# Understanding the Congestion Child Penalty: a Look at Labor Force Participation, Time Use and Work from Home

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**Abstract**

We study the impact of long commuting times on the labor supply of women with children. We show that congestion and long commutes discourage the labor force participation of mothers and exert a disproportional impact on the labor supply of mothers with low levels of education, affecting their time-use and exacerbating task-specialization among low-education couples. We provide theoretical arguments and empirical evidence suggesting that our findings are not driven by the selection of mothers with large utility cost of working in highly-congested metropolitan areas. We then show that the asymmetry in the availability of work-from-home arrangements between college graduate women and women without a college degree can explain the stronger effect of congestion on the labor supply of mothers without a college degree.

**JEL Codes**: R41, J16, J22, J32
**Keywords**: Congestion, commuting time, child penalty, labor supply, labor force participation, work from home, remote work.

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# 1 Introduction

The secular rise in women's labor force participation is one of the most striking phenomena that characterized the evolution of labor markets over the course of the 20th Century (Goldin, 2006). In the United States, the labor force participation rate of prime-age women grew from 35% in 1948 to 74% in 1990 (Department of Labor, 2025). Since the late 1990s, however, women's labor supply plateaued (Albanesi, 2023; Blau & Kahn, 2013), contributing to a slow-down in convergence in labor market outcomes between male and female workers.

As gender convergence stalled over the last few decades, a growing body of literature emphasized the role of persistent gender differences in constraints to workers' labor supply in determining gender imbalances in labor market outcomes (Olivetti, Pan, & Petrongolo, 2024). Men and women, for example, differ in their geographical mobility and in their willingness to commute (Caldwell & Danieli, 2024; Faberman, Mueller, & Şahin, 2025; Le Barbanchon, Rathelot, & Roulet, 2021). Such differences may increase with parenthood, as women are more likely than men to give up non-local employment and to decrease their commute after the birth of a first child (Albanese, Nieto, & Tatsiramos, 2022; Borghorst, Mulalic, & van Ommeren, 2024).

While work-family tradeoffs may affect women's labor market outcomes by contributing to their low willingness (or ability) to commute, in this paper we study whether long commuting times themselves represent barriers to women's labor supply whose impact may be exacerbated by parenthood. Specifically, we study how long commuting times and traffic congestion affect the labor force participation of mothers and their allocation of time, and investigate the role of remote work arrangements in mitigating the negative effect of congestion on the labor supply of women with children.

A large body of literature documents the hampering effect of parenthood on women's labor supply (Adda, Dustmann, & Stevens, 2017; Angelov, Johansson, & Lindahl, 2016; Cortés & Pan, 2023; Goldin, Kerr, & Olivetti, 2024; Kleven, Landais, & Søgaard, 2019). Recent work by Kleven, Landais, and Leite-Mariante (2024) shows the pervasiveness of such employment child penalties across countries and the positive relationship, within countries, between child penalties and urbanization. Consistent with these findings, Moreno Maldonado (2022) provides evidence that, in the United States, the labor force participation of women with children is lower in large metropolitan areas than in small cities, partly due to the long commuting times that characterize large urban areas. Black, Kolesnikova, and Taylor (2014) and Farré, Jofre-Monseny, and Torrecillas (2023) also show that commuting times and congestion negatively affect the labor force participation of married women.

We contribute to this literature by documenting several novel facts regarding the impact of congestion on the labor supply of American mothers. First, we show that the effects of commuting times and congestion are heterogeneous across different groups of women. In particular, we provide evidence that congestion explains a larger share of the labor force participation gap between mothers and non-mothers for more disadvantaged women: single women and those without a college degree.

Using data from the American Community Survey between 2005 and 2019, we employ two different empirical strategies. Our main specification exploits the variation in congestion over time within metropolitan areas to identify the differential impact of commuting time on the labor supply of mothers by comparing it to the labor supply of women without children who live in the same geographical area. Comparing the labor supply of different groups of women within MSAs should reduce concerns that the estimated relationship between the labor force participation gap between mothers and women without children and congestion is strongly affected by selection bias. In our second empirical strategy, we instrument congestion using two instruments proposed by Duranton and Turner (2011) to estimate the impact of road supply on traffic: the kilometers of railroad development in 1898, and the kilometers of highway development in 1947 specific of each metropolitan area.[1]

The methods we implement lead to qualitatively similar results: congestion exacerbates the gap in labor force participation between mothers and women without children, with particularly detrimental effects for single mothers and for mothers without a college degree. Even restricting our analysis to women who cohabit with male partners, we find that congestion has an especially strong impact on the labor force participation of mothers with lower levels of education. Simultaneously, we show that congestion has

[1]This approach is complementary to the IV estimation used by Farré, Jofre-Monseny, and Torrecillas (2023), who rely on the shape of cities to instrument commuting times, and to the IV strategy implemented by Black, Kolesnikova, and Taylor (2014), who instrument MSA commuting time through commuting times in women's state of birth.

negligible effects on the labor force participation of men cohabiting with female partners, irrespective of the presence of children, suggesting that congestion may exacerbate within-household specialization between paid work and unpaid household work.

We then use data from the American Time Use Survey (2005-2019) to study parents' allocation of time across metropolitan areas characterized by different levels of congestion and corroborate our main results. We show that the time allocation of fathers and of mothers with a college education is similar across urban areas characterized by different levels of congestion. Mothers without a college degree living in highly congested areas, instead, work for pay fewer hours per week compared to their counterparts in low-congestion areas, while devoting 1.9 more hours per week to household management and caring activities and, importantly, to travel for activities related to these tasks.

Our second contribution is to show that the availability of work-from-home arrangements can mitigate the negative effect of congestion on mothers' labor supply. As employees who telework spend less time commuting (Ji, Oikonomou, Pizzinelli, Shibata, & Tavares, 2024; Pabilonia & Victoria Vernon, 2022), remote work arrangements may allow women with children to reconcile paid work and family responsibilities (Sherman, 2020; Woods, 2020), and to remain in the labor market without paying the monetary and time costs of congestion.

Using ACS data, we document that employed women with a college education are more likely to work from home compared to women without a college degree, and increasingly so if children are present.[2] Furthermore, we show that motherhood is associated with an increase in the probability of working from home, while congestion increases the probability of working remotely among college graduate mothers only. Consistent with this result, we also show that congestion decreases the commute time of working college graduate mothers, while it increases the commute time of working mothers without a college education. Using American Time Use diaries, we further document that the difference in weekly commuting time between working mothers without a college degree and college graduate women with children is higher in highly congested urban areas.

These results are key to interpret the asymmetry in the impact of long commutes on the

[2]While we use data from 2005 to 2019, these findings are consistent with the evidence provided by Bartik, Cullen, Glaeser, Luca, and Stanton (2020), showing that during the COVID-19 pandemic remote work was more widespread in industries employing larger shares of highly educated workers.

labor supply of mothers with different levels of education. As mothers without a college degree have more limited opportunities to access remote-work arrangements, congestion may induce some of them to leave the labor force while exposing labor force participants to the time cost of long commutes. Access to remote work, instead, may attenuate the work-family tradeoff due to congestion among college gradute mothers, thus limiting the negative impact of congestion on their extensive-margin labor supply and inducing labor force participants to switch towards remote work.

These results are also relevant in light of the ongoing debate regarding the multi-faceted effects of alternative work arrangements on women's labor market outcomes. On the one hand, the provision of work arrangements that enhance work-life balance may contribute to the gender wage gap. As first theorized by Goldin and Katz (2011), several contributions found evidence that gender differences in earnings tend to increase due to the the wage gains associated to inflexible and long work hours (Cortés & Pan, 2019; Gicheva, 2013; Goldin, 2014), and due to women's strong willingness to pay for work arrangements such as schedule flexibility (Wiswall & Zafar, 2018), and telework (Maestas, Mullen, Powell, von Wachter, & Wenger, 2023; Mas & Pallais, 2017). On the other hand, however, benefits and work arrangements that reconcile work-family tradeoffs may contribute to slack constraints to women's labor supply and enhance their labor force attachment. Bloom, Liang, Roberts, and Zhichun (2015) provide evidence that the availability of telework increases workers' satisfaction and decreases their quit rates, Albanesi (2023) and Alon, Doepke, Olmstead-Rumsey, and Tertilt (2020) indicate that the diffusion of remote work recently induced by the COVID-19 pandemic could be beneficial to the labor force participation of women, and Ji, Oikonomou, Pizzinelli, Shibata, and Tavares (2024) argue that telework can increase households' welfare. Our results suggest that remote work arrangements may alleviate mothers' mobility constraints and reduce the time costs of congestion, thus encouraging their labor force participation.

The paper is organized as follows. In section 2, we describe the data we use, our sample-selection decisions, and the measures of metropolitan-area congestion that we construct. In section 3, we describe the main empirical strategy we use to estimate the impact of congestion on the labor force participation gap between women without children and mothers, show our main results, and document differences in parents' time use associated with congestion. Section 4 details a theoretical framework to interpret the effects of congestion on labor supply and uncover patterns of selection of women across metropolitan areas characterized by different levels of congestion. We perform robustness exercises in section 5. We show, first, that the results we obtain are not a mechanical implication of the big-city child penalty uncovered by Moreno Maldonado (2022) and, second, that the estimated effects of congestion on women's labor supply are larger in magnitude when implementing instrumental variable methods. Section 6 contains our analysis of the role in remote work arrangements in mitigating the negative impact of congestion on mothers' labor supply. Section 7 concludes.

# 2 Data

## 2.1 Sample selection

We use data from the American Community Survey (ACS) and the American Time Use Survey (ATUS) for the years 2005 to 2019. The ACS is a detailed national demographic survey, which is sent to approximately 3.5 million addresses annually. From the set of participants we construct two different samples. First, we construct a sample of women who are either household heads or heads' spouses, who are between 18 to 44 years old. For women with children we further limit the sample to those whose first childbirth occurred at age 18 or above, and whose eldest child living in the household, is at most 17 years old. We exclude individuals who are currently enrolled in school, who have missing information on labor force status, regarding salary and wage work or self-employment, and regarding any demographic and geographical variables of interest. Second, we construct a sample of cohabiting heterosexual couples by merging the previously defined sample of women to their male partners, and drop couples in which the age difference between partners is larger than 15 years. We further restrict allsa mples to individuals in metropolitan areas for which we have reliable congestion data. We follow Duranton and Turner (2011) and define time-constant metropolitan statistical areas (MSAs) using the 1990 Census Bureau delineation of metropolitan areas. We associate individuals in the ACS to 1990 metropolitan areas using their county of residence, and keep MSAs where at least 50 individuals are observed at least twice between 2005 and 2019.

