

## **Differences in Trip Chaining by Men and Women**

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### **ABSTRACT**

Men and women's commuting behavior continues to be distinctly different. The difference may be most apparent in the tendency to trip chain—that is to link short stops into the trip to or from work. As more women entered the workforce, and went from higher education to professional careers, it was widely assumed that women and men's travel behavior would converge. However, research has found persistent gender differences in distance to work, mode of travel and auto occupancy, and the propensity to trip chain. This paper examines whether trends in trip chaining behavior show convergence or the continued persistence of gender differences.

Trends show that trip chaining during the commute increased between 1995 and 2001, and men's trip chaining increased nearly twice as much as women's. The growth in men's trip chaining is robust, but a large amount of that growth is for stops to get a meal or coffee on the way to work. We call this the "Starbucks" effect.

Understanding trends in the incidence of trip chaining, and more importantly the details in terms of the direction, time of day, and purpose of the stops during commuting, helps us understand the persistence of gender roles in travel behavior. Such an understanding is vital to policy directives that aim to change travel behavior to ease congestion, reduce emissions, and save fuel. This paper examines the differences trip chaining behavior between men and women.

## INTRODUCTION

Women's travel is distinctly different from men's. Overall, working age women make more trips but travel fewer miles and minutes than their male counterparts. During their commutes, women make more short stops, and stop for different reasons than men. In addition, the occupations and job locations of working women are different than men's—women work closer to home than men, even within the same general occupation categories.

The focus of this paper is to examine trends in trip-chaining between men and women. Levinson and Kumar (1995) reported an increase in trip chaining. They related the increase to higher family incomes and less time as women have entered the workforce, and the fact that dual career households buy services (such as day care) that were formerly conducted in the home. McGuckin and Murakami (1999) determined that trip chaining was predominantly the domain of females, rather than males, in the household, even as women have entered the workforce. Bianco and Lawson (1998) found specifically that the work trip was becoming more complex as workers incorporated personal, household, and child-care activities into their commutes. Likewise, Nishii, Kondo, and Kitamura (1998) discovered that an important secondary role for the work trip was to provide an opportunity to link non-work travel.

Few researchers have examined trends in trip chaining behavior. Definitions of what constitutes an incidental stop between destinations such as home and work can complicate the comparisons between years and/or areas. In this paper trends are derived from the 1995 Nationwide Personal Transportation Survey (NPTS) and the 2001 National Household Travel Survey (NHTS). Both datasets were processed using the same definitions, which defines an incidental stop during the commute as a stop of 30 minutes or less. The similarities in survey design and the definition of variable allow comparison between the two years, although the short time frame between the surveys gives an indication of direction rather than a 'trend'. However, the findings suggest that there has been an increase in trip chaining during the weekday commute between 1995 and 2001.

Between 1995 and 2001, women made more short stops on the way to or from work than men to perform household-sustaining activities, such as shopping and family errands, and working women in two-worker families were twice as likely as men to pick-up and drop-off school age children at school during their commute.

In the same period, (1995 to 2001), men added more stops into their commutes for child-care and household errands, especially men in families with young children. But a substantial part of the growth in men's trip chaining was to make a short stop for a meal or coffee on the way to work.

To the extent that trip chaining is a more efficient use of time and fuel, increasing such behavior is good. But what if the increase in trip chaining is for the kind of activities that were previously done at home, such as breakfast and coffee, but now are an added trip during the morning commute? If adding a trip changes the travel route or departure time, it complicates the forecasting of travel demand. Since adding a trip may add an engine start (or for drive-throughs, idling time) such stops may not bode well for the air quality.

Understanding trends in the incidence of trip chaining, and more importantly the details of trip chaining behavior in terms of the direction, time of day, and purpose of the stops during

commuting, helps us understand the persistence of gender roles in travel behavior. Such an understanding is vital to policy directives that are aimed to change travel behavior to help ease congestion, reduce emissions, and save fuel.

