The Gendered Effect of Larger Family Size on Married Individuals' Willingness to Commute for Work

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I. Introduction

The impact of COVID-19 not only challenges the healthcare systems across the world, but also extends to the way individuals work. With the influence of the ongoing pandemic, 42 percent of the US labor force found themselves staying at home and working remotely full-time, rather than commuting in private vehicles or public transportation to get to the office (Bloom, 2020). In addition, this change of work styles may very much become the "new normal" of how people work in the US in the near term: a fraction of US firms in certain industries have announced remote working will be a permanent option for their employees, no matter if the health guidelines in workplaces are in place or not. Under this situation, commute times disappeared for workers. However, at the same time, the additional leisure time workers gain from the disappearance of the commute times may be sacrificed by taking care of their children who are not able to go to school or be accepted by childcare institutions, or by other household duties that arise. This implication can change how people make choices of their jobs in the future. Before the pandemic, workers were balancing their work hours, household chores, as well as personal leisure time. Workers who bore a heavy burden of caregiving and household responsibilities faced two essential strategies to trade for more personal leisure time: one was to reduce their hours of work, and two was to reduce their commute times to work. Therefore, some workers faced constraints on which jobs they could choose from with the respect to their commute times. This limitation might disproportionately be experienced by female workers who were expected to make more commitments to household obligations – which was dependent on the number of children in the household – and thus might lead to a preference to choose jobs with shorter commute times. This paper intends to test the relationship between the number of children in a household and individuals' travel time to work, analyze the potential gender

differences of this relationship, and shed light on the implications of remote working on individuals' job choices and work-life balance.

Travel time to work has been a topic of investigation for economists to understand individuals' choices among work, family obligations, and leisure time. The theoretical foundation of the gender differences in commute patterns is presented by White's (1986) Household Responsibility Thesis, which suggests that travel time to work is a function of wages, housing prices, income, and other demographic variables. Empirical studies on the topic of commute lengths of men and women that came afterwards almost all confirm that women on average have shorter commute times than men, but have not yet determined which factors contribute to the gender difference. The majority of the literature have focused on analyzing the role of wages and job qualities on women's commute times. While many literatures conclude that women have a tendency to travel further for work with an increase in wages, Iwata and Tamanda (2014) found that the effect of wage rates on commute times becomes negative after the wage rates hit a certain level for married women. This finding implies that after married women reach a high level of wage rates, an increase in wages and longer commutes is less attractive to them in terms of choosing jobs, as they prefer to secure more time for household chores and personal leisure. However, sufficient access to job benefits, including scheduling and maternal leave, is correlated with longer commutes, despite women's orientation toward traditional gender expectations (Haley-Lock, Berman, and Timberlake, 2013). In addition to wage rates, Turner and Niemeier (1997) confirmed the Household Responsibility Hypothesis and observed a statistically significant effect of the presence of children on the gender differences of commute times, even though men are found doing more housework and caregiving (Blau, and Ferber 1992). Employing more recent data from the 2003-2010 American Time Use Survey, Fan

(2017) analyzed the different travel behaviors and patterns of US male and female workers, influenced by partner presence, parenthood, and breadwinner status. The results of this study demonstrate that gender difference in commute times is observable only when individuals are married and have at least one child in the household.

This research intends to build upon previous studies on the relationship between commute times and an individuals's work-life balance, as well as to explain factors behind the gender gap in commute times. Previous literature has tested how parenthood – having children or not – interacts with individuals' commute times and this study intends to find out the influence of additional children on married individuals' commute times and to understand potential differences experienced by male and female workers. Moreover, this study will also look into if this relationship and the potential gender gap vary among White, Black, and Asian individuals.

This study is structured as follows: Section II will present data from American Community Survey (ACS) and summary statistics. Section III will explain the methodology of this empirical research and regression models. Section IV will illustrate regression results and discussion. Section V will conclude this study, draw implications on working virtually, and offer future areas of study.

