-0.600	-27.06	-0.090	-9.76	-0.589	-19.66	-0.097	-7.10
	correct	--	--	-0.284	-9.58	--	--	-0.319	-7.74
	constant	-0.2060	-1.13	0.391	0.00	0.1468	0.60	0.286	3.14
Number of observations		139,495		139,495		139,495		113,680	
Rho-squared (R-squared)		0.151		0.115		0.141		0.114	
Log likelihood		-56718		--		-2.57E+08		--	

Table 8-3 Personal Business Sojourns Unweighted & Weighted Estimates

Pers. Business Sojourns		**Unweighted Estimation**				**Weighted Estimation**			
		Discrete Model		Continuous Model		Discrete Model		Continuous Model	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.626	12.44	1.21	14.26	0.5961	8.63	1.0609	9.34
	lnmotor	0.0904	1.85	0.266	3.83	0.077	1.18	0.21	3.88
Age	a25to34	0.0122	3.47	0.0213	5.32	4.03E-03	0.81	8.04E-03	1.63
	a35to44	1.05E-02	3.65	0.0280	8.13	8.05E-03	2.01	0.0189	4.47
	a45to54	-9.99E-03	-3.17	-0.0181	-5.08	-0.0092	-2.09	-0.0177	-4.20
	a55to64	0.0168	4.96	0.0283	6.54	0.0179	3.83	0.0268	5.11
	a65to74	-5.85E-04	-0.15	-5.98E-03	-1.37	-1.36E-03	-0.26	-0.0077	-1.71
	a75plus	-0.0478	-9.86	-0.0971	-12.57	-0.0525	-7.86	-0.102	-10.16
Period	year83	0.212	8.09	0.592	14.99	0.201	7.04	0.545	13.46
	year90	0.407	15.53	1.03	19.54	0.401	12.13	0.98	14.97
	year95	0.99	32.83	2.41	23.06	1.01	25.14	2.35	15.91
Household	family	0.0881	4.66	0.166	7.51	0.084	3.18	0.147	5.02
Role &	ch0to4	-0.089	-4.56	-0.266	-12.03	-0.097	-3.61	-0.242	-7.29
Structure	hh_0to17	0.158	14.37	0.389	19.13	0.143	9.37	0.331	11.45
	hhsize	-0.101	-11.70	-0.199	-13.75	-0.094	-7.87	-0.161	-8.03
	black	-0.0653	-2.92	-0.0626	-2.45	-0.0855	-2.92	-0.0713	-2.12
	female	0.697	13.61	1.38	15.47	0.6943	9.61	1.285	10.12
	fe0to12	0.233	10.32	0.553	17.69	0.229	7.36	0.515	11.13
Capabilities &	lnincome	0.0508	5.94	0.126	11.93	0.0475	3.98	0.138	9.70
Commitments	highed	0.207	12.12	0.522	16.67	0.199	8.81	0.475	11.35
	colled	0.309	13.81	0.737	17.70	0.313	10.14	0.678	11.54
	graded	0.388	15.87	0.869	17.84	0.386	11.18	0.825	11.88
	worker	-0.219	-14.38	-0.478	-17.64	-0.165	-7.86	-0.365	-10.62
Mobility &	vehsatur	-0.0173	-1.13	-0.0769	-4.61	-0.0073	-0.34	-0.0321	-1.44
Accessibility	licveh	0.719	33.50	1.58	18.67	0.718	24.24	1.52	11.93
	urban	0.0305	2.13	0.0359	2.34	0.0130	0.64	-0.0467	-2.38
	ptfourth	0.0734	4.77	0.131	7.35	0.0572	2.68	0.115	5.06
	ptone	0.0792	4.67	0.132	6.86	0.0480	2.00	0.122	4.98
Other	travwknd	-0.179	-14.12	-0.508	-22.31	-0.202	-11.65	-0.525	-14.58
	proxy	-0.654	-38.69	-1.29	-18.52	-0.639	-26.84	-1.21	-12.02
	correct	--	--	-2.35	-14.91	--	--	-2.21	-9.92
	constant	-1.95	-15.03	-5.64	0.00	-1.67	-9.16	-5.07	-8.44
Number of observations		139,495		139,495		139,495		72,210	
Rho-squared (R-squared)		0.0723		0.0828		0.0642		0.0846	
Log likelihood		-89616		--		-3.78E+08		--	

