# What Drives Gender Differences in Commuting? Evidence from the American Time Use Survey*

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November 10, 2016

**Abstract**

A wealth of research has shown that the commutes of American women are shorter, both in time and distance, than those of American men. This study takes advantage of a large, nationally representative dataset, the American Time Use Survey (ATUS), to examine gender differences in commute character and time. A method of calculating commuting time that accounts for stops along the journey is applied to ATUS data; analysis of gender differences in the number, type, and length of stops demonstrates the need for this commuting measure. Explanations for women's shorter commutes are reviewed and tested alongside predicted relationships from a simple labor supply model. Controlling for marital status and the presence of children, women are more likely to be accompanied by children for their commute, and women tend to make longer stops than men. Multivariate regression results support two previously proposed explanations for the gender commuting time gap, based on gender differences in wages and types of jobs held. Contrary to the previously proposed Household Responsibility Hypothesis, this analysis provides evidence that greater household responsibility does not explain women's shorter commutes.

JEL Classification: J22, R41, J16
Keywords: commuting, gender, labor supply, time use data.

*I thank Dave Ribar, Ken Snowden, Chris Swann, Stephen Holland, and attendees at the 2016 Time Use Across the Life Course Conference in College Park, Maryland, for their comments and helpful discussion.

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# 1 Introduction

Commuting plays an integral role in both labor force participation and the allocation of time to other activities. Moreover, the journey to work is unpleasant to many, ranking as one of the least desirable activities undertaken by workers (Kahneman, Krueger, Schkade, Schwarz, and Stone, 2004). Many researchers (for example, White (1986) and Turner and Niemeier (1997)) have noted a gender gap in commuting: consistently, working women's trips to work are shorter in distance and time than those of their male counterparts. This gap persists despite major changes to women's labor market opportunities and the structure of American families.

The nationally representative survey datasets commonly used to examine this gap have significant drawbacks. This analysis utilizes a dataset that has not been used widely to study commuting behavior, the American Time Use Survey (ATUS). The ATUS collects extensive information on how Americans spend their time, including all episodes of travel time. While it does not distinguish between commuting and other travel episodes, it has advantages over other available datasets which are leveraged in this analysis. First, the ATUS contains some information on respondents' wage and salary, which many commonly used transportation datasets lack. Second, unlike other large surveys including those focused on transportation behavior, the ATUS captures other uses of time on the same day. This includes information about the activities individuals perform at stops along their journeys. Commuting behavior can be imputed using the method of Kimbrough (2016) and combined with these additional characteristics to broaden the analysis beyond what is possible with other large datasets.

This analysis examines two dimensions of observed gender differences in commuting behavior that are revealed by the unique information available in the ATUS. First, I show that fundamental gender differences in the character of commuting arise because women are more likely to stop along the way between home and work. Second, I find that a gender gap

in commuting time persists even when commutes are measured using a methodology that accounts for differences in stops along the way.

To investigate the second source of gender differences in commuting behavior, I examine hypotheses offered by previous researchers. To do so a standard labor supply model with fixed time costs of work is formalized. This structure predicts associations between commuting time and characteristics which differ significantly between women and men. These predictions, as well as suggested relationships from the literature, are tested in Sections 6 and 7. I find that gender differences in wages, non-labor income, and job characteristics all help to account for differences in commuting time not related to stops. There is no evidence, however, that the shorter commute times of women are related to greater levels of household responsibility.

The contributions of this paper are threefold. First, this analysis is a novel application of time use data to the study of the gender commuting gap in the United States; combined with previous methodological work by Kimbrough (2016), this opens up new avenues for exploring the role commuting time plays in the lives of Americans. This unique dataset makes possible the second major contribution, an examination of gender differences in the character of commutes that develops what had previously been disjointed observations across various studies. Third, this analysis explores and tests multiple explanations for the gender gap in commuting time. This study provides evidence that the gap is related to women's low wages and the more even distribution of jobs that hire women. Additionally, women's greater household responsibility does not contribute to the commuting time gap for American women. These conclusions can inform policy and planning discussions in addition to guiding further investigations of gender differences in commuting and work.

# 2 Background

A variety of researchers have examined gender differences in American commuting behavior. MacDonald (1999) reviewed much of this research, finding consistent evidence that American working women have shorter commutes, in both distance and time, than their male counterparts. Surveying the variety of conclusions in this research, MacDonald offered four explanations for the gap.

First, women may have shorter commutes because their wages are lower than their male counterparts. Consistent with this explanation, Bianchi and Spain (1996) hypothesized that jobs typically held by women offer a narrower range of pay than those more commonly held by men. Therefore, women receive less in return for taking on a longer commute than men. Examining data from Buffalo, New York, Johnston-Anumonwo (1997) indeed found a lower return to longer commutes for women.

A second explanation holds that women shorten their commutes to balance their dual roles as mothers and wage earners. Some researchers, such as Johnston-Anumonwo (1992) and Turner and Niemeier (1997), have referred to this as the Household Responsibility Hypothesis. Consistent with this hypothesis, Hanson and Pratt (1995) found that women's household responsibilities constrained their job search and employment patterns, leading to shorter commutes. Similarly, this greater household responsibility could translate to more trips for non-work purposes. Along these lines, Rosenbloom (1995) analyzed the 1990 National Personal Transportation Survey (NPTS), concluding that women on average make more trips than men yet travel fewer miles, with these effects exacerbated by the presence of young children in the household. Gimenez-Nadal and Molina (2016) also examined the relationship between imputed time spent on home production and childcare on commuting time using Dutch time use data. They found larger effects for women of home production or childcare time on commuting time.

A third explanation suggests that the types of jobs held by women are more likely to be closer to home. While occupational segregation has declined over time, significant gender differences in employment by industry and occupation remain. For many of the occupations and industries that employ women disproportionately, jobs are spread more even geographically. For example, Hanson and Pratt (1995) found that women working in male-dominated industries have similar commutes to men, while women in female-dominated industries have shorter commutes. This has been disputed by, for example, Gordon, Kumar, and Richardson (1989), who argue that the gender commuting gap persists across occupational categories. As noted by MacDonald (1999), this relationship remains uncertain.