The ATUS is a national survey on time use, collected for a representative sample of households within the US. It includes a randomly selected set of individuals from households that have completed their participation in the Current Population Survey (CPS). Respondents are then asked to report their primary activities during the 24 hour period from 4:00 AM the day before the interview to 4:00 AM of the day of the interview. We follow the same criteria described above to construct samples of married men and women. We then construct six different broad time-use categories: sleep, paid work, leisure and self-care, household activities and care activities, travel, missing or unknown. We further split travel-related activities into three subgroups: travel related to paid work (commuting), travel related to household activities or to care for others, travel related to leisure or self-care.

For each metropolitan area, we use ACS data to construct time-varying characteristics of their labor markets by computing the year-MSA specific population, the share of employed 16-to-64 year old men in different industry classes, the share of employed 16-to-64 year old men in, respectively, professional occupations and executive occupations, the average occupation score of college graduate employed men, the average occupation score of employed men without a college degree, the average hourly wage earned by, respectively, college graduate employed men and employed men without a college degree.

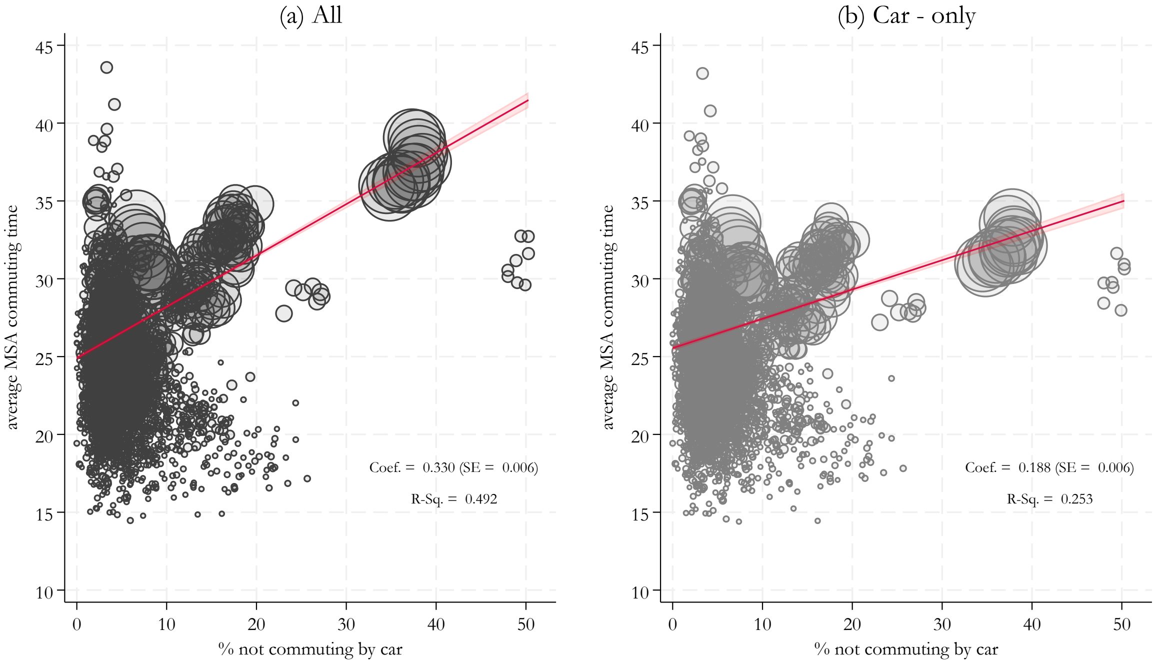
## 2.2 Commuting-time and congestion measures

We use the MSA-specific and year-specific average commuting time of 16-to-64 year old employed men who commute by car, cab or motorbike as our main measure of metropolitan area commuting times and congestion. Calculating MSA-specific commuting times excluding individuals who use public transportation, commute by bike, or walk to their workplace provides a clean measure of congestion. This measure is not confounded by the possibly high commuting times of individuals who choose to commute using alternative means of transportation, and who arguably contribute to decreasing congestion rather than increasing it.

As shown in Figure 1, panel (a), there is a strong positive relationship between the MSA-specific share of individuals who do not commute by car and the MSA-specific average commuting time in minutes. Importantly, the cross-MSA variation in the share of workers who do not commute by car explains more than 49% of the cross-MSA variation in average commuting times of all commuting workers. As shown in panel (b), instead, the cross-MSA variation in the share of workers who do not commute by car explains only

25% of the cross-MSA variation in average commuting times of workers who commute by car.

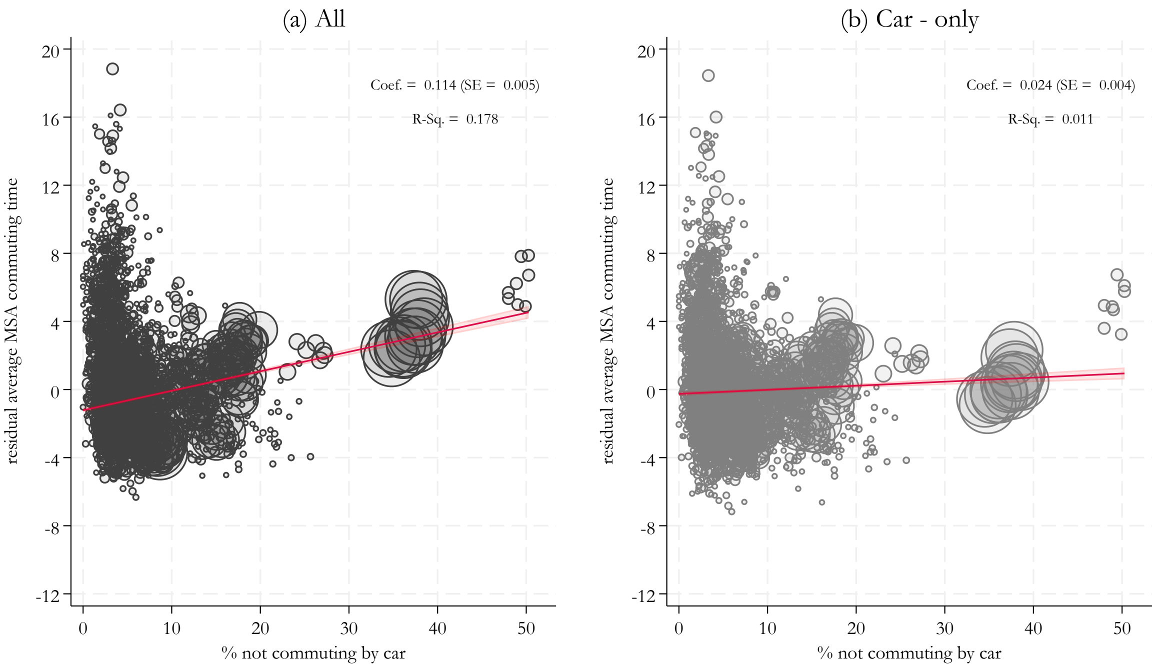
Figure 1: Commuting time and no-car transit




*Notes*: American Community Survey 2005-2019. The figures represent the cross-MSA relationship between commuting time and the incidence of alternative means of transportation. The latter variable is measured by the MSA-and-year-specific share of 16-to-64 year old employed men who either commute by public transit, or walk or bike to their workplace. In panel (a), commuting time is measured by the MSA-and-year specific average commuting time of all 16-to-64 year old employed men. In panel (b), commuting time is measured by the average commuting time of 16-to-64 year old employed men who commute by car, motorbike or cab. The MSA-specific commuting time and incidence of alternative transportation means are calculated applying ACS individual weights. The cross-MSA scatter plots and simple linear regressions in panels (a) and (b) are weighted by the year-specific MSA population.

The remaining association between the average commuting times of workers who commute by car and the share of individuals who do not commute by car is explained by the underlying positive correlation between MSA size and the incidence of alternative transportation means. As shown in Figure 2 panel (b), in fact, there is no economically significant relationship between the residual MSA-specific commuting times not predicted by the MSA-specific population and the share of workers who do not commute by car. As shown in panel (a), instead, a 10 percentage-point increase in the share of workers who do not commute by car is associated with a 11.4-minute increase in residual commuting times of all workers, and the cross-MSA variation in the share of workers who commute through alternative transportation means explains more than 17% of the cross-MSA variation in the residual average commuting times of all workers.

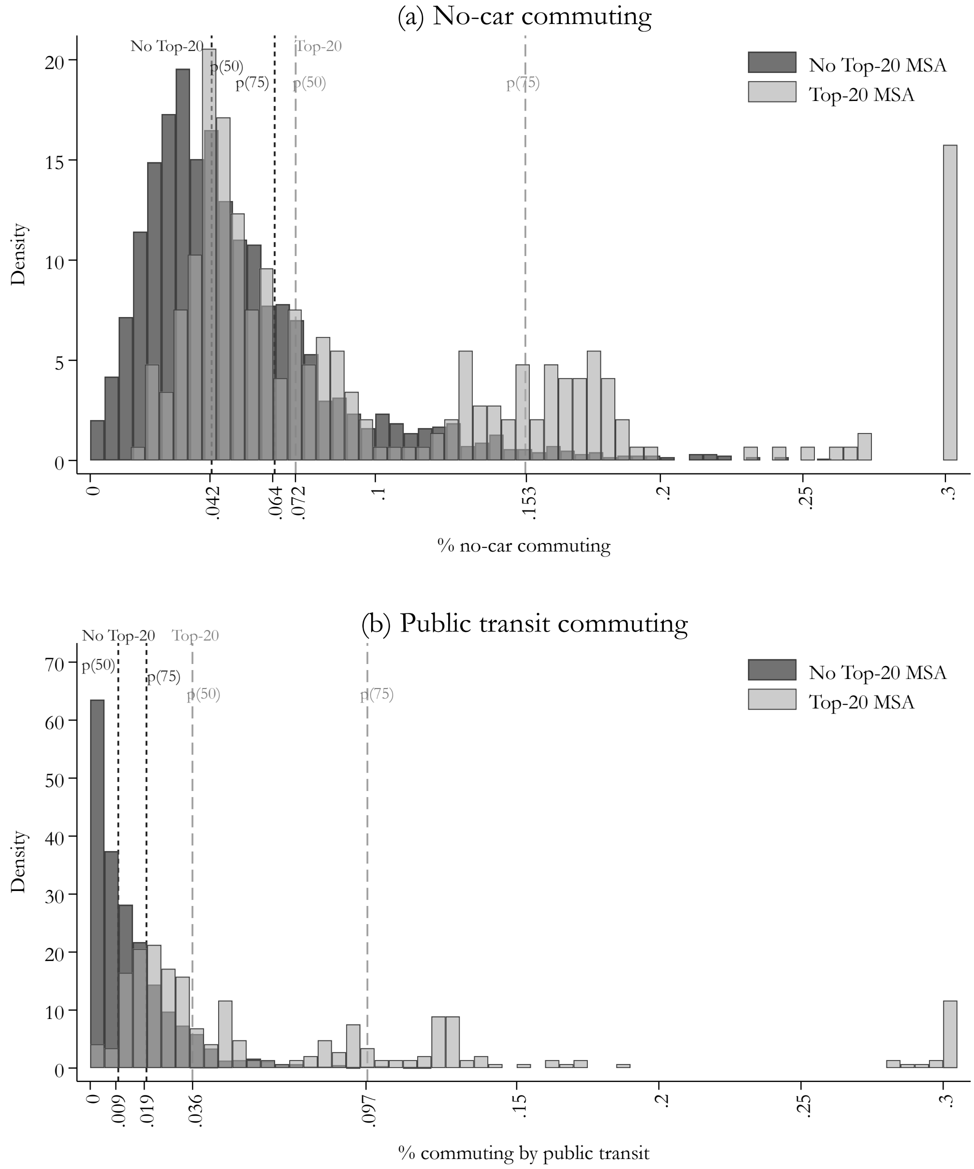
Figure 2: Regression adjusted commuting time and no-car transit