II. Data and Summary Statistics

The data used in this study come from Integrated Public Use Microdata Series (IPUMS). More specifically, the data are collected from the American Community Survey (ACS) from 2012 to 2018. This sample contains pooled cross-section data about individual-level information on their commute time to work, number of children, sex, race, individual salary, family total income (from all sources in the previous year), and residence location (whether they live in metropolitan areas).

Since this research aims to shed light on the gender disparity in a family setting about how much time married individuals spend on the road commuting to jobs, those who do not currently have a job or who are not married should not be included in the sample. For the purpose of this research, I only keep the individual data points who are married and are employed. This left 5,178,582 sample observations for analysis.

Among all the information this data set provides, commute time to work (dependent variable) and an individual's number of children (key variable) are the two variables that merit exploration on their potential relationship. Drawing insights from previous literature related to this topic, I included individual salary, family total income, and an individual's residence location as relevant variables, since they may have a potential effect on an individual's travel time to work. Sex and race variables are used to segment individuals into different groups, testing if the effect of having more children on an individual's commute time is different between male and female, if the possible male-female gap is statistically significant, and if this potential gender disparity varies by race.

The tables below (Table 1-2) provides summarized information for all the important variables included in this study.

Table 1

Summary Statistics: commute time, number of children, individual salary, and total family income

Variable	Mean	Std. Dev.	Min.	Max.
Commute Time (mins)	26.75	23.83	0	200
# of Children	1.12	1.18	0	9
Individual Salary	62,742.06	73,306.51	0	736,000
Total Family Income	131,540.40	113,169.00	-19,770	2,868,000

Table 2

Summary Statistics: distribution of individual residence location, sex, and race

Residence Location	Frequency	Percent
In metropolitan area: in central/principal locations	321,852	6.22
In metropolitan area: not in central/principal locations	612,614	11.83
In metropolitan area: central/principal location undetermined	3,653,375	70.55
Non-metropolitan area	590,741	11.41
Sex		
Male	2,880,104	55.62
Female	2.298,478	44.38
Race		
White	4,270,143	82.46
Black	330,945	6.39

Asian	410,307	7.92
Other races, mixed or indeterminable	167,187	3.23
Total	5,178,582	100.00

One explanatory variable included in this study is an individual's salary. The rationale is that, as an individual's salary increases, they may be more likely to commute for a longer time. The greater amount of time spent on the road is compensated by higher wage rates. As this research considers every subject in a family context, it also makes sense to include an individual's spouse salary as another explanatory variable. However, this information is not available in the ACS dataset and therefore family total income is chosen as a substitute for an individual's spouse salary. Family total income includes combined salary of the married couple and other income sources, from the previous year such as investment returns.

Another explanatory variable included in this research is the individual's location of residence, given that an individual's travel time to work is influenced by where they live. The data segments an individual's location of residence into four categories shown in Table 2.

As the research's principal purpose is to find if the effect of having more children on commute times differs between men and women, an interaction term between number of children and an individual's sex is created to evaluate whether the difference of this effect between two genders is statistically significant. An additional purpose of this study is to understand if the family size effect on commute times holds the same or differs across different racial groups in terms of the potential gender disparity. Therefore, the sample will also be segmented into groups based on race to run regression analyses in order to find the corresponding OLS estimator that indicates the possible gender disparity of a particular racial group. For example, running

regressions on data points consisting only Asian individuals allows comparison of the family size effect on commute times between Asian men and Asian women, and in addition enables observation about if the possible gender disparity of this effect remains the same, or differs from other races. The dataset contains four different categories for a subject's race: White, Black, Asian, and others (other races, mixed, or indeterminable). Given the data availability and this study's interest in testing the family size effect on commute times across different races, this effect will be tested in regression analyses for White, Black, and Asian individuals, and the possible gender disparity of this effect can be observed for different racial groups.