Finally, a fourth explanation is that women have shorter commutes as a result of spatial entrapment in local labor markets. The spatial entrapment hypothesis holds that women are segmented into local labor markets, affecting job search and switching. This may be a larger factor for women than for men. For example, Hanson and Pratt (1988) found that women in their Worcester study sample are significantly more likely to choose employment based on their residential location than their male counterparts. However, this explanation is difficult to examine with the limited geographic data available in nationally representative datasets.

Since MacDonald's review, additional analyses have verified that the gender gap continues to persist across nationally representative datasets, including the 1995 National Personal Transportation Survey (Doyle and Taylor, 2000) and the 2005 American Housing Survey (Crane, 2007).

A related body of research has investigated the differences in how women and men commute. McGuckin and Murakami (1999) found, using travel diary data from the 1995 National Personal Transportation Survey (NPTS), that gender and family structure are strongly related to the number of stops made between home and work. Further refining a measure of trip tours to examine stops using the 1995 NPTS and 2001 National Household Transporta-

tion Survey (NHTS), McGuckin and Nakamoto (2004) settled on an operational definition allowing for stops of up to 30 minutes during a trip tour between home and work. Applying this measure to weekday workers in the 2001 NHTS, McGuckin, Zmud, and Nakamoto (2005) noted that women make more stops between home and work.

Kimbrough (2016) applies this definition to ATUS data, detailing the methodology and establishing the comparability of commuting time estimates from the ATUS using this methodology to those from NHTS and American Community Survey (ACS) data. When the commuting trip tour measure is applied to the ATUS, observed commuting behavior matches up closely with observed behavior in the NHTS, both in the aggregate and at times throughout the day. The evidence presented in Kimbrough (2016) supports the use of this methodology to produce measures of commuting that mirror those in the NHTS–an established survey used to produce reliable estimates of travel behaviorat the sample level. The analysis also demonstrates that measures of to-work commuting in the ATUS show similar patterns to those from the ACS, an additional large, nationally representative survey often used to study commuting.

The trip tour measure retains the disadvantage that it is not derived directly from respondents. However, survey questions focused on commuting behavior can have their own disadvantages; for example, the ACS measures average commuting time to work over the past week. The derived ATUS measure, by contrast, allows for more flexible examination of travel to and from work across the entire day. Additionally, while it includes assumptions about the length of stops allowed along the way, this assumption can be relaxed, as shown in Section 5.

# 3 A Static Labor Supply Model of Commuting and Work

This proposed basic static model of labor and commuting decisions is intended to generate predictions about observed behavior. The basic model is motivated by an individual's decision whether or not to work when faced with a given job and its associated commute. In subsequent sections, the predictions of this model will be applied to ATUS data to decompose the relationships between gender, commuting time, and employee characteristics.

A commute functions as a fixed time cost of work, a basic extension of the simple static model of labor supply as explained by, for example, Cogan (1981) and Killingsworth (1983). Two strands of theoretical models for examining commuting behavior differ in their treatment of household residential location decisions, with urban models (e.g. Wales (1978) and White (1988)) generally treating this decision as endogenous and labor supply models (e.g. Black, Kolesnikova, and Taylor (2014)) treating it as exogenous. I adopt the latter approach for this analysis.

Utility is a general function of consumption ($C$) and leisure time ($l$). There are no monetary costs of work, and the only time cost of work is commuting ($t$); this cost is incurred only when an individual chooses to work. An individual maximizes her utility subject to a time budget constraint based on the choice of whether to work $h$ hours:

$$T = h + t + l \tag{1}$$

If an individual chooses not to work, her utility is a function of consumption from non-labor income ($N$) and leisure time, equal to the total hours available ($T$):

$$U = W(N, T) \tag{2}$$

Where $W_N > 0$.

Her utility when she chooses to work is expressed as the indirect utility of working, a function of the wage $w$, non-labor income $N$, and commute time $t$ (when she chooses the optimal number of hours to work):

$$U = V(w, N, t) \tag{3}$$

Where $V_w > 0$, $V_N > 0$, and $V_t < 0$.

In order for the individual to choose to work, the indirect utility of working must exceed the utility of not working. This condition is expressed through the function $D$, equal to the indirect utility of working minus the utility gained when not working:

$$D = V(w, N, t) - W(N, T) \tag{4}$$

An individual will choose to work when $D$ is positive for a given bundle of $w$, $N$, and $t$. This can also be expressed in terms of the minimum wage and maximum commute that will make her at least indifferent between working and not working.

For a given $N$ and $T$, the individual has a reservation wage $w^\star$ and a reservation commute time $t^\star$. She will choose to work only when the commute is equal to or less than the reservation commute, and only when the wage available is at least equal to the reservation wage.

Implicit differentiation gives the following conditions on $t^\star$:

$$\frac{\partial t^{\star}}{\partial w} = -\frac{\frac{\partial D}{\partial w}}{\frac{\partial D}{\partial t}} > 0 \tag{5}$$

$$\frac{\partial t^{\star}}{\partial N} = -\frac{\frac{\partial D}{\partial N}}{\frac{\partial D}{\partial t}} \begin{cases} > 0 & \text{if } \frac{\partial V}{\partial N} > \frac{\partial U}{\partial N} \\ < 0 & \text{if } \frac{\partial V}{\partial N} < \frac{\partial U}{\partial N} \end{cases} \tag{6}$$

The sign of $\partial t^*/\partial N$, ambiguous in Equation 6, can be determined due to differences in the marginal utility of non-labor income $N$ in working and non-working states. Because a worker has wage income $w(T-l-t)$ in addition to non-labor income $N$, the marginal utility of non-labor income is lower than if she does not work, when her total income is only $N$. Therefore $W_N < V_N$. Since $W_N < V_N$, $\partial t^*/\partial N < 0$.

