# A COMPARATIVE ANALYSIS OF WEEKDAY TIME USE AND ACTIVITY PATTERNS BETWEEN ITALY AND THE UNITED STATES

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**ABSTRACT**
Recent advances in microsimulation modeling of activity and travel demand have recognized the central role played by time use in influencing daily activity-travel patterns. The availability of recent large-scale national time use data sets offer the opportunity to understand and compare daily time use and activity patterns across geographical and socio-cultural contexts. This paper presents a comparison of daily time use and activity patterns between Italy and the United States using national time use data sets collected within the past few years. Such a comparison sheds light on differences and similarities in time use and activity patterns between the contexts and helps one understand the role of socio-economic and demographic attributes in shaping daily time use and activity patterns. The comparison also provides the potential to assess the extent to which activity-based travel demand models may be transferable from one context to another. The paper provides detailed descriptive statistics of time use and activity patterns for Italy and the United States and identifies differences that could play a key role in the specification, development, and application of activity-based models in the respective contexts. In addition, the paper attempts to provide an interpretive discussion regarding the implications of the daily time use and activity patterns for people's quality of life in the respective contexts.

*Keywords*: time use, activity analysis, travel behavior, international comparison, transferability

## 1. INTRODUCTION

Recent advances in microsimulation modeling of travel demand have focused on the central role played by time-space interactions in influencing daily time use and activity-travel patterns. Time is a finite resource. Individuals allocate time to various in-home and out-of-home activities and travel episodes; however, such time allocation behavior is subject to time constraints imposed by the 24-hour clock that governs people's lives. Not only does time availability dictate the pursuit of various activities, but it also influences mode choice, route choice, and destination choice. If time availability is very limited, one may choose to use a faster mode (which may often be the personal automobile), visit a destination that is closer, and/or use a faster route. Thus, there is a clear link between time use, activity engagement, and travel behavior. Understanding daily time use and activity patterns is increasingly being recognized as a prerequisite to the modeling of travel behavior.

In this paper, a comparison of daily time use and activity-travel patterns between Italy and the United States is presented. This comparison is motivated by several considerations. First, there is increasing interest around the world in the development of activity-based microsimulation models of travel demand. In this context, researchers are interested in understanding the extent to which activity-travel relationships and specifications incorporated in models developed in one context may be potentially transferable to a different geographical context. If there are certain common elements that define time use and activity patterns across geographical contexts, perhaps models that represent those elements may be easily transferred across contexts without the need for collecting new data related to those elements.

Second, a comparison of time use and activity patterns can shed considerable light on how land use patterns and transportation infrastructure influence quality of life. Presumably, people would like to spend more time participating in activities that are enjoyable (e.g., social-recreation) and less time stuck in traffic traveling to and from various activities. Italy and the United States offer somewhat contrasting land use and transport infrastructure systems that allows one to draw potentially interesting inferences regarding the role of land use and transportation infrastructure in influencing time use and activity patterns – and therefore, quality of life. In Italy, land use patterns are characterized by high-density concentrated activity centers while in the United States, land use patterns are generally characterized by lower density decentralized activity centers. These differences suggest that people in the United States (hereafter, Americans) will be more automobile-oriented while people in Italy (hereafter, Italians) will be more prone to using alternative modes such bicycle, walking, and public transportation. However, due to the higher land use density, Italians may have to spend more time stuck in traffic thus contributing to differences in travel time expenditures.

Third, daily time use and activity patterns are likely to be influenced by socio-economic and demographic characteristics of individuals and households. In many countries around the world, there are several common themes that are playing out. These phenomena include the increase in percent of multi-worker and multi-car households, decreasing household sizes, rising disposable incomes, increasing penetration of technology, increasing urbanization, and rising levels of suburban development. However, even though these phenomena appear to be recurring themes in cities and countries around the world, there may be important differences in the extent and manner in which these phenomena are occurring in different geographical contexts. These differences may have important consequences for time use and activity-travel patterns. For example, the increase in multiple-worker households in not as high in Europe as has been in the

United States and this difference can have important implications for task allocation, trip chaining, and joint activity engagement.

The focus of this paper is therefore to examine the nature of differences in time use and activity-travel patterns between Italy and the United States as a function of key selected socio-economic and demographic attributes that influence travel behavior. The research study involves examining several dimensions of time use and activity-travel engagement including daily activity time allocation, activity and travel episode-level statistics, and activity episode sequencing and scheduling. The analysis is performed using recent national level time use data sets collected in the respective countries – the 2005 American Time Use Survey (ATUS) and the 2003 Italian Time Use Survey (ISTAT). The paper provides detailed descriptive statistics on daily and episode-level time use and activity-travel behavior and offers key insights into the similarities and differences that exist between the two contexts. The paper concludes with some thoughts on the implications of the findings for activity-based model development and specification, quality of life in relation to land use and transport infrastructure provision, and the role of socio-economic and demographic attributes in explaining similarities and differences.

## 2. TIME USE AND ACTIVITY PATTERN ANALYSIS

There is an extensive body of literature devoted to the analysis of activity and time use patterns. Axhausen and Garling (1992) provide a review of the conceptual issues and challenges associated with activity-based analysis of travel demand while McNally (2000) provides a general overview of the activity-based approach. The book edited by Ettema and Timmermans (1997) about 10 years ago contains a series of articles that describe activity, travel, and time use relationships. Similarly, Pendyala and Goulias (2002) edited a special issue of *Transportation* devoted to the theme of activity and time use perspectives in travel behavior research. Kurani and Kitamura (1996) review developments in the prospects for modeling activity schedules. The role of time in modeling activity-travel behavior has been further articulated very clearly by Pas and Harvey (1997), Pas (1998), Bhat and Koppelman (1999), and Pendyala (2003).

Comparisons of activity and time use patterns across geographical contexts have been undertaken at various times over the past few decades. Szalai (1972) presented a cross-national comparison of time use patterns in 12 different countries. Kitamura et al. (1992) and Pendyala (2003) also present cross-national and within USA comparisons of activity and time use patterns. Gangrade et al. (2000) present a comparison of activity and time use patterns using activity data sets collected in San Francisco Bay Area and Miami, Florida. More recently, Robinson and Godbey (1999) present a cross-national comparison of activity and time use patterns and conclude that Americans have the most free time in their lives as opposed to any period in the past for which data is available.