III. Methodology and Empirical Framework

A) Estimating the effect in the entire sample population

This econometric research performed regression analyses to test the hypothetical relationship between an individual's commute time to work and the number of children. Evaluating the possible gender gap of this relationship enables this study to shed light on whether the influence of an increasing number of children may have different implications for male versus female on their time invested in travelling for work, and on their choice of jobs. The model used is as follows.

$$CommuteTime = \beta_0 + \beta_1 Children + \beta_2 Female + \beta_3 Female * Children + \beta_4 Salary + \beta_5 FamIncome + \beta_6 NonMetropolitan + \beta_7 Central + \beta_8 NonCentral + \beta_9 White + \beta_{10} Black + \beta_{11} Asian + \mu$$

Table 3 Name and definition of regression variables

Variable Name	Definition
CommuteTime	An individual's travel time to work (mins)
Children	An individual's number of children
Female	A dummy variable for female
*Female * Children*	An interaction term of an individual's number of children and sex
Salary	An individual's salary from their job(s)
FamIncome	An individual's family total income from all sources in the previous year
NonMetropolitan	A dummy variable for individuals living in non-metropolitan areas
Central	A dummy variable for individuals living in a metropolitan area's central locations
NonCentral	A dummy variable for individuals living in a metropolitan area but not in its central locations
White	A dummy variable for individuals who identified themselves as White

Black	A dummy variable for individuals who identified themselves as Black
Asian	A dummy variable for individuals who identified themselves as Asian

This analysis uses a multivariate regression model to test the relationship. In this study, the dependent variable *CommuteTime* is an individual's travel time to work, measured in the unit of minutes. The key variable of interest is an individual's number of children (*Children*). The coefficient β_1 indicates the amount of change (either increase or decrease) in commute times for men in the entire sample population on average caused by having one additional child. The coefficient β_3 of the interaction term $Female * Children$ indicates the amount that women's commute time increases or decreases more than men's, for every additional child. Therefore, the coefficient β_3 helps quantify the possible gender gap – how differently an increasing number of children affects women's commute time to work, compared to men's – and test whether this disparity is statistically significant or not. Looking into the possible difference helps confirm or deny the original hypothesis that, compared to men, women are more likely to be responsible for household duties, sacrificing job choices or prospects, and thus having more children may have a negative correlation with commute time. The model estimates the coefficients of right-hand side variables by the Ordinary Least Squares (OLS) method.

The primary challenge of this econometric study is the omitted variable bias. Having relevant variables omitted in the regression analysis will cause bias in the OLS estimators. Therefore, several explanatory variables are added to the model, including an individual's personal salary, family total income, residence, and race. Having these variables in this econometric model prevents the possible omitted variable bias. However, it is worth recognizing

that other non-measurable variables which this model is not able to capture may still cause bias to the estimators and will be addressed in the discussion.

Among the explanatory variables (*Salary, FamIncome, NonMetropolitan, Central, NonCentral, White, Black, Asian*), Variables *Salary* and *FamIncom*e are continuous, measuring an individual's precise annual job salary and family total income (including investments) respectively, while the rest of them are categorical. For an individual's residence location, their metropolitan status has four categories in the dataset. Thus, three dummy variables ($NonMetropolitan$,$Central$, and $NonCentral$) are generated. For example, for $NonMetropolitan$, 1 indicates that an individual does not live in metropolitan areas, and 0 indicates otherwise. For an individual's race, the original data set presents four categories – White, Black, Asian, or others, and thus three dummy variables are generated (*White, Black, Asian*) to prevent the possible influence of race on commute times in the regression analysis. For the race variables, 1 indicates that an individual falls into that specific racial category, while 0 indicates otherwise. For example, a Black individual would have *Black* equal to 1 and have *White, Asian* equal to 0.