*Notes*: American Community Survey 2005-2019. The figures represent the cross-MSA relationship between residual commuting time not explained by the year-MSA-specific population and the incidence of alternative means of transportation. Residuals are obtained from the following cross-MSA regression: $y_{ct} = \alpha + \beta \log{(pop)}_{ct} + u_{ct}$, where $y_{ct}$ is the year-MSA-specific commuting time and $\log{(pop)}_{ct}$ is the logarithm of the MSA-year specific population. Commuting times and the incidence of alternative transportation means are computed as described in Figure 1 notes.

These results are especially driven by the behavior of workers who reside in the 20 largest metropolitan areas. Figure 3 represents the distribution of the incidence of alternative transportation means across metropolitan areas between 2005 and 2019, calculated separately for large metropolitan areas (Top-20 MSA) and for small and medium urban areas (No Top-20 MSA). Panel (a) depicts the distribution of the incidence of all transportation means alternative to cars, cabs and motorbikes, while panel (b) depicts the distribution of public transit incidence. The incidence of alternative transportation means is measured as the MSA-specific share of employed men who commute using any transportation mean alternative to cars (panel a), or using public transit (panel b). Both panels (a) and (b) also depict the median and the 75-th percentile of the distributions.

Figure 3: Incidence of alternative transportation means by MSA dimension



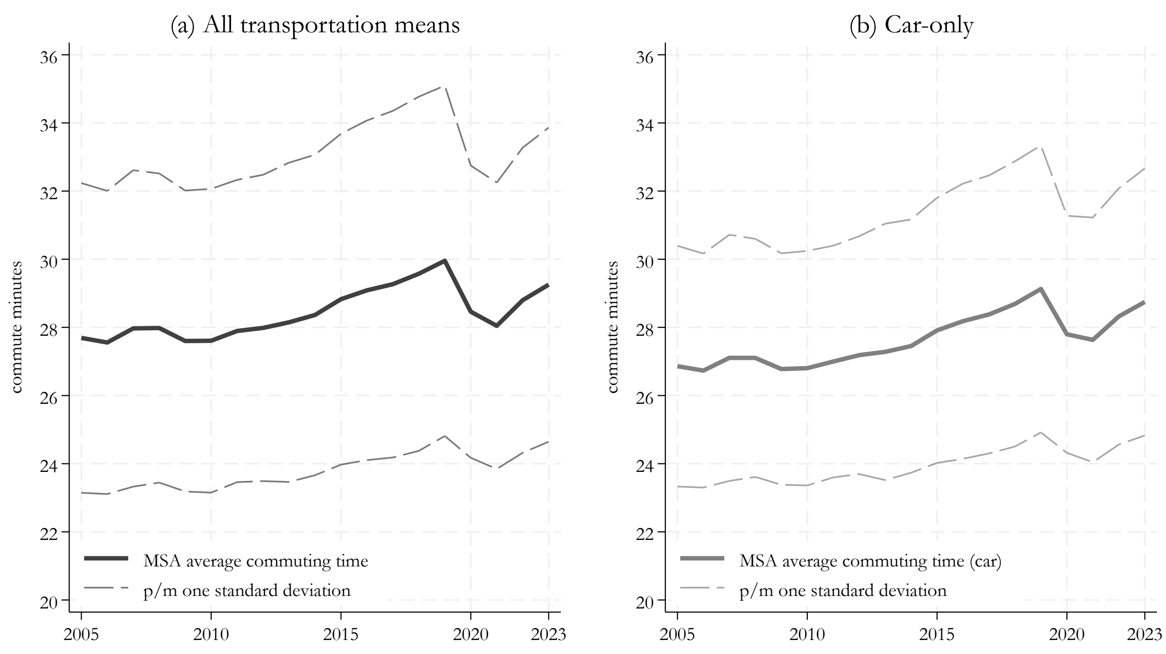

*Notes*: American Community Survey 2005-2019. The figures represent the distribution of the incidence of alternative transportation means (panel (a)) and public transit (panel (b)) by MSA and year. The incidence of no-car commuting is measured by the MSA-year-specific share of 16-to-64 year old employed men who do not commute by car. The incidence of public transit is measured by the MSA-year-specific share of 16-to-64 year old employed men who commute via public transit. The $x$-axis label .3 indicates MSAs where at least 30% of employed men rely on the panel-specific transportation means.

As shown in the figure, the use of alternative transportation means including public transit is considerably more widespread in large metropolitan areas than in small and medium cities. At most 6.4% of employed men do not commute using cars in 75% of small and medium cities, while at least 7.2% of employed men do not commute using cars in 50% of large metropolitan areas. Furthermore, less than 2% of employed men commute via public transit in 75% of small and medium cities, while at least 3.6% of men commute via public transit in 50% of large urban areas.

Figure 4 represents the time trends in the cross-MSA average commuting time. In panel (a), each MSA-specific commuting time is calculated using observations on all commuting employed men, while panel (b) represents the commuting time of employed men using car, cabs or motorbikes. The latter is our preferred measure of commuting times.

As shown in panel (a), the cross-MSA average commuting time of all men increases between 28 minutes per commute and 30 minutes per commute between 2005 and 2019, while dropping in 2020. One cross-MSA standard deviation in commuting time measures approximately 4 minutes. As shown in panel (b), the cross-MSA commuting time of men using cars, cabs or motorbikes rises from approximately 27 minutes in 2005 to 29 minutes in 2019 and drops thereafter. For approximately 68% of MSAs in every year, car-only commuting time averages are between 23.5 and 30.5 minutes (plus/minus one 3.5-minute standard deviation).

Figure 4: Cross-MSA average commuting time by year




*Notes*: American Community Survey 2005-2022. The figures represent the time trends in cross-MSA average commuting times among employed men commuting, respectively, using any transportation mean (panel a) or using car, cab or motorbike only (panel b). The year-specific cross-MSA averages are weighted for MSA-specific population. The dashed lines in the figures represent trends in average commuting times plus and minus one standard deviation in year-specific MSA commuting times.

# 3 Empirical analyses

## 3.1 Commuting times and women's labor force participation

We investigate the relationship between congestion and mothers' labor force participation using the following regression model

$$y_{imt} = \alpha + \beta c_{imt} + \gamma z_{mt} + \delta c_{imt} \times z_{mt} + x'_{ict}\zeta + \eta_t + \nu_m + u_{imt} \tag{1}$$

Where $y_{imt}$ is a dummy variable taking value 1 if woman $i$ in MSA $m$ in year $t$ participates in the labor force, $c_{imt}$ is a dummy variable taking value 1 for mothers and 0 for women without children, and $z_{mt}$ is a year-specific standardized measure of the MSA average commuting time of employed men who commute by car, cab or motorbike. The coefficient $\beta$ captures the percentage-point difference in labor force participation between mothers and women without children in city $m$ and year $t$, while $\gamma$ represents the percentage-point change in the labor force participation of women without children associated with one standard deviation increases in the year-specific MSA commuting time. The main coefficient of interest, $\delta$, measures the degree of heterogeneity in the labor force participation difference between mothers and women without children across MSAs characterized by different levels of congestion.

This empirical strategy exploits the within-MSA variation in congestion over time to identify the differential impact of commuting time on the labor supply of mothers by comparing it to the labor supply of women without children who live in the same geographical area. The underlying intuition is that comparing the labor supply of different groups of women within MSAs should reduce concerns that the relationship between the labor force participation gap between mothers and women without children and congestion is strongly affected by selection bias.

We control for year ($\eta_t$) and MSA ($\nu_m$) fixed effects, for individual characteristics and for time-varying MSA characterics ($x_{ict}$) that proxy for time-varying differences in labor demand and in the offered wages across metropolitan areas. Additionally, we control for the state-year-specific Federal Housing Finance Agency seasonally adjusted housing prices. Standard errors are clustered at the MSA level.

Table 1 reports the estimated coefficients in different samples of women. Column (1) shows the results for the full sample of 18-to-44 year-old women. Conditional on observable characteristics, in metropolitan areas characterized by average levels of congestion, women with children are 9.2 percentage-points less likely to participate in the labor force than women without children. While the labor force participation of women without children is higher in more congested areas, the labor force participation gap between mothers and women without children also increases with congestion. In metropolitan areas whose level of congestion is one standard deviation above the year-specific cross-MSA average, women with children are 10.5 percentage-points less likely to participate in the labor market than women without children.[3] The result is economically meaningful. In all years, the cross-MSA standard deviation in commuting times is around 3.5 minutes. It implies that a 5-minute increase in commuting times is associated with a 1.85 percentage-point decrease in the labor force participation of women with children compared to women without children ($-0.013 \times \frac{5}{3.5}$).

Columns (2) to (5) show results for different groups of women. Columns (2) and (3) compare single to married women; columns (4) and (5) compare women without a college degree to college graduates. The results reported therein highlight two additional notable facts. First, conditional on individual and household characteristics and on the features of MSA-specific labor demand, the labor force participation of women without children is higher in more congested areas. Second, in relative terms, the labor force participation gap between mothers and women without children increases more with congestion among single women and among women without a college degree. Among singles, for example, women with children are as likely to participate in the labor force as women without children in metropolitan areas with average levels of congestion, conditional on individual and MSA characteristics. The labor force participation gap increases by 0.7 percentage-points (7 times) in areas whose congestion level is one standard deviation above the average. Among women without a college degree, mothers are 7.5 percentage-points less likely to participate in the labor market compared to women without children in MSAs with average levels of congestion. The labor force participation gap between mothers and women without children increases by 1.4 percentage points (or 18.9% of 7.5 pp)

[3]This estimate is based on the sum of the coefficients for 'Has child' (-0.092) and the interaction between 'Has child' and 'Congestion' (-0.013), as shown in Table 1.

in metropolitan areas whose average commuting times is one standard deviation above average.