## DEFINITION OF TRIP CHAINING

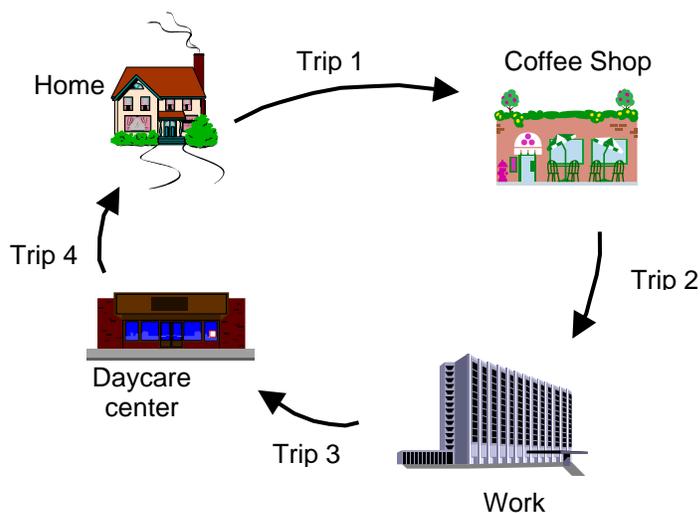
The NHTS, like most household travel surveys, collects travel information about trips—movement from one address to another. In this way, every movement by any mode for any distance is reported for all respondents.

A trip chain is a sequence of trips linked together between two anchor destinations, such as home and work. Economists, geographers, and transportation planners have recognized trip-chaining behavior since the 1960s, but even then the conceptualization of a trip chain was easier to agree on than the definition (Thill and Thomas, 1987).

Still today, there is no formal agreement on the definition of a chained trip, and little empirical research on the incidence or trends in trip-chaining behavior within comparable travel markets or using comparable data for the same market has been published. Different terms and expectations exist as to what types of trips should be considered as part of a chain, whether only trips for certain purposes (e.g. dropping a passenger) or only trips with certain dwell-times (e.g. 15 minutes or less). Some of the earlier national research used no time or purpose constraints at all (Strathman and Dueker, 1995 and McGuckin and Murakami, 1999), so direct comparison with that earlier work is difficult.

Trip chaining may be difficult to define, but this common behavior complicates our understanding of commuting. Like the example in Figure 1, a person can make a total of 4 separate trips but two chained trips during their commute—from home to a coffee shop to work and then from work to a daycare center and then home. If looked at as separate trips, the trip from home to the coffee shop would not normally be seen as part of the commute. But linked together with the next trip, from the coffee shop to work, we see the chain of trips from home to work.

Figure 1 - Example of Four Trips and Two Trip-Chains



Stops made during a commute may be regular, daily activities, weekly scheduled activities, or infrequent and unscheduled. The stops may take the traveler well out of his or her way, or be very close to home or work. Since the NPTS/NHTS data series obtains travel for a sample day, the frequency of stops during an individual worker's weekly commute is not known.

Destinations in the national datasets are not geocoded to latitude and longitude, so the proximity to home and work are also not known.

However, using a common definition (trip-chains include stops of 30 minutes or less) allows analysis of the change in incidence and purpose of short stops during the commute between 1995 and 2001. The analysis presented in this paper describes the trends in trip chaining using this definition.

### DIFFERENCES IN WORK LOCATION AND OCCUPATION

Over the last decades, women have increased driving and have their own vehicles, have better education and professional careers, and as a result women's travel has grown immensely, and the nature of their travel has radically changed. These changes have had a permanent effect on travel behavior analysis and transportation planning and policy.

Working women make more trips than working men (110 more trips/year), but the trips are shorter on average. The largest differences are found in households with small children, where women make 5.2 trips to men's 4.7, but travel on average 12 fewer miles a day (shown in Table 1).

Table 1 – Miles and Minutes of Travel per Day for Men and Women Workers, 2001

|       |                          | Trips/Day | Miles/Day | Minutes/Day |
|-------|--------------------------|-----------|-----------|-------------|
| Men   | No Child                 | 4.6       | 62        | 103         |
|       | Small Child (<6 yrs.)    | 4.7       | 58        | 104         |
|       | Middle Child (6-15 yrs.) | 4.8       | 63        | 105         |
|       | Teen Child (16-21 yrs.)  | 4.8       | 52        | 98          |
| Women | No Child                 | 4.7       | 50        | 94          |
|       | Small Child (<6 yrs.)    | 5.2       | 46        | 90          |
|       | Middle Child (6-15 yrs.) | 5.4       | 47        | 93          |
|       | Teen Child (16-21 yrs.)  | 5.0       | 45        | 90          |