Cross-national comparisons of activity and time use patterns have generally shown considerable similarity in overall activity and time use profiles (Pendyala, 2003), although there are discernable differences that can be traced to cross-cultural, socio-economic, demographic, land use, and lifestyle differences. Cross-country comparisons of time use patterns have been conducted for numerous purposes. For example, Craig (2006) performs a cross-national inquiry to determine if time use patterns influence fertility decisions. Eurostat (2004) examined how Europeans in various countries spend their time with particular emphasis on gender differences. Fraire (2006) reports on a multiway data analysis for comparing time use patterns across six European countries. Gershuny (2000) examines changing times for work and leisure in post-industrial society in several countries. Harvey and Grönmo (1986) examine social contact and

perform a comparison of use of time in Canada and Norway.  Joesch and Spiess (2006) analyze time spent by mothers looking after children across nine countries. Researchers such as Pendyala et al. (2005) and Southerton (2006) analyze the organization of activities along the time scale while explicitly considering time constraints and other social constraints that exist in the organization of life.  Srinivasan and Bhat (2006) examine joint activity participation characteristics using recent data from the American Time Use Survey.

In summary, it can be seen that there is considerable interest in time use research and in particular, in performing cross-national comparisons that can shed light on similarities and differences in activity and time use behavior and the consequent implications for travel demand modeling, transport policy analysis, and quality of life issues.  This paper is intended to further add to this body of literature and generate behavioral hypotheses relevant to the transportation planning context that merit examination in future studies of activity and time use analysis.

## 3. DATA SETS AND SAMPLE DESCRIPTION

The comparative analysis presented in this paper is based on national time use data sets collected in the United States and Italy over the past few years.  In the United States, the American Time Use Survey (ATUS) is conducted annually since 2003 by the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor.  In the survey, detailed individual-level time use and activity information is collected for a period of one day from a randomly selected individual 15 years of age or older in each of a subset of households responding to the Current Population Survey (CPS), the monthly federal survey of labor force participation in the United States.  For purposes of this paper, the 2005 ATUS survey sample was used in the analysis.  The detailed account of the respondents' activities include the type of activity episode, start and end times of each activity episode, location of activity episode participation, and other individuals participating in the activity episode with the respondent.  Furthermore, data on individual and household demographics, employment characteristics, and characteristics of the day on which the respondent reported activities are also recorded.  Detailed information about the ATUS may be obtained from the ATUS website (http://www.bls.gov/tus/#overview).  Time use and activity data are obtained for Italy from the 2003 Italian Time Use Survey (ISTAT).  ISTAT is very similar to the ATUS and provides disaggregate individual-level activity and time use data.  Thus, ATUS and ISTAT provide consistent sets of information facilitating a rich and insightful cross-country comparison.

In order to facilitate a consistent comparison between the Italian and American time use data sets, appropriate samples were extracted from the survey data sets.  For both data sets, the following rules and steps were applied to ensure consistency in the comparison.  First, only individuals aged 18 years and higher were included in the analysis sample.  Second, individual records that contained missing information were excluded from the analysis.  Thus, only individuals aged 18 and higher who had complete information on all activity records were included in the analysis.  Third, the disaggregate activity classification scheme was aggregated into eight activity types.  They are: (1) *Work/Study* (including work and school related), (2) *Meals* (eating and drinking), (3) *Household Chores* (including family and child care), (4) *Social* (including conversations, free aid to other than family members, parties, visiting friends and relatives, and religious services), (5) *Sport* (including outdoor activities), (6) *Leisure* (unorganized hobbies, arts, games, outings, reading, playing, TV viewing, listening to music, ICT use, telephone calls, relaxing, thinking), (7) *Personal Business* (including shopping, obtaining services, paying bills) and (8) *Personal Care* (sleep and personal care activities).

Table 1 presents a summary comparison of selected key socio-economic and demographic characteristics between the two extracted survey samples.  In both survey samples, it is found that the majority of respondents are female, although the gender split is more even in the Italian data set.  The American data set shows a higher prevalence of individuals in the age bracket of 36-55 years, while the Italian data set shows a higher prevalence of elderly folks 56 years of age and up.  A higher proportion of respondents in the American sample are employed. In the American sample, about two-thirds of respondents indicate that they are employed.  The household size and number of children variables show consistent patterns.  In the American sample, just over one-half of the sample report having no children.  The corresponding percent in the Italian sample is about 35 percent.  The percent of respondents living in 3- and 4- person households is higher in the Italian sample consistent with the higher percentages of respondents reporting living in households with one or two children.  On the other hand, the percent of American respondents who reported living in households with five or more persons is higher than that in the Italian sample.  Similarly, nearly 10 percent of American respondents report living in households with three or more children; the corresponding percentage in the Italian sample is just about 7 percent.  Overall, it appears that the Italian sample is more male and employed, living in larger households with children, and older than the American sample.

## 4. INDIVIDUAL DAY-LEVEL TIME USE COMPARISON

This section of the paper focuses on individual day-level comparisons between the time use and activity patterns of Italian and American samples.  To control for day-of-week effects, the analysis in this paper focuses on weekday activity and time use patterns consistent with the continuing emphasis in travel demand forecasting on weekday activity-travel demand modeling. Table 2 presents a comparison of activity participation rates and overall daily average activity time allocation.

The average daily time allocations are computed for the subsamples of individuals who actually participated in each specific activity.  The comparison makes an explicit distinction between in-home and out-of-home activity participation due to the potential substitution and complementary effects between in-home and out-of-home activity engagement (for example, eat meal inside home versus outside home, work at home versus work at the office, relax at home watching TV versus relax outside home at the park, and so on).