Table 1: Labor force participation - women

| | (1) All | (2) S | (3) M | (4) No Col | (5) Col |
|---|---|---|---|---|---|
| Has child | -0.092** | -0.000 | -0.149** | -0.075** | -0.118** |
| | (0.004) | (0.002) | (0.004) | (0.004) | (0.004) |
| Z(MSA CT) | 0.008** | 0.002 | 0.007* | 0.008* | 0.006+ |
| | (0.003) | (0.002) | (0.003) | (0.004) | (0.003) |
| HC*Z(MSA CT) | -0.013** | -0.007** | -0.010** | -0.014** | -0.010** |
| | (0.003) | (0.002) | (0.003) | (0.004) | (0.003) |
| Obs. | 2430260 | 751863 | 1678397 | 1274898 | 1155362 |
| R-squared | 0.110 | 0.105 | 0.094 | 0.102 | 0.094 |
| Controls $i$ | Y | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y | Y |
| $MSA$ F.E. | Y | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection is described in Section 2. Column (2) restricts the sample to non-married women, column (3) includes married women, column (4) includes women without a college degree, column (5) restricts the sample to women with a college degree. All regressions include a cubic function in individual's age, controls for race and ethnicity, for whether a person resides in their state of birth, for (the log of) non-labor income, for detailed levels of education and marital status (not included in columns (2) and (3)). MSA-specific controls include the year-specific share of employed men in, respectively, executive and professional occupations, the state-specific distribution of employed men across industries, the average occupation score of, respectively, college-graduate men and men without a college degree, the average hourly wage earned by employed college-graduate men and by men without a college degree, the share of men who do not commute by car, and the (log) MSA population. All models control for state-year specific housing prices. Standard errors, in parentheses, are clustered at the MSA level. p-Value $< 0.1$ ($^+$), 0.05 ($^*$), 0.01 ($^{**}$).

Among married women and college graduate women, the labor force participation gap between mothers and non-mothers is higher in metropolitan areas with average levels of congestion than among single women and non-college graduate women, respectively. In these groups of women, however, increases by approximately 3.5 minutes (one standard deviation) in average commuting times are associated with smaller relative increases in the labor force participation gap between mothers and non-mothers by 1 percentage point (6.7%) among married women and by 1 percentage point (8.5%) among college graduate women.

## 3.2 Commuting times and household specialization

The stronger relative effect of congestion on the labor force participation of mothers without a college degree could be due to the higher share of single mothers within this group than among college graduate mothers. In this section, we restrict our analysis to cohabiting couples and provide additional evidence that congestion exerts an especially detrimental impact on the labor supply of less advantaged mothers.

To do so, we estimate regression (1) on the sample of cohabiting heterosexual couples that we construct using ACS data, splitting couples in different education groups. The results of this exercise are reported in Table 2. Columns (1) and (2) show results for, respectively, all cohabiting women without a college degree and all college graduate women who cohabit with male partners. Columns (3) to (6) show results for, respectively: women without a college degree who cohabit with similarly educated men (3), women without a college degree who cohabit with college graduate men (4), college graduate women who cohabit with similarly educated men (5), and college graduate women cohabiting with male partners with lower levels of education (6).[4]

Table 2 shows several interesting patterns. First, while having one child is associated with a decline in labor force participation for women of all levels of education, comparing women with the same level of education, the drop is larger among women cohabiting with college educated male partners. Second, even restricting our analysis to cohabiting couples, we observe that the labor force participation of women without children is not lower in more congested metropolitan areas. Third, higher commuting times are associated with a larger increase in the labor force participation gap between women without children and mothers among women without a college degree, irrespective of their partners' education level. As shown in columns (1) and (2), the labor force participation gap between mothers and women without children increases by 1.3 percentage points with one-standard-deviation increase in commuting times. Among college graduates, the gap increases by a not statistically significant 0.5 percentage point with one standard deviation increases in commuting times. As shown in columns (3) to (6), these results are not

[4]The differences in the sample sizes show that, among heterosexual cohabiting women in our sample, 79% of women without a college degree and 98% of college graduate women live with similarly educated male partners, reflecting well-known patterns of educational assortative mating (Eika, Mogstad, & Zafar, 2019).

driven by partners' level of education.

Table 2: LFP - women cohabiting with male partners, by couple type

| | (1) No Col | (2) Col | (3) N-N | (4) N-C | (5) C-C | (6) C-N |
|---|---|---|---|---|---|---|
| Has child | -0.145** | -0.170** | -0.126** | -0.207** | -0.171** | -0.081** |
| | (0.004) | (0.005) | (0.004) | (0.007) | (0.005) | (0.009) |
| Z(MSA CT) | 0.008* | 0.002 | 0.008* | 0.004 | 0.002 | 0.012 |
| | (0.004) | (0.004) | (0.004) | (0.007) | (0.004) | (0.017) |
| HC*Z(MSA CT) | -0.013** | -0.005 | -0.012** | -0.009* | -0.005 | -0.011 |
| | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) | (0.007) |
| Obs. | 707017 | 593633 | 558257 | 148760 | 582183 | 11450 |
| R-squared | 0.096 | 0.092 | 0.101 | 0.092 | 0.093 | 0.081 |
| Controls $i$ | Y | Y | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y | Y | Y |
| $MSA$ F.E. | Y | Y | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. All regressions include cubic functions in age and partner's age, controls for own and partner's race and ethnicity and education and for the partner's labor income, for whether an individual is married and for whether they reside in their state of birth. MSA-specific controls include the year-specific share of employed men in, respectively, executive and professional occupations, the state-specific distribution of employed men across industries, the average occupation score of, respectively, college-graduate men and men without a college degree, the average hourly wage earned by employed college-graduate men and by men without a college degree, the share of men who do not commute by car, and the (log) MSA population. All models control for state-year specific housing prices. Standard errors, in parentheses, are clustered at the MSA level. p-Value $< 0.1$ ($^+$), 0.05 ($^*$), 0.01 ($^{**}$).

These results corroborate the hypothesis that high commuting times exert a stronger negative impact on the labor supply of less affluent mothers, and suggest that changes in within-household specialization among cohabiting couples associated with congestion may also differ by couples' socio-economic and educational status. While having a stronger negative impact on the labor force participation of low-education mothers, in fact, Online Appendix Table A3 columns (1) and (2) replicate Table 2 columns (1) and (2) and show that congestion does not impact the labor force participation gap between fathers and men without children, for men who cohabit with female partners.

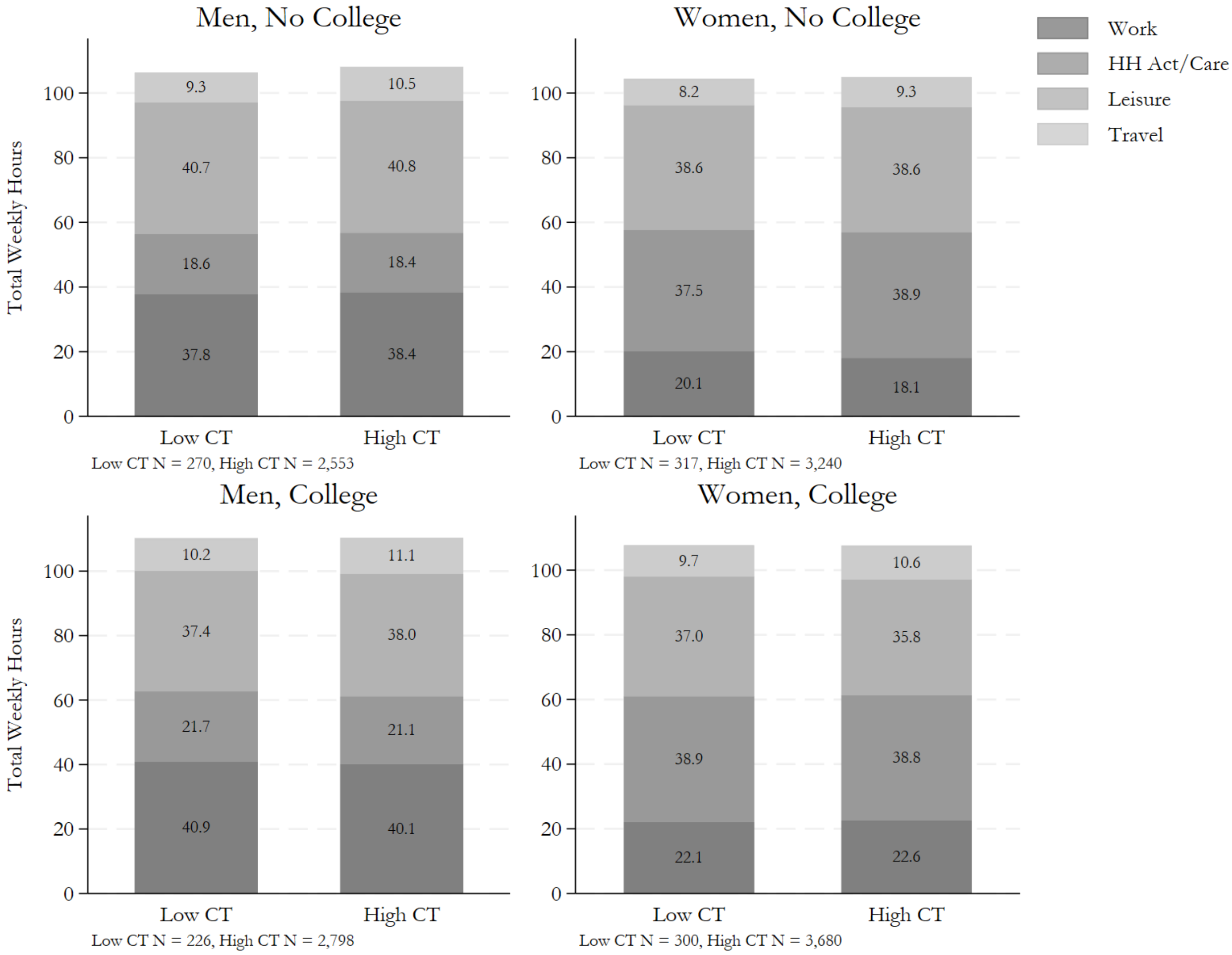
### 3.3 Commuting times and parents' time use

We analyze the time use of married parents using data from the American Time Use Surveys (ATUS) to understand whether and to what extent commuting times shape household members' specialization between paid work and housework related to household management and care activities. Relying on the ATUS time-use diaries, we construct weekly hours spent in, respectively, paid work, within-household work and care activities, leisure, and travel, by married fathers and mothers of different levels of education living in either high-commuting-time areas or low-commuting-time areas. We define high-commuting-time (low-commuting-time) areas as MSAs whose year-specific commuting time is at least one-half standard deviation above (below) the year-specific cross-MSA average. Following Bick, Blandin, and Rogerson (2022), we calculate weekly hours spent in each activity as the weighted sum of average daily hours spent in the activity during weekdays and the average daily hours spent in the activity during weekends.