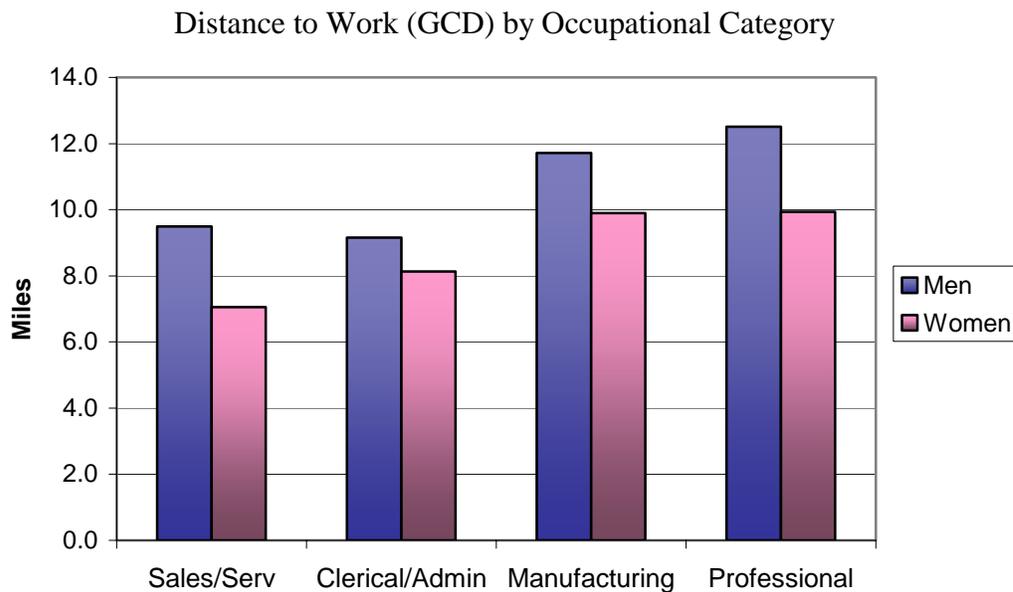
One of the reasons for the difference in travel miles is that women have traditionally held jobs closer to home than men. In the 2001, women report working about 11 miles from home compared to 15 miles for men. Wachs (1998) notes that while women have moved into the labor force, they are over-represented in what is called the 'secondary' work force, consisting of part-time and seasonal workers. The NHTS shows that women are twice as likely to be part-time workers (12 percent of women but only 6 percent of men are part-time).

Secondly, Wachs says women are concentrated in occupations such as clerical and sales work. These positions pay lower wages, and it is argued that women do not search for jobs farther away because they gain no wage advantage in these traditional occupations.

Thirdly, Wachs argues that women may work closer to home because the suburbanization of service and retail activity has resulted in ‘women’s’ jobs being more evenly distributed than the professional and technical jobs typically held by men. Spain (1998) asserts that the jobs women are concentrated in (teaching, clerical, and nursing) differ in that they are closer to home and require less travel.

However, Figure 2 shows that even within the same general occupation category women chose jobs closer to home. Figure 2 shows the distance to work measured as the crow flies (the great circle distance (GCD)). Professional, managerial, and technical women work, on average, 2.6 miles closer to home than men in the same occupations (9.9 miles vs. 12.5). Because these occupational categories are large and inclusive, it would be interesting to analyze differences in distance to work from an establishment survey to see if directly comparable occupations in the same location showed the same differences in trip length to work.

Figure 2 -



Another explanation offered in the literature focuses on family commitments (child and elder care). For example, Gordon, Kumar, and Richardson (1989) postulate that women may work closer to home to minimize their work-related travel time and maximize the time they have for non-work related trips and activities.

Single women work closer to home than single men, but the difference in distance to work becomes more pronounced in 2-adult families with children. Some evidence of the amount of time women spend in household-sustaining activities comes from the recent American Time Use Survey ([www.bls.gov/tus/home.htm](http://www.bls.gov/tus/home.htm)). The 2003 results show that employed adult women (18 and over) spend about an hour more per day than employed adult men doing household activities and caring for household members. Twenty percent of men reported doing housework on the

survey day compared to 55 percent of women, and 35 percent of men did food preparation or cleanup compared to 66 percent of women.

### TRENDS IN MEN'S AND WOMEN'S TRIP CHAINING

Almost two million more workers stopped during their commutes in 2001 compared to 1995—overall, nine percent more workers trip-chained during their commute. This compares with an 8 percent growth in civilian employment in the same time period, according to the Census.

