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Not driving alone: Commuting in the Twenty-first century

Stephen B. DeLoach
Elon University

Thomas K. Tiemann
Elon University

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2075 Campus Box
Elon, NC 27244
Phone: (336) 278-5951
Fax: (336) 278-5952

Abstract

This paper investigates recent commuting trends in American workers. Unlike most studies of commuting that rely on Census data, this study utilizes the unique American Time Use Survey to detail the complex commuting patterns of modern-day workers. The data confirm what has been suspected, that incidence of driving alone has decreased substantially in recent years while carpooling has rebounded. The results from the multi-nominal logistic estimation of workers' commuting choices yield support for both the traditional economic determinants as well as for the newer, socio-economic factors. In addition to the cost savings, many commuters appear to value the social aspect of carpooling. Surprisingly, there is little evidence that the need for autonomy plays much of a factor in explaining worker's choice of the journey to work. The estimated short-run "elasticity" of carpooling with respect to real gas prices appears to be quite high and largely accounts for the significant decline in the incidence of "driving alone".

JEL Code: R4
Keywords: **Ride sharing, carpooling, commuting, gasoline process, social capital**

1. Introduction

In the last decades of the twentieth century, driving alone increased while commuting with others declined. Explaining the shift from carpools to driving alone between 1970 and 1990, Ferguson (1997) argued that three traditional economic factors were at play: the increase in average wealth resulting in more cars per capita; the decrease in the real price of gasoline; and the increase in the average education level of workers. While most economists explained the trend strictly in traditional economic terms, others are likely to see it as indicative of a larger cultural movement. In “Bowling Alone: America’s declining social capital,” Robert Putnam (1995) describes the decline in informal interaction among Americans. In the same way that Americans no longer join bowling leagues or civic clubs, the vast majority of workers in the United States journey to work alone in a car, no longer interacting with neighbors at the bus stop, train platform, or in a carpool.

Recently, however, there is reason to suspect that this long-run trend towards driving alone may be reversing. Along with rising gasoline prices since 2003, the last five years have seen the advent of “ride-sharing” web sites, opening of new rapid transit systems in some American cities, and increased demand for public transportation in many others.

The first decade of the twenty-first century has also seen a revival of research that implies that the traditional transportation economics/urban economics models of commuting transportation choice, which balance monetary cost against journey time, are overly-simplistic. In a purely theoretical exposition, Huang, Yang and Bell (2000) argue that preferences for autonomy: self-reliance, independence, and privacy, should be considered along-side more traditional economic incentives. Such complexity of incentives is backed by empirical evidence as well. For example, McGuckin and Srinivasan (2005) find that 54 percent of weekday commuters do non-work errands during their commute time. This result reinforces the older research of Rosenbloom and Burns (1993), who argue that women’s household duties explain important differences between men and women in response to a Transportation Demand Management program.

There may also be a social dimension to modal choice. Charles and Kline (2006) argue that carpooling requires social capital. While they find that some traditional economic factors (e.g. urban form, population density, public transportation, gas prices, etc.) affect carpooling, they also find evidence that social identification matters. Workers living in neighborhoods with a greater proportion of workers of the same race are increasingly likely to carpool. Much earlier, research by Dueker, Bain and Levin (1977) found that people preferred to form carpools with friends of the same sex and job levels. They also found that those who perceived that riding with others would result in a lack of privacy were less likely to join carpools. This reinforced the finding of Horowitz and Sheth (1977) that the perception of the comfort and pleasantness of ride sharing varied between those who carpooled and those who drove alone. Though they did not specifically address it, the use of public transit is also likely to require higher levels of social capital as commuters will probably be more willing to wait at a transit stop if they are comfortable with those waiting with them.

The purpose of this paper is to investigate recent trends in American's journey to work. As argued above, this necessitates building a more complete empirical model of commuting behavior, one that incorporates social capital as well as more traditional economic determinants. Specifically, there are three key features to our model: first, we account for "sociability," following the work of Putnam (1995) and Charles and Kline (2006); second, building on Huang, Yang, and Bell (2000) we control for differences in time demands from work and other family obligations that might also play a role in determining a worker's relative preference for the independence and convenience driving alone versus carpooling or taking public transportation; and third, we follow McGuckin and Srinivasan (2005) and others in making a distinction between two types of carpools. A "true carpooler" is one who drives with friends and co-workers, while a "fampooler" is one who drives with family members. Not surprisingly, the factors responsible for choosing to join a true carpool are quite different from those responsible for choosing to fampool. Another complexity we found is that many commuters, especially carpoolers, fampoolers, and transit users, make complex, multimodal journeys.