B) Estimating the effect within each racial group

Since this research is interested in finding out if the possible gender disparity differs across racial groups, regression analyses are performed on individuals who fall into a specific racial group. Results of each of the three racial categories are compared with the rest on the possible gender gap. For example, this study runs regression with data containing only individuals who identify as Asian. It allows an understanding of the possible gender difference

among Asian Americans as well as a comparison about whether this possible difference aligns with those observed in other racial groups.. The model used is as follows.

$$CommuteTime = \beta_0 + \beta_1 Children + \beta_2 Female + \beta_3 Female * Children + \beta_4 Salary + \beta_5 FamIncome + \beta_6 NonMetropolitan + \beta_7 Central + \beta_8 NonCentral + \mu$$

In Section (B), the regression model consists of dependent variable (*CommuteTime*), key variable of interest (*Children*), the interaction term, and other explanatory variables. Compared to Section (A), regression analysis in this section only uses individual data of one racial group from the sample. Therefore, three regressions are run on White, Black, and Asian individuals respectively, and race variables are not included in the model. To estimate the family size effect on commute times for White Americans and its possible gender disparity, regression analysis uses data points of White individuals only (4,270,143 observations). For Black individuals, there are 330,945 observations; for Asian individuals, there are 410,307 observations. The coefficient β_1 indicates the amount of change in commute times with one additional child for men within each race; and the coefficient β_3 of the interaction term implies whether the gender gap exists in this racial group and whether it is statistically significant. The results will also indicate whether or not the pattern of gender disparity remains the same or differs across three racial groups.

IV. Results

A) Estimating the effect in the entire sample population

Results of the regression are presented in Table 4. The regression uses the model defined in the empirical framework Section A with 5,178,582 observations. Table 4 summarizes OLS estimated coefficients for each right-hand-side variable as well as their standard errors which are put in parentheses under each estimate.

Table 4

OLS Estimates of Effect of Number of Children on Individual's Commute Time to Work

Variable	Results
Children	0.48*** (0.011)
Female	– 2.60*** (0.029)
*Female * Children*	– 0.72*** (0.018)
Salary	0.000035*** (0.00000021)
FamIncome	– 0.000013*** (0.00000013)
NonMetropolitan	– 5.61*** (0.033)
Central	14.34*** (0.043)
NonCentral	– 1.07*** (0.032)
White	– 1.52*** (0.048)
Black	0.54*** (0.060)

Asian	0.68***
	(0.057)
Observations	5,178,582
R^2	0.049

Standard errors are in parenthesis

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

The estimated coefficient for variable Children is 0.48 and the estimated coefficient for the interaction term Female * Children is – 0.72. These estimates indicate that for men, having an additional child increases commute time to work by 0.48 minutes; for women, having an additional child decreases commute time to work by 0.24 minutes.

Both of the coefficients β_1 and β_3 are statistically significant (p-value < 0.001), demonstrating that for men, there exists a statistically significant positive correlation between number of children and commute time to work; for women, however, there exists a statistically significant negative correlation between number of children and commute time to work. More importantly, the male-female difference is statistically significant, suggesting that the gender gap exists in terms of the "child" effect on an individual's travel time to work. The regression predictions confirm the original economic hypothesis that the effect of having more children on an individual's travel time to work is indeed "gendered" — more children add to the household duties that disproportionately fall under women's responsibility rather than men's, pushing women to sacrifice job-related commitments, in this case, commute time.

For other estimated coefficients for control variables, the coefficient of an individual's salary is positive, suggesting that there is a positive correlation between an individual's salary and commute times. At the same time, the coefficient of the family total income (including

investments) is negative. For an individual's residence location, the coefficients are both statistically significant and economically powerful – compared to those whose residence location in metro areas is undetermined, individuals living in non-metropolitan areas on average spend 5.61 fewer minutes in commute; individuals in central locations of metro areas spend 14.34 more minutes; and individuals in non-central locations of metro areas spend 1.07 fewer minutes. These differences may be explained by greater amounts of traffic in central locations of metropolitan areas and less traffic in non-metro areas. Benchmarking against the category of subjects whose race is not identified, the race coefficients demonstrate that, on average, White men and women spend the least amount of time on the road for their jobs compared to Black and Asian individuals. All of the coefficients for control variables are statistically significant at 0.1% level.