Men and women both increased, especially in the home to work direction. For men the increase was dramatic in the home to work direction—24 percent more men stopped during their commute in 2001 than in 1995 (see Table 2).

Table 2 – Percent Change in the Number of Workers who Trip Chain 1995 and 2001

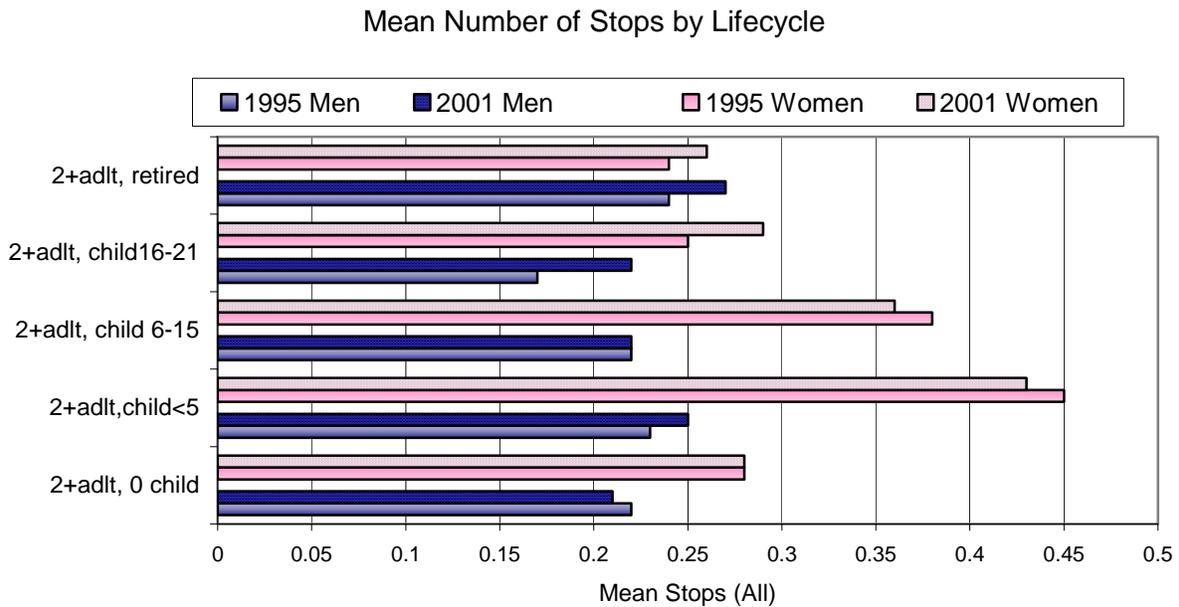
| Number of Men and Women who Chain Trips Into Commutes |       | 1995      | 2001      | %Change 95-01 |
|---|-------|-----------|-----------|---------------|
| Chain Home-Work                                       | Men   | 4,378,082 | 5,441,096 | 24.3%         |
|   | Women | 6,060,274 | 6,553,425 | 8.1%          |
| Chain Work-Home                                       | Men   | 5,942,466 | 6,076,712 | 2.3%          |
|   | Women | 6,471,233 | 6,767,123 | 4.6%          |

The typical demographic variables used to forecast travel demand (e.g., age, income, geography, etc.) did little to explain differences in trip chaining behavior (this is similar to findings by Cao and Mokhtarian, 2004; Li, et al., 2004). Especially disappointing was the failure of the geographic variables available in the NHTS to show descriptive differences. Instead, the starkest differences in trip chaining behavior, such as the number and purpose of stops, were related to life cycle, especially combined with sex and the presence of children.

Twenty percent of men in families with two adults and small children trip chained, more than any other group of men, and the change since 1995 is noteworthy (see Figure 3). In addition, men in households with teen children or no children also showed increases in trip chaining behavior.