Lower reservation commutes translate to lower observed commuting time, since those with commutes higher than the reservation commute will choose not to work. Hence, under these plausible assumptions, the model yields two main predictions about relationships between commuting time and two underlying parameters, each of which might be expected to vary between men and women:

1. A positive relationship between commuting time and the wage rate $w$, and
2. A negative relationship between commuting time and non-labor income $N$.

As discussed in Section 2, numerous previous studies have explored the relationship between commuting time and wages. Since women in general earn lower wages than men, this has been a central explanation of the gender commuting gap, consistent with the predicted positive relationship between wages and commuting time. However, the nature of this relationship is less straightforward. One hypothesis is that the types of jobs women tend to hold systematically offer lower wages than the types of jobs held by their male counterparts.

The second relationship is more difficult to investigate. Like many datasets, the ATUS lacks detailed information on sources of income other than a respondent's wage income.

However, for married individuals, a spouse's employment serves as a source of non-labor income. Married women's spouses are more likely to be employed than married men's spouses, so this would also be expected to shorten women's commutes relative to the commutes of men.

The following sections examine these predicted relationships, first descriptively and then using a variety of multivariate analyses. As detailed in Section 4.2, the ATUS contains no directly appropriate measure of non-labor income for all respondents, but does have a proxy for some individuals. Wage measures can be constructed for most ATUS respondents.

# 4 Data

This analysis uses American Time Use Survey (ATUS) data from 2003 to 2014 to examine the gender commuting gap.[1] The ATUS collects extensive information on how Americans spend their time, including all episodes of travel time, as well as a range of household and worker characteristics. The ATUS is an annual, national time use survey administered by the Bureau of Labor Statistics (BLS). One respondent per household is chosen from a subset of households which have recently completed the Current Population Survey (CPS). Begun in 2003, data are now available for years 2003 through 2014, with about 14,000 respondents per year. Response rates vary from 49.9% in 2013 to 57.8% in 2003. Respondent probability weights are used to account for nonresponse and oversampling of some groups, producing nationally representative estimates.

While the ATUS does not distinguish between commuting and other travel episodes, it has advantages over other available datasets. The ATUS contains respondent characteristics that commonly used transportation datasets like the NHTS lack, such as wage and salary information. Moreover, unlike both the NHTS and the ACS, the ATUS captures other uses

[1] I use hierarchical extracts of ATUS data obtained from the ATUS-X extract system (Hofferth *et al.* 2013)

of time on the same day. This includes details of time spent at stops along the way between home and work. This allows for examination of stops along journeys, including the number, type, and length of these stops. Such analysis is not possible with the ACS, and while the NHTS contains some information about the number of stops, it does not provide the extensive detail about type and length of stops available in the ATUS. Finally, the ATUS contains information on who is present for each activity, important for examining whether women are more likely to be accompanied by children while traveling.

For each respondent, the survey collects time diary information on activities performed in a 24-hour period (from 4 AM the previous day to 4 AM the day of the interview) as well as a range of respondent and household characteristics. The time diaries are collected using "conversational interviewing," intended to help respondents generate time diaries through open-ended questions (Shelley 2005). Each activity is then assigned an activity code based on the classification of the primary task being carried out. Information on those with whom the activity took place and the location (or, for travel, mode) is also collected.

The reported and coded activities include travel episodes. ATUS respondents are not asked to provide the purpose of any trips, nor are they asked to identify travel specifically. Instead, a spell is coded as travel if it involves movement from one location to another. Overall, estimates of the total amount of time spent traveling in a day from the ATUS appear to be comparable to those using NHTS data, as demonstrated by Bose and Sharp (2005). However, classification of this travel time by its purpose is inexact.

The purpose of a travel spell is then coded on the basis of the activities taking place immediately before and after (Shelley 2005). As detailed in Kimbrough (2016), using this ATUS classification of travel is unsatisfactory, especially when examining groups which systematically differ in the number of stops along the way between home and work. As shown in Section 5, this holds for gender in the sample examined.

## 4.1 Trip Tours

The trip tour methodology outlined by McGuckin and Nakamoto (2004) addresses the fundamental issue of assigning trip purpose to reported travel in trip chains. Classifying travel in this way necessitates the following terminology:

- *trip chains*: sequences of travel with stops;
- *trip tours*: trip chains that, following the McGuckin and Nakamoto methodology, contain stops of no more than 30 minutes; and
- *commuting trip tours*: trip tours that begin at home and end at work or begin at work and end at home.

All trips in a trip chain containing stops of no more than 30 minutes each are combined to form tours anchored by home, work, or another location. Using this framework, commuting trip tours are those that either begin at home and end at work, or begin at work and end at home.

Tours are classified as occurring from home to work if the first trip begins at home, the last trip in the sequence ends at work, and the respondent does not report a dwell time of more than 30 minutes at any stop along the way. Tours beginning at home but ending with a 31 minute or longer stop somewhere other than work are classified as home-to-other. The same rules apply to trips from work to home. Therefore, this methodology classifies trips as commuting tours that contain no stop of more than 30 minutes and either begin at home and end at work or begin at work and end at home.

This methodology is applied to the ATUS data, as outlined in Kimbrough (2016). When stops of an allowed length are made along the way, the time spent at stops is not included in the calculation of commuting time. A threshold for allowed stop time of 30 minutes is chosen, as proposed by McGuckin and Nakamoto. However, to explore the impact of including

different length stops on the gender gap, this threshold is adjusted for some analyses in Section 5.

## 4.2 Analysis Dataset Construction

Few measures of wages and income are included in the ATUS. Hourly earnings information is included for less than half of the respondents in this sample, since it is only available for those who report hourly earnings. For the remainder of the sample, information on weekly earnings and the usual weekly number of hours worked is available. These data are used to construct hourly wages for those individuals who do not report hourly wages. If the usual number of hours worked in a week is not reported, this analysis uses 40 hours per week for those reporting full time work and 20 hours for those reporting part time work. Wages are adjusted for inflation using the Consumer Price Index for Urban consumers (CPI-U) to 2003 dollars. Individuals whose constructed hourly wages are less than $5 or greater than $200 are then excluded. Finally, the log of hourly wages is used in all subsequent multivariate analyses.

