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Use of Time for Outdoor Recreation in the United States, 1965–2007

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Abstract

This study examines time-use for outdoor recreation during 1965 to 2007. Using data on over 47,000 individuals from six nationally representative time-use surveys, we first document time-use trends between 1965 and 2007. We then develop a two-part instrumental variable censored regression model (a hurdle model) to predict individual-level time-use. Our results show that per capita time-use in outdoor recreation has more than doubled since 1965. This long-term increase was driven largely by increased participation rate. However, in the last decade or two, per capita time-use in outdoor recreation has stayed constant or slightly decreased. This change was driven mostly by reduced time-use by active participants; participation rate has not changed considerably. Demographics, amount of leisure, and other factors all have contributed to changes over time, but their effects and relative importance vary between participation, time-use per active participant, and time periods.

Key Words: time use, survey, outdoor recreation, leisure, censored regression, hurdle model, two part model, decomposition

JEL Classification Numbers: C24, D12, Q26, Q50

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Use of Time for Outdoor Recreation in the United States, 1965–2007

Juha Siikamäki*

Executive Summary

This study documents and examines Americans' use of time for outdoor recreation from 1965 through 2007. Using data on over 47,000 individuals from six nationally representative time-use surveys conducted between 1965 and 2007, we address the following questions: How much time did Americans spend on outdoor recreation between 1965 and 2007? What were the trends of time use across different demographic groups? What factors explain the trends over time (e.g., changing demographic, the amount of leisure, or some other factors)?

According to our results, the amount of time spent for outdoor recreation has more than doubled since the 1960s. Whereas in 1965 the U.S. adult population spent on average 0.93 hours per week per capita on outdoor recreation and other physically active sports, this statistic had increased to 1.48 hours per week in 1975, then to 2.23 hours per week in 1985, and thereafter to 2.68 hours per week in 1993. In recent years, 2003 and 2007, Americans spent 1.86 and 2.00 hours per week per capita on outdoor recreation, respectively. Given these trends, the amount of time spent for outdoor recreation seems to have peaked in the 1980s and 1990s, followed by a slight downward shift during the last decade. However, from a historical perspective, the current level of time use on outdoor recreation is still high. Moreover, though the use of time for outdoor recreation decreased between 1993 and 2003, the declining trend has not continued since 2003.

What has driven these changes? Our analysis shows that the long-term increase was largely driven by increased participation in outdoor recreation. Whereas in 1965 only 8.9 percent of the U.S. population actively participated in outdoor recreation on a given day, the rate of participation has since then roughly doubled to approximately 17–19 percent from 1985 through 2007. Changing demographics, the changing amount of leisure per person, and other factors have

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all contributed to changes in the use of time for outdoor recreation over the last five decades, but the effects and relative importance of different factors vary between participation in outdoor recreation, the amount of time spent per active participant, and time periods examined.

Though increased participation has been the main driver of the long-term increase in the amount of time spent for outdoor recreation, the recent slight decline in time use for outdoor recreation has been driven primarily by the reduction in recreation time by active participants. Participation rates in outdoor recreation have not considerably changed in the last decade or two. In other words, compared to the 1980s and 1990s, people today are about as likely to participate in outdoor recreation, but when they do so, they spend less time recreating. This change is, at least in part, due to reductions in the amount of leisure people have at their disposal.

Gender differences in the use of time for outdoor recreation are salient and persistent over time. Compared to women, men participate more often in outdoor recreation and they also spend more time per participation. More specifically, the participation rate of men is nearly one and a half times that of women, though this gap has somewhat closed, especially during the last two decades. As active participants, men spend about 16 percent more time in outdoor recreation than women. Keeping everything else (e.g., income, leisure, education, work) constant and combining gender differences in participation and time use per active participant, men on average use about 70 percent more time per person on outdoor recreation.

Age groups vary both in their time use and participation in outdoor recreation, but the differences across age groups are more idiosyncratic than those based on gender. By and large, young adults (under 35 years old) use more time and participate more frequently in outdoor recreation than other adult populations. Interestingly, the amount of leisure by the under-35-year-old population has remained relatively constant since 1965, yet this age group has noticeably increased involvement in outdoor recreation and roughly tripled the percentage of the total amount of leisure allocated toward outdoor recreation. Another major change since the 1960s and 1970s has been the dramatic increase in the amount of leisure for the age group 60 years and older. Though in percentage terms individuals in this age group use less of their available leisure in outdoor recreation than in 1965, the absolute number of hours per person they spend on outdoor recreation has remained roughly constant.

Education and time use for outdoor recreation are strongly associated. The greater the educational level of an individual, the more likely she or he is to participate in outdoor recreation. Whereas about 5 percent of individuals with at most high school education participate in outdoor recreation, the participation rate is about 11 percent in groups with at least some

college education, keeping everything else equal. In other words, individuals with at most high school education are less than half as likely to participate as those with higher education but otherwise similar backgrounds.

The amount of leisure plays an important role in outdoor recreation decisions. Individuals with more leisure are more likely to participate in outdoor recreation, and they also spend more time per participation than those with less leisure. For example, our results suggest that over one-third of the approximately 22 percent total reduction in the use of time for outdoor recreation between 1993 and 2003 was due to changes (reductions) in the amount of leisure.

In sum, data from time-use surveys conducted between 1965 and 2007 indicate that in the long-term, the use of time per capita for outdoor recreation and physically active sports has considerably increased. Despite the recent slight decline, the use of time per capita for outdoor recreation continues at a level about twice the level in the 1960s. Though our findings lend some support to the arguments that the popularity of outdoor recreation might be declining, the most recent data (2003–2007) suggest that the use of time per capita for outdoor recreation has been relatively stable, not decreasing, over the last five years or so. Whereas the long-term increase in outdoor recreation has been due mostly to increased participation in outdoor recreation, the more recent changes reflect the reduced amount of time used for outdoor recreation by those who participate in outdoor recreation; the participation rate itself has not considerably changed over the last two decades.

What do our findings suggest in the context of outdoor recreation policy? First, public policies during the last five decades or so to greatly improve access to outdoor recreation, for example, by establishing national and state parks and other recreation areas, likely have contributed to the long-term increase in outdoor recreation, though the exact magnitude of these effects is difficult to discern. Second, the popularity of outdoor recreation continues at high levels today, but participants may be able to spend less time in recreation than before. Many factors likely contribute to this trend, among them the declining amount of leisure in groups most active in outdoor recreation, possibly increased competition among different forms of recreation, and, perhaps, the fragmentation of leisure and consequent challenges in finding common leisure among all individuals in the household. In any case, when the availability of free time is reduced, accessing remote recreation resources becomes more difficult, and near-home outdoor recreation opportunities become increasingly important. Local-level resources thus become more significant in the context of outdoor recreation policy. Third, demographic differences in outdoor recreation are pronounced and persistent. It would be important to assess to what extent these trends have resulted from outdoor recreation policy versus “natural” tendencies such as

differences in the preferences of different demographic groups toward outdoor recreation. For example, it is not well known to what extent past and current policies have contributed to the relatively inactive roles certain demographic groups (women, individuals with less than college education, older populations) have in outdoor recreation, and what might be done to develop policies to better reach these groups if that were in the interest of policymaking.

Introduction

Outdoor recreation is a popular activity with a great deal of importance to many Americans.[1] Its relevance to public policy is indisputable. For example, public lands management often explicitly seeks to provide the public with access to different forms of outdoor recreation, such as walking, hiking, camping, fishing, or hunting (e.g., USFWS 2008). In addition, government at all levels, including federal, state, and local governments, has made and continues to make considerable infrastructure investments to meet different demands from the public for access to outdoor recreation. In addition to its relevancy to natural resources policy, outdoor recreation is also more broadly important to policy. For example, outdoor recreation positively contributes to physical activity and fitness, which have well-recognized public health benefits (U.S. Department of Health and Human Services 2000). Finally, the importance of outdoor recreation obviously is not limited to the government, but cuts across the entire society, including individual citizens, outdoor recreation groups, the conservation community, and outdoor industries.

The prevalent importance of outdoor recreation means that its popularity trends are of general interest. Trends in outdoor recreation are usually tracked by using measures such as the number of visitors to national and state parks, the number of hunting and fishing licenses sold, and survey-based estimates of participation in different outdoor recreation activities. For example, according to the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS 2002), about 34 million people went angling, 13 million people hunted wildlife, and almost 19 million people took bird-watching trips in 2000. Data from the National Survey on Recreation and Environment, another major recreation survey, suggest that though the popularity of activities such as fishing and hunting has declined, the popularity of other activities, such as bird watching, may be increasing (Cordell 1999; Cordell and Super 2000). Regarding specific outdoor recreation areas, total visitation, for example, to national parks has remained relatively constant over time, leading to steady or slightly declining visitation per capita (e.g., Pergams and Zaradic 2008).

[1] This study is one of a series of studies for the Outdoor Resources Review Group (see www.rff.org/orrg), which is funded through Conservation Fund by the Laurance S. Rockefeller Fund, the Richard King Mellon Foundation, and the David and Lucile Packard Foundation. The author thanks especially Margaret Walls, whose comments throughout this research helped to considerably improve it. The author also thanks Douglas Larson for helpful discussions and comments on the report, and Jeffrey Ferris for excellent research assistance.

Though annual statistics on park visits and some historical data on participation in various outdoor recreation activities are informative, those data provide a partial view of the "total amount of outdoor recreation" over time. For example, the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation focuses exclusively on hunting, fishing, and wildlife-associated recreation, excluding other forms of outdoor recreation. The National Survey on Recreation and Environment, on the other hand, collects data on a wide range of outdoor recreation activities, but it is not designed to collect information on the total amount of effort allocated toward outdoor recreation as a whole. Moreover, data from past outdoor recreation survey instruments are not well suited for developing consistent and representative statistics of the long-term popularity of outdoor recreation in the United States (USFWS 2002). Even so, within their boundaries, recreation surveys provide useful snapshots on the popularity of outdoor recreation.