Table 8-4 Total Recreation & Work Unweighted & Weighted Estimates

		Recreation Sojourns				Work Sojourns			
		Unweighted		Weighted		Unweighted		Weighted	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.260	4.91	0.2316	3.19	0.0037	0.05	-0.0131	-0.12
	lnmotor	0.281	4.80	0.081	1.14	0.405	2.67	0.199	1.10
Age	a25to34	-0.0193	-5.32	-0.0265	-5.21	-0.0127	-2.61	-0.0162	-2.43
	a35to44	-0.0107	-3.49	-0.0170	-4.06	9.99E-03	2.08	1.48E-03	0.24
	a45to54	3.57E-03	1.05	-3.08E-03	-0.65	-4.92E-04	-0.09	-0.0042	-0.57
	a55to64	0.0118	3.25	-1.08E-03	-0.21	-0.0157	-2.62	-0.0182	-2.28
	a65to74	5.00E-03	1.21	-1.30E-03	-0.23	-0.0277	-3.05	-0.0296	-2.49
	a75plus	-0.0344	-6.49	-0.0440	-5.88	-0.0416	-2.59	-0.0802	-3.10
Period	year83	0.074	2.58	0.134	4.29	-0.244	-5.79	-0.2386	-5.10
	year90	-0.0284	-0.96	0.052	1.44	-0.2313	-3.99	-0.1941	-2.77
	year95	0.334	9.79	0.473	11.14	-0.042	-0.58	0.038	0.43
Household	family	-0.0678	-3.47	-0.0687	-2.47	0.0084	0.33	0.0391	1.08
Role &	ch0to4	-0.219	-10.86	-0.213	-7.55	-0.0740	-3.08	-0.0358	-1.07
Structure	hh_0to17	0.113	9.62	0.124	7.47	0.0297	2.11	0.0329	1.63
	hhsize	-0.0748	-7.98	-0.0819	-6.18	-0.0155	-1.37	-0.0097	-0.60
	black	-0.294	-11.79	-0.297	-9.15	0.0408	1.37	0.0207	0.53
	female	0.165	3.10	0.1352	1.81	-0.245	-3.24	-0.169	-1.62
	fe0to12	0.0157	0.67	0.0230	0.70	-0.256	-9.07	-0.239	-6.02
Capabilities &	lnincome	0.122	13.50	0.126	9.76	1.48E-02	1.24	-5.31E-04	-0.03
Commitments	highed	0.176	9.45	0.185	7.42	0.0990	3.88	0.0808	2.39
	colled	0.245	10.36	0.233	7.10	0.0826	2.66	0.0552	1.31
	graded	0.356	13.99	0.399	10.99	0.0973	2.94	0.1263	2.75
	worker	-0.341	-21.78	-0.356	-16.01	4.03	122.62	4.20	87.48
Mobility &	vehsatur	0.105	6.49	0.0945	4.14	0.0632	3.00	0.0655	2.17
Accessibility	licveh	0.440	18.68	0.456	13.76	0.170	5.04	0.164	3.53
	urban	0.0253	1.71	0.0171	0.80	0.0761	4.00	0.1020	3.78
	ptfourth	0.0518	3.25	0.0222	0.99	0.0102	0.50	0.0210	0.74
	ptone	0.0439	2.52	0.0108	0.43	0.0216	0.97	0.0385	1.22
Other	travwknd	0.630	49.29	0.626	35.48	-2.29	-127.95	-2.24	-88.96
	proxy	-0.223	-12.42	-0.252	-9.91	-0.056	-2.53	-0.083	-2.61
	constant	-1.45	-10.83	-1.37	-7.19	-2.54	-14.60	-2.69	-11.03
Number of observations		139,495		139,495		139,495		139,495	
Rho-squared		0.0436		0.0476		0.409		0.410	
Log likelihood		-84609		-3.46E+08		-55077		-2.27E+08	

