Institute for International Economic Policy Working Paper Series
Elliott School of International Affairs
The George Washington University

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IIEP-WP-2015-19

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September 2015

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Travel Time Use Over Five Decades

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September 4, 2015

Abstract

In this paper, we use five decades of time use surveys, including the annual American Time Use Survey between 2003 and 2013, to document travel time uses in the aggregate and across demographic groups. We find that total travel time features an inverted-U shape over time, registering a 20 percent increase from 1975 to 1993, but an 18 percent decline from 1993 to 2013. We find that demographic shifts explain around 45 percent of the increase in total travel time from 1975 to 1993. Increases in educational attainment alone contribute to around 28 percent of the increase. Demographic shifts play a much smaller role in the evolution of total travel time afterwards. From 2003 to 2013 the shift of time allocation from travel-intensive non-market work to travel-non-intensive leisure accounts for around 50 percent of the decline in total travel time.

JEL Codes: J22, R41, D13

Key words: Travel time use; Time use survey; Market work; Non-market work; Leisure

[1]We thank Erik Hurst, Arun Malik, Anthony Yezer, and seminar participants at the Bureau of Economic Analysis, Department of Transportation, and the George Washington University. We gratefully acknowledge the financial support of the IIEP at the George Washington University. The corresponding author's email address: cdwei@gwu.edu. Mailing address: Department of Economics, George Washington University, 2115 G St. NW, Washington DC 20052.

1 Introduction

In this paper, we use five decades of time use surveys to examine trends in travel time use within the United States. Our measure of travel time includes all modes of travel related to market work, non-market (household) work and leisure. We find that there have been dramatic changes in travel time over the past five decades. Total travel time increased by around 19 percent from 1965 to 1993 for an average individual between 19 and 65 year old, and by around 20 percent from 1975 to 1993 if we expand the sample to those 18 and up. In 1975, average travel time for an adult was 8.43 hours per week, and grew to 10.1 hours per week in 1993. Average travel time peaked some time between 1993 and 2003, possibly around the turn of the century. Due to the lack of annual data, we cannot exactly pin down the peak year. By 2003, average travel time per adult had already declined to 9.03 hours per week, a decline of around 11 percent since 1993. The decline has then continued throughout the following decade. In 2013 average travel time per adult was 8.29 hours per week, registering a decline of 18 percent compared to that in 1993. Despite dramatic changes in all aspects of economy since 1965, people in 2013 spend similar amount of travel time as those five decades ago.

The dramatic change in travel time is not an isolated phenomenon. Total vehicle miles of travel (VMT) within the U.S. began to plateau in 2004 and dropped in 2007 for the first time since 1980. Similarly, the growth rate in VMT per capita began to plateau around 2000, and per capita level started to slide after 2005.[2] In addition, distance driven per light-duty vehicle, and the number of light-duty vehicles per capita also peaked shortly after the turn of the century (Sivak, 2013). Since vehicle travel remains the primary travel mode of the country, the peak and subsequent decline in distance driven and vehicle ownership corroborate the dramatic turn in the total travel time around the same time. Considering that total travel time is also closely related to mobility patterns and gasoline use in this country, the importance of explaining forces behind variations in travel time becomes self-evident.

The intriguing questions are: What are the forces behind the dramatic variations in total

[2]See, for example, Puentes and Tomer (2008) report for the Metropolitan Policy Program at Brookings.

travel time over the five decades? To what extent do demographic shifts, including the aging of baby boomers, the peak of female labor force participation, and changes in education composition and the fraction of population with children, contribute to the evolving patterns of travel time use? What are the causes behind the recent decline in total travel time, especially after 2003? Can the decline in travel time be attributed to an increase in efficiency as a result of telecommuting and e-commerce, or is it caused by less time allocated to activities complementary with travel? Will the forces behind the decline over the past decade carry into the future and cause continuing decline in total travel time?

To address these questions, we link five major time use surveys to characterize patterns of travel time use. These time use surveys are: 1965-1966 America's Use of Time; 1975-1976 Time Use in Economics and Social Accounts; 1985 Americans' Use of Time; 1992-1994 National Human Activity Pattern Survey; and the 2003-2013 Annual American Time Use Survey (ATUS). We seek to explain travel time variations by taking a close look at two driving forces. The first driving force is changes in demographic composition in terms of age, gender, work status, education and whether there are children in the household. We decompose unconditional changes in average travel time to gauge the contribution by shifts in each demographic attribute. The second driving force is changes in travel time allocation that are common across demographic groups. We examine how travel time co-varies with other time use categories. The common components represent changes not explained by shifts in demographic composition.

We have the following main findings: First, demographic shifts explain around 45 percent of the increase in total travel time from 1975 to 1993. Increases in educational attainment alone contribute to around 28 percent of the increases, followed by around 18 percent contributed by changes in age, work and gender composition. However, demographic shifts play a much smaller role in the evolution of total travel time afterwards. Between 2003 and 2013, the negative effect on total travel time due to aging of baby boomers and decreasing labor force participation is mostly offset by the positive effect due to increases in education attainment. As a result, changes in total travel time are not explained by demographic shifts. Second, variations in total travel time from 2003 to 2013 are dominated by time effects that are common to all demographic groups. In particular, the shift of time allocation

from travel-intensive non-market work to travel-non-intensive leisure accounts for around 50 percent of the decline in total travel time. There are no strong evidence for economizing on travel during the recent decade. Third, travel time is complementary with time spent on obtaining goods and services, civil activities, and leisure outside, including exercises, sports and social activities. Time spent on travel is substitutionary with time spent on home entertainment on computer and TV, sleeping, and home production. The substitutionary and complementary patterns of travel time use with other time use categories indicate that there has also been a shift of time allocation from leisure outside to leisure at home, in addition to the shift of time from non-market work to leisure.

Our work contributes to the existing literature on measuring changes in time allocation. Robinson and Godbey (1999) use the same time use surveys we use from 1965, 1975, and 1985, as well as some additional information from the early 1990s, to document time uses in all categories. Aguiar and Hurst (2007) (henceforth A&H) document trends in leisure from 1965 to 2003 by using time use surveys in 1965, 1975, 1985, 1993 and 2003. Similar to Ramey and Francis (2009), they find a dramatic increase in leisure time during the sample period. We further extend A&H sample to include annual time use surveys from 2003 to 2013 conducted by the Bureau of Labor Statistics. The availability of annual data and consistency of time use definitions for surveys after 2003 provide more detailed information on time uses compared to previous surveys. While A&H focus on leisure, which makes up more than half of the time use, we focus on total travel time. Although travel time makes up a small fraction of total time use, percentage changes in total travel time have been dramatic. Our work also differs from A&H in the choice of sample population. Our sample includes population aged 18 and up, while A&H only include those between 21 and 65.

The U.S. Department of Transportation conducts the Nationwide Personal Transportation Survey (NPTS) and National Household Travel Survey (NHTS) periodically to gather data such as mode of transportation, duration, distance and purpose, and then links the travel related information to demographic and economic data for analysis. In that survey respondents only need to report the trips they took on a single day, but not all the activities within 24 hours as done in the time use surveys we work with. Robinson and Godbey (1999) find that time use surveys seem to show more travel and more trips than reported in

the 1992 National Transportation Survey. However, they also find that the Department of Transportation data show much the same distribution across trip purposes and correlations of travel time as time use surveys, despite the overall lower numbers. One of the important advantages of the five time use surveys we use is that we can not only relate travel time with the corresponding activity based on the purpose of the travel, but also examine travel time as part of optimal time allocation among all time uses. Since 2003, the linking of time use surveys with the Current Population Survey yields a large sample with rich demographic and economic data on respondents, making it a valuable data source for optimal time allocation. American time use surveys have become annual after 2003, while NPTS and NHTS Surveys are only conducted periodically in 1969, 1977, 1983, 1990, 1995, 2001 and 2009. When applicable, we use information from transportation surveys to corroborate our findings on travel trends from time use surveys.

2 Time Use Surveys and Data Construction

We link five major time use surveys to characterize travel time patterns. In addition to surveys used in A&H, we include the ATUS from 2003 to 2013. We also examine different sample population, construct new measures of travel time, and form demographic cells differently from A&H due to our focus on travel time use. Below we describe the three differences in detail. Table 1 reports our sample sizes and the number of time use categories.

2.1 Two Samples

The primary sample of A&H consists of respondents aged 21 through 65 who are neither students nor retirees. Since we focus on travel time allocations, it is appropriate to include all possible drivers, both younger than 21 and older than 65 in the sample. However, time use surveys differ in terms of the minimum and maximum age. We form two different samples based on a tradeoff between the size of our sample population and the length of sample periods. Our first sample consists of respondents aged 18 and up from 1975 to 2013, where 18 is the minimum age allowed by all surveys from 1975 on. Our second sample consists of respondents aged 19 through 65 from 1965 to 2013, to accommodate the narrow

age limit in the 1965-1966 America's Use of Time. We exclude respondents whose answers on age, gender, working status, education and having child or not are missing, or whose time use record is incomplete (i.e. all time use components in the diary do not add up to 1440 minutes per week).

As shown in Table 1, during the period from 1975 to 2013 when two samples can be formed for the same year, the second sample can be as much as 20 percent smaller than the first sample. The first sample is the primary focus of our investigation.[3]

2.2 Measures of Non-travel Activity and Corresponding Travel Time

We characterize three major uses of non-travel time and their corresponding travel time: (non-travel) market work and work travel; (non-travel) non-market work and non-market work travel; (non-travel) leisure and leisure travel. From now on, we omit the "(non-travel)" qualification unless confusion might arise. Our time use conventions are broadly similar to A&H except for two differences: First, A&H's measures of market work, non-market work and leisure include their corresponding travel time, whereas here those three terms refer to non-travel component of the three major time uses; Second, child care either stands alone or counts as part of broad measure of leisure in A&H, while we count child care as non-market work. There has been debate on whether child care should be counted as non-market work or leisure. Ramey and Francis (2009) count a subset of child care as leisure. However, since we do not have disaggregated travel time corresponding to each subset of child care, we choose to treat all the time spent on child care as non-market work.

Table 1 shows that time use surveys from 2003 to 2013 have the most comprehensive measures of both non-travel and travel time.

2.2.1 Measures of Non-travel Time

Our measure of market work includes non-travel portion of work for pay (all time spent working in the market sector on main jobs, second jobs, overtime, and working at home) plus time spent on ancillary work activities, such as time spent at work on breaks or eating

[3]The Blinder-Oaxaca decomposition results obtained by using the second sample are presented in Appendix B. Other results for the second sample can be provided upon request.

a meal, and time spent on searching for a job. The measure is the same as A&H's measure of market work excluding commuting to/from work and other work-related travel.

Our measure of non-market work includes four categories of time uses: home production, obtaining goods and services, child care and other care. Here home production includes any time spent on meal preparation, housework, and vehicle maintenance.[4] Obtaining goods and services includes time spent on non-travel portion of acquiring any goods and services (excluding medical care, education and restaurant meals). Child care includes time spent on non-travel portion of primary, educational and recreational child care as defined in A&H. Other care includes time spent on helping and caring for household and non-household adults.

We have both narrow and broad measures of leisure. We define a narrow measure of leisure as time spent on sports, exercises, recreation, socializing and communicating, hosting and attending social events, relaxing and leisure, arts and entertainment, and telephone calls. These are activities that are pursued solely for direct enjoyment. Our broad measure of leisure also includes time spent on eating and drinking, sleeping, personal care, own medical care, religious, spiritual, volunteering, gardening and pet care, and other leisure activities, in addition to those core leisure activities included in the narrow measure.

In addition to the narrow and broad measures of leisure, we also group leisure into three categories by the most likely location of enjoying the leisure time. We define home leisure as leisure time most likely spent at home, including time spent on watching TV and computer, sleeping, and other home-based leisure.[5] We define outside leisure as time spent on some typical outside activities, such as exercise and sports, socializing, entertainment and arts. We put the rest of leisure time, including gardening and petting, personal care and other self care into the third category. We later examine how travel time covary with measures of leisure time by location.

[4]Different from A&H, we include time spent on gardening and pet care in leisure, instead of as both home production and leisure. Our main results do not change if we categorize it otherwise.

[5]Other home-based leisure includes hobbies, listening to radio, listening to/playing music (not radio), reading, relaxing and thinking, and tobacco and drug use.

2.2.2 Measures of Travel Time

Our measure of travel time includes all modes of travel. The period from 2003 to 2013 has the most comprehensive disaggregation of travel time. Table A1 summarizes travel time use classification and definitions. Table A2 summarizes coding rules of traveling in ATUS.[6] Table A3 summarizes coding rules of traveling in 1975-1976 Time Use in Economic and Social Accounts. We define work travel as travel related to work, including commuting to and from work. The non-market work travel is defined as travel for the purpose of obtaining goods and services (obtaining travel), for home production (home production travel), for child care (child care travel) and other care (other care travel). Obtaining travel is a major component of non-market work travel. Leisure travel includes travel time related to the broad measure of leisure defined above. Taken together, work travel, non-market work travel and leisure travel make up around 95 percent of total travel time in our sample period. We also define a narrow measure of leisure travel as the travel time related to the narrow measure of leisure.

We consider total travel time comparable across all the time use surveys, but take a conservative approach toward disaggregated travel time. There are far fewer categories of disaggregated travel time prior to 2003. As a result, we restrict our attention to a selected few disaggregated measures when we examine the long horizon from 1975 to 2013.

3 Total Travel Time Over Five Decades

This section describes the evolution of total travel time for the full sample and by demographic groups from 1965 to 2013. Figure 1 displays the total travel time for our first (1975-2013) and second (1965-2013) samples. The primary difference between the first and second sample is that the former includes population older than 65, who may travel less than younger population. As shown in Figure 1, the path of total travel time for the first sample stays below that for the second sample, but shares similar patterns of variations over time. For the second sample, total travel time in 1965 is slightly below that in 1975.

[6] The coding rules for 2003-2013 ATUS are generally the same. Refer to Differences between the 2003 to 2013 lexicons to see minor changes across these surveys.

Given the similar patterns of variations, from now on we focus on the first sample when describing variations of total travel time for both the full sample and demographic groups.[7]

Total travel time on average increased by 1.67 hours per week from 1975 to 1993, an increase of around 20 percent. From 1993 to 2003, total travel time declined by 1.07 hours per week, followed by a decline of 0.74 hours per week from 2003 to 2013. The changes in the three periods: 1975-1993, 1993-2003, 2003-2013, are statistically significant. In the past two decades total travel time has declined by 18 percent. The decline puts total travel time in 2013 at an amount statistically indifferent from that in 1975, despite drastically different demographic compositions and transportation environment at those two points in time.

In Table 2 we report results from a pooled regression with all available observations over the five decades. We give equal weight to each year. Columns 2 and 4 report estimation results of regressing total travel time on demographic dummies using the weighted OLS method on two samples. Regression results show that estimated coefficients are statistically significant for demographic dummies based on age, gender, work status, and having children or not.[8] Even after controlling demographic characteristics, total travel time still demonstrates the same patterns of evolution: first increasing, reaching the peak in the mid-80s or mid-90s, and embarking on a declining trend afterwards.

The pooled regression helps us to identify demographic attributes that may affect total travel time. The results show that those who are younger, male, working, having children, or more educated spend more time on travel than others. By pooling observations across all years together, the regression also imposes a restriction that coefficients for demographic attributes are the same for each year. However, the impact of each demographic attribute on total travel time may vary over years, which may be reflected in changes in average travel time within a group sharing the same demographic characteristics. In the next subsection we examine evolutions of total travel time by demographic groups.

[7] We examine the second sample over the period 1965-2013 in Appendix B.

[8] We also include additional demographic variables such as race and marital status in the pooled regression. The estimated coefficients for those two additional variables are statistically insignificant.