Much less is known about individuals' use of time for outdoor recreation than the frequency of their involvement in some specific recreational activities, such as fishing or hunting. With the exceptions of Clawson and Knetsch (1966), whose influential book on the economics of outdoor recreation includes an approximate national outdoor recreation time budget, and Robinson and Godbey (1997), whose book documents overall time use by American households and examines its sociological aspects, to our knowledge the amount of time used for outdoor recreation, and especially its long-term development, has not been subject to systematic inquiry. Our goal is to start filling this gap by documenting and examining historical trends in time use for outdoor recreation in the United States during the last five decades.

Time as an individual resource, of course, has received substantial attention in economics research on outdoor recreation. For example, it is standard practice in recreation demand studies to consider time as a form of travel cost to access recreation sites (e.g., Englin and Shonkweiler 1995; Phaneuf and Smith 2005). Valuation of benefits from outdoor recreation therefore critically depends on the valuation of time as a travel cost. Rather than setting travel time values ad hoc at some fraction of the wage rate, some studies have concentrated on estimating the value of travel time by structurally incorporating a time budget constraint into recreation decisions (e.g., Larson and Shaikh 2004; Larson et al. 2004). However, basic research on the general use of time for outdoor recreation, including what explains its historic trends, has not been conducted.

More broadly, this study is motivated by both the practical policy usefulness and the potential scholarly importance of learning more about the use of time for outdoor recreation. General economics research has long recognized the importance of individual time allocation decisions (e.g., Becker 1965), but empirical research on detailed time-use data has only recently become more frequent and recognized (e.g., Hamermesh and Pfann 2005; Aguiar and Hurst

2007). Research on outdoor recreation is an essential subfield of environmental and natural resource economics, and empirical research on time use complements existing research, which mostly relies on visitation data.[2] From a practical policy perspective, better understanding people's use of time for recreation and the drivers of their time-use decisions provides potentially important lessons for the design and evaluation of public policy toward outdoor recreation. For example, much of the policy and physical infrastructure for outdoor recreation was developed decades ago, and it is vital to evaluate whether this infrastructure still meets the demands of today and the future. Today's society also presents new emerging policy problems, such as obesity and other public health issues associated with the physical fitness of individuals. Understanding where and to what extent Americans engage in physically active recreation is important for evaluating public policies intended to promote physical fitness.

Another rising policy topic is the suggested decline in the popularity of nature-based recreation, especially among adolescents. Recently, some authors have suggested that nature-based recreation is "fundamentally and pervasively decreasing" (Pergams and Zaradic 2008; Kareiva 2008) and that children are becoming subject to a "nature deficit disorder" (Louv 2005). This has prompted, for example, legislative efforts (No Child Left Inside) to boost the popularity of nature activities among children. But to evaluate whether outdoor recreation policy and infrastructure adequately reflect these emerging concerns, and to decide how recreation policy and infrastructure might be modified to better meet new and existing policy goals, we first need to better understand the recreational behavior of our population. Time use is an important component of this behavior.

We concentrate in this paper on the following three questions: What was the overall trend in the use of time for outdoor recreation between 1965 and 2007? What were the trends in different demographic groups? What contributed to the major changes observed in this time period: changing demographics, the changing amount of leisure, or some other factors?

Our analysis uses data from six nationally representative time-use surveys conducted between 1965 and 2007 (Fisher et al. 2006; Bureau of Labor Statistics 2008). Overall, these data comprise over 47,000 observations. Time-use surveys collect individual, detailed minute-by-minute observations of the daily use of time over a 24-hour recall period. Survey respondents are provided with diaries that allow the timing and verbatim descriptions of daily activities to be

[2] See Phaneuf and Smith (2005) for a history and current issues in the economics research on demand for outdoor recreation.

easily listed. With the help of meticulous coding manuals, individual listings from completed diaries are converted to measures of the amount of time used in meaningfully specified activity categories. Although the general principles of eliciting and categorizing time-use data have remained fairly unchanged over time, surveys from different years are not exactly alike. For example, the level of aggregation of time-use categories varies between surveys, sometimes considerably. Therefore, one of the main challenges in this research has been to compile a measure of outdoor-related time use that is workable and consistent across data from six different surveys over five decades.

By examining original coding manuals and other material describing each survey, we determined that making consistent comparisons across different surveys requires using relatively aggregate categories to classify the use of time for outdoor recreation. Using detailed categories, such as time spent hiking or fishing, is not practical because some of the surveys, especially those conducted between 1965 and 1993, did not elicit data at that level of detail. Because time-use data were elicited and coded by using more overarching classifications such as "outdoor recreation" and "active sports," we needed to aggregate outdoor recreation and active sports to achieve consistency of time-use data on outdoor recreation from different surveys. We often refer to this aggregate measure in brief as "outdoor recreation."

Our results comprise summary statistics and econometric analyses. Summary statistics are helpful for describing overall changes in time use, such as how many hours on average people used per week in outdoor recreation between 1965 and 2007. Econometric analyses facilitate understanding the drivers of intertemporal changes in the use of time. Econometric models can help identify, for example, the relative importance of the changing amount of leisure and demographics as the determinants of the use of time for outdoor recreation.

In the econometric analysis, we formulate a two-part censored regression model (a hurdle model) to predict individual-level observations on the use of time for recreation. In this model, a probit model first predicts the likelihood of nonzero time use by an individual, and then a continuous regression model predicts the amount of time spent in outdoor recreation by those with a nonzero time use. We use "participation probability" to denote the likelihood of nonzero time use, "active participants" to denote individuals with nonzero time use, and "time use per capita" to denote estimates of the use of time across the entire U.S. population.

We use data on demographics such as age, education, gender, working status, and the number of children in the household to predict both participation probability and time use by active participants. In addition, we are interested in the association between the amount of leisure and outdoor recreation. The amount of leisure per capita by Americans has changed considerably

over time (Aguiar and Hurst 2007). Though this likely affects time use for outdoor recreation, the endogeneity of leisure to outdoor recreation decisions complicates estimating this effect. To avoid biases due to endogenous regressors, we use an instrumental variable method to identify how the amount of leisure has affected outdoor recreation. After developing and estimating a two-part hurdle model to predict time use, we use the model predictions of participation, time use per active participant, and time use per capita to decompose observed intertemporal changes in the use of time for outdoor recreation into factors related to the demographic composition of the population, the amount of individual leisure, and other factors unobservable to us.

Our results show that the amount of time spent in outdoor recreation per capita has considerably increased since 1965. According to our estimates, this long-term increase was largely driven by increasing participation in outdoor recreation. For example, our results suggest that time use per capita for outdoor recreation increased about 2.2-fold between 1965 and 2003. About 85 percent of this increase was due to greater participation; an increased time use per active participant contributed the remaining 15 percent of the change. Our results also show that although there has been an overall increase in the use of time per capita for outdoor recreation, it peaked around 1985–1993 and has thereafter stalled or somewhat declined. Compared to 1985–1993, the use of time in outdoor recreation in 2003–2007 was roughly 20 percent lower. Interestingly, compared to the change between 1965 and 2003, the more recent change in 1993–2003 was more evenly distributed across changes in participation and changes in time use per active participant. More specifically, changing time use per active participant contributed 60 percent of the change per capita between 1993 and 2003, and the rest (40 percent) of the change was due to reduced participation. Demographics, the amount of leisure, and other factors all contribute to the observed changes, but their effects and relative importance vary between participation, time use per active participant, and time periods examined.

In addition to the six time-use surveys we examine here, two earlier studies have been especially helpful to us. First, the American Heritage Time Use Study documented and harmonized different time-use datasets, which we use for the period between 1965 and 2003 (Fisher et al. 2006). Second, Aguiar and Hurst (2007), who rigorously examine changes in leisure between 1965 and 2003, provided us with helpful programs for preprocessing American Heritage Time Use Study data, and we also use their definition of the amount of leisure.

Data

Our data comprise six time-use surveys conducted over five decades between 1965 and 2007 (Table 1). Each survey was designed to be a nationally representative and methodologically rigorous time-use survey. The first three surveys (1965, 1975, and 1985) were conducted by

Survey Research at the University of Michigan between November 1965 and May 1966, October 1975 and November 1976, and January 1985 and December 1985, respectively. The fourth survey (1993) was conducted between September 1992 and October 1994 by the Survey Research Center at the University of Maryland. The last two surveys (2003 and 2007) are part of the American Time Use Survey (ATUS), which the U.S. Bureau of Labor Statistics (2008) has conducted continuously since 2003. Sample sizes vary considerably by survey. The 1965 survey data comprise 1,241 individuals, whereas the 2003 sample has nearly 20,000 respondents. Other surveys have sample sizes between the sample sizes of the 1965 and 2003 surveys. Though some of the surveys originally elicited data from individuals less than 18 years old, others sampled only the adult population. To keep our data consistent across different surveys, we exclude all individuals less than 18 years old from our analysis. As a result, we are left with 47,271 observations between 1965 and 2007.

Response rates by survey vary between 51 percent and 74 percent (Table 1). Because certain subpopulations were either over- or underrepresented relative to their share of the U.S. population, survey data needed to be reweighted to obtain accurate aggregate predictions (Fisher et al. 2006). Population weights assign each individual a unique weight that reflects the share of the U.S. population represented by that observation in the year of the survey. In addition, some of the surveys unevenly sampled different days of the week. For example, in the ATUS sample (2003 and 2007) half of the sample is for weekend days (Saturday and Sunday) and the other half for weekdays. By using day weights, we can generalize the sample estimates to the population level.