Figure 5 presents the results. The first panel shows results for fathers with no college education, the second for mothers with no college education, and the third and fourth for college-educated fathers and mothers, respectively.

As far as paid work is concerned, Figure 5 shows that the labor supply decisions of married men with children are quite similar across metropolitan areas characterized by different levels of congestion: paid-work hours increase by a small amount for fathers with no college education and decrease by a small amount for fathers with a college education. Among married women with children, instead, weekly labor supply declines by around 2 hours per week among women without a college degree and remains relatively stable (increasing by a small amount) among women with a college degree. These results capture both the heterogeneity in women's labor force participation across metropolitan areas with different levels of congestion and, if any, heterogeneity in intensive-margin labor supply.

Figure 5: Weekly time use for married fathers and mothers

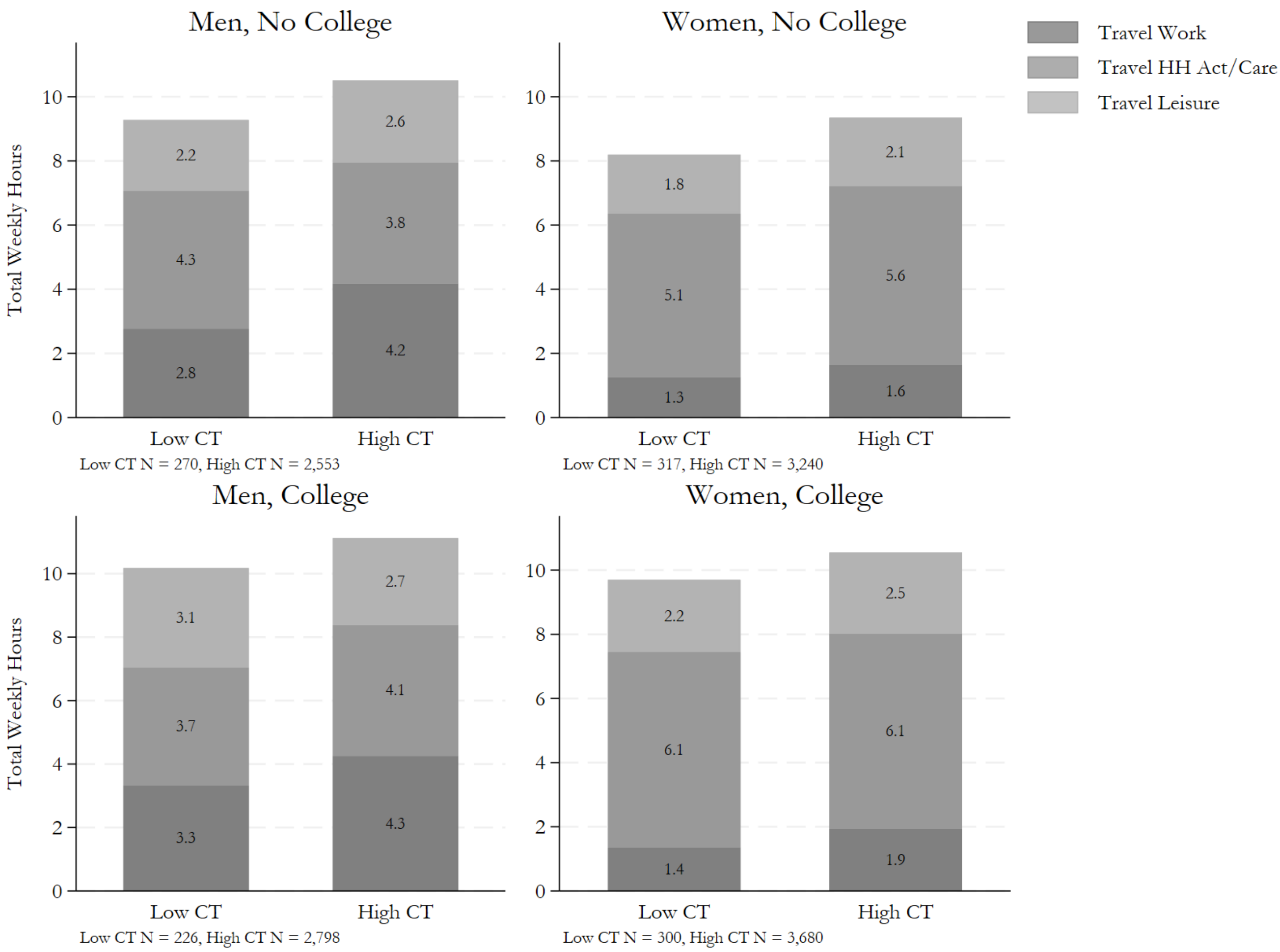



*Notes*: American Time Use Survey 2005-2019. The figure shows weekly hours spent on paid work, household activities and care for others, travel and leisure and self-care for men and women with children, with and without a college degree. Remaining hours are primarily spent sleeping and a small share missing or unknown. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average.

While on average mothers' paid-labor time declines with congestion, the overall time devoted to paid work and unpaid household and care activities is virtually unchanged across metropolitan areas with different levels of congestion for both mothers and fathers. Married mothers and fathers without a college education devote approximately 57 hours per week to paid work and within-household work, while married mothers and fathers with college degrees spend about 61 hours per week in these activities. Although fathers do not change the share of time they spend in each of these activities in high- vs. low-commute time MSAs, we do find evidence that non-college educated mothers shift their time away from paid work and towards household activities and caring for others. Mothers without a college education in highly congested areas compensate their lower paid-labor time with an increase in household work and care activities of 1.4 hours per week, and with a one-hour increase in travel time, while the weekly time they devote to leisure and self-care does not change across metropolitan areas with different levels of congestion. College educated women seem to reduce their time spent in leisure and self care as a response to the increasing time they dedicate to travel in high congestion MSAs.

For married fathers and mothers, the number of hours spent traveling each week increases with congestion. To further understand which activities drive parents' increases in travel time in highly congested MSAs, we consider three different travel categories: travel for work, travel for household activities or care for others, and travel for self-care or leisure. For each category of travel, we calculate the average weekly hours devoted to it by married fathers and mothers, respectively.

Figure 6: Weekly hours spent traveling for married fathers and mothers




*Notes*: American Time Use Survey 2005-2019. The figure shows weekly hours spent traveling for married men and women with children, with and without a college degree. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average.

The results, reported in Figure 6, show that both mothers and fathers spend more time traveling for work in high-commute time MSAs than in low-commute time MSAs, even though non-college educated mothers work less in these areas. Irrespective of congestion, mothers devote the bulk of their travel time (about 60 percent) to activities related to household management and caring for others. For non-college educated mothers in particular, the time spent traveling for these activities increases in high-commute time MSAs. The time spent traveling for household and care activities by non-college educated fathers, instead, decreases in highly congested metropolitan areas.

This evidence suggests that, among non-college educated individuals, high-commute times exacerbate within-household specialization by shifting mothers' allocation of time from paid work and towards household and care tasks including related travel. In fact, the differences in time-use between high- and low-congestion areas appear especially strong among mothers without a college degree, whose overall time devoted to household and care activities (including related travel) is 1.9-hour higher per week in highly congested areas than in low-congestion areas.

## 4 Disentangling congestion vs. selection effects

In the previous section, we showed that long commuting times are associated with systematic increases in the labor force participation gap between mothers and women without children, and contribute to increase specialization between housework and paid work especially among low-education parents. Interestingly, however, we could not find evidence that long commutes are associated with a decline in the labor force participation of women (including married and cohabiting women) without children. As shown in Table 1 and Table 2, in fact, among women without children, the likelihood of participating in the labor force tends to be higher in MSAs characterized by higher levels of congestion, controlling for individual characteristics and for time-constant and time-varying features of local labor demand.

This result sheds light on the sign of the bias in our estimates of the total effect of long commutes on the labor force participation of mothers ($\delta + \gamma$). First, the positive estimates of $\gamma$ may capture, due to simultaneity, the positive effect of higher labor force participation on congestion. To the extent that employment opportunities and local labor demand shocks are an important driver of within-US migration (Diamond, 2016), it is plausible that labor force participation determines increases in congestion and commuting times.

Second, the higher labor force participation rate among women without children in MSAs characterized by higher levels of congestion (estimated $\gamma > 0$) suggests that, even conditional on observable characteristics, women who self-select into highly congested metropolitan areas may have a lower idiosyncratic marginal utility cost from working and commuting compared to women residing in less congested cities.[5]

Both simultaneity and selection bias would imply that our empirical strategy may identify the relative effect of congestion on the labor force participation of mothers compared to women without children ($\delta$), while underestimating the magnitude of the total impact of congestion on the labor force participation of mothers, ($\gamma + \delta$).

The hypothesis that women with stronger labor force attachment (or lower marginal utility cost of working) are likely to self-select in more congested areas is consistent with the implications of a neoclassical labor supply model that incorporates exogenous commuting times. Because the regressions we estimate compare mothers to women without children conditional on individual characteristics (including marital status) and household characteristics (including partners' education and income, if any) we rely on an individual labor supply model that highlights the roles of commuting times and of the idiosyncratic utility cost of working in determining individuals' labor supply decisions. The model builds upon the unitary household labor supply model with commuting time developed by Ji, Oikonomou, Pizzinelli, Shibata, and Tavares (2024).

Consider an individual $i$ who derives utility from their consumption $y$ and who incurs a convex utility cost when working in the labor market or commuting. Consumption depends on $i$'s non-labor income, $n$, and on their labor income $wh^w$, where $w$ is the wage rate offered to worker $i$ in their local labor market, and $h^w$ is the number of hours that

[5]The most urbanized areas are characterized by the availability of non-tradable amenities that attract mostly young and highly educated workers (Albouy & Faberman, 2025; Couture & Handbury, 2020). As these workers tend to be strongly attached to the labor market, their selection into congested metropolitan areas may at least partly contribute to the correlation between commuting times and labor force participation.