The incorporation of all three of these factors is possible because we exploit a dataset (American Time Use Survey 2003-07) previously unused in this literature. This dataset provides a number of advantages in the context of our research question. First, unlike other nationally representative samples (e.g., samples based on the decennial Census) it allows us to look at trends in commuting since 2000. This is important since it is only recently that gas prices have begun to rise precipitously. Second, unlike studies which are regionally focused (Hartgen and Bullard 1993; Fellows and Pitfield 2000), because the American Time Use Survey is nationally-representative we are able to control for differences in urban form. Third, because the data are collected from individual activity diaries, the data reveal the length of each activity (e.g., traveling to work), where it takes place (e.g., private car) and who, if anyone, was present during the activity (e.g., friend). This allows for a detailed view of contemporary commuting behavior of American workers that has yet to be chronicled. It also allows us to identify those who make multimodal journeys. Finally, since the activity diaries provide a glimpse into the daily life of the American commuter, we are able to infer the degree to which family demands are present and the extent of socialization in which workers are engaged.

The organization of the paper is as follows: (1) the data from 2003-07 are examined to investigate the recent trends in commuting; (2) an econometric model is developed that extends the traditional models from the urban/transportation economics literature on the determinants of commuting by incorporating measures that account for individual preferences towards autonomy and social capital formation; (3) results from the multinomial logistic regression are discussed; and (4) conclusions and policy recommendations are made.

2. Recent Trends in the Journey to Work

This study examines weekday commuting decisions of American full-time workers between 2003 and 2007. Unlike previous studies that rely on Census data or data collected from a narrow geographic region, this project exploits national, individual cross-sectional data from the American Time Use Survey (ATUS). By merging data from the Current Population Survey (CPS) with the ATUS, we are able to study how daily worker decisions about commuting are affected by other behaviors (proxied by time spent on household tasks and social activities), individual characteristics, and urban form. In addition, pooling the data over a number of years allows us to estimate the short-run elasticity of commuting with respect to changes in gasoline prices.

While we stress understanding recent trends in carpooling, it is important to understand the complexity of Americans' journey to work. Any worker not working at home must decide how to get to their job. Some commuters have little choice but to travel in a private car, while others can choose between walking and riding, or between public transit and walking or public transit and a private car, or some combination of modes. Faced with a variety of choice, the commuter must then weigh the monetary costs, the time the journey takes, the importance of flexibility in arriving and leaving work and performing other tasks as part of their commute, and the probability and importance of social interaction as part of the journey.

The time and mode of the journey to work are determined from the daily time use diaries in the ATUS survey. Participants in the CPS are surveyed about their place of residence, personal and household characteristics and work experience for eight months. Four months following their last CPS interview, a subset is chosen to complete the ATUS. Respondents are randomly assigned a diary day and are asked to keep track of every activity during that 24 hour period. If a respondent went to work on their diary day, they are included in our sample. This results in 12,902 usable observations from 2003-2007. For the journey to work, we used the "where" and "who with" questions that correspond to each activity. For example, suppose a respondent says they traveled to work from 8:00am until 8:45am. We also know from the data where they were while they did this activity (e.g., car, bus, train, plane, ferry, walking, etc.) and who they were with at that location (e.g., with spouse, friends, co-workers, children, etc.) so we know the mode of transportation and whether commuters are (1) alone, (2) with family members or (3) with friends or co-workers. In completing this process, we found that many workers have multimodal journeys as they combine modes of commuting. A significant number spend part of this journey in a carpool or fampool, for example carpooling to the train station where they board for the final part of their journey to work. The percentages of workers in our sample who commute in all these various ways are detailed in Table 1.

Table 1 illustrates the complexity of the journeys for many commuters; about 15% of commuters in 2007 combined modes of transport or types of car journeys on their trip to work. Given this information, we have constructed our dependent variable from the following four categories:

1. *Single Drivers*: those who drive alone in a private car, exclusively;
2. *Fam-poolers*: those who drive at least partly with family members but only travel in private cars;
3. *Carpoolers*: those who drive at least partly with friends or co-workers but travel only in private cars;
4. *Other*: those who commute in all other ways, including via bus, train, ferry, subway, limo, walking, biking, multimodal. Note that more than half of these people have a multimodal journey combining other forms of travel with traveling in a private car.

Table 1: Journey to Work by Detailed Type (weighted percentages)