Overall, it appears that time use patterns are rather similar between the geographical contexts.  From a qualitative standpoint, there are no glaring differences in time use patterns that would suggest that there are fundamental differences in activity and time use behavior between the contexts.  However, there are some subtle differences that are very noteworthy and could have important implications for activity-based travel behavior analysis.  Consistent with the higher percent of workers in the American sample, a higher percent of Americans work inside and outside the home compared to their Italian counterparts.  This may be reflective of the higher prevalence of multi-worker households in the US compared to Italy and suggests a greater prevalence of work/study-related constraints in the US sample.  However, among those who actually participate in work/study, the average daily time allocation is quite similar between the contexts - on average, about three hours of work/study in-home and almost eight hours of work/study outside home.  A higher percent of Italians prepare and eat meals at home compared to the Americans.  Conversely, a higher percent of Americans eat meals outside home when compared to Italians.  On average, it is found that Italians dedicate about 1.5 hours to eating

while Americans dedicate a little less than one hour to eating meals.  This appears lower than what one might expect over the course of a day.

US respondents show a higher participation rate in household and family chores than the Italian respondents, particularly in the context of out-of-home activity engagement.  In both Italian and American samples, about 75-80 percent of the respondents indicate participating in in-home household and family chores.  However, the percentages differ considerably for out-of-home household and family chores.  Only about 16 percent of Italians report pursuing this activity type outside home while more than twice that figure (about 40 percent) report pursuing this activity type outside home in the US sample.  Among those who actually participate in the activity, the US sample shows lower average daily time allocations.  These findings are particularly intriguing given the fact that respondents in the American sample come from smaller households and more than one-half indicate living in households with no children.  It appears that American respondents engage in general household maintenance activities at a greater rate than their Italian counterparts.

With respect to Social/Volunteer/Religious activities, a higher percent of Italians report participating in this activity type, both in-home and out-of-home.  However, among those who actually participate in the activity, the US sample shows in-home daily average time allocations higher by about 20 minutes than the Italian sample, while out-of-home daily time allocations for this activity are virtually identical.  An examination of the statistics for Sports and Shopping activities suggest that these activities are undertaken more out-of-home than in-home.  On the other hand, Leisure and Relaxing activities are undertaken much more in-home rather than out-of-home.  Across these three categories, there is considerable consistency between the two samples, both in terms of participation rates and daily average time allocations.  In the US sample, a slightly higher percent engages in sports activities (both in-home and out-of-home), while a lower percent engages in relaxation activities.  In both samples, about 50 percent engage in shopping activities out-of-home and among those who participate in shopping, just over an hour is allocated to this activity.  Considerable time is allocated to relaxation inside home; on average, Italians who participate in in-home relaxation activities spend almost three hours and Americans almost four hours on this activity type.  For those who participate, the Italian sample shows higher time allocations of nearly two hours for both sports and relaxation activities in the out-of-home context.  The American sample shows average activity time allocations of about 30 minutes less.

The authors examined activity participation rates and daily time allocations (among those who participated in an activity category) by gender, age, and presence/absence of children. For the sake of brevity, detailed tabulations and discussions are not presented for each of those analyses. However, all of the tabulations provided results consistent with expectations and many of the similarities and difference seen in Table 2 carried over into the analyses by gender, age, and presence of children. For example, in both Italy and US, males participate in work at a greater rate than women and Americans are found to participate in work at a greater rate than Italians. In both contexts, women are found to engage in shopping activities at a greater rate than men. Remarkably, the percent difference in rate of participation (between men and women for both work and shopping) is very similar across the two contexts. Women participate less in sports activities, but men and women are very similar in their participation of relaxation activities. In both contexts, women participate in and devote more time to household and family chores; however, this is one instance where the difference between men and women is greater in the Italian context (than in the US context) suggesting a greater traditional gender role in the

Italian sample.    The primary difference across age categories is that older individuals, particularly those above 75 years of age participate in and spend less time for work/study and engage more and spend more time in relaxation activities.  This difference is consistent between the Italian and US samples; however, the difference is more pronounced for the US sample suggesting a more dramatic shift in time use and activity patterns among the US elderly (above 75 years of age) in comparison to the Italian elderly (who depict a more gradual shift in time use patterns).    The presence of children leads to enhanced engagement in family and household chores and shopping activities, as expected, but diminished engagement in sports and relaxation activities.    One noticeable difference between the US and Italy is that, in Italy, presence of children leads to diminished participation in religious and social activities; the exact opposite is true in the United States.    Why the presence of children has such an opposite effect in social/religious activity engagement in these two contexts merits further investigation.

Overall, the analysis has shown that there are considerable similarities in activity participation rates and time allocation behavior between US and Italy.  Socio-economic attributes and demographic characteristics also show very similar impacts between the two contexts.  However, the discussion also pointed out some subtle and key differences between the two contexts that suggest a stronger presence of gender role, less devotion to work and study, and more engagement in out-of-home social activities among Italians.  These fundamental lifestyle differences need to be recognized in any activity-based modeling effort.

## 5. EPISODE-LEVEL COMPARISON
This section focuses on individual activity episodes as opposed to the overall daily time allocation examined in the previous section.  Although much can be understood about behavior from daily time use allocation analysis, it is also important to analyze activity participation and time use at the individual episode-level.  This is because there are many facets of travel behavior that are inextricably linked to individual activity episodes and can only be analyzed/modeled through an examination of individual activity episodes.    Activity frequency, scheduling, sequencing, and location can be examined and modeled only in the context of individual activity episodes and not in the context of a daily time use allocation.  As the subject of interest is "travel" behavior, the analysis in this section focuses on out-of-home activity episodes (that entail travel) as opposed to in-home activity episodes.  It is, however, important to recognize that in-home activity episodes are likely to impact out-of-home activity episodes, and therefore, travel.  In the interest of brevity, such a detailed analysis could not be included in the scope of this paper.