Table 8-5 Total Medical & Education/Religious Unweighted & Weighted Estimates

		Medical Sojourns				Education/Religious Sojourns			
		Unweighted		Weighted		Unweighted		Weighted	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.910	6.86	0.8066	4.39	-0.0071	-0.08	0.0259	0.21
	lnmotor	0.361	3.01	0.365	2.22	0.140	1.73	0.193	2.02
Age	a25to34	0.0455	4.34	0.0535	3.61	-0.0277	-4.31	-0.0213	-2.35
	a35to44	0.0312	3.95	0.0233	2.07	5.36E-03	1.02	1.65E-03	0.23
	a45to54	0.0175	2.10	1.38E-02	1.15	9.05E-03	1.55	1.75E-02	2.22
	a55to64	0.0233	2.76	2.30E-02	1.91	0.0125	2.02	9.48E-03	1.11
	a65to74	0.0253	2.86	3.08E-02	2.37	0.0238	3.53	0.0261	2.91
	a75plus	0.0142	1.42	0.0095	0.69	-0.0231	-2.57	-0.0118	-0.94
Period	year83	-0.189	-2.40	-0.2281	-2.74	-0.277	-5.79	-0.268	-5.18
	year90	-0.322	-4.33	-0.3402	-3.60	-0.310	-6.76	-0.319	-5.82
	year95	0.231	2.86	0.198	1.83	-0.274	-5.29	-0.248	-3.82
Household	family	0.0635	1.29	0.0865	1.17	0.0819	2.29	0.0887	1.82
Role &	ch0to4	0.0251	0.46	9.29E-02	1.20	-0.306	-8.73	-0.312	-6.30
Structure	hh_0to17	0.0319	1.05	0.0415	0.97	0.128	6.47	0.137	5.05
	hhsize	-0.0628	-2.64	-0.0444	-1.33	0.0353	2.24	0.0329	1.52
	black	0.0245	0.42	0.0239	0.32	0.351	9.36	0.346	7.13
	female	1.19	8.52	1.114	5.56	0.258	2.71	0.320	2.44
	fe0to12	0.0867	1.47	0.098	1.16	0.0383	0.98	0.0075	0.14
Capabilities &	lnincome	-0.135	-6.37	-0.013	-0.38	-0.0362	-2.33	-0.0353	-1.68
Commitments	highed	0.203	4.48	0.182	2.95	0.380	11.33	0.377	8.68
	colled	0.288	4.85	0.239	2.79	0.613	14.47	0.646	11.33
	graded	0.345	5.38	0.218	2.25	0.857	19.32	0.888	14.32
	worker	-0.537	-14.40	-0.551	-10.16	-0.398	-15.08	-0.367	-9.46
Mobility &	vehsatur	-0.0147	-0.37	-0.0378	-0.70	0.0552	1.97	0.0782	2.03
Accessibility	licveh	0.0542	1.04	0.016	0.22	0.400	9.85	0.405	7.37
	urban	0.0505	1.36	0.0514	0.94	0.0648	2.45	0.0202	0.56
	ptfourth	0.0304	0.76	0.0009	0.02	0.0228	0.82	0.0030	0.08
	ptone	0.135	3.14	0.136	2.14	0.0130	0.42	0.0308	0.71
Other	travwknd	-1.55	-28.32	-1.56	-20.77	1.15	55.74	1.12	39.22
	proxy	-0.269	-5.64	-0.293	-4.21	-0.272	-7.77	-0.275	-5.63
	constant	-3.53	-9.55	-4.86	-9.19	-2.48	-10.59	-2.66	-7.98
Number of observations		139,495		139,495		139,495		139,495	
Rho-squared		0.0614		0.0578		0.0618		0.0604	
Log likelihood		-19878		-7.37E+07		-35077		-1.50E+08	