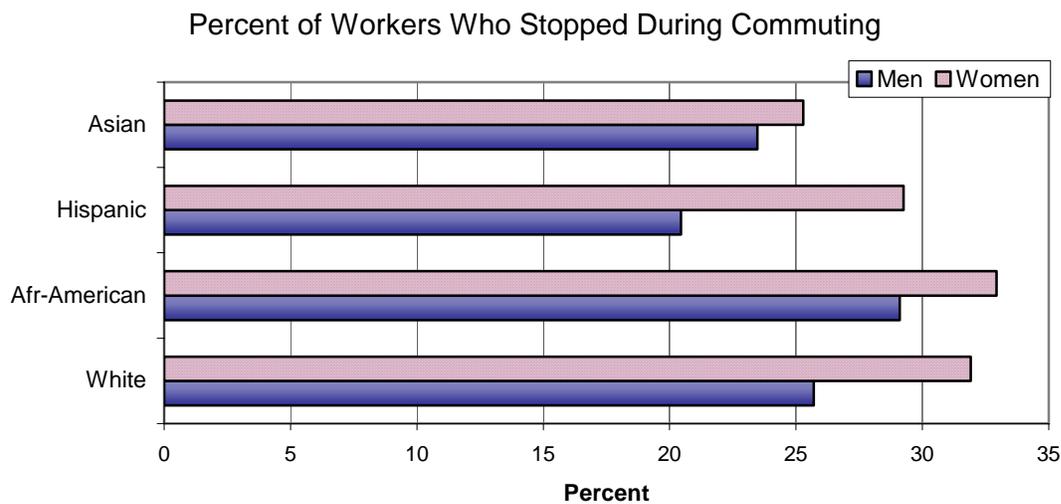
Over 40 percent of the women in two-adults households with small children chained non-work trips into their commutes, a percent that grew little between 1995 and 2001 (see Figure 3). On the other hand, similar to men, increases were found among women who have teen children in the household or those with no children.

Figure 3 -



The proportion of men and women stopping during their commutes to or from work varied within race/ethnicity as shown in Figure 4. Hispanic men are the least likely to report stopping for any purpose during their commutes, whereas Hispanic women were almost as likely as Whites and African-Americans to trip chain. African-American workers, women in particular, are more likely to stop during their commutes than any other group.

Figure 4



## THE REASON FOR STOPS DURING THE COMMUTE

The most common purpose in the commute *to* work is to drop-off or pick-up a passenger, family or personal errands, or to buy a meal or coffee. On the other hand, the most common purpose *after* work is to stop to shop, serve a passenger, or run family errands.

Dropping off and picking up a passenger is a common stop in both directions. Of all the multi-occupant vehicle trips to and from work, three-quarters were ‘fam-pools’ (all occupants were from the same household) and women drove 60 percent of those. Of the quarter of carpools with non-household members, men drove 64 percent.

Many of the passengers in ‘fam-pools’ are children being dropped at day-care or school or other activities by parents. This discovery is compatible with the finding by Lee and Hickman (2004) that the presence of children in households positively affects the duration of out-of-home activities. The recently released American Time Use Survey (2003) indicates that the average women in the U.S. spends 84 hours a year picking up and dropping off household children (in the ATUS all women are averaged, not just families with children).

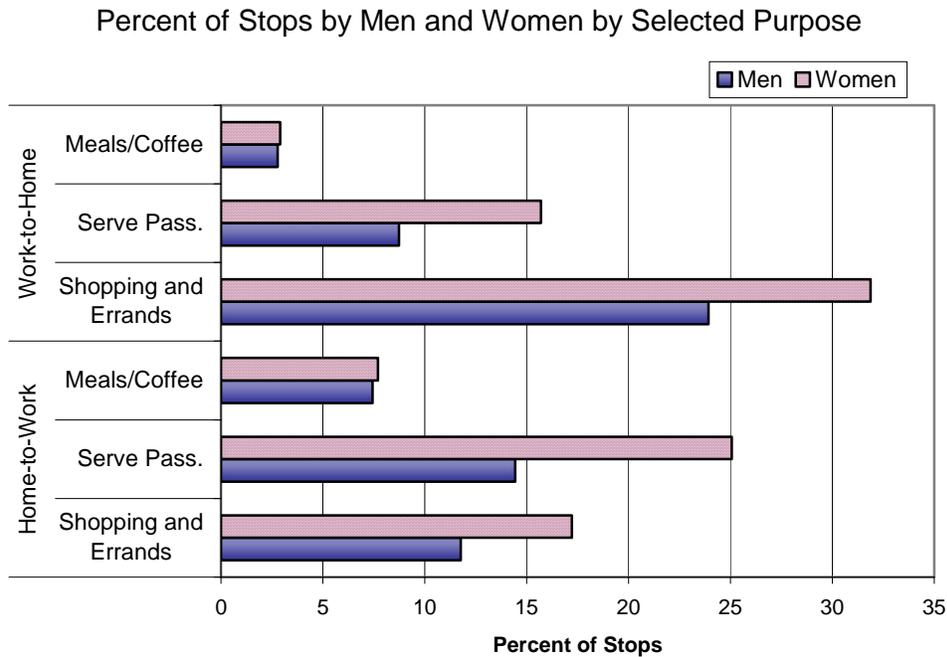
To understand this common type of stop during the commute, serve passenger trips to drop-off or pick-up children (less than 14 years old) were examined further.