Table 3 presents the average number of activity episodes and the average duration per episode for various activity categories.  The statistics are computed for the subsamples that actually report participating in the various activity categories.  Thus, for example, among those who participated in work/study, the Italian sample reports an average of 2.2 work/study episodes per day while the American sample reports an average of 2.5 work/study episodes per day. Average individual episode duration is nearly 4 hours for both samples.  Except for work, household and family chores, and shopping where Americans engage in more episodes per day, Italians engage in higher average number of episodes than Americans.  In other words, Italians engage in more social, recreational, and discretionary activity episodes while Americans participate in more mandatory and maintenance activity episodes.  With respect to average episode duration, Italians spend more time per episode for household chores, relaxation or leisure activities, and shopping activities.    Thus, it appears that, while Italians engage in fewer

maintenance activity episodes outside home, the time spent per maintenance activity episode is higher thus suggesting that maintenance activity engagement is overall rather similar across contexts. Americans have more short-duration episodes while Italians have fewer long-duration episodes. In summary, the analysis suggests the following. Americans engage in more maintenance and subsistence (work/study) activity episodes; however, Italians actually spend more time on a per-episode basis for these types of activities suggesting that the overall engagement in these types of activities is quite consistent across the two contexts. Americans engage in fewer recreational/relaxation episodes and spend less time than Italians on these activities on a per-episode basis. This suggests that Italians, on average, partake in greater level of recreational/leisure discretionary activities, both in terms of number and duration. On the other hand, while the American sample engages in fewer social/religious and sports activities when compared with the Italian sample (similar to leisure activity episode frequency), the time allocation per episode is not smaller (unlike what was seen for the leisure activity category). For social/religious activities, Americans allocate more time per episode and for sports activities, the time allocation per episode is virtually identical. This series of similarities and differences suggest that there are certain fundamental differences in lifestyle, perhaps influenced by socio-economic, demographic, and built environment attributes.

The time use data was used to examine selected travel characteristics in the context of time use and activity episode participation, as shown in Table 4. First, an examination of trip lengths (travel times) was conducted with mean travel times computed for those who actually participated in each activity type. It is found that Italians spend less time traveling to work/study (commuting). However, for all other activity categories, Italians spend as much time or more than Americans traveling to their destinations.

The differences in travel times are best seen in conjunction with a comparative analysis of mode choice between the two contexts. The key findings are consistent with expectations. The Italian sample shows a much higher percent mode split for non-motorized (walk/bike) modes when compared with the American sample. More than 25 percent of commute activities are undertaken by walk/bike. About 50 percent of social and shopping activities are undertaken by walk/bike. About 30-40 percent of relaxation, family/household chore, and meals activities are undertaken by walk/bike. This high percent of walk/bike mode use clearly contributes to the higher travel times as walk/bike is, by nature, a slower mode than the automobile mode. In the United States, about 85 to 95 percent of all activities (regardless of activity type) are undertaken by the faster automobile. Although the automobile-oriented mode use provides faster travel times, it is interesting to note that it is the Italian sample that is engaging more in discretionary leisure activities.

These differences could potentially be explained by the higher mix and density of land uses in the Italian context. This higher density and mix of land uses contributes to a higher level of congestion and provides an environment suitable for bicycling and walking. As a consequence, travel times are higher for the Italian sample. The fact that work/study show lower travel times in the Italian context may be a manifestation of the tendency for Italians to locate residences closer to their work/school location than in the American context. Americans may be considering other factors such as proximity to good schools for children, shopping amenities, and size of home and plot of land in arriving at residential location decisions.

The differences in travel times, mode use, and activity episode engagement raise interesting questions regarding the role of land use and lifestyle in influencing activity and travel patterns and the policy implications of these findings from a quality of life perspective. The

analysis suggests that life in an environment characterized by the dispersion of activities (such as in the USA) reduces travel times (lower congestion levels and more automobile orientation). However, an examination of the episode frequencies and durations by activity type suggests that a higher percent of Italians are able to engage in more relaxation/leisure discretionary activity episodes for longer periods of time. The higher density and mix of land uses coupled with fundamental lifestyle differences are factors that are potentially contributing to this phenomenon.

## 6. ANALYSIS OF WORKER SCHEDULES
The time use and activity patterns of workers tend to be influenced by the rather rigid work schedules and associated temporal constraints. Recent work in the development of activity-based microsimulation model systems has explicitly recognized the time-space constraints often imposed by rigid work schedules (Pendyala et al., 2005; Bhat et al., 2004; Pendyala et al., 2002). The time periods at work may be considered fixed or blocked periods in which other discretionary activities and travel can not be undertaken. The work start and end times may be considered pegs or constraints around which other activities and travel must be scheduled and arranged. In light of the importance of work schedules, it was considered useful to compare work start and end time distributions between the two countries.

Figure 1 presents a comparison of work start and end times between the Italian and American samples for weekday workers. As expected, the work start time distributions show peaks in the morning while the work end time distributions show peaks in the afternoon or evening hours. It is noteworthy that while the work start time distributions show a sharper and more pronounced peak, the work end time distributions tend to be more spread-out with more blunt and less pronounced peaks. This pattern is seen in both countries and constitutes an interesting similarity that is likely to be consistent in an international context. In general, people tend to undertake other household and personal activities during the evening hours either on the way home from work or after work and thus one can surmise that the work end time is at least partially influenced by the other activities that the person plans to undertake in the evening. Moreover, it is possible that part-time workers start work at the same time as full-time workers, but end their work day earlier to take care of household and child care obligations that occur in the early afternoon when schools are dismissed.

Although the overall patterns exhibit similarities as noted in the previous paragraph, there are some noteworthy differences as well. First, the work start time distribution for the Italian sample is taller and shifted to the right in comparison to that of the American sample. This suggests that Italian workers tend to, on average, start work later than their American counterparts, even though the highest point of the distribution occurs at 7-8 AM for both countries. The major difference is seen in the 8-9 AM category; while more than 30 percent of Italian workers start work in this time interval, the corresponding percent for American workers is less than 20 percent. On the flip side, while nearly 20 percent of American workers start work between 6-7 AM, the corresponding percent for the Italian sample is just about 8 percent.