3.1 Travel Time Use by Demographic Groups

We divide our sample population by demographic groups for better understanding of travel patterns within our sample population. Based on regression results in Table 2, Figure 2 displays evolution of total travel time by demographic groups defined respectively by age, work and gender, education and whether or not there is a child in the household. In the following subsections we analyze each panel of Figure 2 in detail. Table 3 records the data on total travel time used to plot the figure.

3.1.1 Travel Time Use by Age Groups

In Panel A of Figure 2, we divide the sample by four age-related groups (18-19, 20-49, 50-64, and 65 and above). We pool the population between 20 and 49 together as they share more common characteristics of travel than the younger and older population.[9] We separately group those younger than 20 as the time use of this group is strongly affected by education needs.

There are three salient patterns of total travel time by age groups. First, the younger population on average spend more time on travel than the older. Second, the total travel time of all age groups have experienced an increase in travel time since 1975, reached a peak before 2003, and continued to decline for more than a decade. Third, the difference in total travel time between the younger population (20-49) and those in the 50-64 age group has been narrowing since 1975, and becomes the narrowest in 2012, before widening again in 2013. The total travel time of younger population (20-49) has declined since 1993, while the travel time of those in the 50-64 age group has increased during part of the recent decade, and in 2012 had almost reached the same level of travel as those in the 20-49 age group.

3.1.2 Travel Time Use by Work-Gender Groups

We divide the sample population into four groups based on gender and employment. Panel B of Figure 2 describes travel patterns by work and gender groups from 1975 to 2013. There

[9]For robustness test we have also categorized those between 20 and 49 into three distinct age groups: 20-29, 30-39 and 40-49. The alternative classification yields similar stylized patterns and decomposition results.

are three notable features. First, workers spend consistently more time on travel than non-workers, with a gap close to 3 hours per week between male workers and nonworkers around years 2008-2010. Second, although males in general travel more than females, the gap has been consistently narrowing among both workers and nonworkers. During a few years of the recent decade female nonworkers travel slightly more than male nonworkers. Third, the total travel time within each work and gender group increased from 1975 and turned downward after reaching the peak some time between mid-eighties and mid-nineties. The turning point for workers has come before that for nonworkers.

3.1.3 Travel Time Use by Education Groups

We divide the sample population by four education categories (less than high school, high school, some college, and college degree or higher). Panel C of Figure 2 describes travel patterns by education groups from 1975 to 2013. The panel shows that more educated groups spend more time on travel than less educated. The difference in total travel time between the most and the least educated can be as large as 3.4 hours per week. It also demonstrates a similar time trend as that for the entire sample: a peak and then a decline in total travel time for each education group.

3.1.4 Travel Time Use by Having Children or Not

We divide the sample population by whether or not there is a child present in the household. Panel D of Figure 2 shows that the sample population with children in the household travel more than those without children. The difference is around one hour or so per week. Total travel time for both groups again follow similar time trend as travel time for the entire sample population: an increase from 1975 to 1980s and 1990s, and then a graduate decline toward 2013.

Panels A to D of Figure 2 show that those who are younger, male, working, more educated, or those with children in the household spend more time on travel than their respective counterparts, consistent with the estimated coefficients in Table 2. Such patterns indicate that shifts in demographic composition may contribute to the evolution of total travel time, even when there are no changes in travel time within each demographic group.

3.2 Patterns of Demographic Shifts

Table 4 shows the evolving weights of aforementioned demographic groups. Over the period from 1975 to 2013, on average the 20-49 age group make up 57 percent of our total sample. The 50-64 group and those older than 65 account for around 23 percent and 16 percent respectively. Those between 18 and 19 account for 3 percent of the sample. Over the past decades relative proportions of each age group have registered substantial variations as baby boomers go through each stage of their life cycle. The fraction of population between 20 and 49 increased by 8.5 percent from 1975 to 1993, but declined by 14.5 percent from 1993 to 2013. By contrast, the proportion of those between 50 and 64 declined by 2.6 percent from 1975 to 1993, but increased by 7.8 percent from 1993 to 2013. The fraction of population above 65 has steadily increased since 1993.

Figure 3 shows the evolving weights of each age-work-gender group from 1975 to 2013.[10] The first to fourth columns are respectively for the 18-19, 20-49, 50-64, at and older than 65-year-old age groups. Those between 20 and 49 year old constitute the dominant group. It is worth noting that changes in relative weights of male and female workers in this age group coincide with those in total travel time. The relative weight of female workers between 20 and 49 increased from 15 percent to 25 percent of total population from 1975 to 1993, and then declined steadily to around 18 percent of total population in 2013. The relative weight of male workers in this age group experienced a small increase from 1975 to 1993, and then a decline of similar magnitude as that of female workers afterwards. The largest decline of the relative weight of working population in this age group occurred from 1993 to 2003, during which period the proportion of male workers declined by 3 percent, while that of female workers declined by 4 percent. Around year 2008 the percentage weights of working population, both male and female within the 20-49 age group, started a sharp decline. The weight of this age group in our sample declined by 3.3 percent from 2008 to 2013, but the working population of both genders declined by around 4.7 percent.

Comparably, the percentage weights of working and nonworking population evolve rela-

[10]There is an issue of over-sampling of gender in 1993 survey population. We conduct a robustness test by adjusting gender weights to those obtained by the Census Bureau. Our results are robust to the weight adjustment.

tively smoothly among the 50-64 age group. The period from 1975 to 1993 is characterized by declines in both total weights, and the relative proportion of male workers of this age group. The total weights and the relative proportion of workers of this age group have increased steadily ever since, with the relative weight of female workers increasing by 2.9 percent and that of male by 3.5 percent from 1993 to 2013. In contrast to sharp declines in relative weights of working population among the 20-49 age group around year 2008, there is no obvious downturn in relative working population among the 50-64 age group around that time.

These observations suggest that the shift from working to nonworking population among the 20-49 age group may help to explain patterns of total travel time over time. The increase in relative weights of the working population among the 50-64 age group may help cushion the decline in total travel time of this age group after 1993. The increase in both relative weights of the age group above 65 and the fraction of nonworking population within this group helps to explain the decline in total travel time. However, given the dominant proportion of the 20-49 age group, the shift from work to non-work status of this younger group may have larger impact on the decline in travel time, as compared to such shifts among the age group above 65.

Panel A of Figure 4 shows evolving weights of education groups from 1975 to 2013 in the sample population. The proportion of people in the third group (with some college) and the fourth group (college degree or more) has steadily increased over time, each rising from about 13 percent in 1975 to around 30 percent in 2013. The portion with less than high school degree declined from around 39 percent in 1975 to around 10 percent in 1993, and has stayed at that level afterwards. The portion with high school education increased from 1975 to 1985, and declined ever since. However, this group has stayed above 30 percent for the entire sample period, and only recently was surpassed by the group with college degree or more in terms of weights. In 2013, the three groups with highest levels of education each make up about 30 percent of sample population, with those less than high school accounting for the remaining 12 percent.

Panel B of Figure 4 shows that the fraction of sample population with children in the household declined from around 47 percent to 34 percent from 1975 to 1993. The weight for

this group increased slightly from 1993 to 2003, resumed the decline after 2003 and settled at around 36 percent in 2013.

In summary, major demographic shifts from 1975 to 1993 are: (i) Baby boomers reached prime driving age; (ii) An increasing number of women shifted into working status; (iii) The fraction of population with high school degree and above increased, while the fraction without high school degree declined dramatically; and (iv) the fraction of people with children in the household declined. Based upon travel time patterns by demographic groups, the first three demographic shifts may contribute positively to the increase in travel time during the sample period, while the last shift may contribute negatively.

From 1993 to 2003, the first two demographic shifts reversed themselves. Baby boomers grew past the prime driving age, and labor participation rates of both males and females declined. The reversals may contribute to the decline in total travel time during the sample period. In the meantime, advances in education attainments slowed down, coupled with a decline in the population with college degree or more, and an increase in the fraction of population with less than high school degree. The fraction of sample population with children slightly increased.

The period from 2003 to 2013 witnessed the following demographic changes: (i) Baby boomers started retiring, raising the fraction of population aged 50 and above. (ii) There was a continuing decline in the fraction of working population, especially those in the 20-49 age group. The fraction of working population in the 50-64 age group increased instead. (iii) The fraction of sample population with college or more increased steadily during this period.

4 Quantifying the Role of Demographic Shifts

In order to understand the change in total travel time use over the past five decades, we seek to distinguish the portion that can be explained by changing demographics and the portion that cannot be explained by demographic shifts, but may be explained by changes in aggregate forces that impact all demographic groups, or by changes in relevances of demographic attributes to travel patterns. The analysis above by each demographic

attribute shows that both portions may have played a role in the evolution of total travel time. In the following section, we conduct a Blinder-Oaxaca style decomposition of changes in the unconditional mean of total travel time to quantify the contribution of demographic shifts and other forces.

4.1 Blinder-Oaxaca Decomposition

Formally total travel time for any given period t can be expressed as the dependent variable of a linear model

$$Y_t = X_t'\beta_t + \varepsilon_t, \tag{1}$$

where Y_t represents a vector of total travel time, with its length equal to the number of observations for that year, and X_t represent a matrix of dummy variables that characterize demographic features of all observations. Based upon our analysis of travel time by demographic groups above, we construct nine dummy variables: three dummy variables for age groups, depending upon whether the observed individual is in the 20-49, 50-64 or at and above 65 year old age group; one dummy variable for gender; one dummy variable for working status; three dummy variables for education groups, depending upon whether the observed individual has high school, some college, or college and above degrees; and one dummy variable for having children in the household. Such a linear regression allows us to capture the correlation among demographic variables, which are not possible if we examine total travel time along only one dimension.

Let $\widehat{\beta}_{t_0}$ and $\widehat{\beta}_{t_1}$ be the least-square estimates for β in periods t_0 and t_1, obtained separately from the two year-specific samples. Furthermore, we use the year-specific sample means $\overline{X}_{t_0}$ and $\overline{X}_{t_1}$ as estimates for unconditional expectation of X_{t_0} and X_{t1}. Here $\overline{X}_t$ is a 10-by-1 vector of sample means of the nine dummy variables and the constant at the end. The $j-th$ element of $\overline{X}_t$ is effectively the fraction of sample population with the $j-th$ dummy variable equal to 1. Thus $\overline{X}_{t_1} - \overline{X}_{t_0}$ represent changes in demographic weights, and $\widehat{\beta}_{t_1} - \widehat{\beta}_{t_0}$ represent changes in both the estimated constant and the estimated relevance of those demographics to total travel time. Based upon these estimates, we can decompose the change in the sample mean of total travel time between year t_0 and year t_1, denoted as

$\overline{Y}_{t_1} - \overline{Y}_{t_0}$, as follows:

$$\overline{Y}_{t_1} - \overline{Y}_{t_0} = \left(\overline{X}_{t_1} - \overline{X}_{t_0}\right)' \widehat{\beta}_{t_0} + \overline{X}'_{t_1} \left(\widehat{\beta}_{t_1} - \widehat{\beta}_{t_0}\right). \tag{2}$$

The term $\left(\overline{X}_{t_1} - \overline{X}_{t_0}\right)' \widehat{\beta}_{t_0}$ represents the contribution to the total change in travel time due to evolving demographic weights, given a fixed set of coefficient estimates, while $\overline{X}'_{t_1} \left(\widehat{\beta}_{t_1} - \widehat{\beta}_{t_0}\right)$ represents the contribution due to changes in the estimated constant and the relevance of demographics to travel time use, given fixed demographic weights. In the Blinder-Oaxaca literature, the first and second terms are sometimes called the "explained" and "unexplained"portions respectively. Here "unexplained" means unexplained by demographic shifts, but possibly explainable by other forces, including time effects that are reflected in the difference in estimates of the constant term. An alternative would be to use the following decomposition:

$$\overline{Y}_{t_1} - \overline{Y}_{t_0} = \left(\overline{X}_{t_1} - \overline{X}_{t_0}\right)' \widehat{\beta}_{t_1} + \overline{X}'_{t_0} \left(\widehat{\beta}_{t_1} - \widehat{\beta}_{t_0}\right), \tag{3}$$

where the coefficient estimates from year t_1 sample are used to weigh demographic shifts.

As decomposition results may be sensitive to using the starting or the end year of coefficient estimates to weigh demographic shifts, we also use pooled sample for more representative coefficient estimates. One way is to pool year t_0 and t_1 observations to obtain coefficient estimates (the "pooled-two" method), and the other way is to pool all observations available, in our cases from 1975 to 2013 to obtain the weights (the "pooled-all" method). Appendix C describes the details of our pooled sample estimation.

We also conduct an alternative Blinder-Oaxaca decomposition by forming 120 cells based upon demographic dummies as described in Section 3.1. We divide the sample into demographic cells defined by four age groups (18-19, 20-49, 50-64, 65 and up), four education categories (less than high school, high school, some college, and college degree or more), two gender categories, two working status categories, and whether or not there is a child present in the household. Since there are only three observations with their age less than 20 but having college (or higher) degrees, we only categorize those younger than 20 into the

first three education cells. This division yields 120 cells.[11] The change in the unconditional mean between year t_0 and year t_1 can be decomposed as:

$$\begin{aligned} \overline{Y}_{t_1} - \overline{Y}_{t_0} &= w'_{t_1} y_{t_1} - w'_{t_0} y_{t_0} \\ &= \left(w'_{t_1} - w'_{t_0}\right) y_{t_1} + w'_{t_0} \left(y_{t_1} - y_{t_0}\right), \end{aligned} \tag{4}$$

where w_t represents the vector of demographic weights for each demographic cell at period t and y_t represents the vector of cell means in year t. Here variations in demographic components are weighed by y_{t_1}, the vector of cell means in t_1, while change in travel patterns are weighted by w'_{t_0}, demographic weights in the base year. This method of decomposition shows that the portion unexplained by demographic shifts (the second term) represents changes in cell means within each demographic group. The decomposition results with regard to the division of explained and unexplained portions are similar to those obtained using the linear regression method, but the latter has the added benefits of allowing detailed decomposition of each demographic component.

4.2 The Role of Demographic Shifts

Table 5 shows the decomposition of unconditional changes in total travel time for three subperiods: 1975-1993, 1993-2003, and 2003-2013. We divide the sample period into three subperiods as these periods feature drastically different trends in both travel and demographics. Panels A, B, and C report the decomposition results for the three subperiods. In all panels, the first column reports decomposition results using the "pooled-two" method, while the second and third columns report results using equations (2) and (3). Since the results are broadly similar using different coefficient estimates, we focus on the pooled-two decomposition when describing the results. The fourth column gives the ratio of explained or unexplained parts relative to the total difference using the pooled-two method.

The first part of Panel A shows the overall decomposition results. The first and second rows show the average total travel time in years 1993 and 1975, with the difference being

[11] For each age by education group, there are eight cells categorized by work, gender, and having child or not. As a result, when we drop the highest education category for those under 20, the total number of cells will be 120 (i.e., 128-8).

1.67 hours per week as shown in the third row. The fourth row reports the portion of the difference explained by demographic shifts and the fifth row captures the rest. The numbers in fourth and fifth rows add up to the total difference reported in the third row. The decomposition shows that around 45 percent of the difference in total travel time from 1975 to 1993 can be explained by demographic shifts.

The second part of Panel A details the individual contribution of each demographic attribute. The four rows in the second part add up to the total "explained" portion in row four of part one. Out of the 45 percent explainable by demographic shifts, advances in education attainment alone contribute to around 28 percent of the increase in total travel time for this subperiod. Around 10.5 percent are explained by changes in age composition. Shifts across work-gender groups, including the increase in female labor force participation contribute to around 7 percent of the increase in total travel, while the rest is explained by declines in the proportion of sample population with children in that sample period, which move total travel time in opposite direction. In all, demographic shifts in age, work-gender, and education contribute positively to the increase in total travel time for this sample period. It is interesting to note that once education is controlled for, shifts in age composition play lesser roles. The third part of Panel A reports the individual contribution of changes in each coefficient estimate to evolutions of total travel time. The individual contribution is statistically insignificant despite the significance of the total "unexplained" portion.