Table 8-6 Transit & Non-Motorized Mode Usage Unweighted & Weighted Estimates

		Transit Usage Propensity				Biking/Walking Propensiy			
		Unweighted		Weighted		Unweighted		Weighted	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.132	2.16	0.02	0.27	0.481	3.25	0.481	3.54
	lnmotor	0.148	1.88	0.06	0.62	0.134	0.84	0.0635	0.25
Age	a25to34	-0.0031	-0.76	-1.07E-02	-1.86	1.44E-02	1.52	3.38E-02	2.44
	a35to44	1.11E-03	0.32	-7.49E-03	-1.55	-3.47E-03	-0.41	-5.51E-03	-0.45
	a45to54	-0.0082	-2.08	-8.49E-03	-1.57	0.0137	1.41	-0.0034	-0.23
	a55to64	0.0073	1.73	-0.0025	-0.43	-3.35E-02	-3.08	-3.55E-03	-0.23
	a65to74	0.0044	0.88	9.39E-03	1.34	1.93E-02	1.50	1.43E-02	0.79
	a75plus	-0.0228	-3.50	-0.0360	-3.82	-0.0391	-2.38	-0.0511	-2.18
Period	year83	-0.003	-0.08	0.004	0.10	-0.153	-1.85	-0.182	-1.94
	year90	0.0025	0.07	0.0430	0.97	-0.102	-1.22	-0.221	-1.90
	year95	0.7008	16.37	0.744	13.50	0.0466	0.50	-0.1540	-1.12
Household Role & Structure	family	-0.044	-2.01	-0.087	-2.79	-0.240	-4.88	-0.252	-3.45
	ch0to4	-0.006	-0.28	-0.0406	-1.33	0.109	1.86	0.069	0.84
	hh_0to17	0.1277	10.03	1.03E-01	5.80	0.011	0.36	-0.001	-0.03
	hhsize	-0.095	-9.31	-0.062	-4.33	-0.131	-5.72	-0.120	-3.66
	black	-0.006	-0.22	-0.019	-0.55	7.27E-01	16.64	6.90E-01	11.40
	female	0.244	4.04	0.1659	1.91	0.419	2.94	0.665	3.33
	fe0to12	0.200	7.87	0.180	5.06	-0.213	-3.24	-0.255	-2.70
Capabilities & Commitments	lnincome	0.115	11.55	0.117	8.23	-0.2958	-13.88	-0.2467	-7.13
	highed	0.290	13.97	0.298	10.77	0.2862	5.69	0.3841	5.69
	colled	0.422	16.09	0.452	12.43	0.944	14.63	0.962	10.59
	graded	0.54	19.18	0.54	13.64	1.112	16.24	1.238	12.63
	worker	0.021	1.22	0.035	1.44	0.723	15.46	0.787	11.72
Mobility & Accessibility	vehsatur	0.03	1.57	0.07	2.82	-1.008	-21.76	-1.089	-16.07
	licveh	0.43	15.98	0.39	10.32	-2.07	-44.62	-2.01	-30.29
	urban	-0.006	-0.35	-0.024	-1.01	0.783	11.83	0.964	8.99
	ptfourth	-0.02	-1.20	-0.03	-1.40	1.531	25.36	1.566	17.36
	ptone	0.000	-0.03	-0.030	-1.08	0.990	14.55	1.086	10.42
Other	travwknd	-0.215	-14.45	-0.215	-10.36	-0.857	-18.92	-0.958	-15.69
	proxy	-4.60E-01	-23.37	-4.45E-01	-15.61	0.006	0.11	0.074	0.94
	constant	-1.611	-10.84	-1.435	-6.84	-0.671	-1.95	-2.069	-4.07
Number of observations		103,649		103,649		113,723		113,723	
Rho-squared		0.052		0.312		0.316		0.114	
Log likelihood		-68015		-5.39E+07		-13544		-1.40E+08	