With respect to work end time distributions, the Italian sample shows a small peak in the early afternoon that coincides with the end of school hours for children. This is consistent with the fact that a larger percent of households in the Italian sample have children and are therefore likely to be more obligated to child care activities in the afternoon hours. Therefore, there is a higher percent of Italian workers who end work in the early afternoon hours. However, after this peak event, the distribution of work end times for Italian workers is clearly shifted to the right (later in the evening) of that for the American workers. The Italian workers' work end time

distribution shows peak values between 5-6 PM and 6-7 PM while the American worker sample shows a peak in the period of 4-5 PM.  In general, the work end time distribution for the Italian sample is more spread-out in comparison to that for the United States and is shifted later in the day.  However, there is a larger proportion of American workers who end work late at night (after 9 PM) when compared with the Italian worker sample.   These differences show the influence of children, the impact of traditional gender roles, and the prevalence of more late night establishments in the United States.  In terms of the gender roles, one could postulate that women (who were earlier seen to carry a much larger share of family and child care responsibilities in the Italian context) either do not work or work part time, thus contributing to the early peak in the afternoon at about the time that schools end.  Full time workers, then, do not have the same level of obligation to leave work to take care of the household and are therefore able to work later in the day as per the schedules set by the employers (note that they also start work a little later when compared with the United States).  In the US context, where male and female household roles are more similar, the work end time distribution is unimodal and earlier in the evening so that both adults can take care of household responsibilities.

Finally, this paper presents an analysis of commute-related trip chaining behavior for workers in the Italian and American samples.  Trip chaining has important implications for several travel choices including mode choice, destination choice, and route choice.  Trip chaining offers efficiencies that may free up time for the pursuit of other activities and travel.  Table 5 presents the percent of stops of a certain activity category occurring in the home-work commute versus the work-home commute.  For example, of all meal-related stops made by commuters in the Italian sample, approximately 40 percent occur in the home-work commute and another 60 percent in the work-home commute.  For leisure activity-related stops, however, only about 7 percent of such stops are made on the way to work with the remaining nearly 93 percent occurring in the work-home commute.

Once again, there are both similarities and differences for which hypotheses can be postulated. Household and family chore-related stops are nearly equally split between the home-work and work-home commutes.  This pattern is very similar between the two countries.  About 60 percent of social/religious stops are allocated to the work-home commute, again a statistic that is virtually identical between the two contexts.  For sports activities, about 80-85 percent of the stops occur in the after work period during the work-home commute.  This is consistent with expectations as people are likely to engage in sports activities after work and this finding applies to both Italy and the United States.  However, a striking difference is seen for leisure activity stops where only 7 percent of such stops are in the home-work commute for Italian workers, but one-half of such stops are in the home-work commute for the American worker sample.  This difference is not easily explained; perhaps American workers go for a walk, run, or to the gym in the morning at a higher rate than their Italian counterparts.  On the other hand, it is possible that Italians engage in discretionary activities at a much higher rate in the evening hours than their American counterparts even on weekdays.  As mentioned earlier, Italians are participating in more discretionary activities than their American counterparts.  As these activities tend to be concentrated in the after-work period, the percentage of discretionary stops occurring in this period is much higher for the Italian sample.  In other words, the differences in percentages do not necessarily imply that Italians are undertaking fewer discretionary stops in the home-work commute; it may imply that Italians are undertaking about an equal number of discretionary stops in the home-work commute, but a much larger number of discretionary stops in the work-home commute when compared with the American sample.  With respect to shopping stops,

there is a small difference between Italy and the United States. About 17 percent of such stops occur in the home-work commute for the Italian sample; the corresponding percent for the American sample is about 26 percent. In general, however, a vast majority of shopping stops are allocated to the after-work period during the work-home commute. Finally, an examination of the overall stop-making propensity in the two countries shows that, in both countries, a majority of stops are allocated to the after-work period during the work-home commute. However, there is a subtle difference between the two countries with respect to the percent split; while 70 percent of stops occur in the work-home commute for the Italian sample, the corresponding percentage is about 60 for the American sample suggesting that Americans are more active trip-chainers in the journey-to-work than their Italian counterparts. These trip chaining considerations have important implications for mode choice and time of departure.

## 7. CONCLUSIONS

This paper uses recent national-level time use data sets from Italy and the United States to present a comparison of weekday time use and activity-travel patterns across the two contexts. This comparison is motivated by the interest to identify similarities and differences in time use and activity patterns that lie at the foundation of observed travel behavior and lifestyles. An identification of such similarities and differences can help in the assessment of the transferability of activity-based models and data sets, role of land use and transportation infrastructure characteristics on time use and quality of life, and the relative importance or impacts of various socio-economic and demographic attributes on time use and activity-travel demand.

The paper includes a variety of analyses to shed light on similarities and differences in time use and activity-travel patterns between the two contexts. Both the day-level and episode-level analyses suggest that Italians engage in discretionary (leisure/relaxation) activities at a higher rate than their American counterparts. In addition, when they do engage in these activities outside home, they do so with a higher frequency and for longer periods of time. The converse is true, however, for in-home leisure activities. Another key finding is that Italian households exhibit stronger traditional gender roles in comparison to American households. Women are found to bear a greater share of household and family chores than men in both contexts, but the extent to which women do so is far greater in the Italian context. These findings suggest that there are fundamental lifestyle and household structure differences between the two contexts that contribute to differences in discretionary activity engagement. At the same time, however, the overall clock constraints, work schedules, and other obligations place enough constraints to limit the magnitude of the differences between the two contexts. Overall, activity participation rates and durations show similar profiles with subtle differences as noted here.

With respect to activity-travel patterns, Italians are found to spend more time traveling to activities when compared with Americans, with the exception of the work trip. When viewed in conjunction with mode split distributions, it is found that these higher travel times are easily explained by the much higher use of slower non-motorized modes of transportation in the Italian context. What is interesting to note is that Italians engage in a higher level of discretionary leisure activities despite experiencing higher average travel times when compared with their American counterparts. Once again, differences in lifestyle and family structure and individual constraints may be playing an important role in this phenomenon. However, it is also possible that land use and transportation infrastructure differences contribute to these differences; a higher density and mix of land uses (as seen in the Italian context) may be more conducive to engaging in a higher level of discretionary leisure activities.

The paper also presented a more detailed examination of worker activity schedules and stop-making characteristics. It is found that Italians generally start work and end work later than their US counterparts, except for a particular segment of Italians who end work at the time that schools are dismissed (presumably due to child care obligations with a more traditional gender role). These differences can have important implications for the definition and location of time-space prisms and blocked time periods in the space-time continuum when other activities and travel can not take place. The blunt and more spread-out distributions of work end time distributions in both contexts are consistent with the notion that people engage in more non-work activities in the post-work period than in the pre-work period. Commute-related stop-making characteristics are also consistent with this notion, although there are some interesting differences between the two countries for which several hypotheses can be postulated to explain the differences.