Survey protocols and instruments also vary by survey, but in each of them, survey respondents listed their time use by using detailed diaries. Completed diaries comprise minute-by-minute recordings of respondent's involvement in different activities during a 24-hour recall period. In each dataset, these verbatim listings are coded by using primary, secondary, and even tertiary categories. For example, the ATUS surveys (in our data, years 2003 and 2007) by the Bureau of Labor Statistics (2008) categorize time-use data by using the following 17 primary categories:

1. Personal Care
2. Household Activities
3. Caring For and Helping Household Members
4. Caring For and Helping Nonhousehold Members
5. Working and Work-Related Activities
6. Education
7. Consumer Purchases
8. Professional and Personal Care Services
9. Household Services
10. Government Services and Civic Obligations
11. Eating and Drinking
12. Socializing, Relaxing, and Leisure
13. Sports, Exercise, and Recreation
14. Religious and Spiritual Activities
15. Volunteer Activities
16. Telephone Calls
17. Traveling

Each primary category comprises several second-tier subcategories, which are further divided into third-tier subcategories. As a result, typical time-use survey data list observations regarding hundreds of potential activities. When the different activities are added together, they sum up to 1,440 minutes (24 hours). Because our data comprise six surveys with different time-use categorization, it is not practical to explain each survey in great detail here. Therefore, we focus on describing the construction of our key variable: time use for outdoor recreation. Readers interested in learning more about the time-use surveys used in our analysis should turn to the reports by the American Heritage Time Use Study (e.g., Fisher et al. 2003) and the documentation of the ATUS by the Bureau of Labor Statistics (2008). These two sources combined provide comprehensive descriptions of the time-use surveys examined in our analysis.

Of the 17 primary categories of ATUS, we concentrate on activities in category 13: Sports, Exercise, and Recreation. Under that category, time use is further classified into several second-tier subcategories, including both physically active and physically inactive forms of recreation. We focus solely on the physically active forms of recreation and exclude activities such as attending sports events as a spectator. The physically active forms of recreation are further classified in ATUS into 37 more specific third-tier categories. These categories include activities such as playing baseball, playing basketball, biking, boating, bowling, climbing, dancing, equestrian sports, fishing, football, golfing, hiking, hunting, skiing, walking, and so forth. Earlier surveys (1965–1993) use analogous yet more general categories. In these surveys, subcategories denoting active recreation generally distinguish between “active sports,” “outdoor recreation,” and “exercise” (Appendix 1). However, the code books of the early surveys are too general for unambiguously determining under which third-tier subcategories different forms of physically active recreation were recorded. For example, the 1985 survey lists “walking” as a possible activity under two different third-tier categories of time use. The 1993 survey uses only “active sports,” “outdoor recreation,” and “exercise” as third-tier subcategories. Under this

classification, for example, walking or hiking might be classified under any of the three third-tier subcategories. However, despite their idiosyncrasies, different surveys provide data for identifying a combination of time-use categories, under which all outdoor recreation and other physically active recreation were classified by different surveys and under which no other activities than outdoor recreation and other physically active recreation were recorded. Given our goal of compiling consistent measures of time use across different time periods, we therefore combine all leisure activities associated with outdoor recreation and active sports. We call this variable "Outdoor Recreation and Active Sports" and refer to it generally as "outdoor recreation." Using variables and examples of activities from the original datasets, Appendix 1 lists and describes the variables that comprise our variable "Outdoor Recreation and Active Sports."

Historical Trends

According to our estimates, in 1965 the U.S. adult population spent on average 0.93 hours per capita per week on outdoor recreation and active sports (Figure 1). This estimate steadily increases throughout the next three decades, first to 1.48 hours per capita per week in 1975, then to 2.23 hours per capita per week by 1985, and thereafter to 2.68 hours per capita per week in 1993. Thereafter, the use of time for outdoor recreation has slightly decreased. It was 1.86 hours per capita per week in 2003 and 2.00 hours per capita per week in 2007. Comparing the averages of the peak period (1985–1993) and the two most recent surveys (2003 and 2007) suggests that the use of time for outdoor recreation in 2003–2007 was roughly 20 percent of its peak in 1985–1993. However, from a historical perspective, even the 2003–2007 level of time use on outdoor recreation is relatively high. Moreover, though the use of time for outdoor recreation decreased between 1993 and 2003, the declining trend has not continued since 2003.

Patterns in participation in outdoor recreation are similar to those in the time use per capita (Figure 2). In 1965, 8.9 percent of the U.S. population actively participated in outdoor recreation on the recall day. Rate of participation increased to 11.5 percent in 1975 and to 18.5 percent in 1985. Thereafter, participation has remained relatively level, with 18.1 percent, 16.5 percent, and 17.5 percent of the population active in outdoor recreation on recall days in 1993, 2003, and 2007. Notice that our estimates of participation relate to participation per day (each survey used a 24-hour recall period). For this reason, the percentage of the population that, for example, weekly or monthly participates in outdoor recreation would likely be considerably higher than our estimates of daily participation.

Gender differences in the use of time are salient and persistent over time (Figure 3). In 1965, women's use of time for outdoor recreation was a meager 38 percent of the amount of time

men used for outdoor recreation (0.5 versus 1.4 hours/week). In the following decades, both men and women increased their use of time for outdoor recreation, but the gender gap closed only slightly. The percentage difference was smallest in 1993, when women's use of time for outdoor recreation was 58 percent of that of men. A gender gap exists also in participation, though it has narrowed over time (Figure 4). For example, whereas 6 percent of women and 12 percent of men actively participated in outdoor recreation in 1965, 16 percent of women and 21 percent of men were active participants in 1985. In 2003, the gender gap almost closed with 15 percent of women and 18 percent of men participating.

The percentage of total leisure spent in outdoor recreation follows similar trends as participation, though the amount of time used for outdoor recreation as the percentage of the total amount of leisure is small (Figure 5). By the amount of leisure, we denote the residual of total time allocated to duties related to work, sleeping, home production, child care, education, personal and medical care, caring for other individuals, and civic and religious activities.[3] Leisure comprises activities such as reading, watching TV, other entertainment, socializing, gardening, hobbies, and sports and exercise. The percentage of leisure per person spent in outdoor recreation increased from 2.5 percent and 3.1 percent in 1965 and 1975, respectively, to 4.9 percent and 5.4 percent in 1985 and 1993, respectively, and then leveled off to 4.5 percent and 5.2 percent in 2003 and 2007, respectively. In comparison to men, women spend considerably less of their leisure time in outdoor recreation (Figure 5), though this difference between men and women has slightly narrowed during the last three decades. In 1965, women used 2 percent and men used 4 percent of their leisure in outdoor recreation; in 2007 the same estimate was 4 percent for women and 6 percent for men.

Age groups vary both in their time use (Figure 6) and participation in outdoor recreation (Figure 7). However, differences across age groups are more idiosyncratic than the exceedingly systematic differences by gender. By and large, individuals under 35 years old used more time and participated more frequently in outdoor recreation than older population groups. Although for the population under 35, the amount of leisure has remained relatively constant since 1965 (Figure 8), this age group has roughly tripled the percentage of the total amount of leisure allocated toward outdoor recreation (Figure 9). Another noteworthy observation is the dramatic increase in the amount of leisure for the age group 60 years and older (Figure 8). Compared to 1965, individuals in this age group have decreased the percentage of the total amount of leisure

[3] This coincides with "Leisure Measure 1" by Aguiar and Hurst (2007).

spent in outdoor recreation (Figure 9). However, because their leisure has considerably increased, the total number of hours per person spent in outdoor recreation has remained nearly unaffected for the age group 60 years and older (Figure 6).

Econometric Modeling

A Censored Regression Hurdle Model of Time Use

Our goal in the econometric modeling is to better understand the factors that influence time-use decisions as well as to learn more about the relative importance of different drivers of the historic changes in the use of time for outdoor recreation. We are interested in the different dimensions of time use for outdoor recreation, including participation, time use by active participants, and time use per capita (average across all population, including participants and nonparticipants). Our data include both active participants and nonparticipants, and we use data on both groups in the econometric modeling. The share of active participants of the total sample varies from 8.9 percent (1965) at the lowest to 18.6 percent (1985) at the highest. Because data on the amount of time used for outdoor recreation include so many observations at zero, we use tobit-style censored regression models for the econometric analysis.

Typically, a censored regression model starts with the premise that the observed dependent variable, y, stems from an incompletely observed latent dependent variable y^*. Our data comprise positive values censored at zero, so the model can be specified as:

$$\begin{aligned} y_i^* &= x_i'\beta + \varepsilon_i \\ y_i &= \max(0, y_i^*) \end{aligned} \tag{1}$$

where y_i is the observed amount of time used for outdoor recreation (hours per week), y^*_i denotes a latent dependent variable for individual i, x_i represents the attributes of individual i, β is a vector of coefficients, and ε_i is a random error term. If an individual spent more than zero hours in outdoor recreation, y^*_i is observed. Otherwise, $y_i = 0$.

The model above supposes that participation and time use per active participant are governed by the same process. In the context of our study, this assumption seems overly restrictive. Instead, it is likely that participation and time-use decisions are more separate. To allow for this possibility, we use a two-part model, in which different processes can drive participation and time-use intensity decisions. Our two-part censored regression model has the following structure:

$$P(y_i > 0) = f(x_i, \beta_1, \varepsilon_{1i}) \tag{2.1}$$

$$\begin{aligned} y_i^* &= f(x_i, \beta_2, \varepsilon_{2i}) \\ y_i &= \max(0, y_i^*) \end{aligned} \tag{2.2}$$

where $P(y_i > 0)$ denotes the probability that individual *i* is an active participant. The above model is often referred to as a hurdle model (Mullahy 1986), or a Cragg model for its original formulation by Cragg (1971). As common, we specify the participation decision (2.1) by using a probit model so that $\Pr(y_i > 0) = \Phi(x_i, \beta_1, \varepsilon_{1i})$, $\varepsilon_{1i} \sim N(0,1)$. The probability of observing zero time use is $P(y^* \le 0) = P(x_i'\beta_1 + \varepsilon_{1i} \le 0) = \Phi(-x_i'\beta_1 / \sigma)$, where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function (Cameron and Trivedi 2005).