	All	2003	2004	2005	2006	2007
Commute via Private Car Only	**88.05%**	**87.70%**	**86.84%**	**89.00%**	**88.88%**	**86.20%**
Simple car journey						
Single Drivers	76.44%	78.04%	73.44%	73.14%	75.11%	72.42%
Fam-poolers	4.49%	4.35%	4.54%	3.55%	4.35%	4.35%
Carpoolers	3.37%	2.96%	3.37%	5.25%	3.64%	2.50%
Sub-Total	84.30%	85.35%	81.35%	81.94%	83.10%	79.27%
Multiple types of car journeys						
Friends + Alone	2.08%	0.84%	3.74%	4.08%	3.93%	5.69%
Family + Alone	1.34%	1.33%	1.58%	2.25%	1.36%	0.12%
Family + Friends	0.29%	0.15%	0.16%	0.48%	0.18%	0.12%
All of the above	0.06%	0.03%	0.00%	0.24%	0.30%	0.01%
Sub-Total	3.77%	2.35%	5.48%	7.05%	5.77%	5.94%
Other Modes of Commuting	**11.95%**	**12.30%**	**13.16%**	**11.00%**	**11.12%**	**13.80%**
No Private Car Used	5.10%	5.18%	4.62%	3.32%	5.38%	4.53%
Simple Car Journey and Other						
Single Drivers	5.08%	5.37%	6.29%	5.39%	4.53%	6.80%
Fam-poolers	0.50%	0.51%	0.53%	0.73%	0.44%	0.52%
Carpoolers	0.57%	0.59%	0.58%	0.27%	0.16%	1.75%
Sub-Total	6.15%	6.47%	7.40%	6.39%	5.13%	9.07%
Multiple Types of Car Journeys and Other						
Friends + Alone	0.25%	0.11%	0.42%	0.92%	0.34%	0.01%
Family + Alone	0.23%	0.22%	0.67%	0.27%	0.14%	0.01%
Family + Friends	0.13%	0.13%	0.06%	0.10%	0.14%	0.01%
All of the above	0.07%	0.19%	0.00%	0.00%	0.00%	0.00%
Sub-Total	0.68%	0.65%	1.15%	1.29%	0.62%	0.03%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table Notes:
ATUS provides sample weights for all cross section years so that the data are nationally representative.
Percentages do not always add up due to rounding.

Figure 1: Decline of the Single Driver 2003-2007

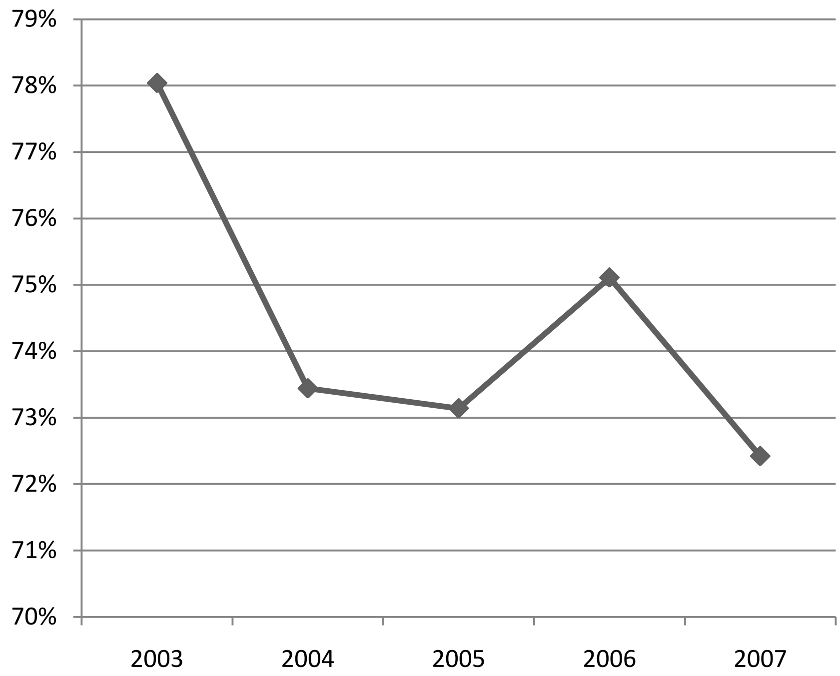
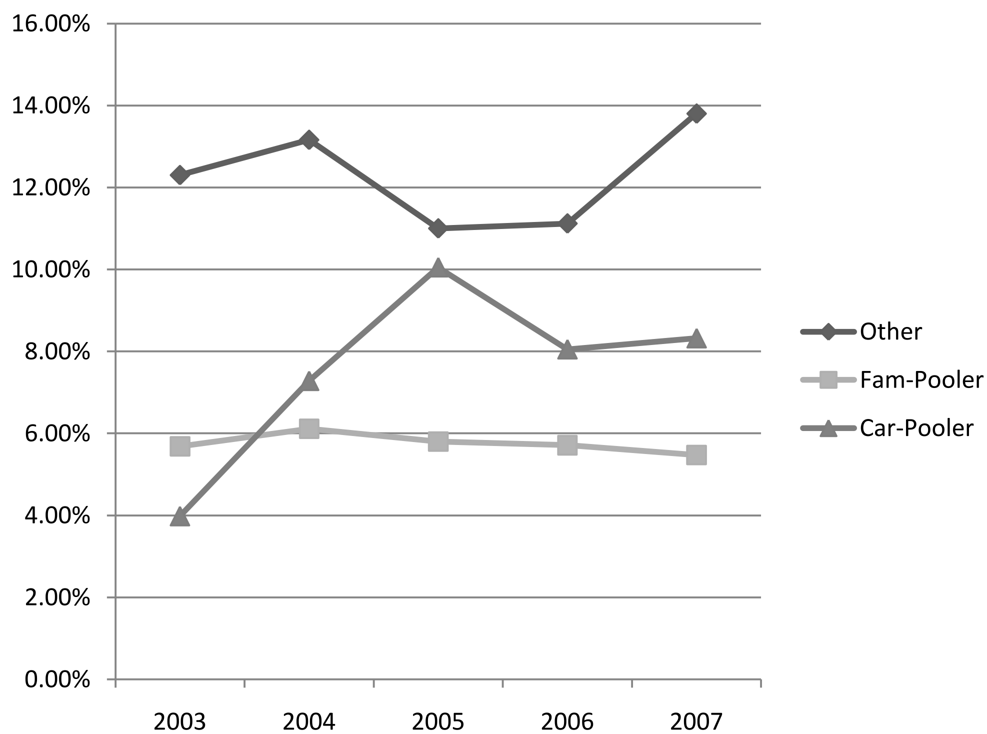