One proxy for non-labor income is the presence of an employed spouse. For married individuals, an employed spouse represents a source of income independent of the individual's labor market decisions. This proxy is used to explore the predicted relationship between non-labor income ($N$) and commuting time. Additional family characteristic indicators are constructed for the presence of children and whether a household child was present for any part of the commute.

Individual controls for age and white non-Hispanic status, as shown in Table 1, are included in these analyses. Additionally, indicator variables for metropolitan status are constructed. Unfortunately, geographic information is not available for all respondents, so the metropolitan status variable can take on one of five values. For 121 individuals, metropolitan status is not identified at all. 3,220 individuals are identified as in a metropolitan area, with

no information about whether they are in the central city. All other respondents are classified as outside of a metropolitan area or within a metropolitan area and residing either in the central city or in the balance of the metropolitan area.

Controls for factors that affect the segment of the labor market faced by the respondent are also constructed. In addition to indicator variables for the highest level of education completed, indicators for each of 22 occupation categories and 21 industry categories are used to control for the occupation and industry of the respondent's main job. The sample distributions of these occupations and industries are shown in Appendix Table A.1.

## 4.3 Sample Characteristics

ATUS data are limited in that they contain information only on a single day for each respondent. The analysis is limited to respondents who work full time and report working on the diary day. Additionally, evidence from Giménez-Nadal, Molina, and Velilla (2015) suggests that the self-employed differ significantly from employed individuals, both theoretically and empirically. The self-employed are also much less likely to have valid wage values in the ATUS. For these reasons, self-employed respondents are excluded.

Furthermore, to produce a sample that most closely resembles normal working days, it is limited to diary days that are non-holiday weekdays. Only individuals who are between the ages of 25 and 60 are examined, using ATUS data collected from 2003 to 2014. Finally, in constructing the commuting measure the sample is limited to those beginning and ending the day at home.[2] The resulting sample contains 21,564 individuals: 11,344 men and 10,220 women. For all analyses, these observations are weighted using ATUS respondent probability weights.

[2]As described in Kimbrough (2016), sleep spells beginning and ending the diary day (which have no associated location) are recoded as taking place at home.

Table 1: Sample Characteristics

| | Full Sample | Men | Women |
|---|---|---|---|
| Male | 56.8% | 100% | 0% |
| Female | 43.2% | 0% | 100% |
| Less than high school | 6.9% | 8.9% | 4.3% |
| High school graduate | 26.9% | 28.5% | 24.8% |
| Some college | 25.6% | 23.6% | 28.2% |
| College graduate | 25.5% | 24.7% | 26.6% |
| Graduate degree | 15.1% | 14.2% | 16.2% |
| Age 25-34 | 29.0% | 29.5% | 28.3% |
| Age 35-44 | 29.3% | 30.0% | 28.2% |
| Age 45-60 | 41.8% | 40.5% | 43.5% |
| Non-Hispanic white | 70.1% | 70.3% | 69.8% |
| Other race/ethnicity | 29.9% | 29.7% | 30.2% |
| Child present in household | 45.9% | 47.6% | 43.6% |
| No children present | 54.1% | 52.4% | 56.4% |
| Spouse present | 64.6% | 68.6% | 59.3% |
| Unmarried partner present | 5.4% | 5.1% | 5.7% |
| No spouse/unmarried partner | 30.0% | 26.2% | 35.0% |
| Metropolitan, central city | 25.6% | 25.2% | 26.0% |
| Metropolitan, balance of MSA | 44.1% | 44.5% | 43.5% |
| Metropolitan, not identified | 14.7% | 15.0% | 15.4% |
| Nonmetropolitan | 14.8% | 15.0% | 14.5% |
| Metropolitan status not identified | 0.6% | 0.6% | 0.6% |
| Number of Observations | 21,564 | 11,344 | 10,220 |

Source: ATUS 2003-2014 samples with restrictions as noted in text. Sample percentages are weighted using ATUS respondent probability weights.

As shown in Table 1, men represent 57% of the weighted sample. Women in the sample are less likely to have a spouse or child present in the household than their male counterparts. Women in the sample tend to be slightly older and more educated than sampled men.

# 5 Gender Differences in Commute Character

The commutes of men and women in the sample differ in multiple ways. First, men's mean commutes are significantly longer: men commute 54.6 minutes on average, while women commute 49.2 minutes on average. Differences in mean times will be explored and decomposed further in Section 6.

Table 2: Stops of up to 30 Minutes Along the Commute

| | Mean number of stops | | % of gender sample | |
|---|---|---|---|---|
| | Men | Women | Men | Women |
| Child present in household | 0.51 | 0.94 | 47.6% | 43.6% |
| No child present in household | 0.37 | 0.39 | 52.4% | 56.4% |
| Child present on commute | 0.93 | 1.32 | 16.6% | 27.2% |
| No child present on commute | 0.34 | 0.37 | 83.4% | 72.8% |
| All | 0.43 | 0.63 | 100% | 100% |

In addition, men and women show significantly different characteristics of stops between home and work. As shown in Table 2, using the adapted McGuckin and Nakamoto commute tour measure allowing for stops of up to 30 minutes, women on average make 0.63 stops along the commute in a day while men make an average of 0.43 stops. Men and women without children in the household make about the same number of stops, 0.37 for men and 0.39 for women. However, women in the sample with children in the household make an average of 0.94 stops, significantly more than men in the sample with household children, who average 0.51 stops. The difference is concentrated among those whose children are present on at least part of the commute. While 44% of women have household children compared to 48% of men, only 17% of men in the sample are joined by a child for at least part of the commute, compared to 27% of women. The increased propensity for stops is concentrated in these individuals; on average, men joined by children along the commute make 0.93 stops and women with children present make 1.32 stops.