Panel B shows that total travel time declined by 1.07 hours per week from 1993 to 2003. However, demographic shifts can only explain around 16 percent of the decline. Shifts in age, work-gender and education composition all contribute to the decline in the total travel time, with shifts in the composition of age and education groups respectively accounting for 8.9 and 6.3 percent of the decline. Shifts across work-gender groups contribute to around 1.8 percent of the decline, while increases in the fraction of people with children during this period push the total travel time in the opposite direction, albeit by a small amount.

As shown in Panel C, total travel time declined by 0.74 hours per week from 2003 to 2013. Contrary to previous periods, contribution from demographic shifts is statistically insignificant, while the decline not explained by demographic shifts amounts to 0.73 hours

per week. Detailed decomposition of the explained part shows countering forces of demographic shifts. Changing compositions across age, work-gender groups and population with and without children explain roughly 15 percent of the total decline in that period, where changes in age and work-gender composition respectively cause 7 and 8 percent of the decline. In terms of the absolute amount, the three demographic shifts reduce total travel time by 0.12 hours per week. However, increases in the fraction of people with higher education add an extra 0.11 hour-per-week travel time, completely offsetting the combined impact of those three demographic shifts. The significance of the unexplained portion of the total change in the travel time indicates that there may be aggregate forces at work from 2003 to 2013 that impact all demographic groups. [12]

4.3 Summary of Decomposition Results

We have the following main findings using Blinder-Oaxaca decomposition:

(i) Demographic shifts can explain roughly 45 percent of the increase in total travel time from 1975 to 1993, around 17 percent of the decline from 1993 to 2003, but have insignificant effect on the decline in total travel time from 2003 to 2013 due to compensating forces of shifts.

(ii) Shifts in the composition of education attainments play prominent roles in driving up the total travel time in two subperiods: 1975-1993 and 2003-2013, dominating other demographic factors in those two periods. Declines in education attainment also contribute to the decline in total travel time from 1993 to 2003.

(iii) From period 2003 to 2013, aggregate forces common to all demographic groups may be at work in driving down the total travel time.

Our analysis supports the view that baby boomers going into retirement is unlikely the major reason for the decline in travel time from 2003 to 2013, or from 1993 to 2013. First, although people in their 50s travel less than those in their 30s, the travel of the senior age group actually increased in the past ten years, while the travel of those in the 30s declined

[12] Appendix B shows the decomposition results from 1965 to 2013.

over time, thus almost closing the gap between the two age groups. Second, the intensified shift of population from working to nonworking population after 2008 is an important force behind the change in work travel time. However, the shift to nonworking population is not unique to senior population. As baby boomers reach the retirement age, changing age demographics may become more important in the coming decades, but it is not a major contributor to the decline in the total travel time in the past decade.

5 Travel Time as Part of Time Allocation

The previous analysis indicates that the portion not explained by demographic shifts also plays important roles, especially from 2003 to 2013. Equation (2) shows that the unexplained portion reflects variations in both time trends common to all demographic groups and relevance of demographic attributes to travel time, where the latter can also be interpreted as variations in within-cell means of demographic cells defined by a combination of demographic characteristics. As shown in Figure 2, there are similar time trends of total travel time within each demographic group, which indicate that aggregate forces common to all demographic groups may be at work driving the portion of variations in total travel time not explained by demographic shifts.

In this section we make use of the data on the time use of respondents on all activities, and treat travel time as part of the individual's time allocation. We ask the following questions: How travel time, both total travel time and disaggregated travel time, co-vary with other time use categories across all demographic groups? What can we say about aggregate forces behind fluctuations in total travel time, especially the decline after 2003?

In order to address these questions, we focus on three aspects of travel time allocation. First, we examine whether there are evidence for or against economizing on travel. Here economizing on travel is interpreted as a decline in the ratio of travel to non-travel time related to the same category of activity, for example, the ratio of time spent on work travel to that on (non-travel) market work. Economizing on travel is most likely caused by aggregate forces related to the transportation sector, such as fluctuation in gasoline prices, or changes in transportation technology. Second, we examine whether there are shifts of time among

activities with different travel intensity. Even absent of economizing on travel, a shift of time use from travel-intensive to travel-non-intensive activity may cause the total travel time to decline. Third, we study common complementary or substitutionary patterns of travel time with other time uses. Co-variation of travel time with other time use categories may be driven by forces within or outside the transportation sector. Examining these three aspects gives us a comprehensive picture of variations in travel time.

In the following analysis, we first focus on the short sample period from 2003 to 2013 before taking a long-run perspective on the entire sample period from 1975 to 2013. We focus on the period from 2003 to 2013 for two reasons: First, variations in total travel time in this sample period are dominated by factors other than demographic shifts, potentially aggregate forces that may last into future decades; Second, the time use data for this period are not only annual, but also most detailed and consistent across all time use surveys. Consistency of disaggregated travel measures becomes an issue when we extend the sample period backward to include 1975, 1985 and 1993 time surveys. While the 2003-2013 time surveys contain around 58 or more detailed measures of travel time, those in previous years contain only 9 or 10 categories. For consistency we have to focus on a limited set of travel time measures to track variations in disaggregated travel time over the entire sample period. Taking all the consideration together, we decide to examine the most recent decade first to make use of the rich data we have.

5.1 The Recent Decade: 2003-2013

As described in Section 2, we have relatively consistent measures of three sub-categories of travel time for the recent decade. They are: work travel, non-market work travel and leisure travel. Their corresponding non-travel time uses are: market work, non-market work, and leisure. For this sample period we use the broadly based measure of leisure time that includes eating, sleeping, personal care, and other religious and civil activities.

Tele-commuting and e-commerce are two primary means of economizing on travel. According to the American Community Survey, 5.8 million or 4.3 percent of the U.S. workforce worked the majority of the week at home in 2010. This is an increase of about 1.6 million

since 2000.[13] Based upon Census Bureau data (FRED, quarterly, seasonally adjusted), e-commerce retail sales only make up around 1.5 percent of total sales at the beginning of 2003, and around 6 percent in 2014.

When there exists a decline in travel time, there are always issues of whether the decline is due to less travel time associated with given amount of specific activity, or less time is allocated to travel-intensive activities even though the ratio of travel to non-travel time for each activity remains unchanged. We examine the two possibilities below.

5.1.1 Shift of Time Allocation or Economizing on Travel?

Figure 5 shows the composition of average time use out of 168 hours per week in 2003. The broad measure of leisure makes up 112.2 hours. followed by 24.9 hours for market work and 19.2 hours for non-market work. Work travel, non-market work travel and leisure travel respectively total 2.1, 3.5 and 2.9 hours per week. The remaining 3.1 hours are for other time uses and related travel, including time use and travel related to education. As shown in the pie chart, non-market work is the most travel-intensive activity during the recent decade. The ratio of travel time to non-travel time related to non-market work ranges between 0.15 and 0.17. Non-travel leisure accounts for the highest amount of total time use. However, leisure is also the least travel-intensive activity, with the ratio of leisure-related travel to non-travel time at around 0.025. The ratio remains the smallest even after we exclude sleeping time from leisure-related non-travel time use. Work travel is about 8 percent of time spent on non-travel market work, for both the working population and the entire sample. Market work is the second most travel intensive activity.

In Figure 6, we focus on the relationship between work travel, non-market work travel, leisure travel and the corresponding non-travel time use on market work, non-market work and leisure. The solid lines in all panels plot percentage changes of non-travel time, while the dashed lines plot those of travel time for each corresponding activity from 2003 to 2013, using 2003 as the base year.

Panel A of Figure 6 shows percentage changes of market work versus those of work

[13]The book by Mateyka et al. (2012) contains findings on tele-commuting from the Survey of Income and Program Participation and the American Community Survey.

travel for the entire sample. Time spent on market work increased initially by 4.2 percent relative to that in 2003, declined to 4.7 percent below after the great recession, and stayed around that level till 2013. The change in market work, however, also reflects shifts out of the working status. In order to focus on time spent on work travel by those who work, we plot percentage changes in time spent on market work by workers only in Panel B. For those who work, the change in the time spent on market work from 2003 to 2013 is statistically insignificant. Thus the decline in time spent on market work after 2007 is driven by shifts out of work status, rather than the decline in work time of those who work. Panels A and B show similar patterns of work travel prior to year 2007. Although work travel for the entire sample population stays at 5 percent below the 2003 level from 2007 to 2012, time spent on work travel by those who work has gone up and reverted to the level of 2003 by 2010. Between 2010 and 2012, percentage changes in both market work and work travel from those in 2003 were close to zero, implying that the ratio of work travel to non-travel market work in those years is close to that in 2003. Although time spent on work travel declined from 2012 to 2013 relative to market work for the working population, the difference in work travel between 2003 and 2013 is statistically insignificant for this group. In all, there is not strong evidence indicating economizing on work travel, that is, a decline in time spent on work travel relative to that on market work.

Panels C and D of Figure 6 show a steady shift of time use from non-market work to leisure during this decade. Non-market work time declined steadily over time in the sample period from 2003 to 2013. As shown in Table 6, time spent on non-market work is about 2 hours less per week in 2012, and 1.5 hours less in 2013 as compared to that in 2003. Leisure time has remained fairly stable prior to 2007, but increased by around 2 hours per week from 2007 to 2009, and then continued a small increase afterwards. Since 2007, there has also been a shift of time from market work to leisure driven by the shift from working to nonworking population. Since leisure is the least travel-intensive activity, the shift of time use from travel-intensive non-market and market work to leisure may lead to a decline in travel time even without any economizing on travel.

Panel C shows that non-market work travel declined steadily over time, mirroring the decline in non-market work time. In 2012 it is 0.48 hours per week less than that in 2003,

and in 2013 0.4 hours less. By contrast, travel time related to leisure has barely changed, as shown in Panel D. There is some evidence for economizing on travel in terms of a decline in the ratio of leisure travel to leisure time. However, since leisure travel registers no significant change from 2003 to 2013, economizing on leisure travel does not contribute to the decline in total travel time.

There is no strong evidence supporting economizing on travel for activities related to market work and leisure. There seems to be evidence for economizing on non-market work travel as Panel C shows the travel time declining more than the corresponding non-travel portion of non-market work. The larger decline in travel time may indicate economizing on travel, or shifts of time allocation within non-market work. A detailed analysis of non-market work supports the latter explanation.

Figure 7 displays the composition of non-travel and travel-related non-market activities. The chart shows that within non-market work category, obtaining goods and services and other care are the two most travel-intensive activities, while home production is the least travel-intensive activity. Travel time spent on obtaining goods and services makes up around 57 percent of non-market work travel.

Figure 8 shows the evolution of non-travel and travel time related to each category of non-market activities. Statistical tests show that time spent on child care travel and home production travel in 2013 is insignificantly different from that in 2003. The declines in travel time related to obtaining goods and services and other care are the main driving forces in the decline in travel time related to non-market work. Moreover, the ratio of travel to non-travel time related to obtaining goods and services and other care have been relatively constant in the past decade. The relatively constant ratios indicate that there is no strong evidence for economizing on non-market work travel.

A careful examination of Figure 8 reveals a shift of time allocation from travel-intensive activities such as obtaining and other care to less travel-extensive activity such as home production. Non-travel time related to obtaining and other care have shown statistically significant declines at 1 percent significance level, proportional to declines in related travel time. The decline in home production is statistically significant at 5 percent level. The decline in non-market work travel is more likely due to shift of time allocation from travel-intensive

to non-intensive activity within the non-market work category, rather than economizing on travel.

5.1.2 Decomposition of Disaggregated Travel Time

We conduct a Blinder-Oaxaca decomposition of changes in unconditional means of total and disaggregated travel time for each year from 2004 to 2013, using 2003 as the base year. Since the change in leisure travel is statistically insignificant in this period, we focus on decomposition of market and non-market work travel instead.

Figure 9 plots total variations, the explained portion (contribution from demographic shifts) and the unexplained portion (contribution from time effects and changes in within-cell means) for total travel, work travel, non-market work travel and leisure travel for each year, as compared to their respective levels in 2003. Consistent with decomposition results in Section 4, contribution from demographic shifts is close to zero throughout the 2003-2013 period. Prior to the great recession demographic shifts contribute little to variations in work travel, but after 2008, shifts in demographic composition have pushed work travel downward, while the portion not explained by demographic shifts has been reverting to its level in 2003. In the end, more than half of the 0.2 hour-per-week decline in work travel time is caused by demographic shifts, represented mostly by the shift out of working population among the 20-49 age group.

Figure 9 shows that similar to decomposition results of total travel time, demographic shifts also play negligible role in total variations of non-market work travel from 2004 to 2013.

Total travel time has declined by around 0.74 hours per week from 2003 to 2013. A close look at the disaggregated travel time shows that the decline is driven by two main forces: First, shifts of time allocation, from travel-intensive activities to travel-non-intensive activities, are the major driving forces behind the decline in non-market work travel time from 2003 to 2013. These shifts include shift of time from market and non-market work to leisure, and also from obtaining goods and services and other care to home production within the non-market work activities. Non-market work travel declined by 0.4 hours per week in the same period, accounting for around 54 percent of the total decline in travel

time. These shifts are not caused by demographic shifts, but more likely explained by the shift of time allocation, which are common to all demographic groups.[14] Second, work travel time declined by 0.21 hours per week, accounting for around 28 percent of the total decline in travel time. More than half of the decline in work travel is caused by changing demographic composition after 2008, possibly declining work population. The declines in leisure and other travel make up equal shares of the rest of decline. Tele-commuting and e-commerce may be on the rise, but there is no strong evidence on economizing on travel in terms of declines in the ratios of travel to non-travel time related to market or non-market work.

5.1.3 Substitutionary or Complementary: Co-variation of Travel Time with Other Time Uses

Previous sections identify the main contributor to variations in total travel time as forces that may be common to all demographic groups. Identification of reallocation patterns between total travel and other time uses common to various demographic groups may shed light on the aggregate forces at work. We divide the sample population into 120 demographic cells as described in Section 4.1 and use sample weights in the surveys to compute the averages. For each year we calculate average time use for each category and demographic cell.

To assess how forgone (augmented) travel time are reallocated across (from) different time use categories, for each time use category j we estimate the following base regression:

$$\triangle H_{it}^{j} = \alpha^{j} + \beta^{j} \triangle H_{it}^{travel} + \varepsilon_{it}^{j}, \tag{5}$$

where $\triangle H_{it}^{j}$ is the change in hours per week spent on time use category j for the average individual in cell i between period $t-1$ and period t, and $\triangle H_{it}^{travel}$ is the change in total travel time for the average individual in cell i between period $t-1$ and period t. Since annual data are available for the years from 2003 to 2013, the variable t represents each calendar year.

[14] We have examined the shift of time allocation within each age and work-gender groups, and find that the shift of time allocation from non-market work to leisure is a common phenomenon for each group. A&H also have similar findings.

Differences in time use across periods for each demographic cell represent within-cell variations, the portion not accounted for by demographic shifts. Thus our regression focuses on how within-cell variations in travel time and other time use categories are related. The coefficient β^j measures the fraction of foregone (augmented) travel time allocated to (from) time use j, identified from cross-cell variations of changes in all time use categories. The estimated coefficient is not a structural parameter intended to identify causal relations. Instead, it is an accounting device that measures how activity covaries with travel time across all demographic cells. A positive β^j indicates that time use of category j comoves with travel time, thus more likely complementary with travel. A negative β^j indicates otherwise. We multiply the coefficients by 100 for easy interpretation.

Table 7 reports the regression results. Column 1 shows the sample average of time use on each category. For example, in each week an average individual in our sample spends around 24 hours on market work, 18 hours on non-market work, and 114 hours on leisure, including 60 hours on sleeping. We further divide leisure into leisure at home, leisure outside and other leisure, where leisure at home includes time spent on computer, TV, sleeping, and other home leisure, and leisure outside includes exercise and sports, socializing, entertainment and arts. Leisure at home makes up close to 80 percent of leisure time.