Table 8-7 Trip Chaining Unweighted & Weighted Estimates

		Trip Chaining Propensity			
		Unweighted		Weighted	
Category	Variable	Coef.	T-stat.	Coef.	T-stat.
Cohort	lnflfp	0.487	5.38	0.395	3.20
	lnmotor	-0.161	-1.98	-0.062	-0.64
Age	a25to34	-6.99E-03	-1.15	-1.76E-02	-2.03
	a35to44	-4.82E-03	-0.93	-9.82E-03	-1.36
	a45to54	-1.64E-02	-2.80	-0.0059	-0.72
	a55to64	-9.32E-03	-1.46	-8.90E-03	-1.02
	a65to74	-3.60E-03	-0.51	3.81E-04	0.04
	a75plus	-0.0478	-4.84	-0.0378	-2.72
Period	year83	1.21E-01	2.59	0.0902	1.83
	year90	-1.65E-01	-3.50	-0.1758	-3.15
	year95	-0.056	-1.07	-0.101	-1.60
Household	family	-0.2789	-8.70	-0.3316	-7.40
Role &	ch0to4	-1.80E-01	-4.95	-2.18E-01	-4.34
Structure	hh_0to17	0.128	6.25	0.145	5.10
	hhsize	-0.1711	-10.61	-0.1748	-7.70
	black	-0.0037	-0.10	-0.0751	-1.56
	female	0.332	3.67	0.239	1.88
	fe0to12	0.105	2.58	0.041	0.73
Capabilities &	lnincome	-0.056	-3.83	-0.088	-4.14
Commitments	highed	0.107	3.35	0.154	3.75
	colled	0.439	10.73	0.442	7.94
	graded	0.729	17.19	0.780	13.14
	worker	-0.2123	-7.77	-0.2642	-6.70
Mobility &	vehsatur	-0.6889	-25.25	-0.6701	-17.18
Accessibility	licveh	-1.352	-42.09	-1.260	-28.18
	urban	0.1641	5.60	0.1099	2.68
	ptfourth	0.6396	22.23	0.5960	15.31
	ptone	2.31E-01	6.90	2.44E-01	5.20
Other	travwknd	-0.208	-8.46	-0.227	-6.78
	proxy	-0.235	-6.69	-0.224	-4.37
	constant	0.44	1.99	1.23	3.81
Number of observations		113,723		113,723	
Rho-squared		0.1211		0.049	
Log likelihood		-32870		-2.70E+08	

Table 8-8 Unweighted & Weighted Hausman Statistic Summary Table

Model	Hausman Statistic
Total Sojourns (Discrete)	4
Total Sojourns (Continous)	7
Log of Total Miles (Discrete)	50
Log of Total Miles (Continuous)	70
Personal Business Sojourns (Discrete)	86
Personal Business Sojourns (Continuous)	176
Recreation Sojourns	74
Work Sojourns	69
Medical Sojourns	15
Education/Religious Sojourns	47
Transit Propensity	107
Biking/Walking Propensity	121
Trip Chaining Propensity	66
Critical Value at 5% significance level (Discrete)	45
Critical Value at 5% significance level (Continuous)	46

9. Forecast Error Appendix

As described in the Results Chapter three sources of forecast error were estimated: sample errors in the estimated coefficients, sample errors in the simulated forecast population, and errors associated with the input assumptions used to generate the simulated future 65+ populations. Each of these estimated error sources are reported in the following tables.

Table 9-1 Sample Errors in the Estimated Coefficients

	1995		2000		2010		2020		2030	
	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error
Daily Sojourns	2.22	0.0174	2.26	0.0201	2.32	0.0299	2.47	0.0425	2.52	0.0542
Daily Miles	27.6	0.285	27.7	0.345	27.9	0.511	29.2	0.726	28.9	0.907
Personal Business Sojourns	1.33	0.0112	1.37	0.0171	1.44	0.0359	1.57	0.0589	1.64	0.0799
Recreational Sojourns	0.350	4.07E-03	0.361	5.56E-03	0.381	9.22E-03	0.415	0.0134	0.434	0.0172
Work Sojourns	0.0779	1.14E-03	0.0829	1.12E-03	0.0968	2.46E-03	0.111	4.44E-03	0.108	5.90E-03
Medical Sojourns	0.0659	1.66E-03	0.0721	2.12E-03	0.0838	4.20E-03	0.0975	7.30E-03	0.114	0.0110
Education/Religious Sojourns	0.0821	1.59E-03	0.0849	2.12E-03	0.0881	3.65E-03	0.0954	5.55E-03	0.0994	7.44E-03
Transit Usage Propensity	0.0288	1.02E-03	0.0304	1.59E-03	0.0326	3.00E-03	0.0354	4.59E-03	0.0381	6.29E-03
Biking/Walking Propensity	0.0866	2.35E-03	0.0875	2.78E-03	0.0882	3.75E-03	0.0901	4.72E-03	0.0917	5.78E-03
Trip Chaining Propensity	0.411	4.86E-03	0.420	6.46E-03	0.433	0.0107	0.463	0.0154	0.473	0.0197