Table 3 summarizes the prevalence of the most common stop purposes for those in the sample who stop along the way between home and work. Women are significantly more likely to make stops for the purpose of caring for and helping household members. Combined with their greater propensity to make stops along the way, this underscores the far greater responsibility of caring for household members taken on by women in the sample.

Table 3: Primary Stop Activities for Stops of up to 30 Minutes Along the Commute

| | % of sample with primary Stop | |
|---|---|---|
| | Men | Women |
| Caring for and helping household members | 26.0% | 42.5% |
| Consumer purchases | 35.4% | 27.8% |
| Caring for and helping non-household members | 6.9% | 4.9% |
| Socializing, relaxation, and leisure | 4.5% | 2.9% |
| Eating and drinking | 4.2% | 1.0% |
| Other | 23.0% | 20.9% |

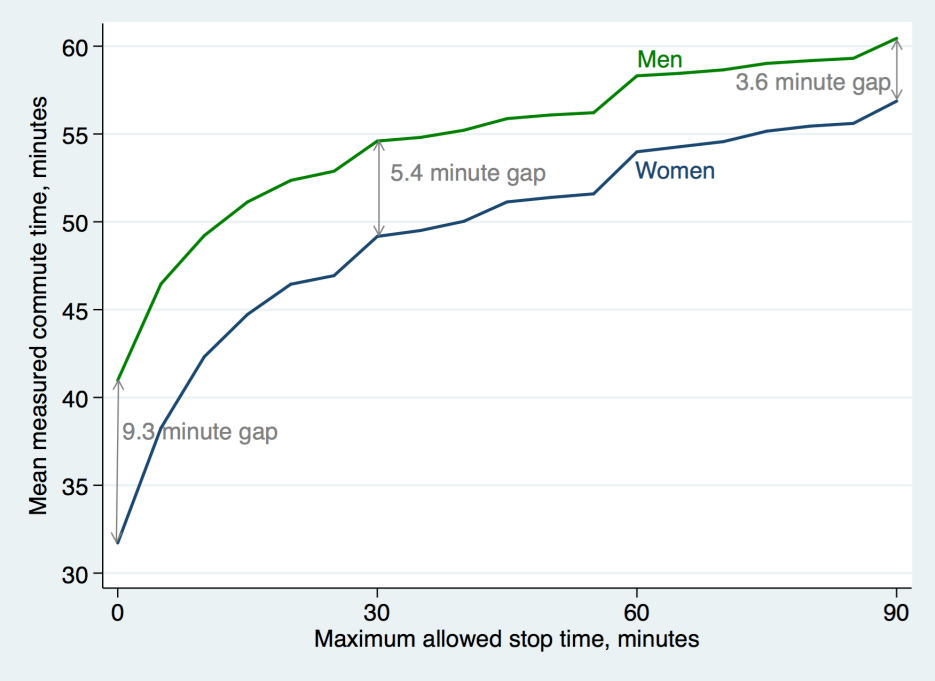
Women in the sample are significantly more likely to stop along the way between home and work, with 38% stopping at least once, compared to 29% of men. As shown in Table 4, more women than men make 2 or more stops: 16.4% of women versus 9.5% of men. These differences in stop behavior translate, on average, into an addition 0.2 stops per day for women, and an additional 2.1 minutes per day spent at stops along the commute.

Table 4: Characteristics of Stops of up to 30 Minutes by Gender

| | Men | Women |
|---|---|---|
| % of sample with stops along day's commute tours: | | |
| 0 stops | 71.3% | 61.8% |
| 1 stop | 19.2% | 21.8% |
| 2 stops | 6.4% | 11.1% |
| 3 or more stops | 3.1% | 5.3% |
| Mean number of stops | 0.43 | 0.63 |
| Mean time spent at stops, minutes | 4.8 | 6.9 |

Tables 3 and 4 use a reasonable threshold of 30 minutes for stops along the commute; allowing for stops of up to 30 minutes, women make significantly more stops and spend longer at these stops than men. Women in the sample also have more stops of longer duration than their male counterparts; if the threshold is relaxed to include more of these stops, the gender gap in commuting time shrinks. Figure 1 plots mean commute time for men and women when the maximum allowed stop time is increased in five-minute increments. If no stops are allowed along the commute, the average gap is 9.3 minutes, falling to 5.4 minutes with up to 30 minute stops and to 3.6 minutes with stops of up to 90 minutes allowed. This underscores the importance of using a commuting measure that accommodates some stops along the way.

Figure 1: Allowing Longer Stops Decreases the Gender Commuting Time Gap




Source: ATUS 2003-2014 samples with restrictions as noted in text, weighted using ATUS respondent probability weights.

In summary, women are more likely to stop along the journey between home and work. The gender difference is concentrated in those who have a child present for at least part

of the commute. Women are almost twice as likely as men to fall in this category, and women who commute with children make even more stops than men who commute with children. This is consistent with women's higher propensity to stop for purposes related to child care. As a result, the gender commuting gap is highly sensitive to whether the commuting measure accommodates stops along the way. This analysis therefore relies on the commuting calculation methodology from Kimbrough (2016) as a reasonable means of allowing for shorter stops along the commute.

# 6 Descriptive Analysis

The weighted mean commuting time for men in the sample is 54.6 minutes, compared to 49.2 minutes for women. The gap in commuting time for men and women, while a modest 5.4 minutes, represents 10% of the mean male commute and is statistically significant. This descriptive analysis focuses on two predicted effects from the theoretical model presented in Section 3. First, individuals with higher wages are predicted to have higher commuting times. Second, those with higher non-labor income are predicted to have lower commuting times. Due to a lack of detailed income information, the only available proxy for non-labor income is (for married individuals) whether a spouse is employed.