This paper makes an important contribution on at least two fronts. First, it provides an insightful set of descriptive statistics and characteristics about time use and activity patterns in Italy and the United States using large sample national-scale time use data sets. These statistics, by themselves, are useful in that they can be used in the specification and validation of activity-travel models that purport to microsimulate activity and travel patterns in the continuous time domain. The similarities and differences identified in this paper can be used to assess the extent to which model specifications or components may be transferable between the two contexts. In fact, the analysis suggests that patterns of behavior are generally similar enough that model specifications and structures may be transferable with the caveat that the models must incorporate the ability to account for both observed and unobserved factors (e.g., fundamental lifestyle differences, gender roles) that influence activity-travel and time use patterns. However, further comparative analysis of model estimation results needs to be undertaken before any definitive statements can be made in this regard. Second, and more importantly, the paper presents these statistics in the context of a qualitative discussion on the socio-economic, demographic, land use and transport infrastructure, and fundamental lifestyle characteristics of the two countries. In other words, this paper has contributed to quantifying differences and similarities in time use and activity patterns between the two countries and in generating several hypotheses that could explain the similarities and differences observed between the contexts. These hypotheses offer insights into the types of considerations that must be included in land use – transport policy analysis and in the specification and development of activity-based models. In addition, the hypotheses offer valuable directions for future research and data collection efforts; by testing the veracity of the hypotheses, one can determine the extent to which various characteristics and factors contribute to similarities and differences in time use and activity patterns, and consequently travel demand and quality of life.

This paper adds to the body of literature aimed at providing a better understanding of cross-cultural differences and similarities in activity-travel and time use patterns. There are several caveats that apply to the work in this paper. Much of the discussion is qualitative in nature without rigorous test statistics applied to test the statistical significance of the differences noted. As this paper was meant to treat the comparison in qualitative terms, statistical tests were deliberately omitted from the analysis presented in this paper. Also, this paper presents statistics on time use and activity patterns for weekdays; however, activity-travel engagement may need to be viewed from a weekly perspective. In the American context, for example, it is found in this analysis that weekday discretionary leisure activity participation is lower than that in the Italian context. However, it is possible that Americans engage in more discretionary activities during

the weekend – thus making overall weekly discretionary activity engagement very similar between the two contexts. A full-fledged analysis and comparison of weekend time use and activity patterns would help answer this question, i.e., are there compensatory effects between weekday and weekend activity participation? In other words, it may not be appropriate to jump to conclusions regarding the relative quality of life based solely on weekday discretionary activity time use allocation as consideration should also be given to weekend activity participation before such assessments can be made. Finally, although both samples are drawn from rigorous time use surveys, subtle differences in survey methodology, questionnaire wording and format, and survey administration/protocols may impact comparisons of the type presented in this paper. Future work should attempt to isolate and control for these effects.

## REFERENCES

ATUS (2004) American Time Use Survey User's Guide 2003-2004,
    http://www.bls.gov/tus/#docs.

Axhausen, K. and T. Garling (1992) Activity-based Approaches to Travel Analysis: Conceptual
    Frameworks, Models and Research Problems. *Transport Reviews*, 12(4), pp. 323-341.

Bhat, C.R., J.Y. Guo, S. Srinivasan, and A. Sivakumar (2004) A Comprehensive Econometric
    Microsimulator for Daily Activity-Travel Patterns. *Transportation Research Record*
    1894*, Journal of the Transportation Research Board*, pp. 57-66.

Bhat, C.R. and F.S. Koppelman (1999) A Retrospective and Prospective Survey of Time Use
    Research. *Transportation*, 26(2), pp. 119-139.

Craig, L. (2006) Do Time Use Patterns Influence Fertility Decisions? A Cross-National Inquiry.
    *Electronic International Journal of Time Use Research* 3(1), pp. 60-87.

Ettema, D.F. and H.J.P. Timmermans (1997) (eds.) *Activity-Based Approaches to Travel
    Analysis.* Pergamon, Oxford, UK.

Eurostat (2004) How Europeans Spend Their Time. Everyday Life of Women and Men, 1998 -
    2002. http://epp.eurostat.cec.eu.int.

Fraire, M. (2006) Multi-way Data Analysis for Comparing Time Use in Different Countries –
    Application to Time-Budgets at Different Stages of Life in Six European Countries.
    *Electronic International Journal of Time Use Research*, 3(1), pp. 88-109

Gangrade, S., K. Kasturirangan, and R.M. Pendyala (2000) A Coast-to-Coast Comparison of Time
    Use and Activity Patterns. *Transportation Research Record* 1718*, Journal of the
    Transportation Research Board*, pp. 34-42.

Gershuny, J. (2000) *Changing Times – Work and Leisure in Post-industrial Society*. Oxford
    University Press, UK.

Harvey, A.S. and S. Grönmo (1986) Social Contact and Use of Time in Canada and Norway: A
    Comparative Analysis of Time Use Patterns. In D. Aas, A.S. Harvey, E. Wunlipinski, and
    I. Niemi (eds) *Time Use Studies: Dimensions and Applications*, Central Statistical Office
    of Finland, Helsinki.

Harvey, A.S., A. Szalai, D.H. Elliott, P.J. Stone, and S.M. Clark (1984) *Time Budget Research*:
    *An ISSC Workbook in Comparative Analysis*. Campus Verlag, Frankfurt.

ISTAT (2007) Multipurpose Survey Time Use 2002 - 2003,
    http://www.istat.it/dati/catalogo/20070301_00/.

Joesch, J.M. and K. Spiess (2006) European Mother's Time Spent Looking After Children –
    Differences and Similarities Across Nine Countries. *Electronic International Journal of
    Time Use Research*, 3(1), pp. 1-27.