B) Estimating the effect within each racial group

Results of the regressions on individuals of specific racial groups are presented in Table 5. All three regressions use the model defined in the empirical framework Section B. Column 1 uses the White individual group – individuals who identify as White – of the sample (4,270,143 observations); column 2 uses the Black individual group of the sample (330,945 observations); and column 3 uses Asian individual group of the sample (410,307 observations). Table 5 summarizes OLS estimated coefficients for each right-hand-side variable as well as their standard errors which are put in parentheses under each estimate.

Table 5

OLS Estimates of Effect of Number of Children on Individual's Commute Time to Work

Variable	**(1) White**	**(2) Black**	**(3) Asian**
Children	0.52***	0.26***	0.42***
	(0.012)	(0.030)	(0.046)

Female	– 2.72***	– 1.85***	– 1.64***
	(0.31)	(0.12)	(0.11)
*Female * Children*	– 0.79***	– 0.19**	– 0.61***
	(0.019)	(0.069)	(0.068)
Salary	0.000036***	0.000040***	0.000026***
	(0.00000022)	(0.0000012)	(0.00000066)
FamIncome	– 0.000015***	– 0.00000062	– 0.0000029***
	(0.00000014)	(0.00000074)	(0.00000014)
NonMetropolitan	– 5.69***	– 4.07***	– 5.62***
	(0.034)	(0.20)	(0.28)
Central	14.19***	12.90***	16.65***
	(0.052)	(0.12)	(0.11)
NonCentral	– 1.23***	0.46***	– 0.71***
	(0.035)	(0.13)	(0.13)
Observations	4,270,143	330,945	410,307
R^2	0.044	0.047	0.067

Standard errors are in parenthesis

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

In column 1 (White individuals), the estimated coefficient β_1 for the variable Children is 0.52; and the estimated coefficient β_3 for the interaction term Female * Children is – 0.79. These estimates indicate that for White men, having one additional child increases travel time to work by 0.52 minutes; for White women, having one additional child decreases travel time to work by 0.27 minutes. The coefficients β_1 and β_3 are statistically significant (p-value < 0.001), showing that for White men, there is a statistically significant positive correlation between number of children and commute time to work; for White women, there is a statistically negative

correlation between number of children and commute time to work. In addition, there is a statistically significant (at 0.1% level) gender disparity among White individuals in terms of the family size effect on travel time to work. The signs of the coefficients β_1 and β_3 and their economic value are highly similar to those of the entire sample population group tested in Section A. The similarity can primarily be explained by the large percentage of White individuals in the entire sample data of this study.

In column 2 (Black individuals), the estimated coefficient β_1 for the variable Children is 0.26; and the estimated coefficient β_3 for the interaction term Female * Children is – 0.19. These estimates indicate that for Black men, having one additional child increases travel time to work by 0.26 minutes; for Black women, having one additional child increases travel time to work by 0.07 minutes. The coefficients β_1 and β_3 are statistically significant, showing that for Black men, there is a statistically significant positive correlation between number of children and commute time to work; for Black women, there is also a statistically positive correlation between number of children and commute time to work. In addition, there is a statistically significant (at 1% level) gap among Black individuals in terms of the "child" effect on travel time to work.

This finding does not demonstrate the same pattern found in the group of White individuals. The relationship between having more children and commute times to work is positive for both Black men and Black women. Although the male-female difference is statistically significant, it is only at 1% level, unlike the 0.1% level found in the White individual group. Therefore, the implication drawn from the findings of the Black individual group is not consistent with the original hypothesis that women would sacrifice job-related time for more caregiving duties. And the results demonstrate variability of this effect across different races.