N=20

Table 9-2 Sample Errors in the Simulated Forecast Population

	1995		2000		2010		2020		2030	
	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error	Estimate	St. Error
Daily Sojourns	2.22	0.0094	2.26	0.0098	2.32	0.0108	2.48	0.0103	2.52	0.0107
Daily Miles	27.6	0.149	27.7	0.146	27.9	0.162	29.2	0.162	29.0	0.170
Personal Business Sojourns	1.33	5.46E-03	1.37	5.86E-03	1.44	6.95E-03	1.57	7.64E-03	1.65	0.0091
Recreational Sojourns	0.350	2.23E-03	0.361	2.22E-03	0.382	2.33E-03	0.415	2.37E-03	0.434	2.61E-03
Work Sojourns	0.0779	2.46E-03	0.0829	2.54E-03	0.0969	2.89E-03	0.111	3.36E-03	0.109	3.43E-03
Medical Sojourns	0.0659	6.45E-04	0.0723	7.50E-04	0.0843	1.00E-03	0.0984	1.29E-03	0.115	1.73E-03
Education/Religious Sojourns	0.0821	8.97E-04	0.0849	9.59E-04	0.0882	1.04E-03	0.0957	1.23E-03	0.0999	1.47E-03
Transit Usage Propensity	0.0288	7.96E-04	0.0304	8.87E-04	0.0329	1.01E-03	0.0359	1.23E-03	0.0388	1.47E-03
Biking/Walking Propensity	0.0866	1.18E-03	0.0875	1.28E-03	0.0883	1.54E-03	0.0903	1.88E-03	0.0919	2.27E-03
Trip Chaining Propensity	0.411	1.90E-03	0.420	1.94E-03	0.433	2.09E-03	0.464	1.95E-03	0.473	2.04E-03

N=20

Table 9-3 Base Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.26	2.32	2.48	2.52
Daily Miles	27.6	27.7	27.9	29.2	29.0
Personal Business Sojourns	1.33	1.37	1.44	1.57	1.65
Recreational Sojourns	0.350	0.361	0.382	0.415	0.434
Work Sojourns	0.0779	0.0829	0.0969	0.111	0.109
Medical Sojourns	0.0659	0.0723	0.0843	0.0984	0.115
Education/Religious Sojourns	0.0821	0.0849	0.0882	0.0957	0.0999
Transit Usage Propensity	0.0288	0.0304	0.0329	0.0359	0.0388
Biking/Walking Propensity	0.0866	0.0875	0.0883	0.0903	0.0919
Trip Chaining Propensity	0.411	0.420	0.433	0.464	0.473

Table 9-4 Population Low Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.26	2.34	2.50	2.55
Daily Miles	27.6	27.7	28.0	29.5	29.4
Personal Business Sojourns	1.33	1.37	1.44	1.59	1.67
Recreational Sojourns	0.350	0.362	0.383	0.418	0.439
Work Sojourns	0.0779	0.0830	0.0971	0.112	0.109
Medical Sojourns	0.0659	0.0723	0.0843	0.0984	0.115
Education/Religious Sojourns	0.0821	0.0850	0.0885	0.0963	0.1007
Transit Usage Propensity	0.0288	0.0304	0.0328	0.0358	0.0387
Biking/Walking Propensity	0.0866	0.0876	0.0885	0.0906	0.0922
Trip Chaining Propensity	0.411	0.420	0.435	0.468	0.479

Table 9-5 Population High Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.26	2.31	2.45	2.48
Daily Miles	27.6	27.6	27.7	28.9	28.5
Personal Business Sojourns	1.33	1.37	1.43	1.55	1.62
Recreational Sojourns	0.350	0.361	0.379	0.411	0.428
Work Sojourns	0.0779	0.0829	0.0965	0.111	0.108
Medical Sojourns	0.0659	0.0722	0.0843	0.0985	0.115
Education/Religious Sojourns	0.0821	0.0849	0.0878	0.0949	0.0988
Transit Usage Propensity	0.0288	0.0304	0.0329	0.0360	0.0389
Biking/Walking Propensity	0.0866	0.0875	0.0881	0.0899	0.0914
Trip Chaining Propensity	0.411	0.419	0.431	0.459	0.467