In column 2 we present the estimated coefficients from regression (5) using weighted least squares and in column 3 we present the associated standard errors. The samples are weighted by their respective cell weights. By weighing observations we put heavier weight on larger cells to reduce sampling errors related to smaller cells. Columns 4, 6 and 8 present estimates when we control for demographic variables, time dummies, and demographics and time dummies simultaneously. Columns 5, 7 and 9 report associated standard errors. As shown in Table 7, coefficient estimates obtained with additional control variables are close to those in the baseline regression. Henceforth we focus on coefficient estimates that are significantly different from zero in the baseline regression.

Based on column 2, time spent on home leisure and home production are strongly substitutionary with time spent on travel across all demographic cells. On average around 53 percent of foregone travel time is allocated to home entertainment on computer and TV, while approximately the same percentage of foregone travel time is allocated to sleeping.

Time spent on other home-based leisure also increases in response to a decrease in total travel time. Within non-market work, home production and child care absorb around 27 percent of foregone travel time.

Column 2 shows that time spent on obtaining goods and services, other care, leisure outside, and other leisure are complementary with time spent on travel. For every hour reduction in total travel time, time spent on obtaining goods and services declines by 0.12 hours, and time spent on leisure outside home declines by 0.18 hours. Time spent on exercises and sports alone declines by 0.1 hour for every hour reduction in travel time.

Figure 10 shows the scatter plots of $\triangle H_{it}^{travel}$ with changes in six other time use categories, ordered by degrees of substitutionarity and complementarity with travel time. The figure verifies that outliers are not driving our results.

From 2003 to 2013, there has been a shift of time allocation from time spent on travel, time spent on leisure outside home and time spent on obtaining goods and services to leisure and non-market work at home, in particular, to activities such as home entertainment on computer and TV, sleeping and home production.

5.2 The Longer Horizon: 1975-2013

When we extend our analysis to a longer horizon, measure consistency becomes an important issue. Since time use surveys prior to 2003 have fewer travel time categories, we have to limit our travel pattern analysis to measures of time use that are present and comparable across all time use surveys. We focus on three categories of non-travel time use and their corresponding travel time. The categories are: market work and work travel (the same measure as post-2003 surveys), obtaining goods and services (17 percent of non-market work) and travel time spent on obtaining (56 percent of non-market work travel), and a core measure of leisure (32 percent of broad-based leisure) and related travel (53 percent of broadly defined leisure-related travel). The narrowed measure includes core leisure activities such as socializing, recreation and passive leisure, but does not include eating, sleep, personal care and organizational activities. In total, the three categories of non-travel time use and their corresponding travel time make up respectively 40 percent and 62-74 percent of non-travel and travel time use in 2003.

5.2.1 Percentage Changes in the Three Time Use Categories

Figure 11 shows percentage changes of non-travel and travel time use of the above three categories as compared to corresponding values in 1975. The two panels in the upper row show respectively percentage changes in market work and work travel for all the sample population and for those who work. A comparison of the two graphs in the upper row shows that shifts in and out of the work force play an important role for the total amount of market work of the entire sample population. When we restrict the sample to workers only, we observe time spent on market work declining from 1975 to 1985, and then remaining at around the same level since 1985. As also shown in Table 8, time spent on work travel for the entire sample increased by close to 28 percent from 1975 to 1993. However, time spent on work travel increased by only 7 percent if we restrict the sample to those who work for the same time period. The contrast between the two numbers indicates that the shift into the working population has played an important role in the increase in the work travel for the sample population. Between 1993 and 2003 time spent on work travel declined by around 20 percent for both the entire sample and workers only, despite a 5.1 percent decline in market work time for the sample population and statistically insignificant change in time spent on market work by workers. Although the narrow-based leisure has followed a steady upward trend, just as the broad-based leisure, travel time related to the narrow measure increased drastically from 1975 to 1993, and then plummeted from 1993 to 2003.[15] From 1975 to 1993, the ratio of time spent on work travel to that on market work and the ratio of time spent on leisure-related travel to leisure both increased, a phenomenon opposite to economizing on travel. From 1993 to 2003, the opposite happened with both ratios declining despite stable time spent on market work and steady increases in time spent on leisure.

To the contrary, the ratio of non-travel and travel time spent on obtaining goods and services has been approximately constant since 1975. Both travel and non-travel time related to obtaining goods and services have steadily declined since 1985, at an accelerating rate after 2003. There is no evidence for economizing on travel related to the activity of

[15] Non-market work travel increased between 1993 and 2003, partly due to inclusion of travel related to other care and home production after 2003. However, the decline in leisure travel dominated the increase in non-market work travel for this period, thus resulting in the decline in total travel time.

obtaining.

5.2.2 Decomposition of Disaggregated Travel Time

Similar to the decomposition of total travel time, we also conduct decomposition of time spent on travel related to work, obtaining goods and services, and leisure to quantify the impact of demographic shifts and other forces for the three types of disaggregated travel.

Table 9 reports decomposition results using the pooled-two method. Columns 1 and 2 show the following decomposition results: (i) From 1975 to 1993, roughly 72 percent of the increase in work travel can be explained by demographic shifts, in particular shifts across work-gender groups. The shift of females from nonworking to working status is among one of the most important contributors to the increase in work travel. (ii) Between 1993 and 2003, around 15 percent of the decrease in work travel can be accounted for by demographic shifts, with changes in age composition equally important as in work-gender composition. (iii) Consistent with our analysis in previous sections, demographic shifts account for 38 percent of the decrease in work travel from 2003 to 2013, with the shifts among work-gender groups, in particular the decline in the fraction of working population the main contributor to the decline in work travel. Shifts in education composition, despite being a prominent factor in evolution of total travel time, do not play a noticeable role in explaining variations in time spent on work travel.

Columns 3 and 4 show decomposition results for travel related to obtaining goods and services. From 1975 to 1993, although changes in the work-gender composition, especially an increasing number of women in the work force, may have reduced the time spent on obtaining, changes in education composition completely offsets the small negative effect. From 1993 to 2003, the shift toward lower education groups explains a small amount of decline in obtaining travel. From 2003 to 2013, demographic shifts, especially increases in educational attainment on average, push the time spent on obtaining to increase, albeit by a small amount. The small positive effect is dominated by forces related to time effects and changes in within-cell means, resulting in a decline in time spent on obtaining travel.

Columns 5 and 6 report decomposition results for travel related to the narrowly defined leisure. From 1975 to 1993, roughly 28 percent of the increase in leisure travel can be

explained by demographic shifts. Increases in the educational attainment, the fraction of people in their 20s to 50s, and the fraction with no children, contribute positively to the increase in leisure travel. However, the shift from nonworking to working status during this period offsets part of the increase. From 1993 to 2003, demographic shifts explain around 6 percent of the decline in leisure travel, with aging of baby boomers, decreases in education attainment and increases in the fraction of people with children all contributing to the decrease. The decline in the fraction of working population in this period, however, exerts a positive but small effect on the time spent on leisure travel. From 2003 to 2013, the change in leisure travel is statistically insignificant. Among the small combined effects of demographic shifts, the increase in education attainment, the shift out of work status and the decline in the fraction with children push up leisure travel, only to be countered by the impact of an aging population.

In all, similar to decomposition results of total travel time, decomposition of disaggregated travel time shows strong impact of demographic shifts in the 1975-1993 subperiod, but much smaller, and even negligible effect in the 1993-2003 and 2003-2013 subperiods. Shifts across work-gender groups play an important role for variations in work travel in all subperiods, while changes in education composition play prominent roles for changes in obtaining and leisure travel. Relating decomposition results with the percentage changes in both travel and non-travel time, it is clear that work travel and leisure travel change more than their corresponding non-travel time in the period before 2003, even conditional on demographic shifts. The decomposition results again point to the importance of the portion not explained by demographic shifts.

In the following subsection we examine substitutionary and complementary patterns between travel time and other time uses for the long horizon. Common patterns across all demographic cells may shed light on aggregate forces behind the changes in time allocation.

5.2.3 Substitutionary and Complementary Patterns over the Long Horizon

We run the same regression as equation (5) to examine reallocation patterns between 1975 and 2013. Since annual data are not available before 2003, we redefine each period as representing ten years. As a result, we examine changes in time use for 120 cells over the

following periods: 1975-1985, 1985-1993, 1993-2003, and 2003-2013.[16]

Table 10 shows the regression results. Column 1 shows sample averages of time use categories. An average individual spends similar amount on market work over the long horizon as in the recent decade. Column 2 shows the baseline regression using weighted least square and column 3 shows associated standard errors. Columns 4, 6 and 8 report regression results controlling respectively demographics only, time dummies only and both demographics and time dummies. Columns 5, 7 and 9 report associated standard errors. In contrast to the role of time dummies in the same regression for annual data from 2003 to 2013, controlling time dummies has strong impact on some regression estimates. The importance of time dummies indicates large ten-year differences in various time use categories across the four decades we examine.

For the long horizon regression, we focus on column 6, in particular those coefficient estimates significantly different from zero. Column 6 shows that for every one hour reduction in total travel time, on average around 56 percent of foregone travel time is allocated to sleeping, a similar amount as in the year-to-year regression for the period 2003 to 2013. Since data on computer use are only available after 1993, we separate leisure at home into TV and other home leisure. Around 40 percent of foregone travel time is allocated to TV watching, and another 25 percent allocated to other types of home leisure. Sleeping, Watching TV and other home-based leisure are the three most prominent destination of time substituted out of travel use.

Column 6 shows that leisure outside home, and time spent on obtaining goods and services are complementary with time spent on travel. As total travel time declines by one hour, time spent on leisure outside home declines by around 0.27 hours, time spent on civil activities decline by 0.21 hours, and time spent on obtaining goods and services declines by around 0.09 hours.

Despite quantitative differences, the substitutionary and complementary patterns of total travel time with other time use categories are similar between the long horizon and the short horizon of the recent decade.

[16] We multiply the changes in time use from 1985 to 1993 by $\frac{10}{8}$ to account for the shorter gap in this period compared to others.

6 Discussion and Conclusion

In this paper we document that total travel time increased between 1975 and 1993, reached a peak sometime between 1993 and 2003, and has declined ever since for at least a decade. As a result, an average individual spends similar amount of time on travel in 2013 as in the 1960s and 1970s. We use the Blinder-Oaxaca method to decompose changes in the unconditional mean of total travel time into the portion explained by demographic shifts and the portion explained by changes in within-cell means and time effects. We find that changes in education composition play a prominent role in the increase in total travel time from 1975 to 1993, even more important than shifts among age, work and gender groups. Shifts across work-gender groups play a dominant role among demographic shifts when we focus on variations in work travel for the 1975-1993 period.

After 1993, demographic shifts play a small role in the evolution of total travel time, even more so during the recent decade. We find that a shift of time allocation from travel-intensive market and non-market work to travel-non-intensive leisure is the main driving force behind the decline in travel time from 2003 to 2013.

We also examine how travel time covaries with other time use categories. We find that the decline in travel time is associated with reduction in time spent on leisure outside home, time spent on obtaining goods and services, and time spent on civil activities. Leisure at home, especially entertainment using computer and TV and sleeping, are the major alternative time uses coupled with a decline in total travel time. Effectively, in addition to a shift of time allocation from market and non-market work to leisure, there is an increasing allocation of time to leisure at home compared to leisure outside.

Covariations of travel time with other time use categories, although not causal, can still provide insight on the aggregate forces affecting total travel time. There are two hypotheses. The first hypothesis relates to fluctuations in gasoline prices. Since vehicle travel remains the primary travel mode for Americans, it is possible that fluctuations in gasoline prices directly impact the demand for travel, and thus affect time allocation between travel-intensive and travel-non-intensive activities. The second hypothesis is based on unbalanced growth rates of productivity in market, non-market work, leisure and transportation sectors. Changes in

either the efficiency of transportation or the productivity of any activities substitutionary with travel may cause reallocation of travel time and other time uses.

The period from 1975 to 1993 witnessed a 24-percent decline in gasoline prices, as well as a 20-percent increase in total travel time, where around 55 percent of the increase is not explained by demographic shifts. The period from 2003 to 2013 witnessed a 73-percent increase in gasoline prices, accompanied by only 9 percent decline in total travel time, mostly unexplained by demographic shifts. Total travel time declined by 11 percent from 1993 to 2003, with a possible peak in between, which is the largest decline seen within a decade. However, that decade is the time period with not only stable but also low gasoline prices compared to other subperiods.

The decline in gasoline prices from 1980 to 1993 may have fueled the increase in total travel time from 1975 to 1993. Due to absence of data on annual travel time between 1993 and 2003, it is difficult to identify a turning point at which total travel time embarks on a declining trend. We also cannot rule out that the turning point in total travel time actually coincides with that in gasoline prices. Thus it is possible that changes in gasoline prices may be a trigger for declines in travel time among other possible causes. The increase in gasoline prices seems to have less impact on travel time during the period from 2003 to 2013 compared to the first subperiod. Despite the dramatic increase in gasoline prices, both work travel for workers and leisure travel barely change significantly. The decline in non-market work travel is in lockstep with the decline in time allocated to non-market work, thus it is hard to attribute that decline to increases in gasoline prices. Although time spent on obtaining goods and services may be sensitive to gasoline price changes, the decline in time spent on obtaining has started even before 1993. Thus it is difficult to establish a convincing connection between increases in gasoline prices and declines in total travel time after 2003.[17]

In addition to variations in gasoline prices, uneven growth rates of productivity in market and non-market sectors may also explain shifts in time allocation. As the growth rate of productivity is higher in the market than non-market sector, the substitutionary nature of

[17] We have also examined whether differences in travel time across states are related to cross-state variations in gasoline prices. The effect of gasoline price change is not significant.

market goods and home goods may lead to a decline in time spent on non-market work. Since non-market work is travel-intensive, the decline in non-market work may cause non-market work travel, and total travel to decline as well. Another change in the growth rate of productivity pertains to the the transportation sector. Traffic congestion and deterioration of road conditions may all make travel a not efficient way to use time compared to other time use categories, thus leading to less travel time. Our substitution patterns point to substitution of travel time toward home entertainment on computer and TV. Such patterns imply an increase in efficiency of leisure time in generating utility, which may persuade people to spend more time at home instead of travel.

Both fluctuations in gasoline prices and unbalanced growth rates across relevant sectors are possible explanations for evolutions of total travel time, in addition to demographic shifts. We have measured the contribution of demographic shifts in the present study. In a companion study, Wei (2015) models optimal time allocation in an environment with fluctuations in gasoline prices and unbalanced growth rates across sectors. The structural model may help us to quantitatively evaluate the validity of each hypothesis.

Appendix A Travel Definitions and Coding Rules

A.1 Travel Classifications

Table A1 presents classifications of travel time use as described in Section 2.2. We also provide examples of travel activities involved for each category.

A.2 Coding Rules

Table A2 lists the coding rules of travel based on 2003 ATUS Coding Rules Manual. Table A3 lists the coding rules of travel based on Time Use in Economic and Social Accounts, 1975 - 1976. We can see that the coding rules are generally consistent between these two surveys. The general rule in 2003 ATUS is to code all travel, except homebound trips, by looking ahead to the next activity or destination before coding a travel episode. Homebound travel episodes are coded by looking look backwards to the previous activity. The coding rules for some special cases are also specified. For instance, for multiple destination trips, each travel episode of a multiple destination trip is coded according to each destination. For example, driving from home to work is coded as traveling related to work (commuting), from work to a bank as traveling related to financial services and banking, from the bank to a grocery store as travel related to consumer purchases, and from the grocery store to home as traveling related to consumer purchases. Another important travel time use is travel as part of a job. For taxi drivers, bus drivers, and other workers who travel as an essential part of their jobs, the rule is to code their travel time as work and work-related activities, unless travel reason is clearly not work.