Kitamura, R., J.P. Robinson, T.F. Golob, M. Bradley, J. Leonard, and T. van der Hoorn (1992) A
    Comparative Analysis of Time Use Data in the Netherlands and California. Institute of
    Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-
    92-09.

Kurani, K.S. and R. Kitamura (1996) Recent Developments and the Prospects for Modeling
    Household Activity Schedules. Report for the Los Alamos National Laboratory, Institute
    of Transportation Studies, University of California, Davis, CA.

McNally, M.G. (2000) The Activity-Based Approach. In D.A. Hensher and K.J. Button (eds)
    *Handbook of Transport Modeling* Vol. 1, Elsevier Science, The Netherlands.

Pas, E.I. (1998) Time in Travel Choice Modeling: From Relative Obscurity to Center Stage. In T. Garling, T. Laitila, and K. Westin (eds.) *Theoretical Foundations of Travel Choice Modeling*, Pergamon, Elsevier Science, Oxford, UK.

Pas, E.I. and A.S. Harvey (1997) Time Use Research and Travel Demand Analysis and Modeling. In P. Stopher and M. Lee-Gosselin (eds.) *Understanding Travel Behavior in an Era of Change,* Pergamon, Elsevier Science, Oxford, UK.

Pendyala, R.M. (2003) Time Use and Travel Behavior in Space and Time. In K. G. Goulias (ed.) *Transportation Systems Planning: Methods and Applications*, CRC Press, pp. 2-1 – 2-37.

Pendyala, R.M., R. Kitamura, A. Kikuchi, T. Yamamoto, and S. Fujii (2005) FAMOS: The Florida Activity Mobility Simulator. *Transportation Research Record* 1921, *Journal of the Transportation Research Board*, pp. 123-130.

Pendyala, R.M., T. Yamamoto, and R. Kitamura (2002) On the Formulation of Time Space Prisms to Model Constraints on Personal Activity-Travel Engagement. *Transportation*, 29(1), pp. 73-94.

Pendyala, R.M. and K.G. Goulias (2002) Time Use and Activity Perspectives in Travel Behavior Research. *Transportation* , 29(1), pp. 1-4.

Robinson, J. and G. Godbey (1999) *Time for Life: The Surprising Ways Americans Use Their Time*. Second Edition, Pennsylvania State University Press, University Park, PA.

Southerton, D. (2006) Analysing the Temporal Organization of Daily Life: Social Constraints, Practices and Their Allocation. *Sociology*, 40(3), pp. 435-454.

Srinivasan, S. and C.R. Bhat (2006) An Exploratory Analysis of Joint-Activity Participation Characteristics Using the American Time Use Survey. Technical Paper, Department of Civil Engineering, The University of Texas at Austin.

Szalai, A. (1972) *The Use of Time: Daily Activities of Urban and Suburban Populations in Twelve Countries*. Mouton, The Hague.

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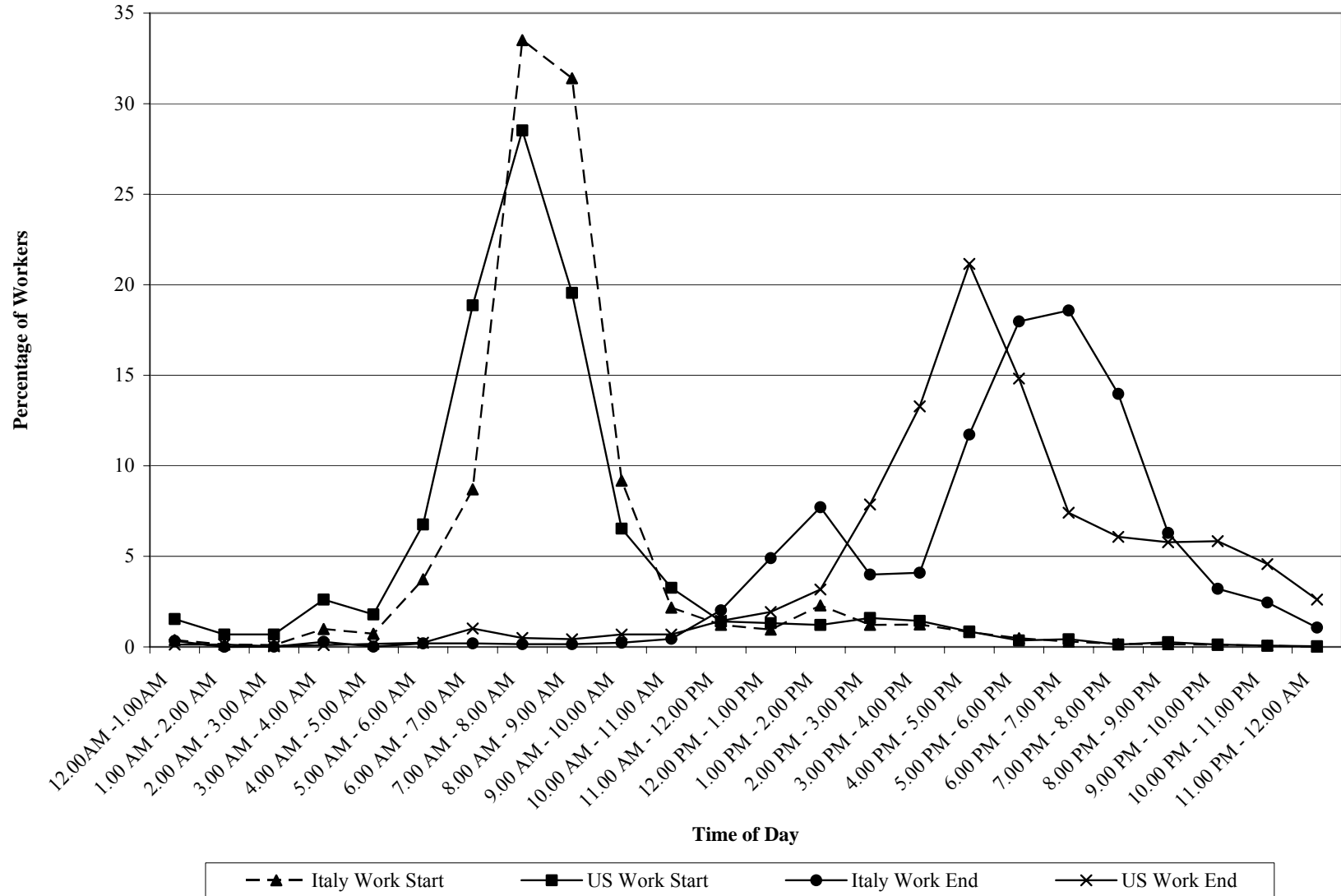**FIGURE 1  Distributions of work start and end times.**