Figure 2: Trends in Alternative Modes of the Journey to Work 2003-2007



Figures 1 and 2 show that the incidence of commuting alone declined from 78 percent in 2003 to 72.4 percent in 2007. This is lower than the most recent Census estimates of 75.6% (Census 2000). At the same time, traditional car-pooling more than doubled. Commuters using only alternative forms of transportation (bus, train, walking, biking) increased only slightly; driving with family members stayed relatively constant. Table 1 also reveals two interesting facts that we do not analyze in this paper. First, while the number of commuters who use only public transportation or walking or biking was roughly constant over the sample period, the number combining private cars and "other" modes increased, including a large rise in the use of carpools in combination with other modes. Second, "Dagwood Bumstead' carpools (private car only, simple journey carpools where each rider is picked up sequentially) are becoming more scarce, while "Park and Ride" carpools (private car only, Friends+alone carpools) are becoming more common.

Overall the data suggest a complex set of factors that determine individuals' choice of transportation to work. Clearly something has changed the costs of commuting for the single driver. At the same time, however, the stability of the so-called fampoolers over time suggests that these workers consider a very different set of factors in making their decisions. Building a model complex enough to capture the different incentives facing individual workers should give us insight into the journey to work decision. This task is taken up in the following section.

3. Econometric Model

The choice of mode of transport to work depends on the relative costs and benefits of the various modes. As the descriptive data suggests, it is reasonable to think about the journey to work decision as having four distinctly different alternatives: driving alone; carpooling; fampooling; and other alternative modes of transportation including multimodal journeys. Some authors have chosen to construct their model around a binary choice between driving alone or not (Duecker, Bair and Levin 1977; Horowitz and Sheth 1977). We believe there are econometric and theoretical advantages to treating the three alternatives to driving alone as independent alternatives, since the costs and benefits of each mode are likely to be considerably different across workers.[1]

For the typical commuter there are four categories of factors that affect their decision: (1) automobile operating costs; (2) assembly costs; (3) value derived from the creation, maintenance and use of social capital and (4) value of autonomy. Each factor will have different values for each commuter and for each mode of transport. For example, when choosing between joining a carpool and driving to work alone, a worker considers the following:

- Decreased automobile operating costs (e.g., fuel, repairs, ownership costs);
- Increased social capital (e.g., time spent commuting with friends and co-workers);
- Increased assembly time costs (e.g., carpooling adds extra time to the journey to work because it is necessary for the members of the carpool to be assembled at the beginning and disassembled at the end of the work day);
- Decreased autonomy (e.g., must agree upon when to arrive at work and when to depart, forego the ability to run errands while journeying to work, etc.).

Carpooling will be preferred over driving alone if the increased benefits compared to driving alone are greater than the increased costs. Carpooling will be the final choice if wins a similar comparison against fampooling and all other modes of transport.

The same logic can easily be applied to other alternatives. For example, riding the subway clearly reduces automobile operating costs. However, there is increased assembly time since one has to wait for the train, transfer, etc., along with a loss of autonomy. Though it is not obvious, social capital is likely to be higher since there is an increased possibility of meeting new people. Fampooling would also increase assembly time in the same way as carpooling, though probably by a smaller amount. It is unclear the extent to which fampooling affects operating costs. On one hand, families are economizing on the number of car trips; however, taking the kids to school rather than having them walk or ride the bus increases total operating costs. Since those choosing to fampool are probably those who need more autonomy to meet family demands, this is likely to play an important role for these people. However, fampooling reduces social capital.

In general, the choice of commuting for the *ith* individual can be written as

(1) $P(Y_{ij}) = X_{i1}B_{1,j} + X_{i2}B_{2,j} + X_{i3}B_{3,j} + X_{i4}B_{4,j} + \epsilon_{ij}\ ; j = 1,2,3,4,$

Where *j* represents the four distinct categories of mode of commuting and:

Y_j is the mode of travel chosen on the diary day;
X_1 is a matrix of variables affecting the expected costs of driving alone (and therefore the benefits of using other modes);
X_2 is a matrix of variables affecting the assembly costs of choosing a type *j* journey;
X_3 is a matrix of variables affecting the value of socializing that may occur during a journey to work of type *j*;
X_4 is a matrix of variables affecting the value of autonomy lost or gained from a type *j* journey to work.