Appendix B Blinder-Oaxaca Decomposition (Sample 2)

Table B1 presents the Blinder-Oaxaca decomposition of total travel time for three sub-periods: 1965-1993, 1993-2003, and 2003-2013. As in Table 5, the first columns reports decomposition results using the "pooled-two" method, while the second and third columns report results using starting and ending years as references. The last column gives the ratio of explained or unexplained part relative to total difference.

Panel A of Table B1 shows that travel time increased by 1.63 hours per week from 1965 to 1993. About 30 percent of the increase can be explained by demographic shifts. Advances in education attainment alone contribute to 25 percent of the increase, which is close to our 1975-1993 decomposition result (28 percent) using the first sample. Shifts across work-gender groups contribute to 6 percent of the increase, whereas the declines in the proportion of population with children pushes travel time down by 5 percent. Finally, different from the result in our main sample, changes in age composition play little role here. Because the second sample excludes those older than 65, shifts of age composition, especially the aging of baby boomers, cannot be fully captured.

Panel B of Table B1 shows that total travel time declined by 0.89 hours per week from 1993 to 2003. Demographic shifts can only explain about 3 percent of the decline. Shifts in age and education respectively contribute to 3.5 and 3.8 percent of the decline, whereas shifts across work-gender groups push total travel time up about 3 percent. The effect of increases in the fraction of people with children is not significant.

As shown in Panel C of Table B1, total travel time declined by 0.8 hours per week from 2003 to 2013. Consistent with the result in the main sample, contribution from demographic shifts is statistically insignificant, due to countering forces of demographic shifts. Changing composition across age, work-gender and population with and without children explain about 12 percent of the total decline in this period. However, the increase in the fraction of people with higher education pushes travel time up about 11 percent, offsetting the impact of the other three demographic shifts.

Appendix C Blinder-Oaxaca Decomposition Details

In this section, we briefly explain the "pooled-two" method and the "pooled-all" method in Blinder-Oaxaca decomposition. Recall that the decompositions shown in (2) and (3) use the starting and the end year of coefficient estimates to weigh demographic shifts, respectively. In the following decomposition, we use the coefficient estimates from pooled models.

$$\overline{Y}_{t_1} - \overline{Y}_{t_0} = \left(\overline{X}_{t_1} - \overline{X}_{t_0}\right)' \widehat{\beta^*} + \left[\overline{X}'_{t_1}(\widehat{\beta}_{t_1} - \widehat{\beta^*}) + \overline{X}'_{t_0}(\widehat{\beta^*} - \widehat{\beta}_{t_0})\right]. \tag{6}$$

The first term is the "explained" portion, and the term in brackets is the "unexplained" portion. For "pooled-two" method, we pool the observations of both periods to run the regression (1), and $\widehat{\beta^*}$ represents the least-square estimate of β in the two-year pooled model. For "pooled-all" method, we pool all observations available, from 1975 to 2013, to run the regression (1). $\widehat{\beta^*}$ represents the least-square estimate of β in the all-year pooled model.

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Table 1: Description of Time Use Surveys and Analysis Samples

Dataset	Survey	Total Sample Size	Analysis Sample 1 Size	Analysis Sample 2 Size	Number of Time Use & Travel Categories
1965	Americans' Use of Time	2,001		1,934	[95], [9]
1975	Time Use in Economic and Social Accounts	2,406	2,217	1,870	[87], [9]
1985	Americans' Use of Time	4,939	4,240	3,629	[88], [9]
1993	National Human Activity Pattern Survey	9,383	7,258	6,018	[91], [10]
2003	American Time Use Survey	20,720	19,759	16,255	[435], [58]
2004		13,973	13,318	10,889	[449], [68]
2005		13,038	12,418	10,255	[456], [76]
2006		12,943	12,200	9,970	[456], [76]
2007		12,248	11,606	9,477	[459], [76]
2008		12,723	12,108	9,876	[459], [76]
2009		13,133	12,568	10,220	[459], [76]
2010		13,260	12,679	10,277	[459], [76]
2011		12,479	11,978	9,623	[459], [76]
2012		12,443	11,975	9,557	[459], [76]
2013		11,385	10,952	8,626	[459], [76]

Analysis Sample 1: uses surveys 1975-2013, including age 18 and above who report age, working and retirement status have children or not, and have complete time use record.

Analysis Sample 2: uses surveys 1965-2013, including age 19 (included) to age 65 (included) who report age, working and retirement status, have children or not, and have complete time use record.

For surveys prior to 2003, the number of time use and travel categories are counted by variables constructed in the dataset. For 2003-2013 ATUS, the number of time use and travel categories are counted by the 6-digit activity codes.

Table 2: Average Total Travel Time Use (Hours per Week)
(Pooled Regression Results)

	1975-2013 Sample				1965-2013 Sample			
	Weighted OLS		Demographics		Weighted OLS		Demographics	
	(1)		(2)		(3)		(4)	
Survey_1965					8.77***	(0.10)	7.05***	(0.23)
Survey_1975	8.43***	(0.09)	7.78***	(0.16)	8.98***	(0.10)	7.36***	(0.22)
Survey_1985	9.78***	(0.09)	8.67***	(0.16)	10.20***	(0.10)	8.27***	(0.23)
Survey_1993	10.10***	(0.09)	8.64***	(0.16)	10.40***	(0.10)	8.16***	(0.23)
Survey_2003	9.03***	(0.09)	7.73***	(0.16)	9.50***	(0.10)	7.27***	(0.23)
Survey_2004	8.92***	(0.09)	7.61***	(0.16)	9.34***	(0.10)	7.12***	(0.23)
Survey_2005	8.84***	(0.09)	7.51***	(0.16)	9.21***	(0.10)	6.95***	(0.23)
Survey_2006	8.76***	(0.09)	7.44***	(0.17)	9.25***	(0.10)	7.01***	(0.23)
Survey_2007	8.61***	(0.09)	7.25***	(0.17)	8.99***	(0.10)	6.72***	(0.23)
Survey_2008	8.41***	(0.09)	7.07***	(0.17)	8.86***	(0.10)	6.59***	(0.23)
Survey_2009	8.42***	(0.09)	7.12***	(0.17)	8.92***	(0.10)	6.69***	(0.23)
Survey_2010	8.37***	(0.09)	7.08***	(0.16)	8.86***	(0.10)	6.65***	(0.23)
Survey_2011	8.49***	(0.09)	7.19***	(0.16)	8.90***	(0.10)	6.68***	(0.23)
Survey_2012	8.44***	(0.09)	7.16***	(0.17)	8.90***	(0.10)	6.70***	(0.23)
Survey_2013	8.29***	(0.09)	7.00***	(0.17)	8.70***	(0.10)	6.47***	(0.23)
Age:20-49			-1.06***	(0.14)			-0.52***	(0.20)
Age:50-65			-1.57***	(0.14)			-0.97***	(0.20)
Age: 65+			-2.64***	(0.15)				
Male			0.53***	(0.05)			0.57***	(0.05)
Working			1.68***	(0.06)			1.71***	(0.06)
Grade:12			0.67***	(0.07)			0.51***	(0.08)
Grade:13-15			1.50***	(0.08)			1.40***	(0.09)
Grade:16+			2.21***	(0.08)			2.03***	(0.09)
Have Child			0.34***	(0.05)			0.34***	(0.05)
Difference:								
1993-1965					1.63***			
1993-1975	1.67***				1.42***			
2003-1993	-1.07***				-0.90***			
2013-2003	-0.74***				-0.80***			

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Average Total Travel Time Use (Hours per Week) by Demographic Groups

	1975	1985	1993	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Panel A: By Age Groups														
18-19	9.37	11.71	10.69	9.75	10.40	10.07	9.52	9.04	8.28	9.01	8.13	8.30	9.09	8.16
20-49	9.53	10.62	10.59	9.77	9.62	9.42	9.58	9.22	9.14	9.23	9.08	9.09	9.05	9.03
50-64	7.67	9.02	9.75	8.90	8.65	8.58	8.52	8.58	8.26	8.21	8.52	8.70	8.66	8.14
65+	5.56	6.61	7.67	6.38	6.48	6.86	6.08	6.43	6.22	6.01	5.89	6.33	6.20	6.39
Panel B: By Work-Gender Groups														
Female Nonworker	6.40	7.20	8.37	7.12	6.89	7.45	6.90	6.65	6.76	6.66	6.45	6.61	6.65	6.57
Female Worker	8.75	10.77	10.51	9.71	9.76	9.41	9.47	9.20	9.10	9.21	9.35	9.19	9.07	9.11
Male Nonworker	8.19	8.76	9.09	7.47	7.75	7.08	6.85	7.06	6.45	6.57	6.60	7.10	7.06	6.73
Male Worker	10.12	11.23	11.03	10.11	9.81	9.74	9.86	9.67	9.41	9.60	9.52	9.67	9.66	9.40
Panel C: By Education Levels														
Grade<12	7.21	7.71	8.33	7.46	7.62	7.62	7.16	7.19	6.74	6.48	6.63	7.13	6.96	7.05
Grade=12	8.74	9.41	9.90	8.33	8.32	8.20	7.96	8.10	7.52	7.68	7.53	7.38	7.48	7.53
Grade:13-15	9.18	11.08	10.41	9.50	9.17	9.29	9.15	8.98	8.93	8.71	8.88	8.71	8.68	8.37
Grade=16+	10.57	11.13	10.72	10.37	10.09	9.84	10.16	9.53	9.68	9.81	9.56	10.01	9.78	9.40
Panel D: By Have Child or Not														
No Child	7.81	9.36	9.86	8.65	8.46	8.35	8.34	8.33	8.10	8.05	7.93	8.13	8.02	7.87
Have Child(ren)	9.12	10.51	10.56	9.61	9.63	9.61	9.42	9.06	8.93	9.06	9.10	9.09	9.18	9.04

Note: The calculations of total travel time by demographic groups are based on Analysis Sample 1 (1975-2013).

Table 4: Evolving Weights (in Percentage) of Demographic Groups

	1975	1985	1993	2003	2013	Average 1975-2013	Difference 1993-1975	Difference 2003-1993	Difference 2013-2003
Panel A: By Age Groups									
18-19	2.7	3.4	3.0	3.4	3.2	3.1	0.2	0.4	-0.2
20-49	58.6	62.4	67.1	58.5	52.5	57.2	8.5	-8.5	-6.0
50-64	20.8	20.4	18.2	22.0	26.0	23.4	-2.5	3.8	4.0
65+	17.9	13.7	11.7	16.1	18.4	16.3	-6.2	4.4	2.2
Panel B: By Work-Gender Groups									
Female Nonworker	31.0	25.0	21.1	21.3	22.3	22.1	-9.9	0.2	1.0
Female Worker	21.7	30.6	33.2	30.7	29.4	30.2	11.5	-2.6	-1.3
Male Nonworker	12.5	12.1	10.1	12.2	14.8	13.00	-2.4	2.1	2.6
Male Worker	34.8	32.2	35.5	35.8	33.5	34.7	0.8	0.3	-2.4
Panel C: By Education Levels									
Grade<12	38.9	17.5	10.3	15.4	11.8	15.3	-28.7	5.1	-3.6
Grade=12	35.6	43.2	36.1	32.5	30.3	33.1	0.5	-3.6	-2.2
Grade:13-15	12.9	17.4	25.0	26.5	26.1	24.8	12.1	1.5	-0.4
Grade=16+	12.6	21.9	28.7	25.6	31.8	26.8	16.1	-3.0	6.2
Panel D: By Have Child or Not									
No Child	52.8	63.2	66.0	60.6	64.2	61.9	13.2	-5.4	3.5
Have Child(ren)	47.2	36.8	34.0	39.4	35.8	38.1	-13.2	5.4	-3.5

Table 5: Blinder-Oaxaca Decomposition of Total Travel Time

Panel A: 1975 -1993				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_1993	10.10***	10.10***	10.10***	
	(0.10)	(0.15)	(0.15)	
Survey_1975	8.43***	8.43***	8.43***	
	(0.42)	(0.20)	(0.20)	
Difference	1.67***	1.67***	1.67***	
	(0.43)	(0.25)	(0.25)	
Explained	0.75***	0.90***	0.65***	45.2%
	(0.12)	(0.17)	(0.14)	
Unexplained	0.91**	0.76***	1.02***	54.8%
	(0.43)	(0.28)	(0.28)	
Explained				
Age	0.18***	0.25***	0.11***	10.5%
	(0.04)	(0.06)	(0.04)	
Work-Gender	0.12***	0.08	0.15***	7.1%
	(0.04)	(0.07)	(0.05)	
Education	0.47***	0.53***	0.41***	27.9%
	(0.10)	(0.14)	(0.13)	
Child	-0.01	0.05	-0.03	-0.3%
	(0.04)	(0.06)	(0.05)	
Unexplained				
Age	-0.20	-0.28	-0.14	
	(0.63)	(0.37)	(0.34)	
Work-Gender	-0.32	-0.28	-0.36	
	(0.61)	(0.41)	(0.35)	
Education	0.06	-0.00	0.11	
	(0.17)	(0.09)	(0.13)	
Child	0.26	0.21	0.29	
	(0.47)	(0.21)	(0.29)	
Constant	1.12	1.12**	1.12**	
	(0.96)	(0.55)	(0.55)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled-two method.

Table 5 Continued: Blinder-Oaxaca Decomposition of Total Travel Time

Panel B: 1993 -2003				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_2003	9.03***	9.03***	9.03***	
	(0.06)	(0.09)	(0.09)	
Survey_1993	10.10***	10.10***	10.10***	
	(0.28)	(0.15)	(0.15)	
Difference	-1.07***	-1.07***	-1.07***	
	(0.29)	(0.17)	(0.17)	
Explained	-0.18***	-0.15***	-0.21***	16.0%
	(0.03)	(0.05)	(0.04)	
Unexplained	-0.89***	-0.91***	-0.86***	84.0%
	(0.29)	(0.18)	(0.18)	
Explained				
Age	-0.10***	-0.09***	-0.11***	8.9%
	(0.02)	(0.03)	(0.02)	
Work-Gender	-0.02	-0.02	-0.03*	1.8%
	(0.01)	(0.02)	(0.01)	
Education	-0.06***	-0.06**	-0.07***	6.3%
	(0.02)	(0.02)	(0.02)	
Child	0.01	0.01	0.00	-1.0%
	(0.01)	(0.02)	(0.01)	
Unexplained				
Age	-0.13	-0.14	-0.12	
	(0.37)	(0.22)	(0.24)	
Work-Gender	0.08	0.07	0.08	
	(0.51)	(0.31)	(0.32)	
Education	-0.01	-0.01	-0.01	
	(0.12)	(0.05)	(0.08)	
Child	-0.05	-0.05	-0.04	
	(0.25)	(0.17)	(0.15)	
Constant	-0.79	-0.79**	-0.79**	
	(0.63)	(0.39)	(0.39)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled-two method.

Table 5 Continued: Blinder-Oaxaca Decomposition of Total Travel Time

Panel C: 2003 - 2013				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_2013	8.29***	8.29***	8.29***	
	(0.15)	(0.11)	(0.11)	
Survey_2003	9.03***	9.03***	9.03***	
	(0.07)	(0.09)	(0.09)	
Difference	-0.74***	-0.74***	-0.74***	
	(0.17)	(0.14)	(0.14)	
Explained	-0.02	-0.00	-0.03	2.2%
	(0.02)	(0.03)	(0.03)	
Unexplained	-0.73***	-0.74***	-0.71***	97.8%
	(0.17)	(0.14)	(0.14)	
Explained				
Age	-0.05***	-0.07***	-0.04**	7.4%
	(0.01)	(0.02)	(0.02)	
Work-Gender	-0.06***	-0.05***	-0.07***	8.2%
	(0.01)	(0.01)	(0.01)	
Education	0.11***	0.13***	0.10***	-15.0%
	(0.01)	(0.02)	(0.02)	
Child	-0.01*	-0.00	-0.02**	1.6%
	(0.01)	(0.01)	(0.01)	
Unexplained				
Age	0.13	0.15	0.12	
	(0.23)	(0.19)	(0.19)	
Work-Gender	0.14	0.13	0.15	
	(0.30)	(0.24)	(0.25)	
Education	-0.06	-0.08	-0.05	
	(0.06)	(0.06)	(0.04)	
Child	0.17	0.16	0.18	
	(0.14)	(0.12)	(0.13)	
Constant	-1.10***	-1.10***	-1.10***	
	(0.42)	(0.35)	(0.35)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled_two method.