In column 3 (Asian individuals), the estimated coefficient β_1 for the variable Children is 0.42; and the estimated coefficient β_3 for the interaction term Female * Children is – 0.61. The regression analyses suggest that for Asian men, having one additional child increases travel time to work by 0.42 minutes; for Asian women, having one additional child decreases travel time to work by 0.19 minutes. The coefficients β_1 and β_3 are statistically significant (p-value < 0.001), showing that for Asian men, there is a statistically significant positive correlation between number of children and commute time to work; for Asian women, there is a statistically negative correlation between number of children and commute time to work. In addition, there also exists a statistically significant (at 0.1% level) gender gap among Asian individuals in terms of the "child" effect on travel time to work. Although the economic values of both the coefficient β_1 and the coefficient β_3 found in the Asian individual group is weaker than those found in the White individual group, the pattern identified in the Asian individual group is consistent with the original economic hypothesis.

V. Discussion and Conclusion

The regression analyses of this research show that in the entire sample population there is a statistically significant positive correlation between married men's commute time and their number of children while this relationship is negative for married women. More importantly, the results demonstrate that the "family size" effect on an individual commute time to work is indeed gendered – the male-female difference exists and is proven to be statistically significant. For

each racial group, however, only White and Asian individuals demonstrate this pattern, whereas Black individuals do not. Among Black individuals, regression results suggest that the relationship between commute times and an individual's number of children is positive and statistically significant for both married Black men and women.

The OLS estimators in this regression may not be the Best Linear Unbiased Estimator due to issues that this research design is unable to resolve. Even though the regression model using randomized data has a linear relationship between dependent and key variables of interest and has no perfect collinearity, OLS estimators can still be biased by potential problems. First, due to limited data availability, this research was not able to exclude situations where individuals choose to move for their work. These situations could be another variable that influences the travel time to work and the gender disparity of the effect estimated in this research. However, this possible flaw does not undermine this research's results for two reasons. One is that, even for the situations where married individuals move cross-state for work, it is much more likely that the family moves for one person's work only rather than for both. Therefore, the other individual still needs to find a job based on the family's new residence location. The other is that some families may lack the financial resources to move, especially moving within a metropolitan area, just for a new job opportunity – individuals can simply commute longer. This leaves the choice to an individual between spending time in commute and spending time in household duties, which is the subject of investigation in this research. At the same time, the fact that this research is not able to incorporate this potential variable into consideration could cause bias in the results. Future research should aim to eliminate this potential bias: focusing on studying the period of time where married individuals have job location changes with no residence location changes. In this case, the selected data can eliminate the influence from the circumstances where individuals

move for jobs. Second, the OLS estimators in this research may be biased by sample selection error. Within this sample, about 82% of individuals are identified as non-Hispanic White. The overrepresentation of White individuals in this sample compared to the US average could lead to a bias in the OLS estimator tested in the Section A. As the White individuals are dominant in the entire data sample, the family size effect on commute times observed in the entire population is heavily influenced by the pattern identified in the overrepresented White individual group. Since the Black individual group demonstrates a different pattern, changing the distribution of race in the sample is likely to influence the OLS estimator estimated in the entire sample population.

In conclusion, this econometric study used pooled-section data from the American Community Survey for regression analyses to understand the effect of increasing number of children in a family on a married individual's commute time to work, and the possible gender disparity of this effect. The regression results confirmed the economic intuition that, as women bear more burden on household duties, they can sacrifice commute time to work as the married couple has more children. The regression results also indicated that the gender difference of this effect is statistically significant and men demonstrate the opposite pattern – as the number of children increases, men's commute time increases, rather than decreases. It is worth noting that potential limitations in this research exist and may influence the estimated coefficients and the interpretation of the results. Future research should aim at finding data samples that eliminate the influence of individuals "moving" residence locations for job opportunities. Given the gender disparity this research identified and women's decreasing time invested in job commutes with more children, corporations in the post-COVID world should consider the balance between in-person office work and work from home to help married individuals manage household duties and to best recruit, retain, and promote female talents.

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