Since the four modes of commuting each carry their own advantages and disadvantages, anything that changes the relative value those factors play in an individual worker's utility function will affect their commuting decision.

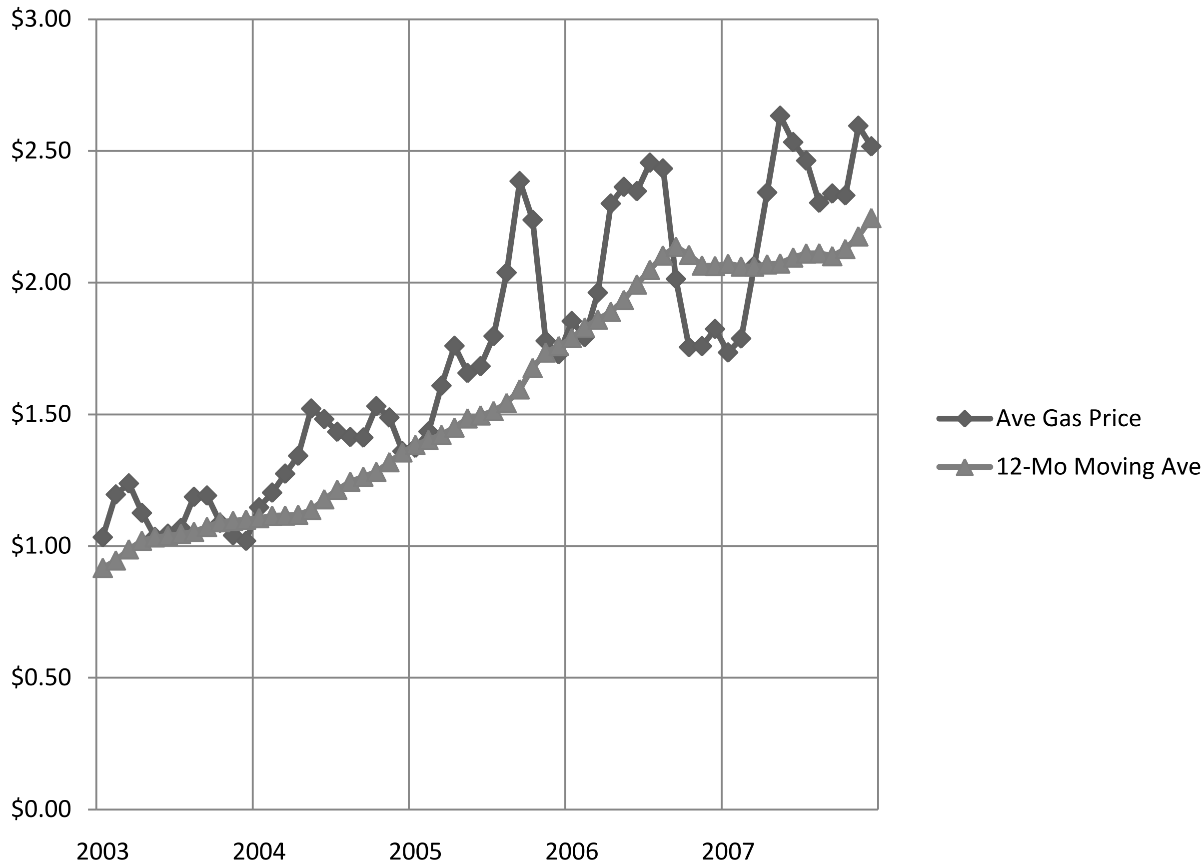
We now turn our attention to discussing the various individual and household characteristics that alter those relative costs and benefits. We also explain our measure of gasoline price. Exact definitions are given in Table 2.

The variables that affect the direct cost of automobile operation included here are the real price of a gallon of gasoline and the length of the individual's commute. Both higher gasoline prices and a longer journey are expected to raise the cost of a trip to work in a private car. For example, as these rise, carpooling should become relatively more attractive than driving alone since the costs are shared by the members of the pool. The length of commute is measured by the total commuting time and is taken from the ATUS. Gasoline prices are measured by a 12 month moving average, with the final month of the 12 month period being the month when the ATUS was collected. It is adjusted for monthly inflation using the CPI. As shown in Figure 3, before leveling off in 2007 real gas prices more than doubled between 2003 and 2006. This represents a precipitous rise in the costs of commuting by car. Of course, the effect of these increases on commuters will vary depending on the relative wealth of the individuals' households. While there is no direct measure of household wealth in the ATUS, we do know if the worker owns a house. This will serve as our proxy wealth in the model.