Table 6: Disaggregated Time Use (Hours per Week) 2003-2013

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Difference 2013-2003	
Panel A: Major Time Use Categories													
Work Travel	2.14	2.05	2.14	2.16	2.07	2.05	2.02	2.03	2.04	2.04	1.93	-0.21***	-9.7%
Work	24.88	24.79	24.94	25.40	25.88	25.41	23.94	23.67	24.19	24.02	23.52	-1.35***	-5.4%
Work Travel (workers)	3.14	3.02	3.12	3.17	2.97	2.99	3.06	3.11	3.15	3.16	3.02	-0.12	-3.9%
Work (workers)	36.89	37.15	36.69	37.53	37.70	37.28	36.46	36.61	37.25	37.27	36.84	-0.05	0.1%
Non-Market Work Travel	3.50	3.51	3.35	3.21	3.18	3.21	3.16	3.09	3.08	3.02	3.10	-0.40***	-11.4%
Non-Market Work	19.22	19.21	18.74	18.44	18.45	17.86	18.11	17.79	17.68	17.28	17.76	-1.46***	-7.6%
Leisure Travel	2.88	3.01	3.11	3.09	3.08	2.86	2.92	2.87	2.93	2.97	2.87	-0.01	-0.3%
Leisure	112.25	112.58	112.78	112.41	112.39	113.44	114.38	114.38	114.17	115.02	114.92	2.68***	2.4%
Panel B: Time Use Categories in Non-Market Work													
Child Care Travel	0.59	0.57	0.62	0.57	0.57	0.59	0.56	0.54	0.56	0.54	0.57	-0.01	-1.9%
Child Care	3.74	3.74	3.69	3.56	3.57	3.68	3.61	3.46	3.43	3.42	3.51	-0.24*	-6.4%
Other Care Travel	0.66	0.64	0.53	0.44	0.44	0.45	0.44	0.46	0.43	0.43	0.44	-0.23***	-34.0%
Other Care	1.09	1.15	0.81	0.82	0.76	0.79	0.74	0.78	0.75	0.64	0.71	-0.37***	-34.3%
Home Travel	0.28	0.28	0.26	0.26	0.27	0.25	0.30	0.28	0.29	0.26	0.26	-0.01	-4.8%
Home Production	11.05	10.95	10.91	10.71	10.89	10.27	10.70	10.51	10.49	10.34	10.56	-0.49***	-4.4%
Obtaining Travel	1.98	2.02	1.94	1.95	1.90	1.92	1.86	1.82	1.79	1.80	1.83	-0.15***	-7.6%
Obtaining	3.35	3.37	3.32	3.36	3.24	3.12	3.06	3.05	3.01	2.89	2.98	-0.36***	-10.8%

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Substitution Patterns across Time Use Categories (2003-2013)

Time Use Category (Non-Travel Time)	Sample Average	Baseline		Demographics		Time Dummies		Demo + Time	
		β	S.E.	β	S.E.	β	S.E.	β	S.E.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Work	24.39	-9.75	(7.24)	-9.80	(7.27)	-10.01	(7.20)	-10.05	(7.22)
Non-market Work	18.36	-11.84*	(7.10)	-11.83*	(7.13)	-12.02*	(7.05)	-12.01*	(7.08)
- Child Care	3.64	-5.19***	(1.85)	-5.22***	(1.85)	-4.96***	(1.87)	-4.99***	(1.88)
- Other Care	0.83	3.09	(2.56)	3.10	(2.57)	3.13	(2.50)	3.14	(2.51)
- Obtaining Goods/Services	3.14	12.45***	(2.61)	12.46***	(2.63)	12.47***	(2.64)	12.49***	(2.65)
- Home Production	10.75	-22.19***	(5.05)	-22.18***	(5.08)	-22.66***	(5.05)	-22.65***	(5.07)
Home Leisure	86.41	-113.53***	(15.44)	-113.50***	(15.49)	-113.98***	(15.52)	-113.95***	(15.58)
- Computer + TV	20.35	-53.37***	(9.54)	-53.33***	(9.58)	-53.14***	(9.58)	-53.18***	(9.63)
- Sleeping	60.33	-53.37***	(10.17)	-53.34***	(10.22)	-53.90***	(10.16)	-53.88***	(10.21)
- Other Home Leisure	5.73	-6.87	(4.19)	-6.82	(4.21)	-6.93	(4.19)	-6.89	(4.21)
Outside Leisure	9.71	17.76*	(9.23)	17.80*	(9.26)	17.75*	(9.29)	17.79*	(9.33)
- Exercise and Sports	2.06	10.33***	(3.52)	10.34***	(3.53)	10.24***	(3.53)	10.24***	(3.54)
- Socializing	7.06	5.94	(8.40)	5.98	(8.43)	6.01	(8.38)	6.05	(8.41)
- Entertainment and Arts	0.60	1.49	(1.38)	1.48	(1.39)	1.51	(1.38)	1.50	(1.39)
Other Leisure	17.57	17.77***	(5.95)	17.75***	(5.98)	18.42***	(5.90)	18.40***	(5.93)
- Garden and Pet	2.05	-2.92	(2.55)	-2.92	(2.56)	-2.86	(2.50)	-2.87	(2.51)
- Eating	7.85	5.53**	(2.54)	5.54**	(2.47)	5.52**	(2.45)	5.53**	(2.46)
- Personal Care	4.73	5.19**	(2.19)	5.20**	(2.20)	5.37**	(2.19)	5.38**	(2.20)
- Self Care	0.61	0.49	(2.53)	0.51	(2.54)	0.75	(2.56)	0.76	(2.57)
- Own Medicare	0.36	3.84**	(1.54)	3.84**	(1.55)	3.85**	(1.56)	3.84**	(1.56)
- Civic	1.97	5.63**	(2.50)	5.59**	(2.51)	5.79**	(2.48)	5.75**	(2.49)
Other	3.02	-0.41	(8.01)	-0.43	(8.04)	-0.16	(8.03)	-0.19	(8.06)
- Education	1.63	-1.17	(7.19)	-1.22	(7.22)	-1.23	(7.23)	-1.28	(7.27)
- Other (excluding education)	1.39	0.77	(3.96)	0.79	(3.98)	1.07	(3.92)	1.09	(3.93)

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All coefficients are multiplied by 100.

Table 8: Disaggregated Time Use (Hours per Week) 1975-2013

	1975	1985	1993	2003	2013	Difference 1993-1975		Difference 2003-1993		Difference 2013-2003	
Work Travel	2.17	2.63	2.77	2.14	1.93	0.60***	27.7%	-0.64***	-23.0%	-0.21***	-9.7%
Work	23.77	24.03	26.22	24.88	23.52	2.45***	10.3%	-1.34***	-5.1%	-1.35***	-5.4%
Work Travel (workers)	3.63	4.02	3.90	3.14	3.02	0.27***	7.4%	-0.76***	-19.5%	-0.12	-3.9%
Work (workers)	39.89	37.37	37.32	36.89	36.84	-2.57***	-6.4%	-0.43	-1.1%	-0.05	0.1%
Obtaining Travel	1.92	2.24	2.03	1.98	1.83	0.11**	5.9%	-0.05	-2.6%	-0.15***	-7.6%
Obtaining	3.26	3.73	3.44	3.34	2.98	0.18**	5.5%	-0.09	-2.7%	-0.36***	-10.8%
Leisure(narrow) Travel	1.80	2.37	2.25	1.53	1.54	0.44***	24.6%	-0.72***	-32.1%	0.01	0.5%
Leisure (narrow)	34.40	34.82	37.01	35.17	36.26	2.61***	7.6%	-1.84***	-5.0%	1.09***	3.1%

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Blinder-Oaxaca Decomposition of Disaggregated Travel Time

	Work Travel		Obtaining Travel		Leisure (narrow) Travel	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: 1975-1993			
Overall						
Survey_1993	2.77***		2.03***		2.25***	
Survey_1975	2.17***		1.92***		1.80***	
Difference	0.60***		0.11		0.44*	
Explained	0.43***	72.2%	0.05	43.0%	0.13**	28.3%
Unexplained	0.17	27.8%	0.06	57.0%	0.32	71.7%
Explained						
Age	0.04***	6.8%	0.01	11.6%	0.07***	16.0%
Work-Gender	0.36***	60.1%	-0.09***	-75.7%	-0.08***	-17.4%
Education	0.03	4.6%	0.12***	109.9%	0.09**	21.1%
Child	0.00	0.7%	-0.00	-2.8%	0.04**	8.5%
			Panel B: 1993-2003			
Overall						
Survey_2003	2.14***		1.98***		1.53***	
Survey_1993	2.77***		2.03***		2.25***	
Difference	-0.64***		-0.05		-0.72***	
Explained	-0.09***	15.0%	-0.02	25.9%	-0.05***	5.8%
Unexplained	-0.55***	85.0%	-0.04	74.1%	-0.68***	94.2%
Explained						
Age	-0.04***	7.2%	-0.00	6.9%	-0.03***	4.2%
Work-Gender	-0.05**	7.5%	0.01	-8.6%	0.01***	-2.0%
Education	0.00	-0.5%	-0.02***	32.8%	-0.01*	1.6%
Child	-0.00	0.7%	0.00	-5.3%	-0.02***	2.1%
			Panel C: 2003-2013			
Overall						
Survey_2013	1.93***		1.83***		1.54***	
Survey_2003	2.14***		1.98***		1.53***	
Difference	-0.21***		-0.15**		0.01	
Explained	-0.08***	38.1%	0.03***	-19.7%	0.01	
Unexplained	-0.12*	61.9%	-0.18**	119.7%	-0.00	
Explained						
Age	-0.01	2.9%	-0.00	0.7%	-0.03***	
Work-Gender	-0.10***	44.1%	0.00	-2.6%	0.01***	
Education	0.02***	-7.6%	0.03***	-19.0%	0.02***	
Child	0.00	-1.2%	-0.00	1.1%	0.01***	

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The decomposition results in this table are based on pooled_two method. Columns (2), (4), and (6) are ratios of explained and unexplained parts relative to the total difference of each disaggregated travel time use respectively. The details of unexplained part are suppressed due to mostly insignificance.

Table 10: Substitution Patterns across Time Use Categories (1975-2013)

Time Use Category (Non-Travel Time)	Sample Average	Baseline		Demographics		Time Dummies		Demo + Time	
		β	S.E.	β	S.E.	β	S.E.	β	S.E.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Work	24.94	-19.80	(12.02)	-20.98*	(12.44)	-13.25	(13.05)	-14.38	(13.53)
Non-market Work									
- Child Care	2.80	-5.40	(5.93)	-5.39	(6.18)	-0.99	(5.78)	-0.90	(6.07)
- Obtaining Goods/Services	3.35	10.35**	(4.28)	10.62**	(4.41)	9.19*	(4.96)	9.45*	(5.14)
Home Leisure	83.81	-116.69***	(21.40)	-116.40***	(22.04)	-120.05***	(19.98)	-119.85***	(20.54)
- TV	17.53	-29.59**	(12.09)	-30.20**	(12.49)	-39.74***	(11.22)	-40.62***	(11.57)
- Sleeping	58.75	-68.56***	(13.42)	-67.94***	(13.58)	-55.60***	(14.33)	-54.69***	(14.60)
- Other Home Leisure	7.52	-18.54**	(7.45)	-18.26**	(7.62)	-24.71***	(7.85)	-24.54***	(7.97)
Outside Leisure	10.42	32.47***	(9.29)	31.73***	(9.50)	27.05***	(9.59)	26.13***	(9.80)
- Exercise and Sports	2.30	15.20***	(5.25)	15.15***	(5.38)	8.84	(5.63)	8.67	(5.80)
- Socializing	7.55	9.87	(10.36)	8.93	(10.55)	11.00	(10.53)	9.98	(10.71)
- Entertainment and Arts	0.57	7.40***	(2.27)	7.65***	(2.31)	7.21***	(2.49)	7.47***	(2.54)
Other Leisure									
- Civic	1.93	17.07**	(8.47)	17.41**	(8.70)	20.59**	(9.43)	21.04**	(9.70)
Other									
- Education	1.70	0.02	(7.17)	-0.35	(7.43)	-2.29	(7.45)	-2.74	(7.73)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Note: All coefficients are multiplied by 100.

Table A1: Travel Time Use Classifications

Travel Time Use Classification	Examples of Travel Activities Included
Work Travel	Travel related to work, such as commuting to/from work, and work-related travel, not commuting.
Non-Market Work Travel	Home Production Travel, Obtaining Travel, Child Care Travel and Other Care Travel
– Child Care Travel	Travel related to helping and caring for household and nonhousehold children
– Other Care Travel	Travel related to helping and caring for household and nonhousehold adults
– Home Production Travel	Travel related to household activities such as meals, vehicle maintenance and other housework
– Obtaining Travel	Travel related to consumer purchases, household and government services, professional and personal care services except medical,
Leisure Travel	Narrow leisure travel and Other Leisure Travel
– Narrow Leisure Travel	Travel related to sports, exercises, recreation, socializing and communicating, hosting and attending social events, relaxing and leisure, arts and entertainment, and telephone calls
– Other Leisure Travel	Travel related to eating and drinking, personal care, own medical care, religious, spiritual, volunteering and other leisure activities
Other Travel	Travel related to education, security procedures related to traveling, and traveling not elsewhere classified

Table A2: Coding Rules of Traveling (2003)

General rule	To code all travel except homebound trips, look ahead to the next activity/destination before coding a travel episode. To code the homebound travel episode, look backwards to the previous activity.
Single destination trips	Direct trips to/from a destination: Code as Traveling/Related to [relevant destination/activity]. Multi-leg trips: Code all legs associated with one destination according to the trip destination.
Multiple destination trips	Code each travel episode of a multiple destination trip according to each destination.
Trips home	Code according to the last stop.
Waiting for bus/train	Code any waiting related to travel as part of the travel episode.
Commuting or work-related travel	Code home to work and work to home (including multi-leg trips) as commuting, provided there are no intervening activity stops. Code travel undertaken after arriving at work according to the next activity destination. If such activities have an M or O in the work column, then code the travel as work-related, not commuting. Travel to return to work after leaving work for another activity should be coded according work-related travel, not commuting.
Walking someplace	Code as Traveling/Related to [relevant activity]. Exceptions: Walking for exercise should be coded as sports and exercise. Walking the dog should be coded as pet care under household activities. Walking a child to [the child's event] should be coded as traveling related to childcare. Walking around as part of another activity should be coded as part of the main activity.
Travel as part of job	For taxi drivers, bus drivers, chauffeurs, traveling sales workers, and other workers for whom travel is an essential part of their job, code travel time as Work and Work-Related Activities/Working/Work, main job or work, other job unless travel reason is clearly not work.
Using a taxi	Code as Traveling/Related to [activity], not as Consumer Purchases.
Warming up the car	Code as part of the next travel episode (traveling related to xx), even if the respondent does other activities before the traveling episode.
Travel with no destination	If the respondent reports driving, but changes his or her mind and returns home before reaching a destination, code as Traveling, n.e.c (not elsewhere classified).
Airport, train station, or bus depot travel activities	Code activities associated with travel (such as "picking up baggage") as Traveling, n.e.c.
Security procedures	If respondent reports undergoing security procedures (such as "being searched at security checkpoint") related to traveling, code as Security Procedures Related to Traveling.

Source: 2003 ATUS Coding Rules Manual, p31-33.