**TABLE 1  Sample Household and Person Characteristics**

| Characteristic | Sample Shares | |
|---|---|---|
| | **Italy** | **United States** |
| Sample Size | 11773 | 4713 |
| *Individual Characteristics* | | |
| **Gender** | | |
| Male | 49.7% | 45.2% |
| Female | 50.3% | 54.8% |
| **Age** (in years) | | |
| 18 - 35 | 28.8% | 29.5% |
| 36 – 55 | 37.3% | 44.7% |
| 56 – 75 | 27.7% | 20.6% |
| > 75 | 6.1% | 5.3% |
| **Employment Status** | | |
| Unemployed | 48.6% | 32.3% |
| Employed | 51.4% | 67.7% |
| *Household Characteristics* | | |
| **Household Size** | | |
| 1 person | 11.2% | 21.4% |
| 2 persons | 24.6% | 27.0% |
| 3 persons | 27.2% | 18.4% |
| 4 persons | 27.0% | 20.3% |
| $\geq$ 5 persons | 10.0% | 12.9% |
| **Children** | | |
| 0 Children | 34.8% | 50.9% |
| 1 Child | 29.4% | 20.1% |
| 2 Children | 28.4% | 19.1% |
| $\geq$ 3 Children | 7.4% | 9.9% |

**TABLE 2  Activity Participation Rates and Daily Activity Time Allocation**

| Location and Activity Type | Italy | | USA | |
|---|---|---|---|---|
| | Participation Percentage | Duration (mins) | Participation Percentage | Duration (mins) |
| *In-Home* | | | | |
| Work/Study | 6.9 | 155.8 | 13.9 | 174.1 |
| Meals | 98.7 | 89.4 | 81.4 | 48.0 |
| Household/Family and Child Care | 76.6 | 209.1 | 80.7 | 170.7 |
| Social/Volunteer/Religious | 29.9 | 53.5 | 22.1 | 74.6 |
| Sports | 1.3 | 38.1 | 4.6 | 47.6 |
| Hobby/Leisure/Relaxing and ICT | 92.4 | 164.0 | 88.6 | 224.7 |
| Shopping | 0.1 | 37.7 | 2.7 | 44.2 |
| *Out-of-Home* | | | | |
| Work/Study | 50.7 | 446.2 | 63.6 | 469.2 |
| Meals | 34.0 | 58.9 | 57.0 | 51.0 |
| Household/Family and Child Care | 16.1 | 82.5 | 40.1 | 54.3 |
| Social/Volunteer/Religious | 45.1 | 105.8 | 29.0 | 107.3 |
| Sports | 9.1 | 105.5 | 13.6 | 90.1 |
| Hobby/Leisure/Relaxing and ICT | 29.7 | 111.4 | 27.0 | 78.1 |
| Shopping | 52.0 | 61.8 | 49.8 | 61.6 |

**TABLE 3  Average Episode Frequency and Episode Duration**

| Activity Purpose | Episode Frequency | | Episode Duration | |
|---|---|---|---|---|
| | Italy | USA | Italy | USA |
| Work/Study | 2.2 | 2.5 | 240.4 | 224.4 |
| Meals | 1.5 | 1.4 | 42.1 | 38.9 |
| Household/Family and Child Care | 1.9 | 2.1 | 48.5 | 28.3 |
| Social and Volunteer/Religious | 2.0 | 1.6 | 61.5 | 74.0 |
| Sports | 1.6 | 1.3 | 74.9 | 74.2 |
| Hobby/Leisure/Relaxing and ICT | 2.0 | 1.5 | 64.8 | 54.7 |
| Shopping | 1.5 | 1.8 | 44.6 | 36.7 |

**TABLE 4  Average Travel Times and Mode Shares by Activity Category**

| Activity Purpose | Travel Time (min) | | Mode Share - Italy | | Mode Share - USA | |
|---|---|---|---|---|---|---|
| | Italy | USA | Car % | Walk/Bike % | Car % | Walk/Bike % |
| Work/Study | 21.1 | 23.3 | 60.3 | 26.5 | 88.9 | 7.4 |
| Meals | 18.2 | 16.7 | 57.2 | 39.5 | 87.6 | 10.4 |
| Household/Family and Child Care | 17.2 | 15.9 | 64.4 | 33.0 | 87.0 | 11.2 |
| Social and Volunteer/ Religious | 17.4 | 17.5 | 47.5 | 49.8 | 85.1 | 12.9 |
| Sports | 18.7 | 14.6 | 70.6 | 25.0 | 90.3 | 8.3 |
| Hobby/Leisure/Relaxing and ICT | 31.0 | 26.9 | 56.4 | 40.4 | 84.1 | 11.2 |
| Shopping | 15.4 | 15.2 | 45.8 | 51.0 | 89.3 | 8.6 |

**TABLE 5  Percent of Stops Occurring in the Commute Trips**

| Activity Purpose | Italy | | USA | |
|---|---|---|---|---|
| | Home-Work Commute | Work-Home Commute | Home-Work Commute | Work-Home Commute |
| Meals | 39.1 | 60.9 | 48.9 | 51.1 |
| Household/Family and Child Care | 53.3 | 46.7 | 48.1 | 51.9 |
| Social and Volunteer/Religious | 40.9 | 59.1 | 38.8 | 61.2 |
| Sports | 19.7 | 80.3 | 15.3 | 84.7 |
| Hobby/Leisure/Relaxing and ICT | 6.7 | 93.3 | 52.1 | 47.9 |
| Shopping | 17.0 | 83.0 | 26.3 | 73.7 |
| Overall | 29.2 | 70.8 | 39.8 | 60.2 |