According the 2001 NHTS, over 7 million families with two working parents drop-off and/or pick up their children (under 14 years old) during a weekday commute. In total, 2.7 million men and 4.3 million women insert a drop-off or pick-up (or both) trip into their work-trip.

When two working parents commute to work, twice as many trips to drop-off and/or pick-up a child are made by women (66 percent compared to 34 percent for men). Eighty percent of the drop-off trips occur before 9:00 am on weekdays, but perhaps because of ‘after-care’ and after-school activities, the pick-up trips are not so clustered.

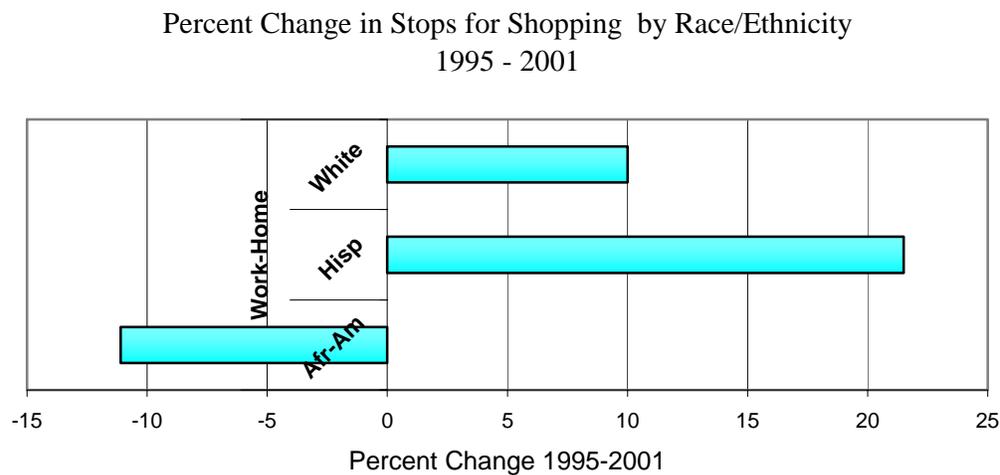
Another common reason to stop during a commute is to shop and conduct family errands, especially on the way home from work, and Figure 5 shows that women make more of these stops than men.

Figure 5



There is dramatic variation by race/ethnicity in the trends for stopping to shop during the work to home commute, as shown in Figure 6. Between 1995 and 2001, the number of shopping stops by Hispanic commuters increased over 20 percent, whereas the number of stops to shop by African-American commuters declined by 12 percent