We model the intensity of participation (2.2) by using a log-normal model $\ln(y_i^*) = \ln(f(x_i, \beta_2, \varepsilon_{2i}))$, where $\varepsilon_{2i} \sim N(0, \sigma^2)$. Under this structure, ε_{1i} and ε_{2i} are distributed normally and their joint distribution is:

$$\Omega = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho \\ \rho & \sigma^2 \end{pmatrix} \right]. \tag{2.3}$$

Ideally, we would like to estimate ρ as a free parameter. However, incorporating a nonzero ρ in the context of instrumental variables and discrete-continuous models is challenging, and we leave it a subject of future work. As an alternative, we considered a seemingly unrelated regression approach, which would have combined linear regression models for both participation and time use per active participant. Though this alternative approach can produce consistent estimates (Cameron and Trivedi 2009) and is not uncommon, for example, in labor economics, we prefer using a nonlinear probability (probit) model for predicting participation even though it requires assuming $\rho = 0$. Our data include many nonparticipants, so the overall probability of participation is low. In this setting, a linear probability model tends to predict many negative choice probabilities, which we want to avoid.[4]

Next, using an indicator $d_{it} = 1$ to denote observations for which $y_i = 0$ (otherwise $d_{it} = 0$), the log-likelihood function is determined as a mixture of discrete and continuous densities (Jones 1989; Cameron and Trivedi 2005):

[4] When $\rho = 0$, models for participation and time use by active participants can be estimated separately.

$$LL(\beta_1,\beta_2,\Omega)=\sum_1^n\left\{(1-d_{it})\ln\left[1-\Phi(x_i'\beta_1/\sigma_1)\right]+d_i\left(-\frac{1}{2}\ln 2\pi-\frac{1}{2}\ln\sigma^2-\frac{1}{2\sigma^2}(y_i-x_i'\beta_2)^2\right)\right\} \quad (3)$$

Model (2) usefully nests the censored regression model specified by (1); it can be estimated by using the above log-likelihood function under the constraint $\beta_1=\beta_2$. As a result, likelihood ratio tests can be used to determine which model—a standard censored regression model (1) or a hurdle model (2.1)–(2.3)—better represents the data. In the preliminary analyses using alternative models, likelihood ratio tests consistently and unambiguously rejected model (1) in favor of the more general model (2). Therefore, we rely exclusively on the two-part model (2) in the following analyses.

Three types of predictions are relevant to this model (Amemiya 1985; Mullahy 1998; Cameron and Trivedi 2005, 2009):

First, the expected probability of participation is determined by:

$$E(y_i>0\mid x_{1i})=\Phi(x_i'\beta_1) \quad (4.1)$$

Second, given a log-normal model, expected time use per active participant is given by:

$$E(y_i\mid x_i,y_i>0)=\exp(x_i'\beta_2+\sigma^2/2) \quad (4.2)$$

Third, expected time use over the entire population is given by:

$$E(y_i\mid x_i)=\exp(x_i'\beta_2+\sigma^2/2)\Phi(x_i'\beta_1) \quad (4.3)$$

Model Specification and Estimation

We concentrate exclusively on modeling time-use data from surveys conducted in roughly 10-year intervals between 1965 and 2003. Therefore, in order to achieve consistency in the length of time between surveys, we do not include the 2007 data in the econometric analysis. The exclusion of 2007 is not critical, but it helps to focus on the long-term trends of time use. We use day and sampling weights in the estimation so that the estimation results are directly usable for generating population-level predictions for each survey year.

We use all available individual data on demographics and the amount of leisure to predict individual time use. Table 2 lists and describes variables used in the estimation, including their summary statistics. We rely mostly on dummies to ensure flexible model specification. In the following, we specify criteria determining when different dummies get a value of one; otherwise, they are at zero. Variables *Year_1965*, *Year_1975, Year_1985*, *Year_1993*, and *Year_2003* are

dummies for surveys conducted in 1965, 1975, 1985, 1993, and 2003, respectively. *Male* is a dummy for men. Variables *Age_Group1*, *Age_Group2*, *Age_Group3*, *Age_Group4*, and *Age_Group5* are dummies for the age groups 18–29 years, 30–39 years, 40–49 years, 50–59 years, and 60 years or more. *Education_1*, *Education_2*, *Education_3*, and *Education_4* are dummies for the maximum educational level attained by the individual (less than high school, high school, some college, and college or more, respectively). *Kids* is a dummy for households with kids. *Weekend* is a dummy for Saturdays or Sundays as recall periods. *Working_FT* and *Working_PT* are dummies for individuals working full time or part time, respectively.

Leisure is a continuous variable denoting the amount of leisure per person per week. Though the amount of leisure likely affects outdoor recreation decisions, it is also likely that leisure is not determined independently from outdoor recreation choices. The endogeneity of the amount of leisure means that estimating its effect on outdoor recreation by using ordinary regression would produce inconsistent estimates. Using the probit model (2.1) for illustration, we handle leisure as an endogenous regressor by using an instrumental variable approach with the following structure:

$$y_i = x_i'\beta_1 + L_i'\beta_{Le} + \varepsilon_i \tag{5.1}$$

$$L_i = x_i'\omega_1 + x_{2i}'\omega_2 + u_i \tag{5.2}$$

where y_i is the latent variable for individual i, L_i is the amount of leisure, and x_i is a vector of exogenous regressors. Vector x_{2i} comprises additional instrumental variables that affect L_i but are excluded from the main equation (5.1) to achieve identification. The model is estimated in two stages: equation (5.2) with parameters ω_1 and ω_2 is estimated in the first stage to develop an identifying instrument so that the effect of L_i can be consistently estimated in the second stage by using the main equation (5.1).

We use instrumental variable estimation both for the probit model predicting participation and for the continuous regression model predicting time use per active participant. For the log-normal model, the instrumental variable formulation is expressed by (5.1) and (5.2) by replacing y_i with y^*_i, the log-normal dependent variable. We use the same exogenous variables for the estimation of both probit and log-normal models. The variable *Weekend* provides the necessary exclusion restriction. In other words, x_{2i} above comprises *Weekend*, and *Weekend* is not in x_i. Our justification for using *Weekend* for the necessary exclusion restriction is that *Weekend* well predicts the amount of leisure, but it is not a strong determinant of time use per active participant when the amount of leisure is controlled for.

Missing data from different surveys regarding several potentially relevant variables prevent us from using yet richer specifications. For example, the 1965 and 1993 data do not include any information on the geographical location of the respondent. Information on home ownership status is missing for 1985 and 1993. Surveys from 1965 and 1985 did not collect general information on the ethnic group of the respondent. 1975 lacks data on Hispanics. Number of small children (under five years) is missing for 1993, as is the marital status of the respondent. Employment income is not available for 1965, 1975, and 1993, and the 1993 survey does not include any sort of income data. Because at least some surveys are missing data for the above variables, we exclude them from the model specification. However, we include all potentially relevant exogenous variables for which data are available consistently across all the surveys conducted since 1965.

Estimation Results

Table 3 lists the estimation results of our econometric models. Results in the left half of Table 3 (models 1a and 1b) are for the probit models predicting the likelihood of participation. Results in the right half of Table 3 (models 2a and 2b) are for the continuous regression models predicting time use per active participant. Models 1a and 2a use regular estimation (not an instrumental variable approach) and therefore do not include the amount of leisure as an independent variable. Models 1b and 2b incorporate the amount of leisure by using instrumental variables. Though they lend support to the treatment of *Leisure* as an explanatory regressor, we do not list or discuss the first-stage estimation results here. However, they are available in Appendix 2.

In each of the models presented, we estimate a constant and exclude for identification dummies *Year_1965* and *Age_Group5*. The age group five (60 years and older) in 1965 therefore provides the baseline in the estimation of model parameters.

Differences between the results from the regular regression models 1a and 2a and the instrumental variable models 1b and 2b illustrate the importance of being able to control for the amount of leisure. For example, in the regular regression model for time use per active participant, the coefficients of year dummies are all either statistically significant or close to it. However, in the instrumental variable model, only one of the year dummies is statistically significantly different from zero; others are highly insignificant. This suggests that intertemporal changes in the amount of leisure rather than other, unobserved decadal changes in time-use decisions drove time use per active participant. In the same set of models, variable *Working_FT* gets a negative, but a statistically insignificant coefficient in the regular regression model. However, the instrumental variable model estimates a statistically significant and positive

coefficient for the same variable. Though the statistical significance does not flip for other coefficients other than annual dummies and *Working_FT*, the magnitude of estimates varies, sometimes considerably, between the regular regression and instrumental variable models. For instance, the coefficient estimates are markedly different for gender-, age-, and education-specific dummies in the models for time use per active participant. Overall, these results demonstrate that using instrumental variable estimation not only helps to incorporate the amount of leisure as an endogenous regressor, but it also affects the estimates for other coefficients.

We use the instrumental variable models 1b and 2b for our final results. They highlight interesting differences between participation and time-use decisions. For example, annual dummies are mostly statistically significant in the participation model, but generally insignificant in the time-use model. Therefore, controlling for other variables, participation rates varied across different years, but time use per active participant did not. Estimation results regarding different age groups are almost a mirror image of this pattern. Except for *Age_Group4*, age group dummies are not statistically significant in the participation model, but they are statistically significant in the model for time use per active participant. Therefore, though age does not seem to determine who participates in outdoor recreation, age does affect how many hours each active participant spends in outdoor recreation. The magnitude of the estimated coefficients for the age group variables suggests that time use per active participant decreases with age. According to our results, given participation, 18–29-year-olds use 35 percent more time, 30–39-year-olds use 38 percent more time, 40–49-year-olds use 26 percent more time, and 50–59-year-olds use 13 percent more time than those 60 years old or older.