Table A3: Coding Rules of Traveling (1975)

General rule	Travel can never be a secondary activity. When travel is reported as a secondary activity and it is a non-concurrent activity: 1. Circle it out and move it to the primary column under the primary it was listed with. 2. Split the time according to travel time not reported rules. 3. Edit item 4 to "transit". 4. Assume item 5 is the same as for the associated primary unless noted otherwise. 5. Assume there is no secondary activity.
Purpose of trip	Travel is generally associated with the purpose of the trip, both going to and coming back from.
Multiple purpose trips	In the case of a trip that had multiple purposes, code each travel segment as travel related to the next primary activity, then code the last segment of the trip as travel time related to the last activity.
Pleasure driving	Code "driving around," "out for a ride," etc. as 817, under sports and active leisure.
Travel while work	Code travel while working as work time.
Travel shopping	Code "picked up friend to go shopping" as travel shopping (not social).
Picking up others	In general, code the travel time related to the purpose of the trip, e.g.,"taking someone else to work" (if r is not going to work), code 498, travel (helping).
Work travel	Travel related to work (code 099) is to capture only the time r spends commuting to get to his/her work place and to get back home from the work place (at the end of r's work day). Any intervening trips are to be coded as travel related to the purpose of the activity (e.g., travel to and from lunch will be coded as travel related to personal care).
Interrupted work travel	Since many respondents do not go directly to work or directly home afterwards: A. First, ascertain if one of the travel times (to or from work) is direct. When one of the times is direct, use that as the travel time for commuting the other way. Any left over minutes should be divided among the travel time related to other activities along the way (use work travel code 099). B. If both the trip to and from work include activities along the way, start with the trip to work: subtract 5 minutes from the total travel time for each different travel activity (but must have at least five minutes left for commute work time) once you have subtracted for stops use the remaining (trip to work) total time for computing the base time for the trip home from work, and divide remaining time equally between other activities on the way home.
Trip within a trip	If there is a clear trip within a trip, then code travel to and from as you would if r went there and back from home.

Source: Time Use in Economic and Social Accounts, 1975 - 1976, Codebook p44-48.

Table B1: Blinder-Oaxaca Decomposition of Total Travel Time (Sample 2)

Panel A: 1965 -1993				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_1993	10.40***	10.40***	10.40***	
	(0.11)	(0.17)	(0.17)	
Survey_1965	8.77***	8.77***	8.77***	
	(0.32)	(0.16)	(0.16)	
Difference	1.63***	1.63***	1.63***	
	(0.33)	(0.23)	(0.23)	
Explained	0.42***	0.52***	0.31*	25.9%
	(0.11)	(0.15)	(0.17)	
Unexplained	1.20***	1.11***	1.32***	74.1%
	(0.36)	(0.27)	(0.30)	
Explained				
Age	-0.00	-0.01	0.01	-0.2%
	(0.01)	(0.01)	(0.01)	
Work-Gender	0.10***	0.12***	0.06**	6.0%
	(0.03)	(0.04)	(0.03)	
Education	0.41***	0.52***	0.29**	25.1%
	(0.08)	(0.12)	(0.14)	
Child	-0.08	-0.10	-0.06	-4.9%
	(0.07)	(0.09)	(0.09)	
Unexplained				
Age	0.43	0.44	0.41	
	(0.70)	(0.44)	(0.44)	
Work-Gender	-1.19**	-1.21***	-1.15***	
	(0.54)	(0.41)	(0.38)	
Education	0.05	-0.06	0.16	
	(0.14)	(0.11)	(0.12)	
Child	-0.09	-0.07	-0.12	
	(0.46)	(0.20)	(0.33)	
Constant	2.01*	2.01***	2.01***	
	(1.04)	(0.65)	(0.65)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled-two method.

Table B1 Continued: Blinder-Oaxaca Decomposition of Total Travel Time (Sample 2)

Panel B: 1993 - 2003				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_2003	9.50***	9.50***	9.50***	
	(0.07)	(0.10)	(0.10)	
Survey_1993	10.40***	10.40***	10.40***	
	(0.31)	(0.17)	(0.17)	
Difference	-0.89***	-0.89***	-0.89***	
	(0.32)	(0.19)	(0.19)	
Explained	-0.03	-0.00	-0.06*	3.2%
	(0.03)	(0.05)	(0.04)	
Unexplained	-0.87***	-0.89***	-0.84***	96.8%
	(0.32)	(0.21)	(0.20)	
Explained				
Age	-0.03**	-0.02	-0.05***	3.5%
	(0.01)	(0.03)	(0.02)	
Work-Gender	0.02**	0.02*	0.02**	-2.7%
	(0.01)	(0.01)	(0.01)	
Education	-0.03**	-0.03	-0.04**	3.8%
	(0.02)	(0.03)	(0.02)	
Child	0.01	0.02	0.01	-1.4%
	(0.02)	(0.03)	(0.02)	
Unexplained				
Age	-0.60	-0.61	-0.59	
	(0.56)	(0.37)	(0.38)	
Work-Gender	0.21	0.21	0.21	
	(0.60)	(0.38)	(0.37)	
Education	0.04	0.03	0.05	
	(0.16)	(0.08)	(0.10)	
Child	-0.06	-0.07	-0.05	
	(0.29)	(0.20)	(0.16)	
Constant	-0.46	-0.46	-0.46	
	(0.84)	(0.55)	(0.55)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled-two method.

Table B1 Continued: Blinder-Oaxaca Decomposition of Total Travel Time (Sample 2)

Panel C: 2003 - 2013				
	(1) Pooled-two	(2) Ref_1993	(3) Ref_2003	(4) Ratio
Overall				
Survey_2013	8.70***	8.70***	8.70***	
	(0.18)	(0.12)	(0.12)	
Survey_2003	9.50***	9.50***	9.50***	
	(0.07)	(0.10)	(0.10)	
Difference	-0.80***	-0.80***	-0.80***	
	(0.19)	(0.16)	(0.16)	
Explained	-0.01	0.02	-0.03	0.7%
	(0.02)	(0.03)	(0.03)	
Unexplained	-0.80***	-0.82***	-0.77***	99.3%
	(0.19)	(0.16)	(0.16)	
Explained				
Age	-0.03***	-0.04**	-0.02	3.6%
	(0.01)	(0.01)	(0.02)	
Work-Gender	-0.06***	-0.05***	-0.06***	7.0%
	(0.01)	(0.01)	(0.01)	
Education	0.09***	0.11***	0.08***	-11.4%
	(0.01)	(0.02)	(0.02)	
Child	-0.01*	0.00	-0.02**	1.5%
	(0.00)	(0.01)	(0.01)	
Unexplained				
Age	0.23	0.24	0.23	
	(0.48)	(0.39)	(0.39)	
Work-Gender	0.15	0.14	0.15	
	(0.38)	(0.31)	(0.32)	
Education	-0.04	-0.06	-0.02	
	(0.10)	(0.08)	(0.07)	
Child	0.22	0.21*	0.23	
	(0.18)	(0.14)	(0.15)	
Constant	-1.35**	-1.35**	-1.35**	
	(0.69)	(0.56)	(0.56)	

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust Standard Errors in Parentheses.

The ratio of explained or unexplained part relative to total difference in column (4) is calculated based on the pooled_two method.

Figure 1: Total Travel Time Use
(1975-2013 Sample vs. 1965-2013 Sample)

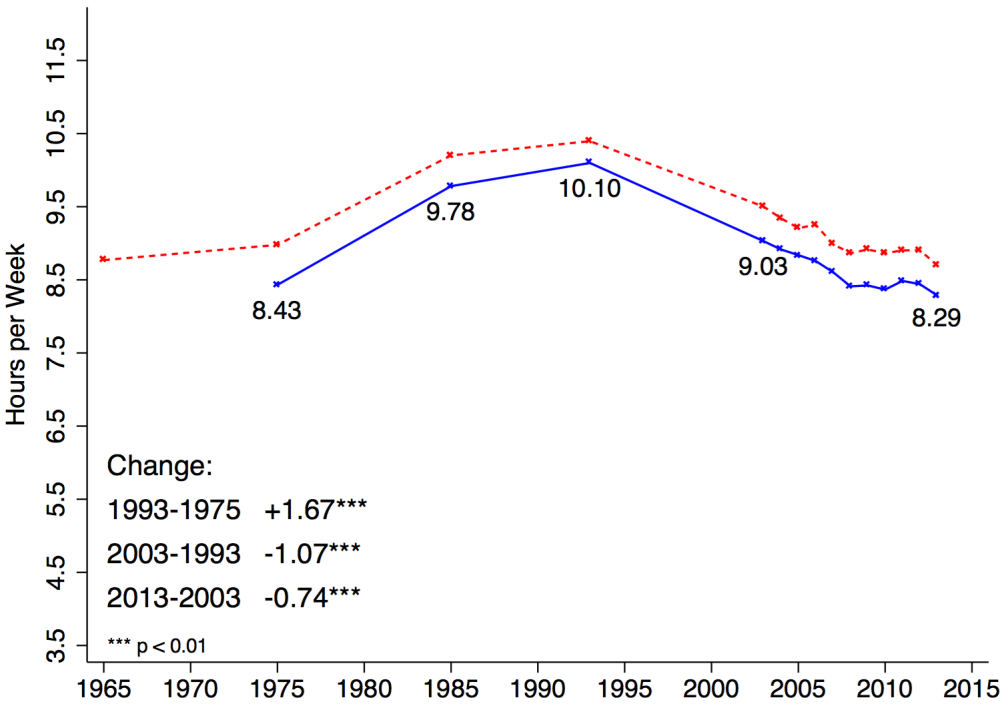

Figure 2: Total Travel Time Use by Demographic Groups

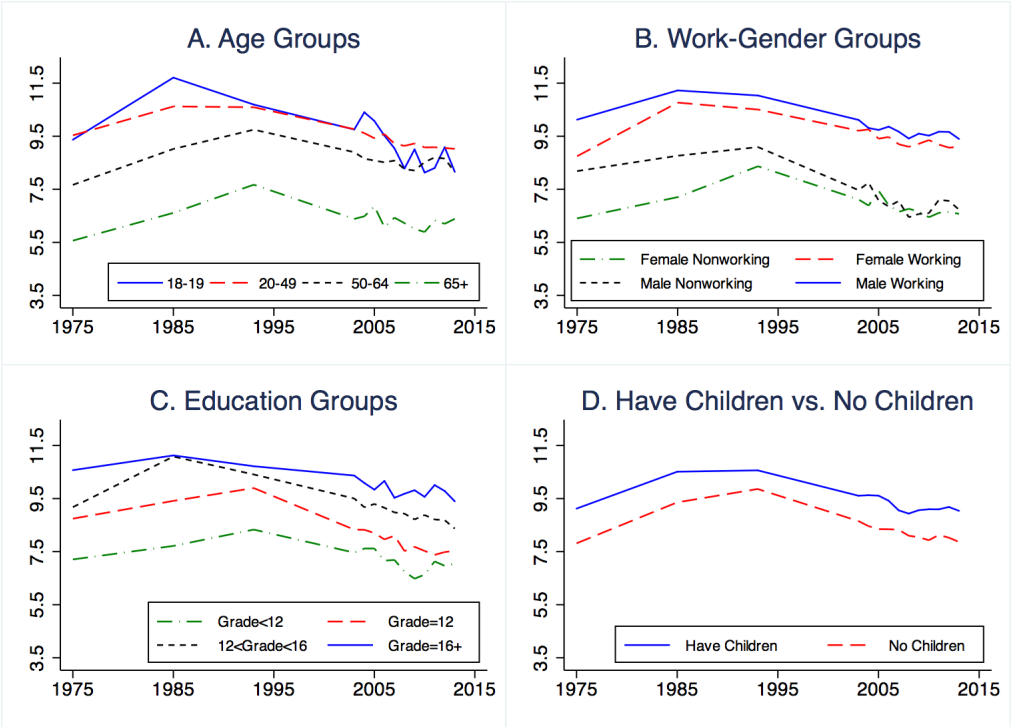

Figure 3: Evolving Weights of Age-Work-Gender Groups

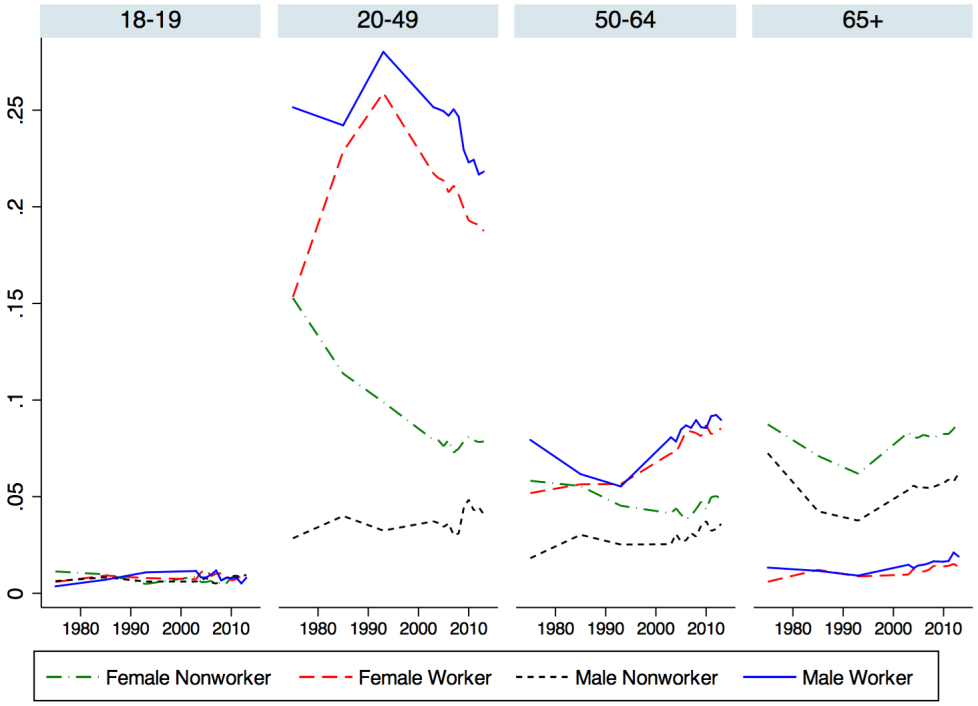

Figure 4: Evolving Weights of Education and With Children Groups

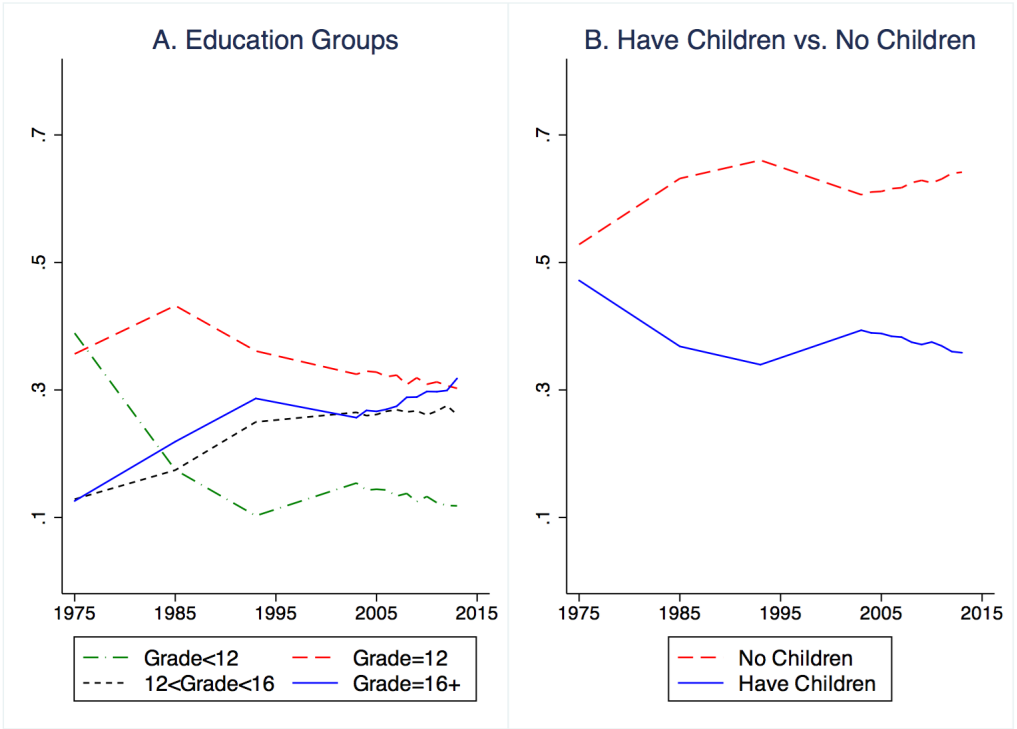

Figure 5: Composition of Average Time Use (2003)