Table 9-6 Education High Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.27	2.35	2.51	2.57
Daily Miles	27.6	27.8	28.2	29.7	29.5
Personal Business Sojourns	1.33	1.37	1.45	1.60	1.68
Recreational Sojourns	0.350	0.362	0.385	0.420	0.441
Work Sojourns	0.0779	0.0830	0.0970	0.111	0.109
Medical Sojourns	0.0659	0.0724	0.0848	0.0993	0.116
Education/Religious Sojourns	0.0821	0.0855	0.0898	0.0982	0.1034
Transit Usage Propensity	0.0288	0.0306	0.0333	0.0366	0.0399
Biking/Walking Propensity	0.0866	0.0878	0.0892	0.0918	0.0941
Trip Chaining Propensity	0.411	0.421	0.438	0.471	0.483

Table 9-7 Work Low Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.26	2.31	2.45	2.48
Daily Miles	27.6	27.6	27.6	28.7	28.2
Personal Business Sojourns	1.33	1.37	1.44	1.58	1.66
Recreational Sojourns	0.350	0.362	0.383	0.418	0.439
Work Sojourns	0.0779	0.0784	0.0807	0.080	0.068
Medical Sojourns	0.0659	0.0725	0.0854	0.1007	0.119
Education/Religious Sojourns	0.0821	0.0852	0.0891	0.0975	0.1023
Transit Usage Propensity	0.0288	0.0303	0.0325	0.0351	0.0377
Biking/Walking Propensity	0.0866	0.0877	0.0889	0.0912	0.0931
Trip Chaining Propensity	0.411	0.419	0.431	0.459	0.467

Table 9-8 Work High Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.27	2.35	2.55	2.59
Daily Miles	27.6	27.8	28.5	31.0	30.4
Personal Business Sojourns	1.33	1.37	1.43	1.55	1.63
Recreational Sojourns	0.350	0.360	0.378	0.404	0.425
Work Sojourns	0.0779	0.0918	0.1291	0.206	0.191
Medical Sojourns	0.0659	0.0717	0.0821	0.0918	0.108
Education/Religious Sojourns	0.0821	0.0845	0.0864	0.0903	0.0951
Transit Usage Propensity	0.0288	0.0306	0.0335	0.0380	0.0409
Biking/Walking Propensity	0.0866	0.0872	0.0872	0.0875	0.0894
Trip Chaining Propensity	0.411	0.421	0.439	0.479	0.487

Table 9-9 High Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.27	2.36	2.54	2.60
Daily Miles	27.6	27.9	28.6	30.4	30.5
Personal Business Sojourns	1.33	1.37	1.43	1.56	1.63
Recreational Sojourns	0.350	0.361	0.379	0.409	0.426
Work Sojourns	0.0779	0.0918	0.1288	0.172	0.189
Medical Sojourns	0.0659	0.0718	0.0825	0.0946	0.109
Education/Religious Sojourns	0.0821	0.0850	0.0876	0.0938	0.0975
Transit Usage Propensity	0.0288	0.0308	0.0340	0.0382	0.0421
Biking/Walking Propensity	0.0866	0.0875	0.0879	0.0896	0.0913
Trip Chaining Propensity	0.411	0.423	0.441	0.476	0.490

Table 9-10 Low Scenario Forecast

	1995	2000	2010	2020	2030
Daily Sojourns	2.22	2.26	2.32	2.47	2.51
Daily Miles	27.6	27.6	27.7	29.0	28.7
Personal Business Sojourns	1.33	1.37	1.45	1.60	1.68
Recreational Sojourns	0.350	0.362	0.385	0.422	0.443
Work Sojourns	0.0779	0.0783	0.0809	0.081	0.068
Medical Sojourns	0.0659	0.0726	0.0854	0.1007	0.119
Education/Religious Sojourns	0.0821	0.0853	0.0894	0.0981	0.1032
Transit Usage Propensity	0.0288	0.0303	0.0325	0.0351	0.0376
Biking/Walking Propensity	0.0866	0.0878	0.0890	0.0915	0.0934
Trip Chaining Propensity	0.411	0.419	0.433	0.463	0.472

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