Before further discussing the estimation results, we note that the incremental effects for the participation model are listed separately table in Table 4. We use the term "incremental effects" instead of marginal effects because all variables except for *Leisure* are dummies. To be consistent, we then also show the incremental effect for leisure by predicting the effect of 10 additional hours of leisure per week on participation. Because the baseline matters in the calculation of the incremental effect, we show the incremental effects by using both 1965 and 2003 for predicting baseline participation. For each dummy variable, we list the full effect of turning the dummy on versus off. This effect is calculated by first predicting baseline participation with a specific dummy at zero and all other variables at their sample means. "New" participation is then predicted by switching the dummy to one while continuing to keep everything else at their sample means. The incremental effect is calculated as the difference between "baseline" and "new" prediction. We do not present marginal effects separately for the time use per active participant model because they are easily obtained from the coefficients. Because we estimate a log-normal model, the coefficients roughly approximate the percentage

change in the dependent variable per one unit change in the independent variable. A precise estimate of the marginal effect of variable *x* on *y* is obtained as $\frac{\Delta y}{\Delta x} = e^{\beta_x}$, where β_x is the estimated coefficient for *x*.

Returning back to the estimation results, they confirm considerable gender differences in the use of time for outdoor recreation. The coefficient *Male* is statistically significant and positive for both participation and time use per active participant (Table 3). The estimates suggest that keeping everything else constant, participation rate for men is 3.4 percentage points higher than for women (Table 4). Given that our prediction for women's participation ranges from 7.1 percent in 1965 to 8.4 percent for 2003,[5] the participation rate of men is nearly one and a half times that of women. The coefficient *Male* in the model for time use per active participant suggests that as active participants, men use about 16 percent more time in outdoor recreation than women. Combining differences in participation and time use per active participant, men use about 70 percent more time on outdoor recreation, keeping everything else equal.

Variable *Kids* is negative and statistically significant in the participation model, but statistically insignificant in the time-use model. In other words, individuals with children in the household are less likely to participate than those with no children, but when individuals with children decide to participate, they spent the same amount of time in outdoor recreation as others do. The estimated incremental effect for *Kids* predicts that the participation rate for individuals with kids is about 1.1 percentage points lower than that for individuals without kids (Table 4).

Variable *Working_FT* is estimated a negative and statistically significant coefficient in the participation model but a positive and statistically significant coefficient in the model for time use per active participant. This means that in comparison to others, individuals working full time are less likely to participate, but when they do participate, they use more time by participation than others. The participation model predicts that individuals in full-time employment have about 1.4 percentage points lower participation rate than those who are not in full-time employment (Table 4). Working full time increases the amount of time spent in outdoor recreation per active participant by about 4 percent.

The estimation results show that education is a strong determinant of participation. The greater the educational level of an individual, the higher his or her participation in outdoor recreation. Participation in groups *Education_1* and *Education_2* is from 6.5 to 7 percentage

[5] Note that this prediction is for the sample means of explanatory variables, not across the overall population.

points lower than the baseline prediction (11–12 percent). In other words, individuals with at most high school education are about half as likely to participate as those with higher education but otherwise similar backgrounds. Interestingly, the results for the time-use model suggest that given decision to participate, time use per active participant tends to decrease with increased education. This effect, however, is more moderate than the effect of education on participation.

Finally, the amount of leisure is positively associated with both participation and time use per active participant. The more leisure an individual has, the greater his or her participation rate and time use per participation. In the model for participation, coefficient *Leisure* is not strongly statistically significant ($p = 0.06$). Nevertheless, the coefficient estimate suggests that 10 hours of additional leisure per person per week increases the rate of participation by 0.6 percentage points (Table 4). The statistically highly significant coefficient in the model for time use per active participant suggests that one additional hour of leisure per week increases an individual's time use for outdoor recreation by about 2 percent. Because one hour is about 2.5 percent of the average total leisure time per week in our sample (41.55 hours; Table 2), the elasticity of outdoor recreation with respect to the amount of leisure is quite high for the participants in outdoor recreation. To examine this elasticity in more detail, we also estimated a log-log model of leisure and time use for outdoor recreation. Those results suggested that the elasticity of time use for outdoor recreation by an active participant with respect to the amount of leisure is about 0.65.[6]

Decomposing Intertemporal Changes in Time-Use Decisions

Next, we predict participation in outdoor recreation, time use per active participant, and time use per capita for different time periods, and then use these predictions to decompose major intertemporal changes in time use for outdoor recreation into factors related to changing demographics, the changing amount of leisure, and "other factors," which are unobservable to us. Predictions are obtained by using equations (4.1)–(4.3) and the estimation results from instrumental variables models 1b and 2b (Table 3).[7] Demographics include all exogenous variables in our model except for the amount of leisure and year dummies. Year dummies represent "other factors" that we cannot observe. Each year's prediction uses the average

[6] For brevity, we do not present a full set of results from the log-log specification. However, it provides similar general findings as the log-normal model. Identification of the log-log model is difficult in practice using a log-log model, especially in the IV context.

[7] In addition to results in Table 4, we need an estimate of σ^2. Using auxiliary estimation, $E(\exp(u) = E(\sigma^2/2) = 1.0802$.

individual characteristics of that year's sample. Because we conduct all the above predictions by using instrumental variables models, demographics and other factors affect time use both indirectly as the instruments of the amount of leisure (in the first stage model [5.2]) and directly as the determinants of participation and time use per active participant.

We examine time periods 1965–2003 and 1993–2003 in the decompositions. Year 1965 is interesting because it is the starting point of our analysis period. It is also the time period with the lowest time use per capita for outdoor recreation in our sample (Figure 1). Year 1993 represents the peak in the time use per capita for outdoor recreation. Year 2003 is the end point of the period examined here, and it also shows a slight decline in time use per capita since year 1993.

In the results, we present separate decompositions for participation, time use per active participant, and time use per capita. This way the effects of different factors on participation and time use per active participant, as well as their combined effects on time use per capita, can be highlighted. This approach also demonstrates the relative effects of changing participation and time use per active participant on time use per capita.

Because both participation and time-use models are nonlinear in the dependent variable, we use the underlying latent variables to gauge the effects of different factors. Otherwise, incremental effects would depend on the order in which demographics, the amount of leisure, and other factors are assessed. The basic idea in the decomposition is to estimate the overall change in the latent variable from one year to another, and then to separate the overall change into effects associated with changing demographics, the changing amount of leisure, and other factors. For the participation model, we first predict the value of the probit index function in, for example, 1965 and 2003 (denoted by $\hat{y}_{1965}$ and $\hat{y}_{2003}$). The overall change in the index function is $\Delta\hat{y} = \hat{y}_{1965} - \hat{y}_{2003}$. To decompose this change into demographics, changes in the amount of leisure, and changes in other factors, we then obtain three additional predictions:

1. Demographic factors: $\Delta\hat{y}_D = (x_{D(03)} - x_{D(65)})'\beta_D$, where $x_{D(03)}$ and $x_{D(65)}$ are vectors of the demographic variables in 2003 and 1965, and β_D is a vector of their estimated coefficients;
2. Amount of leisure: $\Delta\hat{y}_L = (x_{L(03)} - x_{L(65)})\beta_L$, where $x_{L(03)}$ and $x_{L(65)}$ denote the amount of leisure in 2003 and 1965, and β_L is the estimated coefficient for the amount of leisure; and

3. Other factors: $\Delta\hat{y}_A = (x_{A(03)} - x_{A(65)})'\beta_A$, where $x_{A(03)}$ and $x_{A(65)}$ denote vectors of other factors (annual constants) in 2003 and 1965, and β_A is a vector of their estimated coefficients.

The contributions of changing demographics, the changing amount of leisure, and other factors to the overall change between 1965 and 2003 are then calculated as $\Delta\hat{y}_D / \Delta\hat{y}$, $\Delta\hat{y}_L / \Delta\hat{y}$, and $\Delta\hat{y}_A / \Delta\hat{y}$, respectively. Decomposition of changes associated with time use per active participant is calculated similarly, but using $\ln(y_i^*)$ for the index function.

Table 5 presents the results of the decompositions. The first three rows of results in Table 5 list baseline predictions for participation, time use for active participant, and time use per capita in 1965, 1993, and 2003. Below the baseline estimates, Table 5 first lists the decomposition of change between 1965 and 2003; the lowest segment of the table lists the decomposition of change between 1993 and 2003.

Table 5 shows that between 1965 and 2003, predicted participation in outdoor recreation increased by 92 percent (from 8.5 percent to 16.3 percent). Changing demographics accounted for 20 percentage points of this change, the changing amount of leisure contributed 10.4 percentage points, and other factors supplied 61.5 percentage points. During the same time period, time use per active participant increased by 15.8 percent. Demographic change between 1965 and 2003 had a negative effect on time use per active participant, contributing a 7.9 percentage point reduction to it. However, the amount of leisure increased considerably between 1965 and 2003, which lifted time use per active participant by 19.5 percentage points. The role of other factors is moderate; they increased time use per active participant by 4.2 percent. As a combined effect of the changes in participation and time use by active participant, time use per capita increased by about 122 percent. Most (85.3 percent) of this change was due to increased participation; increased time use per active participant contributed only 14.7 percent to the overall change between 1965 and 2003. Of the overall increase (122.3 percent) in the use of time per capita, 13.8 percentage points were due to changing demographics, 33.9 percentage points were due to increased leisure time, and 74.6 percentage points were due to other factors.

The drivers of the change in time use per capita between 1993 and 2003 are markedly different. The 22.2 percent decline in the use of time per capita is more evenly distributed across changes in participation and time use per active participant, with time use per active participant having a greater role. About 60 percent of the change between 1993 and 2003 was due to reduced time use per active participant, whereas reduced participation rate contributed about 40 percent of the overall reduction in time use per capita. Demographic factors increased participation by 4.7 percentage points, but the amount of leisure and other factors reduced it by

0.5 and 13.6 percentage points, respectively. As a consequence, participation declined overall by 9.4 percent. Time use per active participant, on the other hand, declined by 14.2 percent. Demographic changes reduced it by 2.3 percentage points, declining amount of leisure contributed an 8.6 percentage point reduction, and other factors added a 3.2 percentage point reduction. Overall, demographic change between 1993 and 2003 increased time use per capita by 2.3 percentage points. However, the declining amount of leisure and other factors reduced it by 8.6 and 15.9 percentage points, respectively. All these changes combined resulted in a 22.2 percent reduction in the time use per capita between 1993 and 2003.