$i$ works for pay. Let the time constraint for individual $i$ be $h^w + h^h + \tau = 1$, where $h^h$ represents the number of hours spent neither working nor commuting. Let $\tau$ indicate the average commute time in the metropolitan area where $i$ lives. Using a quasi-linear utility function to disregard income effects, $i$'s can take the following form

$$u(y, h^w) = n + wh^w - \phi_i \frac{[h^w + \tau]^{1+\gamma}}{1+\gamma} \tag{2}$$

The individual chooses $h^w$ to maximize their utility, so that $\frac{\partial u}{\partial h^w} = 0$. This first order condition implies

$$h^{w*} = \left(\frac{w}{\phi_i}\right)^{1/\gamma} - \tau \tag{3}$$

Where $1/\gamma$ is the wage-elasticity of $i$'s labor supply $h^{w*}$.

Given $i$'s optimal choice of work-hours, $i$'s labor force participation condition can be derived. Individual $i$ participates in the labor market, choosing $h^{w*} > 0$ if

$$w > \phi_i \tau^\gamma \equiv w^r \tag{4}$$

Individual $i$ participates in the labor force if the wage they would receive for every work hour compensates them for the marginal utility cost of their first work hour, which includes the idiosyncratic marginal utility-cost component, $\phi_i$, and the utility cost due to commuting, $\tau$. $\phi_i \tau^\gamma$ is worker $i$'s reservation wage, $w^r$.

The model has two main implications. First, a ceteris paribus increase in commuting times $\tau$ increases workers' reservation wages, thus exerting a negative impact on labor force participation of any worker for whom $\phi_i > 0$. Longer commutes diminish the marginal utility of every work-hour, representing a time cost for which workers are not compensated. Second, to the extent that the presence of children increases the relative value of non-market time, mothers $(m)$ should have a higher marginal utility-cost of working compared to women without children $(n)$, $\phi_m > \phi_n$. Hence, an equal increase in congestion $\tau$ should have a more negative impact on the labor force participation of mothers than on the labor force participation of women without children.

While the second implication of the model is consistent with the empirical evidence we provide, the first implication appears at odds with the finding that, among women without children, labor force participation is (at least) equal across MSAs characterized by different levels of congestion, conditional on MSA fixed-effects and on several time-varying proxies of MSA-specific labor demand, hence on the average wages $w$ offered to women in different metropolitan areas.

This result can be explained if women with lower idiosyncratic utility cost of working, $\phi$, select into more congested areas. Keeping fixed labor demand, that is, the distribution of wages, $F(w)$, in high commuting-time ($H$) areas and low commuting-time ($L$) areas, so that $F^H(w) = P^H(W \leq w) = P^L(W \leq w) = F^L(w)$, the equality in labor force participation between women without children in different metropolitan areas, $P^H(w > w^r_H) = P^L(w > w^r_L)$, implies that women without children living in different areas have similar reservation wages. Given $\phi$, the reservation wage in high-commuting time areas should be higher to compensate women for longer commutes ($\tau_H > \tau_L$). If reservation wages are equal, however, it must be that $\phi^H < \phi^L$.

It is worth noting that the implication that women with relatively low idiosyncratic utility cost of working and commuting are likely to self-select in high commuting-time metropolitan areas can hold even if, conditional on the MSA characteristics noted above, high commuting-time labor markets offer higher wages compared to low commuting-time areas.[6]

The implications of the model suggest that selection bias may lead us to underestimate the actual impact of congestion on the labor force participation of mothers ($\delta + \gamma$) and of women without children ($\gamma$). We empirically corroborate this implication in the next section.

# 5 Robustness Checks

Our baseline empirical specification exploits the within-MSA variation in congestion across years to identify the impact of commuting time on the gap in labor force participation between mothers and non-mothers who live in the same geographical area. The underlying intuition is that comparing the labor supply of different groups of women within urban areas should reduce concerns that the relationship between the labor force

[6]Formal proofs are provided in Section B in the Online Appendix.

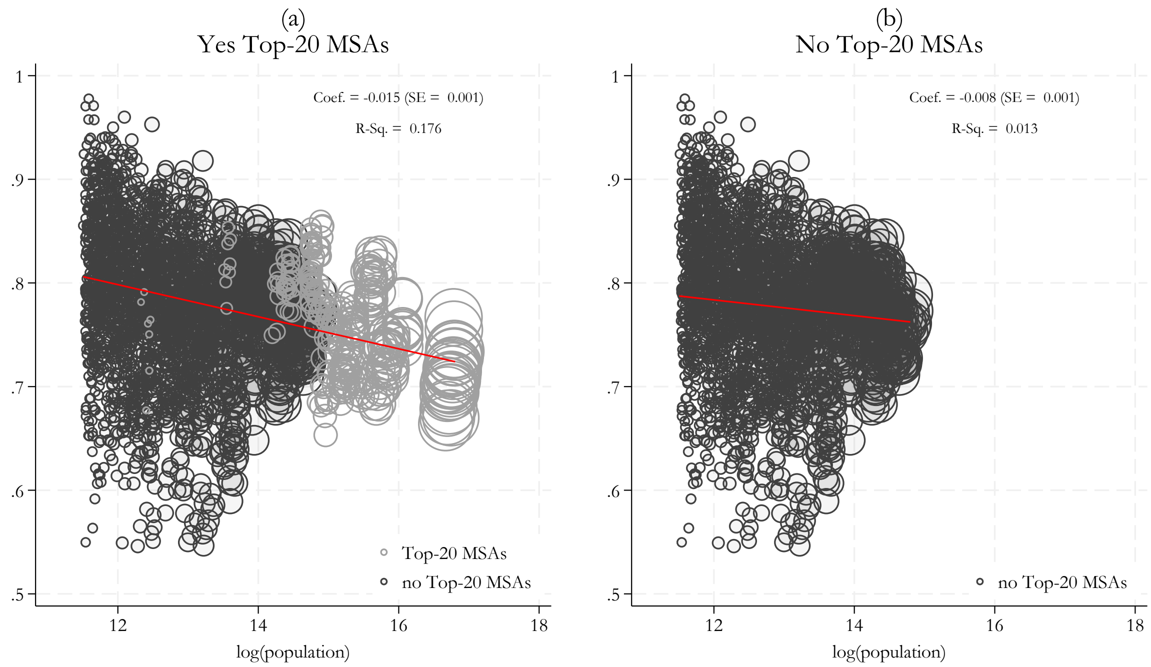
participation gap between mothers and women without children and congestion is strongly affected by selection bias. In this section, we investigate the robustness of this approach.

First, we show that our estimates of the impact of congestion on the labor force participation gap between mothers and women without children is robust to the exclusion of very large metropolitan areas and to implementing an instrumental variable estimation of regression (1). Second, using an IV strategy we provide evidence corroborating the hypothesis that women who self-select into more congested areas may have lower marginal utility cost of working than others.

## 5.1 Commuting times and women's LFP by MSA dimension

One area of concern is that the effect of congestion on mothers' labor force participation that we estimate may be capturing the effect of living in a large city. In a recent contribution, Moreno Maldonado (2022) argues that long commuting times, together with high childcare prices, induce couples with children in large metropolitan areas to specialize, thus attracting couples with stronger preferences for non-working mothers into large cities. Her findings suggest that these factors explain the lower labor force participation of mothers in large cities compared to smaller cities. Figure 7 panel (a) shows that the labor force participation of mothers, in fact, tends to be lower in highly populated areas and that cross-MSA variation in population explains at least 17% of the cross-city variation in mothers' labor force participation. This result, however, does not hold when the sample excludes the 20 largest metropolitan statistical areas in the United States. As shown in panel (b), the relationship between city dimension and mothers' labor force participation becomes economically irrelevant, while the cross-MSA size variation explains only 1.3% of the cross-MSAs variation in mothers' labor force participation. Differences in labor force participation of mothers across metropolitan areas whose population ranges from between approximately 60,000 and 3,000,000 residents do not appear to be related to city dimension.

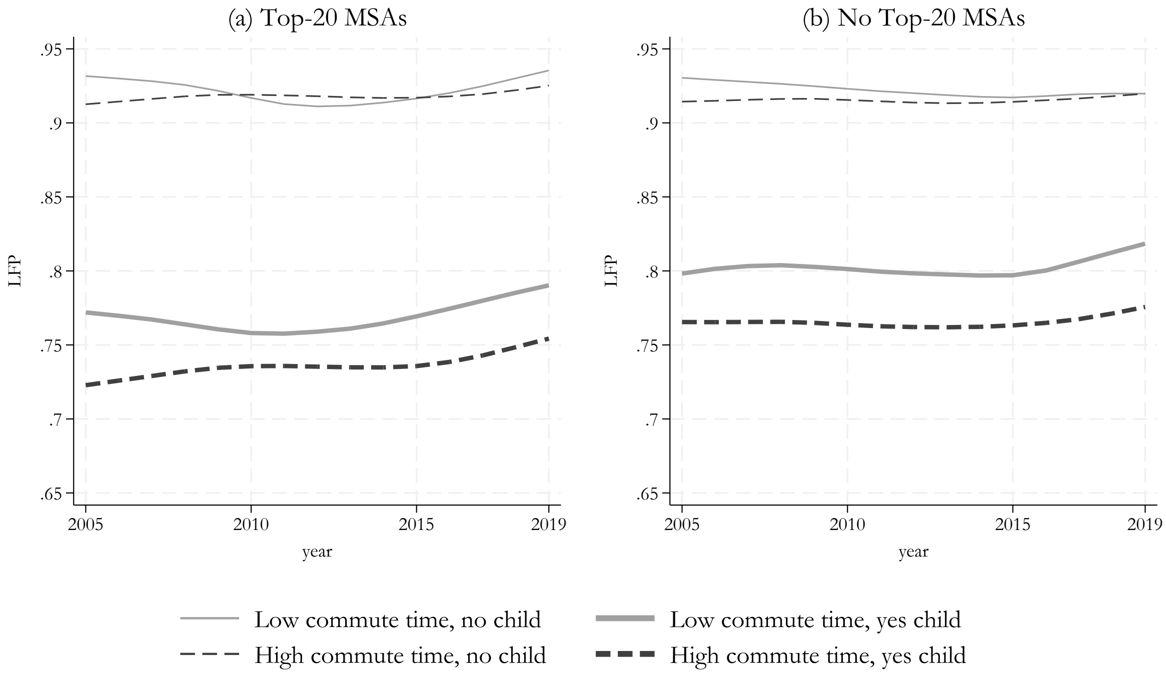
Figure 7: MSA population and the LFP of women with children




*Notes*: American Community Survey 2005-2019. The figures represent the cross-MSA relationship between city dimension, measured by its year-specific (log) population, and the labor force participation of women with children. Panel (a) includes all metropolitan areas, panel (b) excludes the 20 largest MSAs, measured by their population in 2000.