## 6.1 Wages

The commuting time gap between women and men is roughly constant across the wage distribution. As one illustration, individuals were ordered by wage and assigned to five quintiles, each containing 20% of workers. As shown in the top panel of Table 5, higher wages are associated with longer commutes for both men and women. However, the gender gap persists when comparing men and women at any of five wage quantiles, holding constant at about four minutes. Moreover, women are more likely to be in the three lower quintiles;

67.6% of women have wages of $19.19 or less while only 54.3% of men do. The within-quintile gap of approximately four minutes combines with different wage distributions for men and women to yield a larger overall gap of 5.4 minutes.

Table 5: Respondent Characteristics and Commuting Time

| | % of gender sample | | Mean commuting time | |
|---|---|---|---|---|
| | Men | Women | Men | Women |
| Quintile wage range, 2003 dollars | | | | |
| $5.00-$10.50 | 17.2% | 23.8% | 47.2 | 43.4 |
| $10.51-$14.42 | 18.2% | 22.4% | 50.2 | 45.5 |
| $14.43-$19.19 | 19.0% | 21.4% | 54.1 | 50.9 |
| $19.20-$27.30 | 21.5% | 18.0% | 56.6 | 52.7 |
| ≥$27.31 | 24.2% | 14.4% | 61.8 | 57.4 |
| Spouse characteristics | | | | |
| Spouse present and employed | 51.5% | 55.9% | 55.3 | 50.0 |
| Spouse present but not employed | 22.3% | 9.1% | 58.7 | 47.2 |
| No spouse present | 26.2% | 35.0% | 49.7 | 48.4 |
| Household children | | | | |
| Children in the household | 47.6% | 43.6% | 57.7 | 52.7 |
| No children in the household | 52.4% | 56.4% | 51.7 | 46.4 |
| Commuting with children | | | | |
| Child present for commute | 16.6% | 27.2% | 59.7 | 56.2 |
| No child present during commute | 83.4% | 72.8% | 53.6 | 46.5 |
| Total | 100% | 100% | 54.6 | 49.2 |

Notes: ATUS 2003-2014 samples with restrictions as noted in text. Means are weighted using ATUS respondent probability weights. Each wage quintile contains approximately 20% of the sample sorted by wage.

## 6.2 Presence of Employed Spouse

As shown in Table 5, more women than men in this sample have an employed spouse present. For men, having an employed spouse present is associated with a decreased commuting time relative to an unemployed spouse. This is consistent with the predicted negative relationship between $N$ and reservation commute.

However, for women the effect is reversed, and an employed spouse is associated with a longer commute than an unemployed spouse. This could be due to the confounding effects of household children. While 53% of women with unemployed spouses have children under 18 present, 65% of those with employed spouses do. By contrast, this is reversed for men, who are about 9% more likely to have a child present if their spouse is unemployed.

### 6.3 Presence of Children

An array of prior studies have suggested that women's greater household responsibilities play a role in their shorter commutes. Section 5 examined how these responsibilities impact the number of stops made along the way. Those who commute with a child are much more likely to stop along the way. While this holds true (at least in part) for both men and women, women are much more likely to have a child present for at least part of the commute.

When commuting time is calculated using the trip tour methodology allowing for stops up to 30 minutes, children are associated with longer commutes for both women and men, as shown in Table 5. This association holds both for the presence of children in the household and for children present for at least part of the commute. Moreover, more men than women in the sample have a child present in the household and on the commute. So while responsibility for children is associated with more stops along the way between home and work, it also seems to be associated with longer commutes. Therefore, this relationship does not help to explain the shorter commutes of women.

## 7 Multivariate Analysis

To further explore the relationship between individual characteristics and commuting time, multivariate models of commuting time as a function of worker characteristics are constructed. First, OLS models containing a gender indicator are estimated to examine the

remaining gender gap after controlling for these factors. All multivariate OLS models regress total work-related travel time for an individual on a $female$ indicator and a host of controls, taking the form:

$$CommutingTime_i = \alpha + \beta female_i + \gamma X_i + \delta Y_i + \epsilon_i \tag{7}$$

where $X_i$ is a vector of controls for ATUS survey year, age range, and whether an individual is White, non-Hispanic. Additional controls are then added incrementally as the vector $Y_i$. All of these controls take the form of indicator variables, with the exception of log wages.

Table 6: Linear Regression Coefficient Estimates: Effect on Commuting Time

| | Model | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Characteristic | | | | |
| Female | -5.44 (0.70) | -3.09 (0.71) | -3.43 (0.70) | -1.64 (0.77) |
| White, non-Hispanic | -4.60 (0.80) | -6.45 (0.83) | -4.23 (0.95) | -4.39 (0.95) |
| Log wage | | 11.30 (0.78) | 8.87 (0.81) | 6.56 (0.86) |
| Spouse present | | 2.76 (1.18) | 3.13 (1.17) | 2.68 (1.15) |
| Spouse employed | | -1.05 (1.04) | -0.76 (1.01) | -0.27 (0.99) |
| Child present in household | | 4.53 (0.77) | 4.68 (0.75) | 4.80 (0.75) |
| Indicators | | | | |
| Year | Yes | Yes | Yes | Yes |
| Age | Yes | Yes | Yes | Yes |
| Education | No | Yes | Yes | Yes |
| Metropolitan status | No | No | Yes | Yes |
| State | No | No | Yes | Yes |
| Occupation | No | No | No | Yes |
| Industry | No | No | No | Yes |

Notes: OLS regressions estimated using ATUS 2003-2014 samples with restrictions as noted in text, weighted using ATUS respondent probability weights. Standard errors are in parentheses.

Estimated coefficients for four models with progressively more controls are shown in Table 6. The gender gap remains statistically different from zero at the 5% level in all models. The gap shrinks markedly when wage, spouse, child, and education controls are added in Models

(2) and (3). It is reduced further by the addition of indicators for occupation and industry in Model (4). Controlling for other factors in the model, women are estimated to spend 5.4 fewer minutes commuting in Model (1), about between 3.1 and 3.4 fewer minutes in Models (2) and (3), and 1.6 fewer minutes in Model (4).