Discussion

Historical data from time-use surveys provide interesting insights to the recreation behavior of the U.S. population over time. The overall trends between 1965 and 2007 indicate that in the long term, the use of time per capita for physically active recreation has considerably increased. Despite the recent slight decline, the use of time per capita for outdoor recreation continues at a level about twice the level in the 1960s. Though our findings lend some support to the arguments that the popularity of outdoor recreation might be declining, the most recent data (2003–2007) suggest that the use of time per capita for outdoor recreation has been relatively stable, not decreasing, over the last five years or so.

Time-use data and our analysis show that considerable changes in the use of time per capita on outdoor recreation can be driven largely by changes in the amount of time used for outdoor recreation per active participants. In other words, holding daily participation constant, demand for recreation may vary simply due to changing time use by active participants. Given this observation, expanding outdoor recreation surveys (e.g., USFWS 2002), which outdoor resource agencies regularly conduct to track the popularity of outdoor recreation, to elicit at least some time-use data may be worth considering. However, as this study has demonstrated, time-use surveys usually have collected, and are perhaps best suited for collecting, data using fairly aggregate categories of outdoor recreation activities. For this reason, in the context of outdoor recreation, well-designed user and population surveys also are necessary for examining in greater detail the popularity of specific recreational activities such as hunting, fishing, hiking, or bird watching.

We have conducted this analysis with an eye toward providing dependable results of general interest. However, several limitations should be kept in mind while interpreting our results. As we have already discussed, historical time-use data do not allow separating nature-based recreation from other physically active recreation. The relative popularity of nature-based recreation and other physically active recreation is central to how well our estimates depict also

the trends of nature-based recreation. If the relative popularity of nature-based recreation and other physically active recreation has remained constant over time, our results well represent also the trends in nature-based recreation. On the other hand, if the relative popularity of nature-based recreation has substantially changed over time, aggregate measures of time use may give misleading results regarding the popularity trends of nature-based recreation. For example, if sports activities such as baseball or football today contribute much more to our aggregate measure of time use than they did two, three, or four decades ago, our estimates could show a steady or possibly an increasing trend in the popularity of outdoor recreation even if nature-based recreation remained constant or trended downward. On the other hand, if nature-based recreation has become relatively more popular over time, our aggregate measure of time use could underestimate its real popularity increase. Unfortunately, we have no historical data on the relative popularity of nature-based recreation and other physically active recreation. Though it seems possible that other physically active recreation has increased in popularity, plausible counterarguments also are easily formulated. For example, health clubs nowadays provide opportunities for physical activity that were not available in the past, and physical sports therefore might have become relatively more important. However, people today also engage in a plethora of outdoors sports and recreation that were not popular or even practiced just a few decades ago. Mountain biking, motorized water sports, other motorized recreation, snowboarding, bird watching, rock climbing, and many other forms of recreation are practiced at entirely different levels today than in the past. Given these observations, it is not possible to unambiguously determine whether our aggregate measure of time use for recreation accurately estimates of the trends in nature-based recreation. And if inaccuracies exist, their directions are difficult to unequivocally determine.

Throughout the econometric analysis, we have assumed that the estimated coefficients are time invariant. So for example, we assume that the associations between recreation, age, and education do not considerably change over time. In reality, of course, it may be that some of the parameters of the model vary by time. If this were the case, our estimates represent average effects over our study period. We attempted to use a more flexible model specification, which would have estimated time variant coefficients for different age groups, for example. This way we could have examined whether time use by individuals in the same age group at different points in time are similar. Unfortunately, this approach is too demanding given the number of observations we have for the early study period. Nevertheless, these additional estimations hinted that when everything else is controlled for, individuals in same age groups in different time periods may not be very different in their time use. Though the coefficients were mostly

statistically insignificant, they suggested that the paths of time use over the life an individual might be fairly similarly shaped across our sample and time periods examined.

Though we consider our results informative, we lacked data to address several potentially important questions. For example, we control for the unobserved factors by using annual fixed effects, but we are unable to conduct more systematic evaluations of the unobservables. For example, we have no data on access to outdoor recreation. This is unfortunate because access to outdoor recreation has considerably changed since the 1960s. In the first two decades of our study period, federal and state governments worked diligently to improve access to outdoor recreation. Many national and state parks were established, and outdoor recreation was generally supported by the governments. The situation today is somewhat different. Though large areas remain designated for outdoor recreation, their infrastructure is aging and requiring increased maintenance. Access to parks is affected by user fees, and they have generally increased in recent years. Distance and the ease of traveling to outdoor recreation resources is another important dimension of access to outdoor recreation. Much of the outdoor recreation infrastructure is located far away from where people live, and today's population is increasingly concentrated in urban centers near the coasts. Although the road network and access to personal transportation probably has improved within the last four decades or so, population movement farther away from outdoor recreation resources might have increased the level of effort required to reach them. In urban areas, where most people now live, outdoor recreation resources exist but are seldom plentiful. Therefore, evaluating how changes in the access to outdoor recreation affect time use for outdoor recreation is an important research topic. We hope to address it in the future by using data from time-use surveys that are detailed and have relatively large samples. Using time-use surveys with location identifiers, and combining their data with spatial information on land uses and the availability of outdoor recreation resources, could help estimate how access to outdoor recreation affects decisions to engage in it. Such information would be especially helpful for designing outdoor recreation policy and evaluating its benefits. Examining the recreation behavior of adolescents would also be useful, especially given the growing concerns regarding their sagging interest in nature-based recreation. Addressing how competing forms of recreation, such as digital entertainment, affect outdoor recreation would also be important in future research. Recent time-use surveys by the U.S. Bureau of Labor Statistics, which use fairly disaggregate activity categories and include data for 16- to 18-year-olds, may provide data to shed light on these issues.

How do the findings from this research fit the broader context of outdoor recreation and outdoor recreation policy? First, public policies during the last five decades or so to greatly improve access to outdoor recreation, for example, by establishing national and state parks and

other recreation areas, likely have contributed to the long-term increase in outdoor recreation, though the exact magnitude of these effects is difficult to discern. Second, the popularity of outdoor recreation continues at high levels today, but participants may be able to spend less time in recreation than before. Many factors likely contribute to this trend, among them the declining amount of leisure in groups most active in outdoor recreation, possibly increased competition among different forms of recreation, and, perhaps, the fragmentation of leisure and consequent challenges in finding common leisure among all individuals in the household. In any case, when the availability of free time is reduced, accessing remote recreation resources becomes more difficult, and near-home outdoor recreation opportunities become increasingly important. Local-level resources thus become more significant in the context of outdoor recreation policy. Third, demographic differences in outdoor recreation are pronounced and persistent. It would be important to assess to what extent these trends have resulted from outdoor recreation policy versus "natural" tendencies such as differences in the preferences of different demographic groups toward outdoor recreation. For example, it is not well known to what extent past and current policies have contributed to the relatively inactive roles certain demographic groups (women, individuals with less than college education, older populations) have in outdoor recreation, and what might be done to develop policies to better reach these groups, if that were in the interest of policymaking.

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Figures and Tables

Figure 1. Time Spent in Outdoor Recreation and Active Sports in 1965-2007 (hrs/week/person)

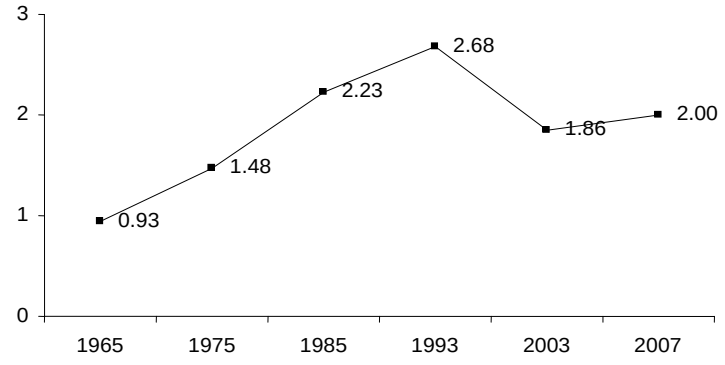


Figure 2: Daily Participants as a Percentage of Total Population

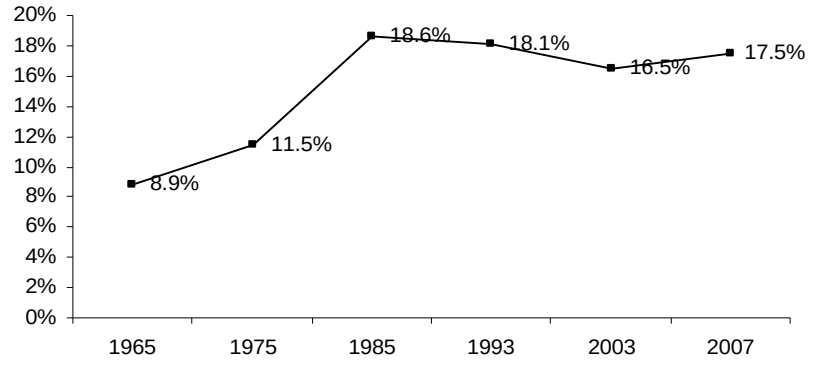


Figure 3: Time Spent in Outdoor Recreation and Active Sports, by Gender (hrs/week/person)