Table 2: Definition of Explanatory Variables

Operating Costs	
Commutetime	Total time spent commuting to work during diary day
ln(rgas12)	Log of the 12-month moving average of the real price of a gallon of regular gasoline
Own house	Dummy = 1 if the respondent owns a house
Assembly Costs	
ln(ftrwage)	Log of full-time wages
Central city	Dummy = 1 if the respondent lives in the principal city
Suburb	Dummy = 1 if the respondent lives in a suburb
Density	Population density for metropolitan area of residence
Value of Social Capital	
Eatdrink	Total time respondent spent eating and drinking during diary day
Ncalonetime	Total time non-commuting time respondent spent alone during diary day
Married	Dummy = 1 if the respondent is married
Male	Dummy = 1 if the respondent is male
Age	Age of respondent
Value of Autonomy	
Working	Total time spent working during diary day
Shopping	Total time spent shopping during diary day
Cooking	Total time spent cooking during diary day
Kids	Dummy = 1 if respondent has children

Figure 3: Trends in National Average Gasoline Prices 2003-2007



All modes of commuting require some degree of assembly and disassembly, the costs of which depend of the opportunity cost of one's time. Since those with higher wages have a higher opportunity cost, higher wages should result in a lower probability of selecting the transportation modes that requires longer assembly: carpools and other modes. Fampoolers incur assembly costs, though less so than carpools. A spouse is dropped off at one workplace and the other continues on to another workplace or a child is dropped at school on the parent's journey to work. In contrast, the single driver incurs very low no assembly cost, simply the time it takes to get to his or her car.

Consider the assembly that takes place in traditional carpools. These "true carpools" can be assembled in two ways. In a Dagwood Bumstead Carpool (named after the cartoon character who is in such a pool), the pool is assembled serially, with the driver going around to pick up those in the carpool. Park and Ride Carpools are assembled by meeting at a designated place, like commuters who individually arrive at a park and ride lot and then join together, forming the carpool. For both Dagwood and Park and Ride Carpools, the form of the built environment (land use) has an effect on assembly time. If population density is greater, assembly time in probably less, and the probability of carpooling will rise. Similarly, people living in suburbs will probably have higher assembly times and carpool less, while those living in central cities are more likely to choose carpooling over driving alone since assembling a carpool is easier. The assembly time for riders of public transportation is also affected by urban form. In cities with a more dense population, bus stops are more frequent and routes are more likely to come closer to home and work. Not surprisingly, residents in the central city are more likely to experience more convenient service than those in suburbs.

The value an individual worker places on the creation and maintenance of social capital depends on a number of factors. The ATUS data tells us how individuals spend their time during a typical day. If people are maximizing utility, we should be able to infer a great deal about one's personality from the amount of time they devote to various activities. Of particular interest is the time individuals spend eating and drinking, and how much time they spend alone (not including commuting time). We expect that people who spend more time eating and drinking are more sociable. As a result, those individuals would be expected to be more likely to choose transportation that allows for more social interaction like carpooling. Those who spend more time alone probably place a lower value on social capital and would be more likely to drive alone. We also expect that younger, single males place the highest value on social capital formation and thus be more likely to choose to carpool.

Like social capital, we do not directly observe the value one places on autonomy. Again, we can use data from the ATUS time use diary to make inferences about individual's preferences towards autonomy and flexibility in their commuting patterns. Those working longer hours likely find it more difficult to coordinate arrival and departure from work times with others, so we expect that those who work longer hours are less likely to carpool. Because of the scarcity of leisure time, they also would tend to stay away from other modes that require large assembly costs, like public transportation. Another set of indicators of the value workers place on autonomy is related to household and family obligations. Those who are more active with their families will find the loss of autonomy more costly. Therefore, those spending more time cooking or shopping are less likely to carpool and are more likely to drive alone or fampool. Similarly, having children will reduce the probability of carpooling and increase the probability of fampooling.

4. Multinomial Results

We estimate two different models: (1) a full sample model, and (2) a model including only those respondents who lived in metropolitan areas so that population density could be included as a variable affecting assembly costs. Since population density is measured only for people living in MSAs, the second model has about 30 percent fewer observations. Nonetheless, the coefficient estimates remain quite stable across the two samples. The multinomial results from each model are reported in Table 3. In Table 3, the baseline is driving alone. Thus, the coefficients in each column show change in the log of the odds ratio of choosing the mode in the column heading. For ease of interpretation, we have reported the marginal effects in Table 4.