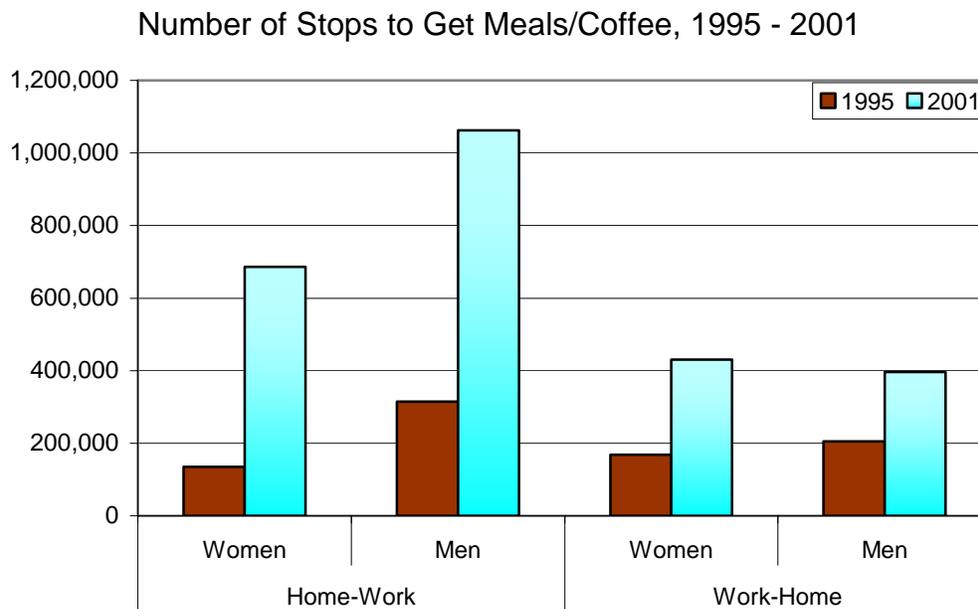
Figure 6



As the research presented here has shown, men have increased their incidence of trip chaining, and modestly increased the types of trips that women traditionally insert into their commutes, such as serving a passenger, running errands and shopping.

One trend is intriguing and accounts for a surprising amount of the growth in men’s trip chaining—the increase in the number of stops to get a meal or coffee on the way to work as shown in Figure 7. In just a six-year span, more than one- and one-half million more stops were added to get a meal or coffee (1995 to 2001). There was a large increase in the number of trips by both women and men workers, but especially men. We call this the “Starbucks Effect”.

Figure 7



## CONCLUSIONS AND FURTHER RESEARCH

The analysis presented in this paper relied on a definition of a trip chain as “a sequence of trips bounded by stops of 30 minutes or less.” This operational definition facilitates a rich analysis of trip chaining behavior, and thus, we invite other travel researchers to use it. The chained files for 1995 NPTS and 2001 NHTS are publicly available for researchers and analysts on the NHTS website (<http://nhts.ornl.gov>).

An important finding is that the presence of children continues to impact women’s travel patterns more than men’s. Overall, women work closer to home than men, even within the same occupational categories. This is especially marked when young children are present in the household.

Women are twice as likely as men to drop or pick-up children in two-worker households. Further, such trips are highly constrained within the morning and evening peaks. This suggests that women may have less flexibility in departure time than men, since the school and day-care start and end times may influence the commute times of women workers more than men.

The evidence continues that travel is a gendered activity. The household and child-care responsibilities of women make it likely that women will chain some of those tasks into the commute.

One surprising finding from the trends shown here is that in-home activities, such as cooking meals, are being replaced with activities requiring travel—picking up a meal. This is even true for a cup of coffee in the morning—no longer brewed at home but purchased at the local coffee shop on the way to work.

Many researchers have expected a substitution of travel linked to the growth of the Internet, and we continue to look for congestion relief from tele-commuting, but the apparent substitution of travel for what was traditionally an in-home activity (breakfast and coffee) needs further study.

One of the biggest questions for the future is how household dynamics, social roles and expectations, and perhaps market and lifestyle changes, will affect travel behavior of both men and women.

While women have made great strides and accomplishments in the last quarter century, change in societal expectations is slow. Differences in travel related to gender roles persisted over the short time frame we studied, although there are indications that men in households with small children have increased their trip chaining for household- and child-related purposes. Perhaps there is a cohort effect in the coming generation.

More research is needed. Especially interesting questions on the effect of geographic factors and commuting distance on the probability of trip chaining have been raised. Nishii, Kondo, and Kitamura (1988) have also raised the importance of incorporating more information about the travel environment into analysis of trip chaining. The clear next step is an analysis with a geographic component.

In addition to these questions of the conditions of the travel environment that encourage or discourage trip chaining, further research into the conditions of the traveler, specifically looking at demographic factors as we have looked at gender and life cycle, would be useful.

#### ABOUT THE DATA USED IN THIS RESEARCH

A National Household Travel Survey (NHTS) has been conducted by the U.S. Department of Transportation periodically since 1969 to obtain an inventory of daily travel for the nation. Detail about the survey methods, questions, and weighting can be found at <http://nhts.ornl.gov>.

Most importantly for trends analysis, the 2001 NHTS and the 1995 NPTS have been processed simultaneously using the same rules and logic streams to develop the trip chains analyzed in this research. Changes in trip chaining behavior found during comparison of the 1995 NPTS and the 2001 NHTS, when statistically significant, are not artifacts of differences in scope, methodology, or question wording.

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