As predicted by the theoretical model in Section 3, log wages are positively associated with commuting time. Similarly, the sign of the effect of an employed spouse for married workers is negative (as predicted), though this effect is not statistically significant. However, much of the gender commuting gap remains in Model (3), even after controlling for wages, spousal employment, the presence of children, and a host of other controls. Model (4) adds controls for industry and occupation, lowering the estimated effect of wages on commuting time and reducing the remaining gender gap significantly. This is consistent with the hypothesis that one component of women's lower observed wages is associated with gender differences in occupation and industry of employment. This is also consistent with the explanation from MacDonald (1999) that the types of jobs women hold are more likely to be closer to home.

## 7.1 Testing the Household Responsibility Hypothesis

To test the Household Responsibility Hypothesis, Turner and Niemeier (1997) estimate separate reduced-form equations analogous to Equation 7 for women and men using data from the 1990 National Personal Transportation Survey (NPTS). They focus on the estimated coefficient for the presence of children for women, after controlling for spouse and individual characteristics. I estimate an equivalent model using the ATUS data:

$$CommutingTime_i = \alpha female_i Z_i + \beta male_i Z_i + \epsilon_i \tag{8}$$

where $Z_i$ is a vector containing an intercept term and a set of controls, all except log wages again expressed as indicator variables.

Table 7: Linear Regression Coefficient Estimates: Effect on Commuting Time, Separated by Gender

| | Model | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Women | | | | |
| White, non-Hispanic | -5.70 (0.98) | -6.77 (1.00) | -4.13 (1.07) | 3.61 (1.10) |
| Log wage | | 11.81 (0.99) | 8.86 (1.01) | 7.11 (1.10) |
| Spouse present | | **-0.85(1.61)** | **-0.35(1.59)** | **-0.42(1.57)** |
| Spouse employed | | **1.92(1.55)** | **2.19(1.53)** | **2.25(1.52)** |
| Child present in household | | 5.26 (0.96) | 5.42 (0.95) | 5.75 (0.95) |
| Men | | | | |
| White, non-Hispanic | -3.80 (1.19) | -6.07 (1.26) | -4.17 (1.46) | -4.74 (1.45) |
| Log wage | | 10.79 (1.12) | 8.46 (1.18) | 5.87 (1.22) |
| Spouse present | | **5.08(1.71)** | **5.30(1.70)** | **4.91(1.66)** |
| Spouse employed | | **-2.45(1.34)** | **-2.07(1.28)** | **-1.58(1.25)** |
| Child present in household | | 3.36 (1.18) | 3.65 (1.14) | 3.74 (1.12) |
| Indicators | | | | |
| Year | Yes | Yes | Yes | Yes |
| Age | Yes | Yes | Yes | Yes |
| Education | No | Yes | Yes | Yes |
| Metropolitan status | No | No | Yes | Yes |
| State | No | No | Yes | Yes |
| Occupation | No | No | No | Yes |
| Industry | No | No | No | Yes |

Notes: OLS regressions estimated using ATUS 2003-2014 samples with restrictions as noted in text, weighted using ATUS respondent probability weights. Standard errors are in parentheses. Bold coefficient estimates differ between men and women at the 5% significance level.

Table 7 presents estimated coefficients for these models. Across the sets of controls used, significantly different coefficients for men and women are only estimated for a spouse's presence and employment. For women, a spouse has little effect on commuting time, while an unemployed spouse is related to a significantly longer commute for men. The estimated

effect of spousal employment is positive for women and negative for men; while neither is statistically significant, the gender difference is significant at the 5% significance level.

For testing the household responsibility hypothesis, the coefficient of interest is the presence of children. Turner and Niemeier (1997) use 1990 NPTS data based on trip segment-level classification of trip purpose to calculate commuting time and distance. They find significant positive relationship between the presence of children and both commuting dimensions for men, and significant negative relationships for women. By contrast, using the trip tour methodology to calculate commuting time using the ATUS, results in Table 7 show estimated positive relationships between children and commuting time for both men and women. The point estimates for women are consistently about two minutes higher than those for men across the sets of controls, but these differences are not statistically significant at the 5% significance level. These estimated effects provide evidence that greater household responsibility is not related to longer commuting time for women, and suggest that household responsibility may be associated with a greater lengthening of commutes for women than for men.

## 7.2 Decomposing Gender Differences

Next, Blinder-Oaxaca decompositions (Blinder, 1973; Oaxaca, 1973) are estimated using a model in which these characteristics are fully interacted with gender. This generates estimates of the proportion of the gap that is (1) associated with differences in covariates, (2) associated with differences in the effects of these covariates, and (3) associated with the interaction of differing characteristics and differing effects.

As shown in Table 8, these results suggest that across models, differences in observed characteristics explain only between 30% and 39% of the commuting gap. When controls for industry and occupation are excluded as in Models (2) and (3), almost all of the remaining difference is associated with gender differences in the impact of observed variation. For Model

(4), almost a third of the gap is estimated to be associated with the interaction of differences in observed characteristics and differences in the impact of those characteristics. Because the difference between this model and Model (3) is the addition of industry and occupation characteristics, the differential impact of these job characteristics (combined with differences between men and women in industry and occupation) may be driving a significant portion of the gender commuting gap. However, the estimated effects in Model (4) are significant at the 10% level but not at the 5% level.

Table 8: Blinder-Oaxaca Decomposition Results: Estimated Effects on Commuting Time

| | Model | | |
|---|---|---|---|
| | (2) | (3) | (4) |
| Difference | 5.43 | 5.43 | 5.43 |
| Associated with differences in: | | | |
| Observed characteristics | 2.12 | 1.62 | 2.16 |
| | (0.33) | (0.35) | (0.92) |
| Coefficients | 3.00 | 3.28 | 1.75 |
| | (0.72) | (0.71) | (0.91) |
| Interaction of observed characteristics and coefficients | 0.31 | 0.53 | 1.52 |
| | (0.44) | (0.44) | (1.16) |

Notes: Blinder-Oaxaca decompositions estimated using ATUS 2003-2014 samples with restrictions as noted in text, weighted using ATUS respondent probability weights. Models include the same characteristics as models 2-4 in Table 6. Standard errors are in parentheses.