Table 3: Multinomial Logistic Regression Results (measured relative to P(single driver))

	Full Sample			Metropolitan Sample		
	P(Fam)	**P(Pool)**	**P(Public)**	**P(Fam)**	**P(Pool)**	**P(Public)**
	Coef. (std. error)	**Coef. (std. error)**	**Coef. (std. error)**	**Coef. (std. error)**	**Coef. (std. error)**	**Coef. (std. error)**
Commutetime	0.0042**	0.0069***	0.0116***	0.0038*	0.0079***	0.0127***
	(0.0018)	(0.0010)	(0.0008)	(0.0023)	(0.0011)	(0.0010)
ln(rgas12)	-0.2715	0.5676***	0.2138	-0.2929	0.5872***	0.2452*
	(0.2207)	(0.1829)	(0.1479)	(0.2560)	(0.2057)	(0.1630)
Own house	-0.1690	-0.4301***	-0.5953***	-0.1177	-0.4933***	-0.5828***
	(0.1296)	(0.1139)	(0.0885)	(0.1440)	(0.1265)	(0.0977)
ln(ftrwage)	-0.5120***	0.1085	-0.2095**	-0.6289***	0.1269	-0.2445***
	(0.0900)	(0.1042)	(0.0728)	(0.1107)	(0.1201)	(0.0836)
Central city	0.1618	0.0424	0.5058***	0.1539	0.2593	0.6004***
	(0.1571)	(0.1541)	(0.1137)	(0.1981)	(0.2181)	(0.1637)
Suburb	0.0095	-0.1556	-0.0652	-0.0102	0.0489	0.0167
	(0.1334)	(0.1340)	(0.1117)	(0.1753)	(0.1927)	(0.1594)
Density	-	-	-	0.0001	0.0000	0.0002***
				(0.0001)	(0.0001)	(0.0001)
Eatdrink	0.0016	0.0044***	0.0023**	0.0020	0.0044***	0.0027***
	(0.0015)	(0.0010)	(0.0009)	(0.0017)	(0.0011)	(0.0010)
Ncalonetime	-0.0035***	-0.0014***	0.0002	-0.0032***	-0.0014***	0.0002
	(0.0006)	(0.0004)	(0.0003)	(0.0007)	(0.0005)	(0.0003)
Married	0.3098**	-0.3169***	-0.2077**	0.2719*	-0.3335***	-0.2416**
	(0.1221)	(0.1119)	(0.0866)	(0.1403)	(0.1266)	(0.0964)
Male	-0.5287***	0.1218	0.0133	-0.6773***	0.1422	-0.0450
	(0.1348)	(0.1194)	(0.0879)	(0.1531)	(0.1350)	(0.0981)
Age	-0.0082	-0.0197***	0.0061*	-0.0109*	-0.0194***	0.0039
	(0.0051)	(0.0047)	(0.0034)	(0.0057)	(0.0055)	(0.0038)
Working	-0.0012**	-0.0013***	-0.0005	-0.0008	-0.0012***	-0.0004
	(0.0005)	(0.0004)	(0.0003)	(0.0007)	(0.0004)	(0.0004)
Shopping	0.0013	-0.0018	0.0014	0.0014	-0.0008	0.0008
	(0.0017)	(0.0018)	(0.0013)	(0.0020)	(0.0019)	(0.0014)
Cooking	0.0035**	0.0009	0.0001	0.0035**	-0.0008	-0.0005
	(0.0015)	(0.0017)	(0.0012)	(0.0016)	(0.0020)	(0.0013)
Kids	0.2289*	0.0396	-0.0755	0.3606***	0.1448	-0.1101
	(0.1197)	(0.1073)	(0.0818)	(0.1374)	(0.1218)	(0.0898)
Pseudo R^2		0.1241			0.1394	
Obs		12,902			10,152	

Notes:
, ** and * denote statistical significance at the .10, .05 and .01 levels, respectively (two-tailed)*
All models include controls for level of education, occupation, state of residence and top 20 cities

Table 4: Selected Marginal Effects: (From Full-Sample Model except where noted)

	P(Fam)=0.0353 *dy/dx*	P(Pool)=0.0501 *dy/dx*	P(Public)=0.10 *dy/dx*	P(Single Driver) *dy/dx*
Operating Costs				
Commutetime/60	0.0053	0.0157***	0.0600***	-0.0811***
ln(rgas12)	-0.0110	0.0264***	0.0175	-0.0329**
Own house	-0.0025	-0.0181***	-0.0569***	0.0775***
Assembly Costs				
ln(ftrwage)	-0.0168***	0.0071	-0.0178***	0.0274***
Central City	0.0035	-0.0012	0.0501***	-0.0524***
Suburb	0.0008	-0.0070	-0.0051	0.0114
Density/750#	-0.0018	-0.0010	0.0162***	-0.0170**
Value of Social Capital				
Eatdrink/60	0.0023	0.0012***	0.0110**	-0.0249***
Ncalonetime/60	-0.0070***	-0.0038***	0.0020	0.0087***
Married	0.0115***	-0.0150***	-0.0185**	0.0220**
Male	-0.0191***	0.0066	0.0026	0.0099
Age	-0.0003	-0.0010***	0.0007**	0.0005
Value of Autonomy				
Working/60	-0.0023**	-0.0033***	-0.0023	0.0078***
Shopping/60	0.0024	-0.0056	0.0080	-0.0048
Cooking/60	0.0070**	0.0023	0.0030	-0.0089
Kids	0.0081**	0.0019	-0.0078	-0.0021