While differences in metropolitan area dimensions do not explain differences in mothers' labor force participation across small- and medium-sized cities, Figure 8 shows that, both among women living in the very large metropolitan areas (panel a) and among women in small and medium cities (panel b), the labor force participation of mothers is lower in more congested areas. The labor force participation of women without children is virtually identical across geographical areas characterized by different levels of congestion. Figure A1 in the Online Appendix shows that the results are qualitatively unaffected when the sample is restricted to married women only.

Figure 8: Trends in LFP of women with and without children




*Notes*: American Community Survey 2005-2019. The figures show trends in the labor force participation of women by parental status. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average. Commute times are calculated separately for top-20 and non top-20 MSAs. Trends in labor force participation are smoothed using a Hodrick-Prescott filter with smoothing parameter 6.5. Panel (a) shows trends for the 20 largest metropolitan statistical areas, panel (b) shows trend for small-and-medium-sized metropolitan areas.

Furthermore, Table 3 replicates the results in Table 1 for women who do not live in the 20 largest US metropolitan areas. For all groups of women, Table 3 shows that the estimated change in the labor force participation gap between mothers and women without children associated with one standard deviation increase in commuting time does not strongly change when the sample is restricted to small- and medium-sized MSAs. The results also highlight that the impact of congestion on the labor force participation gap between mothers and women without children remains relatively larger for single women and for women without a college education.

Table 3: Labor force participation - women in small and medium size MSAs

| | (1) All | (2) S | (3) M | (4) No Col | (5) Col |
|---|---|---|---|---|---|
| Has child | -0.091** | 0.001 | -0.145** | -0.076** | -0.115** |
| | (0.003) | (0.002) | (0.004) | (0.004) | (0.004) |
| Z(MSA CT) | 0.006* | 0.001 | 0.004 | 0.004 | 0.009* |
| | (0.003) | (0.002) | (0.003) | (0.003) | (0.003) |
| HC*Z(MSA CT) | -0.011** | -0.008** | -0.006+ | -0.011** | -0.010* |
| | (0.003) | (0.002) | (0.003) | (0.003) | (0.004) |
| Obs. | 1034798 | 322062 | 712736 | 593499 | 441299 |
| R-squared | 0.100 | 0.105 | 0.089 | 0.093 | 0.091 |
| Controls $i$ | Y | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y | Y |
| $MSA$ F.E. | Y | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection is described in Section 2. In addition, the sample is restricted to women that do not live in the top-20 MSAs listed in Online Appendix Table A1. The regression models are described in Table 1. Standard errors, in parentheses, are clustered at the MSA level. p-Value < 0.1 (+), 0.05 (*), 0.01 (**).

## 5.2 Instrumental variable approach

We now estimate the impact of congestion on women's extensive-margins labor supply using an instrumental variable approach. We instrument the MSA-specific congestion levels using two instruments proposed by Duranton and Turner (2011) to estimate the causal effect of road supply on vehicle traffic: the MSA-specific kilometers of railroad development in 1898, and the MSA-specific kilometers of highway development in 1947.

The instruments are arguably relevant to the extent that, as shown by Duranton and Turner (2011), they explain changes in vehicle traffic and, consequently, in travel and commuting times. To ensure that the instruments satisfy the exclusion restriction, thus affecting women's labor supply decisions solely through their impact on commuting times, we keep including controls for year-and-MSA-specific population. We instrument the year-specific MSA population using the Duranton and Turner (2011) estimates of MSA-specific population in 1970.[7]

[7] Duranton and Turner (2012) show that the development in the road network, instrumented through the

Table 4: Labor force participation - women - IV

| | (1) All | (2) S | (3) M | (4) No Col | (5) Col |
|---|---|---|---|---|---|
| Has child | -0.091** | -0.001 | -0.144** | -0.076** | -0.115** |
| | (0.005) | (0.003) | (0.005) | (0.005) | (0.005) |
| Z(MSA CT) | 0.002 | -0.023 | 0.012 | -0.002 | 0.006 |
| | (0.014) | (0.017) | (0.018) | (0.019) | (0.013) |
| HC*Z(MSA CT) | -0.015** | -0.006 | -0.015** | -0.013* | -0.013** |
| | (0.004) | (0.004) | (0.004) | (0.006) | (0.004) |
| Obs. | 2430260 | 751863 | 1678397 | 1274898 | 1155362 |
| R-squared | 0.109 | 0.103 | 0.093 | 0.101 | 0.093 |
| First Stage Z F-Test | 25.4 | 26.4 | 25.7 | 23 | 29.6 |
| First Stage Z*HC F-Test | 27.6 | 20.9 | 29.4 | 25.1 | 32.2 |
| Hansen J stat | 1 | 2.2 | .6 | 2.4 | 2.7 |
| Hansen J p-Value | .605 | .325 | .732 | .298 | .254 |
| Endogeneity test p-Value | .832 | .14 | .198 | .738 | .737 |
| Controls $i$ | Y | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y | Y |
| $MSA$ F.E. | Y | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection is described in Section 2. The regression models are described in Table 1. Because the instruments vary across MSAs but not within MSAs over time, we exclude MSA fixed effects and include state fixed effects. F-Tests for the first-stage of the regressors $Z$ (the standardized MSA commuting time) and $Z * HC$ (the interaction between the MSA commuting time and the indicator variable for women with children) test the joint significance in the first-stage regressions of the following excluded instruments: the two instruments proposed by Duranton and Turner (2011), their interactions with the child dummy variable, and the (log of the) MSA-specific population in 1970. Using the Hansen-Sargan test of overidentifying restrictions, we test the exogeneity of the excluded instruments. We also test for the endogeneity of the instrumented regressors: the MSA commuting time ($Z$), its interaction with the child indicator variable ($Z * HC$) and the current MSA population (in log terms). Standard errors, in parentheses, are clustered at the MSA level. p-Value $<$ 0.1 ($^+$), 0.05 ($^*$), 0.01 ($^{**}$).

We estimate equation (1) on the sample of all women. Because the instruments do not vary within MSAs over time, we substitute MSA fixed effects with state fixed effects.

19th century railroad development and mid-20th century highway network plans caused differences in population growth across metropolitan areas between 1980 and 2000. To the extent that population and city dimension affect mothers' labor supply decisions beyond their impact on congestion (Moreno Maldonado, 2022), not controlling for MSA population could lead to a violation of the exclusion restriction in our framework.

The estimation results, presented in Table 4, are very similar to the results obtained via OLS estimation and shown in Table 1.

The table also reports results of several diagnostic tests for our IV model. The results of F-tests for the joint significance of the excluded instruments in the first-stages of the endogenous regressors of interest suggest that the instruments are relevant. The results of the Hansen-Sargan test of overidentifying restrictions show that we cannot reject the null hypothesis that the excluded instruments are exogenous. The results of the test for the endogeneity of the regressors show that we cannot reject the null hypothesis that the instrumented regressors can be treated as exogenous.

Table 5: LFP - women cohabiting with male partners - IV

| | (1)<br>No College | (2)<br>College |
|---|---|---|
| Has child | -0.142** | -0.168** |
| | (0.005) | (0.005) |
| Z(MSA CT) | 0.001 | -0.003 |
| | (0.020) | (0.020) |
| HC*Z(MSA CT) | -0.017** | -0.007+ |
| | (0.005) | (0.004) |
| Obs. | 707017 | 593633 |
| R-squared | 0.094 | 0.091 |
| First Stage Z F-Test | 22.4 | 33.9 |
| First Stage Z*HC F-Test | 25.3 | 36.4 |
| Hansen J stat | 1.7 | 2.2 |
| Hansen J p-Value | .433 | .325 |
| Endogeneity test p-Value | .576 | .992 |
| Controls $i$ | Y | Y |
| Controls $MSA$ | Y | Y |
| Year F.E. | Y | Y |
| State F.E. | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The regression models are described in Table 2. Because the instruments vary across MSAs but not within MSAs over time, we exclude MSA fixed effects and include state fixed effects. IV diagnostic tests are explained in Table 4. Standard errors, in parentheses, are clustered at the MSA level. p-Value < 0.1 (+), 0.05 (*), 0.01 (**).

In Table 5 we show the IV estimation results for the subsample of women cohabiting with male partners, and corroborate the result that long commuting times tend to increase the labor force participation gap between mothers and women without children among individuals with no college education.[8]

Interestingly, the instrumental variable estimation results in Table 4 and Table 5 also corroborate the hypothesis that women living in highly congested areas have lower marginal utility cost of working compared to women in less congested areas. The IV-estimated effect of one standard-deviation increase in commuting time on the labor force participation of women without children is not statistically significant but negative in sign in most specifications. This result also implies that long commuting time determine a larger drop in the labor force participation of women with children compared to our baseline and more conservative specification results.

# 6 Mechanisms

Congestion and longer commutes discourage the labor force participation of mothers, having an especially detrimental impact on mothers without a college degree. The asymmetry in the impact of congestion on the extensive-margin labor supply of mothers with different levels of education may be explained by several mechanisms. Farré, Jofre-Monseny, and Torrecillas (2023), for example, provide evidence suggesting that long commute times may exacerbate social norms that assign the role of primary caregiver to women. Consistent with these results, Oreffice and Sansone (2023) show that within-couple gender gaps in commute times are substantially larger in heterosexual couples than in same-sex couples. If gendered social norms are more widespread among couples with lower levels of education, they may also explain our findings that congestion is particularly detrimental to the labor force participation of mothers without a college degree.