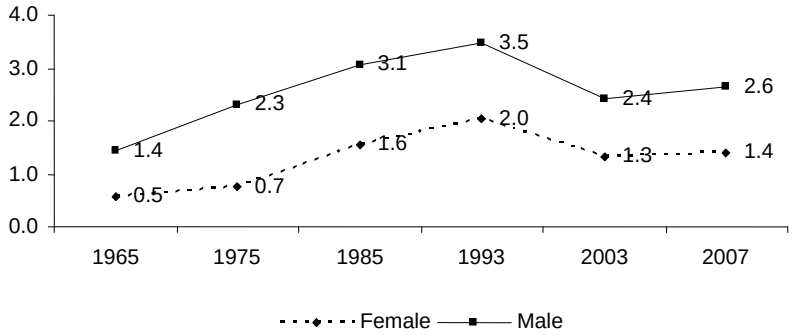


Figure 4: Daily Participants in Outdoor Recreation and Active Sports, by Gender

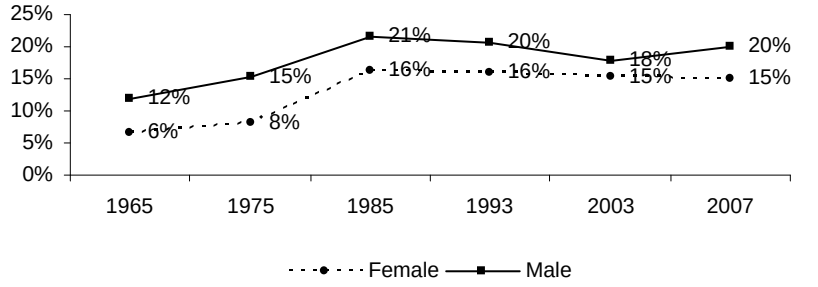


Figure 5. Percentage of Leisure Spent in Outdoor Recreation 1965-2003, Overall and by Gender

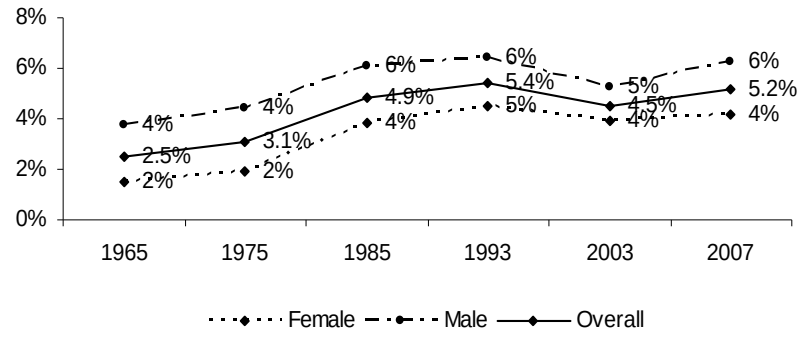


Figure 6: Time Spent in Outdoor Recreation and Active Sports, by Age Group (hrs/week/person)

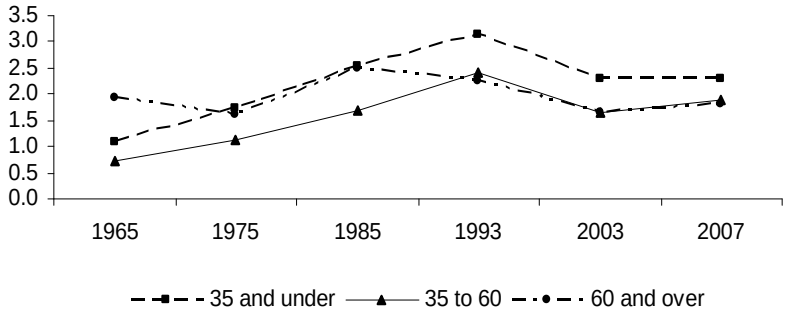


Figure 7: Daily Participation in Outdoor Recreation and Active Sports, by Age Group

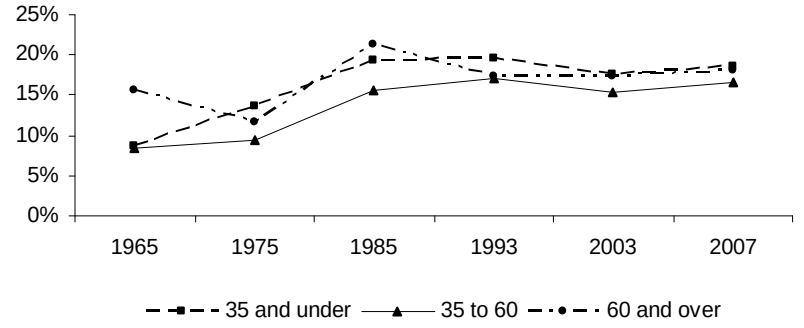
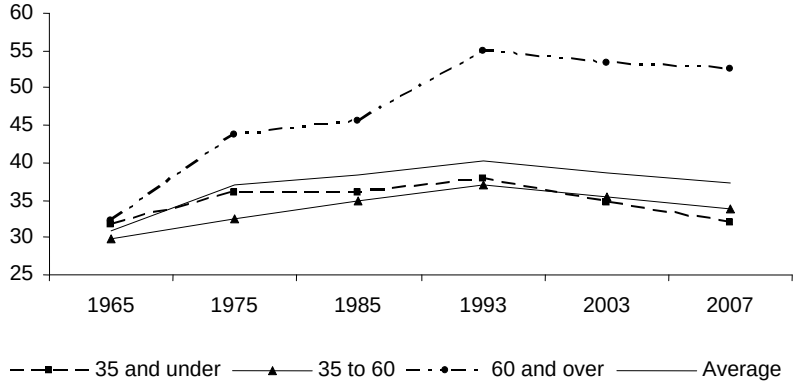


Figure 8: Leisure, by Age Group (hrs/week/person)



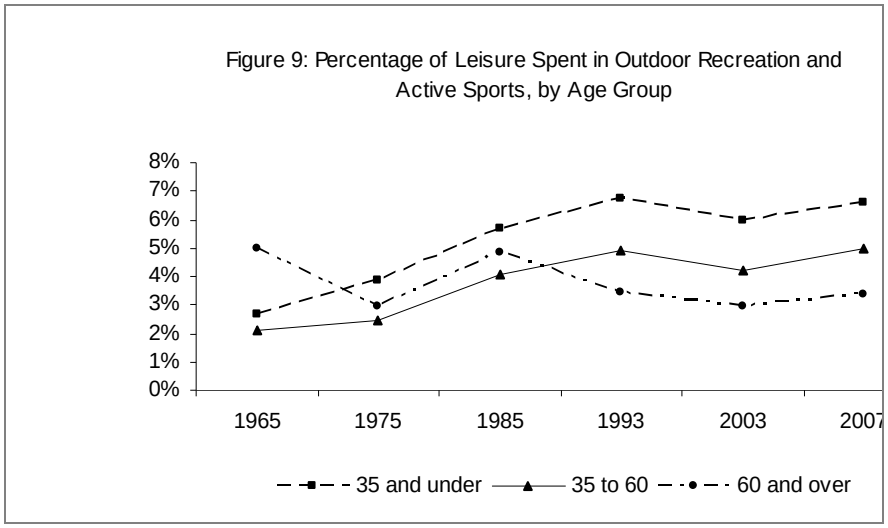


Figure 9: Percentage of Leisure Spent in Outdoor Recreation and Active Sports, by Age Group
8%
7%
6%
5%
4%
3%
2%
1%
0%
1965
1975
1985
1993
2003
2007
35 and under
35 to 60
60 and over

Table 1. Description of Time-Use Surveys

Survey	*Year*	*Administrator (funding)*	*Number of Observations**	*Response rate*	*Field work period, other notes*
Comparative Time-Budget Research Project	1965	Survey Research, University of Michigan (NSF)	1,241	74%	November 1965–May 1966, targeted working age (19–64) population
American's Use of Time	1975	Survey Research, University of Michigan (NSF, U.S. Dept. Health, Education, and Welfare)	2,394	72%	October 1975–November 1976, targeted adult (18+) population. Panel survey with four waves, only the first wave (October–December) included here.
Americans' Use of Time	1985	Survey Research, University of Michigan (NSF, ATT)	4,939	51%	January 1985–December 1985, targeted past secondary school age (10+) population. Only 18 years or older are included in this study.
National Human Activity Pattern Survey	1993	Survey Research Center, University of Maryland (U.S. EPA)	7,322	63%	September 1992–October 1994, targeted individuals of any age. Only 18 years or older are included in this study
American Time Use Survey	2003	Bureau of Labor Statistics	19,759	58%	Continuous throughout the year, targeted 15 years or older population. Only 18 years or older are included in this study
American Time Use Survey	2007	Bureau of Labor Statistics	11,606	53%	Continuous throughout the year, targeted 15 years or older population. Only 18 years or older are included in this study

* In our analysis. We exclude from the original 1965 dataset its separate Jackson (MI) sub-sample. Other datasets exclude from the original datasets individuals less than 18 years old. Total number of observations is 47,271.

Table 2. Variables and Their Summary Statistics

	Mean	Std. Dev.	Min.	Max.	Description
Year_1965	0.04	0.18	0	1	Year 1965
Year_1975	0.07	0.25	0	1	Year 1975
Year_1985	0.14	0.35	0	1	Year 1985
Year_1993	0.20	0.40	0	1	Year 1993
Year_2003	0.55	0.50	0	1	Year 2003
Male	0.44	0.50	0	1	Gender (male = 1)
Age_Group1	0.18	0.39	0	1	Age 18–29
Age_Group2	0.21	0.41	0	1	Age 30–39
Age_Group3	0.20	0.40	0	1	Age 40–49
Age_Group4	0.16	0.36	0	1	Age 50–59
Age_Group5	0.25	0.43	0	1	Age 60 or older
Education_1	0.15	0.36	0	1	Less than high school
Education_2	0.34	0.47	0	1	High school
Education_3	0.24	0.43	0	1	Some college
Education_4	0.28	0.45	0	1	College or more
Kids	0.55	0.50	0	1	Family with children
Weekend	0.42	0.49	0	1	Weekend recall period
Working_FT	0.64	0.48	0	1	Working full time
Working_PT	0.11	0.31	0	1	Working part time
Leisure	41.55	25.13	0.12	168.00	Leisure, hrs/week

Note: All variables except for leisure are dummies.