Consistent with the OLS results, the Blinder-Oaxaca decomposition results suggest that gender differences in wages and household characteristics explain some (about 1/3) of the gender gap. Much of the remaining gap is associated with the interaction of gender differences in observable characteristics–especially occupation and industry of employment–and gender differences in the impact of those characteristics.

Like the OLS results, these results are consistent with the predictions of the theoretical model: a positive association of wages and negative association of spousal employment and commuting time. Moreover, these results are consistent with two of the explanations for

the gender gap offered by MacDonald (1999): women's lower wages, and the more even distribution of jobs that hire women.

# 8 Conclusions

The persistent gender gap in commuting has been the subject of an array of previous studies. This analysis has used a novel data source, the ATUS, that allows for the examination of aspects of commuting character as well as overall commuting time. Women are more likely to make stops along the way between home and work. They are also more likely to stop for purposes related to child care, consistent with the explanation that women have more household responsibility than men.

Descriptive and multivariate analysis suggests that, largely consistent with the implications of a simple static labor supply model, differences in wages and non-labor income explain a significant proportion of the gender gap. Another large portion of this gap may be explained by differences in job characteristics, as well as the differential impact of those characteristics for women and men. Combined with the previous picture of differences in commuting character, these analyses provide evidence to support two of the explanations that MacDonald (1999) offers for the gender gap in commuting:

- Women's low wages
- The more even distribution of jobs that hire women

The impact of differences in distribution of jobs that hire women appears to be felt not directly but through an interaction with differences in the impact of these job characteristics for women. Additionally, spatial entrapment in local labor markets may play a role, but cannot be examined using the ATUS data.

This study provides evidence that women's greater household responsibility does not contribute to the gender commuting time gap. The presence of children–and in particular

children brought along on the commute–is associated with longer commutes for both women and men when commuting time is calculated using a method that allows for brief stops along the way. In multivariate analyses controlling for individual and household characteristics, children are associated with longer commutes. Moreover, the increase in commuting time associated with children is about the same or even greater for women than for men. These results do not provide support for the Household Responsibility Hypothesis, which predicts that the greater household responsibilities of women with children would lead to shorter commutes.

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# Appendices

## A Additional Characteristics

Table A.1: Additional Sample Characteristics

| | Full Sample | Men | Women |
|---|---|---|---|
| Occupation Categories | | | |
| Management | 13.4% | 14.5% | 12.0% |
| Business and financial operations | 6.6% | 5.2% | 8.4% |
| Computer and mathematical science | 4.2% | 5.7% | 2.1% |
| Architecture and engineering | 3.2% | 4.9% | 1.0% |
| Life, physical, and social science | 1.4% | 1.3% | 1.6% |
| Community and social service | 2.2% | 1.4% | 3.2% |
| Legal | 1.4% | 1.1% | 1.9% |
| Education, training, and library | 6.9% | 3.5% | 11.5% |
| Arts, design, entertainment, sports, and media | 1.6% | 1.6% | 1.7% |
| Healthcare practitioner and technical | 4.5% | 2.2% | 7.5% |
| Healthcare support | 1.5% | 0.3% | 3.0% |
| Protective service | 1.7% | 2.4% | 0.8% |
| Food preparation and serving related | 2.0% | 1.9% | 2.1% |
| Building and grounds cleaning and maintenance | 3.0% | 3.7% | 2.1% |
| Personal care and service | 1.2% | 0.7% | 2.0% |
| Sales and related | 8.1% | 9.1% | 6.8% |
| Office and administrative support | 14.3% | 6.3% | 24.9% |
| Farming, fishing, and forestry | 0.6% | 0.8% | 0.3% |
| Construction and extraction | 5.5% | 9.5% | 0.3% |
| Installation, maintenance, and repair | 4.7% | 7.8% | 0.5% |
| Production | 7.4% | 9.5% | 4.6% |
| Transportation and material moving | 4.5% | 6.7% | 1.6% |
| Industry Categories | | | |
| Agriculture, forestry, fishing, and hunting | 0.8% | 1.2% | 0.3% |
| Mining | 0.6% | 1.0% | 0.2% |
| Construction | 6.7% | 10.9% | 1.2% |
| Manufacturing - durable goods | 9.7% | 12.6% | 5.8% |
| Manufacturing - non-durable goods | 5.3% | 6.1% | 4.2% |
| Wholesale trade | 3.6% | 4.4% | 2.5% |
| Retail trade | 7.8% | 8.6% | 6.8% |
| Transportation and warehousing | 3.7% | 4.9% | 2.1% |
| Utilities | 1.5% | 2.3% | 0.6% |
| Information | 3.0% | 3.2% | 2.7% |
| Finance and insurance | 7.6% | 5.6% | 10.1% |
| Real estate and rental and leasing | 1.7% | 1.9% | 1.5% |
| Professional, scientific, and technical services | 7.5% | 7.9% | 7.0% |
| Management, administrative and waste management services | 3.6% | 4.1% | 2.9% |
| Educational services | 10.6% | 6.1% | 16.5% |
| Health care and social services | 12.1% | 5.2% | 21.2% |
| Arts, entertainment, and recreation | 1.1% | 1.1% | 1.0% |
| Accommodation and food services | 3.1% | 3.1% | 3.2% |
| Private households | 0.2% | 0.0% | 0.4% |
| Other services, except private households | 3.4% | 3.9% | 2.7% |
| Public administration | 6.5% | 5.9% | 7.3% |

Source: ATUS 2003-2014 samples with restrictions as noted in text. Sample percentages are weighted using ATUS respondent probability weights.