Notes:
, ** and * denote statistical significance at the .10, .05 and .01 levels, respectively (two-tailed)*
From metropolitan sample with full controls and normalized by its standard deviation (750)

Looking at operating costs, the results are consistent with economic theory. As commuting time and the cost of gasoline increase, the likelihood of being a single driver decreases. Most interesting is the effects on the alternatives. Commuting time has the largest positive effect on the use of public transportation with a smaller effect on carpooling. However, some caution must be taken here since commuting time is likely to be endogenous to the choice of transportation type. In contrast, as the price of gasoline increases, there is a relatively large effect on carpooling but a statistically insignificant effect on public transportation. The estimated carpooling elasticity with respect to gas prices is 0.527.[2] This is high, but still lower than the "naive" long-run estimates of 0.71 found by Ferguson (1997). Fampooling is not affected at all by operating costs. This lack of an effect is consistent with our theory that fampooling would be more a function of autonomy and socialization. Wealth, as proxied by homeownership, increases the likelihood of driving alone since the relative costs of operating a car decrease as wealth increases. But like the direct costs (commuting time and gas) discussed above, it plays no part in the decision to fampooling.

Turning to the value of social capital, we see markedly different effects across the 4 modes of commuting. As expected, workers who spend more non-commuting time alone (introverts) are also more likely to favor driving alone. Fampoolers and carpoolers, however, are positively affected by social engagement, though the people they interact with are likely to differ. Those who socialize more as measured by eating and drinking time also are more likely to use other alternatives. Being married decreased the probability of carpooling or using alternative methods of commuting, but it did increase the probability of fampooling and driving alone. Fampooling more when one is married is not surprising, but driving alone might be. Theory tells us that being married decreases the marginal benefits from socializing, a key motivator for carpooling and taking other public alternatives to commuting.

Assembly costs appear to mostly affect driving alone (positive) and alternative modes (negatively). Surprisingly, assembly costs did not have a significant effect on carpooling. Urban form (density) and the location within the metropolitan area (city or suburb) had expected effects. Density decreases the assembly time for alternative modes of commuting since distances are shorter and public transportation more readily available. But the opportunity cost of one's time (measured by wages) makes a big difference. Within a family, the higher wage earner is less likely to fampool (drop the kids off at school, etc.).

The costs associated with the loss of autonomy are often cited as reason people do not carpool or take public transportation. However, with the exception of the total hours worked (working) on carpooling, there is no evidence here to support that excuse. But autonomy does factor into the decision to fampool. Parents who do the cooking or pick up the kids are the ones more likely to fampool. Not surprisingly, the longer one works, the less likely they are to fampool that day. Overall, however, the variables associated with the need for autonomy have relatively little qualitative effect on commuting decisions.

5. Conclusion

This paper has investigated recent trends in commuting behavior of American workers. While the topic has been researched for years, this paper has made a number of important contributions to our understanding of commuter's choices. First, we have exploited a dataset that has previously been unused in this literature. As a result, we are the first to document with nationally representative data the recent decline in the number of workers who drive alone on their daily commute. Second, by relying on individuals' daily activity diaries of their time use rather than census data, we have been able to document the complexity of contemporary American commuting patterns. Third, the time use data allows us to make inferences about the effects of individual workers preferences for autonomy, convenience and social capital on their modal choice. Though such factors have been discussed in the literature before, little research has been undertaken to test such hypotheses with broad-based data sets.

The results indicate that far more goes into the cost-benefit calculus of deciding how to commute to work than is often presumed. In addition to the obvious monetary considerations and assembly costs, social capital plays a significant role in determining worker's decisions. Interestingly, though people often use the excuse of autonomy when they don't carpool, our results find little evidence that such concerns play a large role for commuters without heavy family obligations. We do, however, find that familial needs largely drive the behavior of so-called fampoolers.

There results also have intriguing policy ramifications. Current campaigns to increase carpooling seem to be limited to billboards and public service announcements that increase awareness of hotlines and websites where partners might be found. Our findings suggest that more effective policy instruments might be awareness campaigns conducted where people socialize like cafeterias or after-work meeting places (a carpool hotline number could be printed on cocktail napkins or embossed on swizzle sticks) since people who are more social are more likely to carpool. Also, providing "park and pool" lots near residences would provide designated places for park and ride carpools to meet, reducing assembly time from that usually required for the stereotypical Dagwood Bumstead carpool. Of course, given the relatively large elasticity of carpooling with respect to gas prices we have found, policy makers could also consider using gasoline taxes as a way to promote carpooling and ridership on public transportation (where available).

6. References

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Notes

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[1] If the choices are not independent, then estimation would require nested logit.

[2] Table 4 shows that the marginal effect of a change in the log of real gas prices is 0.0264. So, a 100 percent increase in gas prices results in a 0.0264 increase in the probability of carpooling. Since the marginal probability of carpooling is 0.0501, this translates into a 52.7 percent increase in the probability of carpooling.