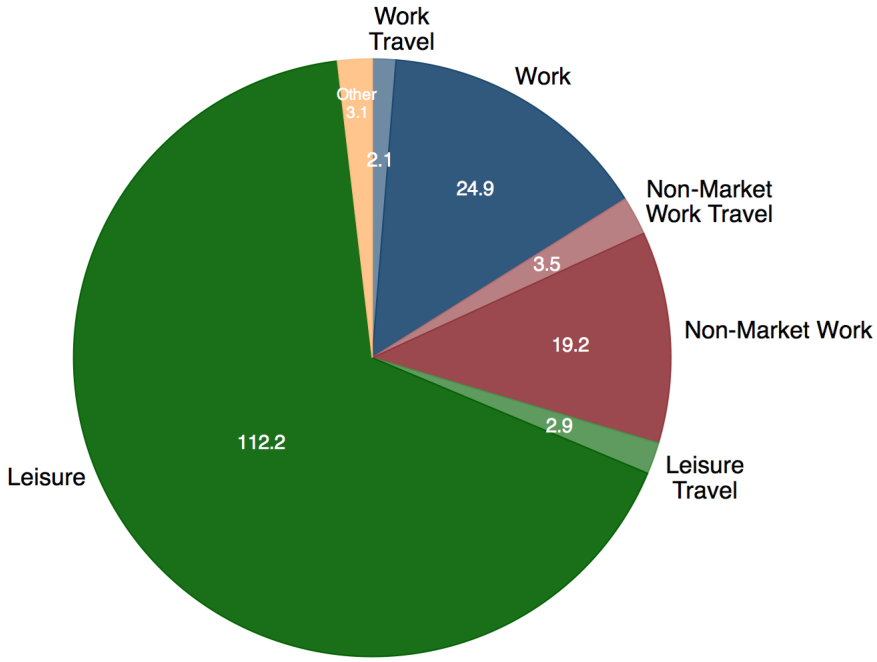

Figure 6: Percentage Change of Time Use from 2003

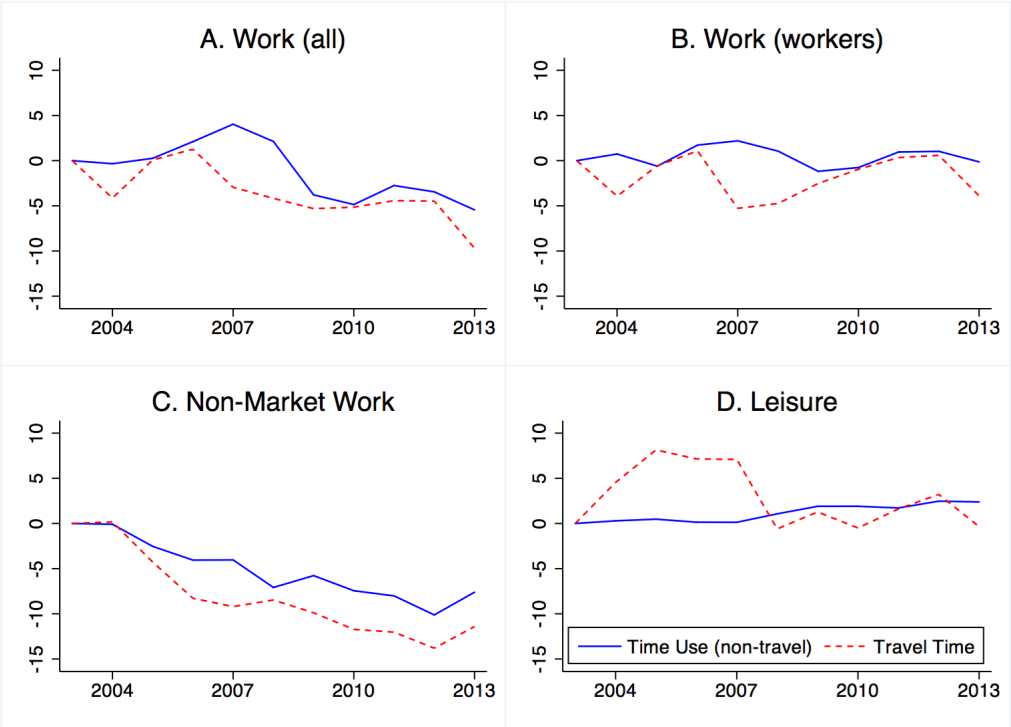

Figure 7: Composition of Average Non-Market Work Time (2003)

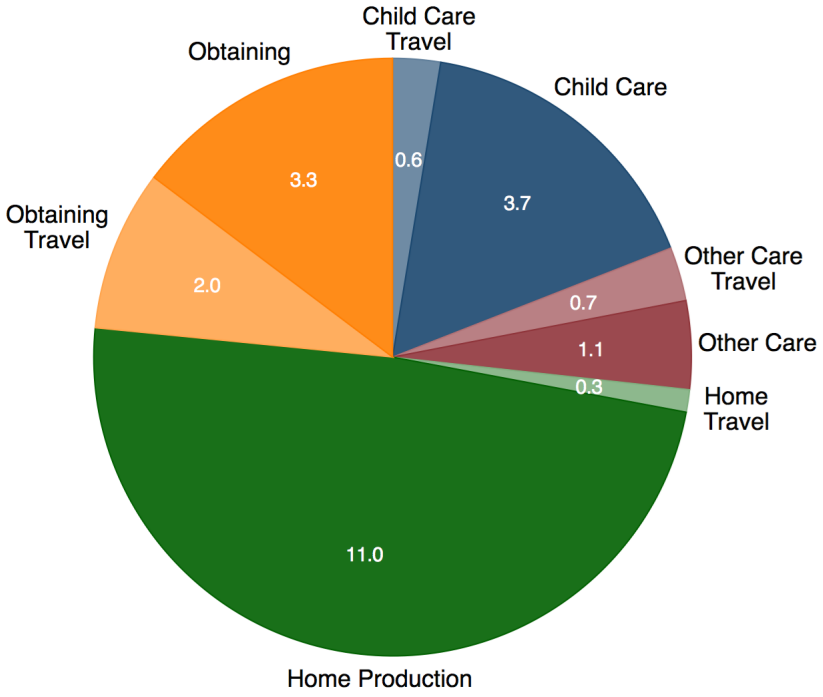

Figure 8: Percentage Change of Time Use in Non-market Work from 2003

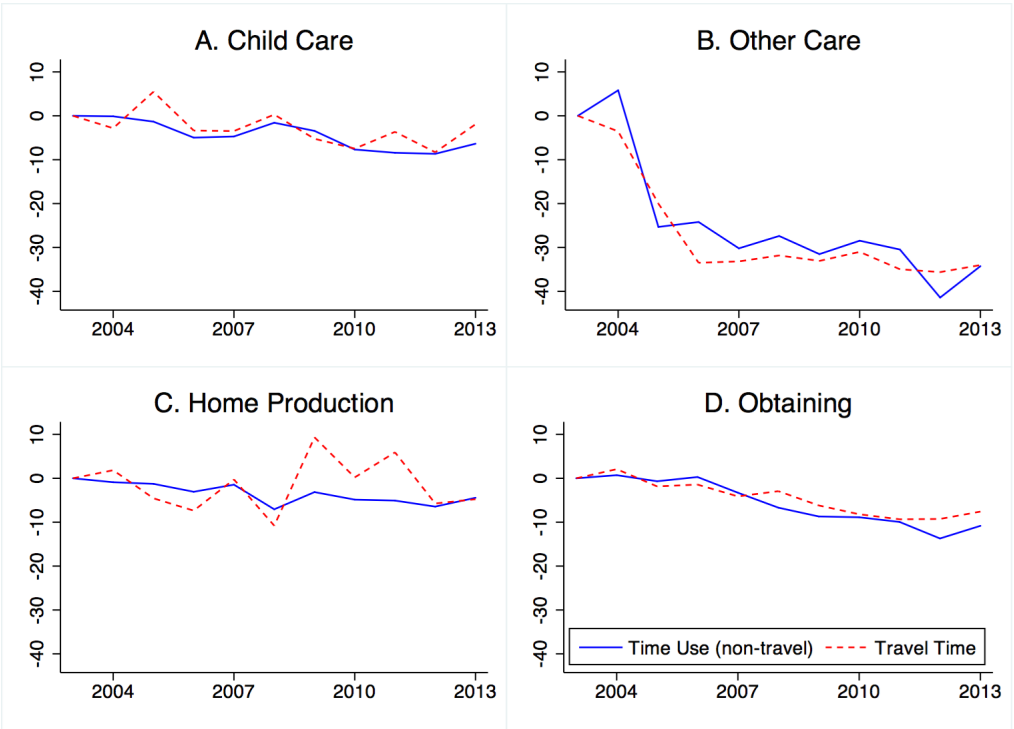

Figure 9: Blinder-Oaxaca Decomposition of Travel Time Variations

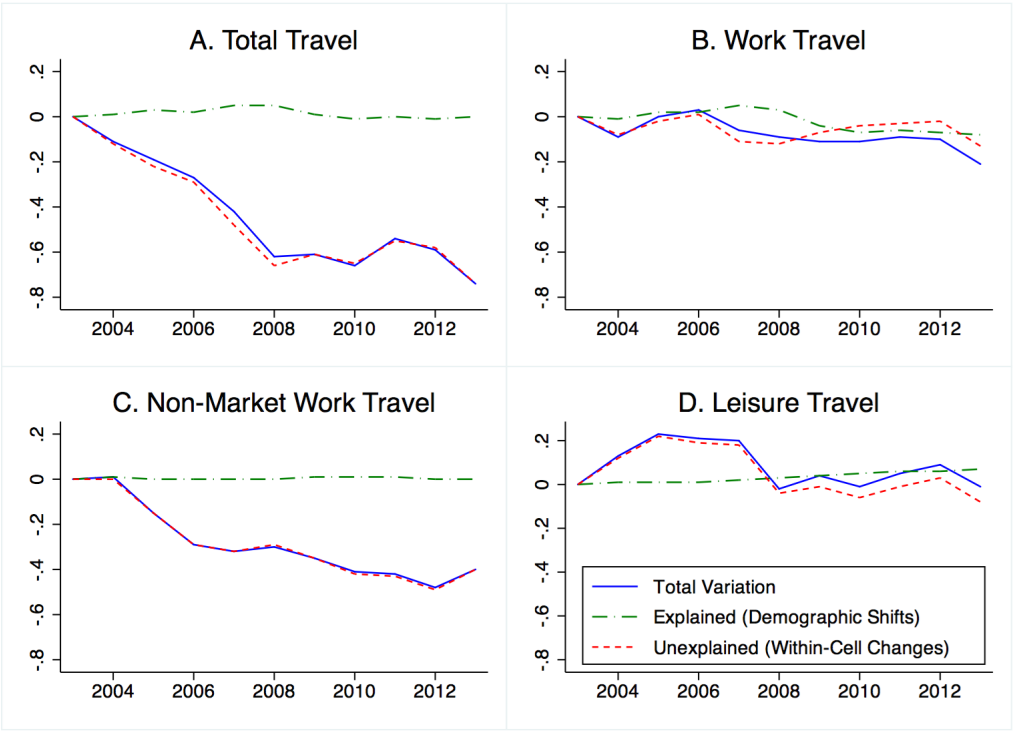

Figure 10: Cross Cell Variation: Selected Activity Time Use vs. Travel Time

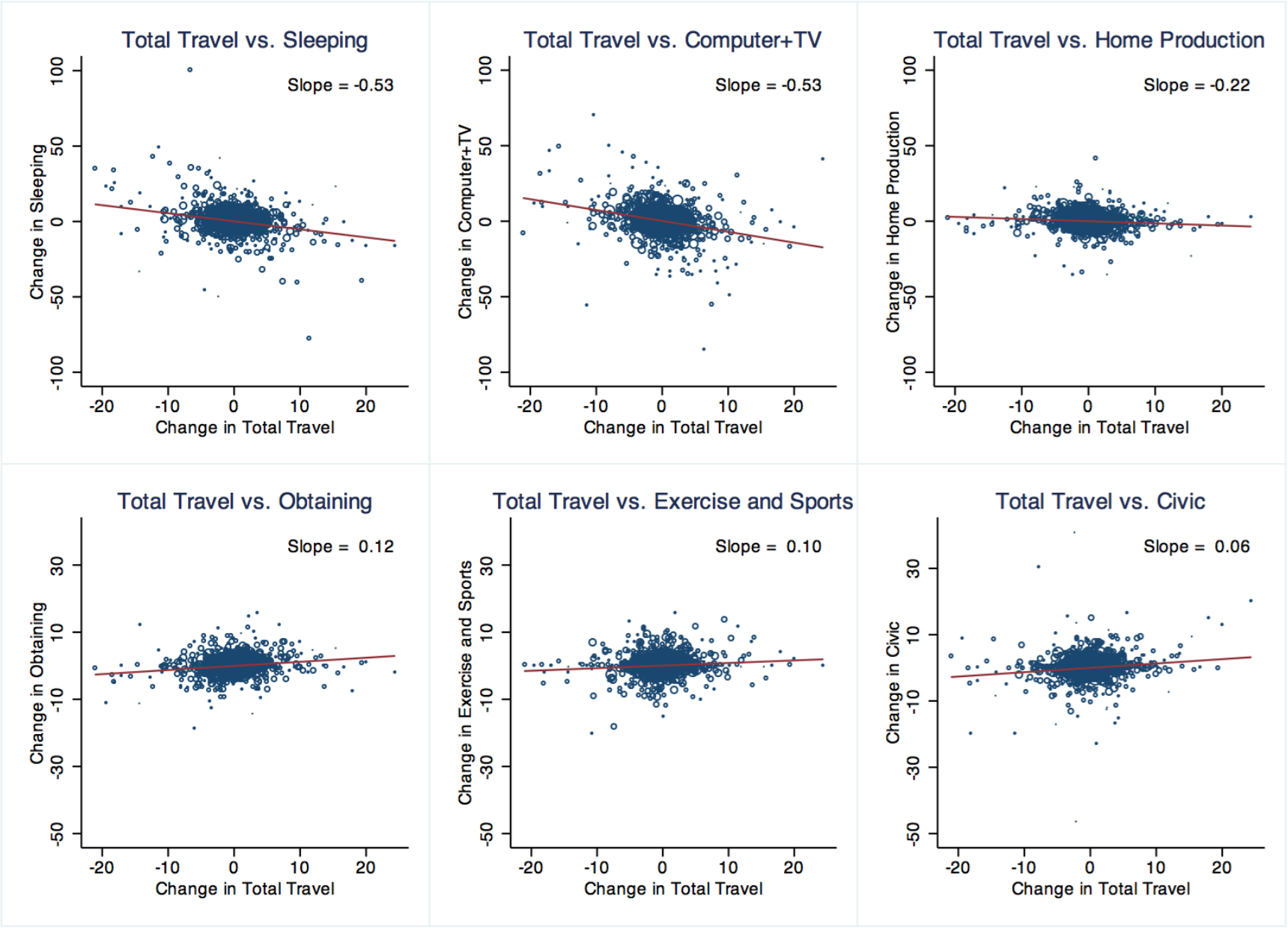

Figure 11: Percentage Change of Time Use from 1975