Table 3. Estimation Results

	Participation Probability						Time Use by Active Participant					
	Model 1a			Model 1b (IV)			Model 2a			Model 2b (IV)		
Variable	Estimate	*t*-value	*p*-value	Estimate	*t*-value	*p*-value	Estimate	*t*-value	*p*-value	Estimate	*t*-value	*p*-value
Constant	–0.924	–8.910	0.000	–1.089	–7.540	0.000	1.449	10.450	0.000	0.587	3.490	0.000
Year_1975	0.121	1.910	0.056	0.105	1.650	0.099	0.062	0.650	0.513	0.003	0.030	0.973
Year_1985	0.414	7.350	0.000	0.395	6.910	0.000	0.117	1.440	0.150	0.044	0.550	0.580
Year_1993	0.415	7.080	0.000	0.357	5.630	0.000	0.332	3.920	0.000	0.074	0.860	0.391
Year_2003	0.290	5.380	0.000	0.261	4.660	0.000	0.126	1.590	0.112	0.039	0.500	0.615
Male	0.245	9.800	0.000	0.213	7.970	0.000	0.344	11.110	0.000	0.145	3.870	0.000
Age_Group1	0.051	1.260	0.207	0.063	1.490	0.136	0.278	5.470	0.000	0.301	6.320	0.000
Age_Group2	–0.050	–1.160	0.248	–0.027	–0.590	0.555	0.232	4.320	0.000	0.319	6.360	0.000
Age_Group3	–0.069	–1.590	0.112	–0.049	–1.080	0.278	0.140	2.440	0.015	0.228	4.470	0.000
Age_Group4	–0.125	–2.930	0.003	–0.113	–2.560	0.010	0.090	1.570	0.116	0.121	2.260	0.024
Education_1	–0.448	–5.040	0.000	–0.482	–5.330	0.000	0.415	3.620	0.000	0.279	2.590	0.010
Education_2	–0.416	–5.310	0.000	–0.451	–5.650	0.000	0.456	4.570	0.000	0.295	3.140	0.002
Education_3	–0.286	–3.430	0.001	–0.308	–3.650	0.000	0.359	3.370	0.001	0.277	2.810	0.005
Education_4	–0.099	–1.280	0.200	–0.111	–1.420	0.156	0.232	2.350	0.019	0.204	2.230	0.026
Kids	–0.083	–2.570	0.010	–0.068	–2.030	0.042	–0.030	–0.720	0.469	0.030	0.780	0.436
Working_FT	–0.153	–4.920	0.000	–0.091	–2.160	0.031	–0.046	–1.170	0.241	0.198	4.200	0.000
Working_PT	0.114	2.530	0.011	0.103	2.180	0.029	0.063	1.260	0.207	0.035	0.790	0.428
Leisure_IV				0.004	1.880	0.060				0.020	8.420	0.000

"Participation Probability" models are probit models for a binary indicator, which equals 1 if the individual listed nonzero time use for outdoor recreation, and zero otherwise. "Time Use by Active Participant" models estimate the logarithm of hours spent in outdoor recreation per week. Models 1a and 2a use regular regression without leisure in the model. Models 1b and 2b use leisure as an endogenous regressor through instrumental variables regression. The number of observations is 34,471 for "Participation Probability" and 5,823 for "Time Use per Active Participant." See Appendix 2 for first-stage estimation results. Age_Group5 in 1965 is the baseline.

Table 4. Predicted Incremental Effects of Independent Variables on Participation*

	Participation, 1965 Data			Participation, 2003 Data			Average Change 1965, 2003
Coefficient	Baseline	New	Change	Baseline	New	Change	
Male	7.1%	10.5%	3.4%	8.4%	12.1%	3.8%	3.6%
Age_Group1**	8.2%	9.2%	1.0%	9.7%	10.8%	1.1%	1.1%
Age_Group2**	8.6%	8.1%	–0.4%	10.0%	9.5%	–0.5%	–0.4%
Age_Group3**	8.7%	7.9%	–0.8%	10.1%	9.2%	–0.8%	–0.8%
Age_Group4	8.8%	7.1%	–1.7%	10.2%	8.3%	–1.9%	–1.8%
Education_1	11.1%	4.4%	–6.7%	11.1%	4.4%	–6.7%	–6.7%
Education_2	11.4%	4.9%	–6.5%	12.4%	5.4%	–7.0%	–6.7%
Education_3	9.3%	5.1%	–4.1%	11.4%	6.5%	–4.9%	–4.5%
Education_4**	8.8%	7.1%	–1.6%	10.4%	8.6%	–1.9%	–1.7%
Kids	9.1%	8.1%	–1.1%	10.4%	9.2%	–1.2%	–1.1%
Working_FT	9.5%	8.0%	–1.4%	10.9%	9.3%	–1.6%	–1.5%
Working_PT	8.4%	10.1%	1.7%	9.6%	11.5%	1.9%	1.8%
Leisure*	8.5%	9.1%	0.6%	9.9%	11.4%	1.5%	1.1%

* Incremental effects are predicted by using results from the instrumental variable probit model of participation (Model 1b, Table 3). Note that except for Leisure, all independent variables are dummies. For dummies, the above estimates denote the full effect of turning the dummy on versus off. For Leisure, we present the incremental effect of an additional 10 hours of leisure per week per person.

** Coefficient is not statistically significant.

Table 5. Results of the Decompositions

	Participation (% of respondents with nonzero time use)	Time use per active participant (hrs/week)	Time use per capita (hrs/week)
Baseline predictions			
1965	8.5%	8.9	0.75
1993	18.0%	12.0	2.15
2003	16.3%	10.3	1.67
Relative change, 1965–2003	92.0%	15.8%	122.3%
% points due to demographics	20.0	–7.9	13.8
% points due to amount of leisure	10.4	19.5	33.9
% points due to other factors	61.5	4.2	74.6
Contribution to overall change, 1965–2003	85.3%	14.7%	100%
Relative change, 1993–2003	–9.4%	–14.2%	–22.2%
% points due to demographics	4.7	–2.3	2.3
% points due to amount of leisure	–0.5	–8.6	–8.6
% points due to other factors	–13.6	–3.2	–15.9
Contribution to overall change, 1993–2003	39.9%	60.1%	100%

Appendix 1

Time-use Categories Related to Outdoor Recreation and Active Sports, by Survey (see Fischer et al. 2006 for more information on different surveys)

Year	*Variables*	*Description, examples extracted directly from the codebook*
1965	v372	Playing or practicing sports; other physical exercise
	v373	Hunting, fishing, camping, excursions, sightseeing
	v374	Taking a walk
1975	V1161	Football, basketball, baseball, volleyball, hockey, tennis, squash, racquetball, paddleball, golf Swimming, water skiing Skiing, skating Frisbee, catch, bowling, pool, ping-pong Exercises, yoga
	V1162	Hunting, fishing, camping, excursions, sightseeing
	V1163	Taking a walk
1985	ACT80	Active Sports
	ACT81	Fishing, hiking, hunting, boating, camping, walking
	ACT82	Walking, biking, running, hiking, horseback riding
1993	ACT80	Active sports
	ACT81	Outdoor recreation
	ACT82	Exercise
2003	Tier 1 code = 13 &	Active sports
	Tier 2 code = 1 &	Participating in sports, exercise, and recreation
	Tier 3 code = 1–37	Doing aerobics, baseball, basketball, biking, boating, climbing, equestrian sports, fishing, football, golfing, hiking, hockey, hunting, rodeo, rollerblading, rugby, running, skiing, skating, soccer, softball, vehicle touring, volleyball, walking, water sports, playing sports

Appendix 2

First-Stage Estimation Results for Instrumental Variable Models for "Participation Probability" (Table 4, model 2a) and "Time Use per Active Participant" (Table 4, model 2b). The number of observations equals that of the corresponding models in Table 4.

	Participation Probability			Time Use per Active Participant		
Variable	Estimate	*t*-value	*p*-value	Estimate	*t*-value	*p*-value
Constant	6.006	16.690	0.000	3.183	1.360	0.173
Year_1975	2.930	4.230	0.000	4.134	2.100	0.036
Year_1985	4.799	8.070	0.000	13.920	6.920	0.000
Year_1993	11.523	18.080	0.000	5.410	2.860	0.004
Year_2003	6.415	11.720	0.000	9.526	10.430	0.000
Male	–3.083	–5.320	0.000	–2.032	–1.380	0.167
Age_Group1	–5.956	–9.770	0.000	–5.472	–3.870	0.000
Age_Group2	–5.064	–8.430	0.000	–4.965	–3.290	0.001
Age_Group3	–3.898	–6.580	0.000	–2.112	–1.440	0.149
Age_Group4	3.473	2.570	0.010	7.212	2.190	0.029
Education_1	3.275	2.650	0.008	8.459	2.920	0.004
Education_2	1.689	1.310	0.190	4.782	1.550	0.122
Education_3	1.052	0.870	0.383	2.304	0.800	0.425
Education_4	–3.872	–8.980	0.000	–3.270	–2.880	0.004
Kids	–15.180	–35.170	0.000	–12.693	–9.940	0.000
Working_FT	3.539	6.020	0.000	1.863	0.890	0.375
Working_PT	13.153	31.960	0.000	14.056	14.240	0.000
Weekend	39.084	26.360	0.000	39.391	10.710	0.000

Note: Statistical tests support estimating the amount of leisure as an endogenous variable in both models. In the model for "Participation Probability," Wald test of exogeneity = 12.16 ($p = 0.0005$). In the model for "Time Use per Active Participant," Durbin and Wu-Hausman tests get values of 5.99 and 5.97 ($p = 0.01$ for both).