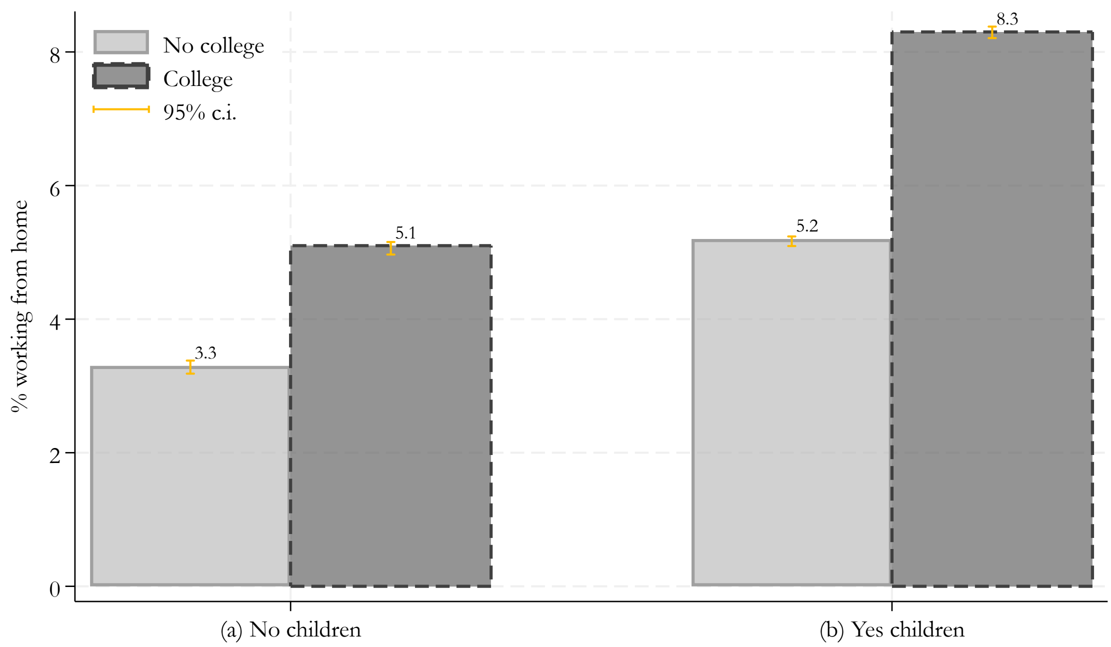
Alternative mechanisms, however, are also possible. For example, it is well-known that women have non-negligible preferences for work-from-home arrangements (Maestas, Mullen, Powell, von Wachter, & Wenger, 2023; Mas & Pallais, 2017), that remote work helps reduce mothers' self-reported family-work conflict (Sherman, 2020), and that access

[8]Online Appendix Table A4 columns (1) and (2) replicates this analysis for men who cohabit with female partners and shows that long commuting times have no impact on the labor force participation gap between fathers and men without children

to remote work reduces workers' need to commute (Ji, Oikonomou, Pizzinelli, Shibata, & Tavares, 2024). If college educated women have more access to remote-work opportunities, high commuting times and congestion may have a smaller impact on their labor supply compared to women with lower levels of education.

Figure 9 reports the incidence of work-from-home arrangements among working women with different levels of education who cohabit with male partners. Panel (a) sample includes women without children, while panel (b) sample includes mothers. The figure shows three interesting facts. First, working women with children are more likely towork from home than women without children. Second, irrespective of the presence of children, college graduate working women are more likely to access remote work arrangements than women without a college degree. Third, the gap in access to work-from-home arrangements between college graduate women and women with lower level of educations is higher in the presence of children. Table A2 in the Online Appendix shows that these facts persist when comparing working women with different levels of education within aggregate occupation classes.

Figure 9: Share of employed women working from home




*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are further restricted to working women in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. The statistics in the figure are computed using ACS individual weights.

This evidence highlights the role that work-from-home arrangements may play in attenuating the congestion child penalty. Women without access to work-from-home arrangements bear the economic and time cost of congestion and of long commutes, which may entrench their ability to participate in the labor force when children are present. Access to remote work arrangements, instead, can reduce women's mobility constraints, especially in highly-congested areas. Thus, congestion may induce a stronger decline in the labor force participation of women without a college degree upon having children due to their limited access to remote work arrangements.

If the asymmetry in the availability of remote-work arrangements explains the stronger negative impact of longer commutes on the labor supply of mothers without a college degree than on college graduate women, then congestion should also affect the actual commuting time of working women with different levels of education differently. Specifically, if college graduate women who remain in the labor force upon having children can switch to remote work, their commuting time may decrease on average due to congestion. If switching to telework is more difficult for women without a college degree, then working mothers with low levels of education may actually commute longer in highly congested areas.

These hypotheses are supported by the evidence reported in Table 6. The table shows the estimates of regression (1) where the dependent variables are (the log of) the minutes of workers' daily commute to work (1) and (2) and an indicator variable identifying whether a woman works from home in columns (3) and (4). The samples include working women who cohabit with male partners. Columns (1) and (3) include women without a college degree, while columns (2) and (4) include college graduates. The regressions are estimated via 2SLS using the instruments described in Section 5.2.[9]

As shown in columns (1) and (2), while employed mothers of all levels of education commute fewer minutes per day compared to women without children, congestion increases the daily commuting time of mothers without a college education by 4.4% (7.6-3.2), while it decreases by 5% the daily commuting time of working college graduate mothers.

[9]We rely on the IV model to study the impact of congestion on individual commuting time and on the probability of working from home because diagnostic tests reported in Table 6 reject that the regressors of interest are exogenous for models (2), (3), and (4). OLS estimates are reported in Table A5 in the Online Appendix.

Table 6: Commute time, remote work and congestion

| | (1) No Col CT | (2) Col CT | (3) No Col WH | (4) Col WH |
|---|---|---|---|---|
| Has child | -0.074** | -0.087** | 0.022** | 0.024** |
| | (0.009) | (0.011) | (0.002) | (0.003) |
| Z(MSA CT) | 0.076+ | 0.017 | 0.011 | 0.010 |
| | (0.040) | (0.067) | (0.008) | (0.013) |
| HC*Z(MSA CT) | -0.032** | -0.050** | -0.002 | 0.005* |
| | (0.010) | (0.010) | (0.002) | (0.003) |
| Obs. | 417903 | 424298 | 417903 | 424298 |
| R-squared | 0.061 | 0.069 | 0.023 | 0.034 |
| First Stage Z F-Test | 22.5 | 34.5 | 22.5 | 34.5 |
| First Stage Z*HC F-Test | 26.4 | 35 | 26.4 | 35 |
| Hansen J stat | 6.5 | 1.8 | .9 | 1.4 |
| Hansen J p-Value | .039 | .413 | .632 | .502 |
| Endogeneity test p-Value | .283 | .002 | .003 | .023 |
| Controls $i$ | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y |
| State F.E. | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. The regressions include all controls listed in Table 2 notes, dummy variables for aggregate occupation and industry groups, workers' wage (in log terms), their partner's work hours, labor force status and commuting time (in log terms). The models are estimated via 2SLS using the instruments described Section 5.2. Because the instruments do not vary within MSA over time, state-level fixed effect are used instead of MSA-level fixed effects. Column (1) shows results for women without a college degree, column (2) shows results for college graduate women. IV diagnostic tests are described in Table 4. p-Value $<$ 0.1 ($^+$), 0.05 ($^*$), 0.01 ($^{**}$).

The result in column 1 should be interpreted with caution as the results of the Hansen-Sargan test cast doubts on the exogeneity of the excluded instruments in the framework of column-1 model only, while the hypothesis that the instrumented variables are exogenous cannot be rejected. Results in column 1 of Table A5 in the Online Appendix, however, show that the results are qualitatively unaffected using our baseline estimation method.[10]

[10] Online Appendix Table A4 columns (3) and (4) replicate this analysis for men who co-habit with female partners and shows that this result does not apply to the hours gap between fathers and men without children.

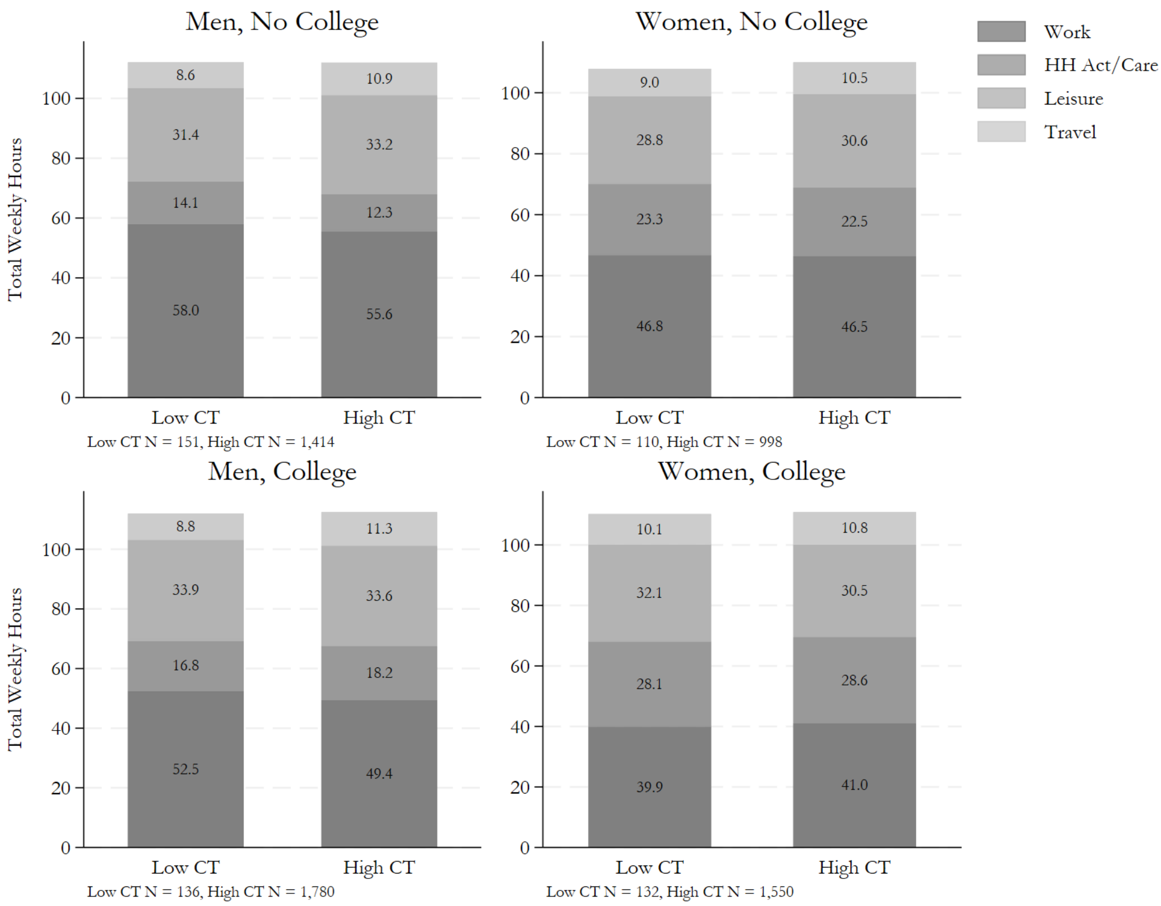
Conversely, as shown in columns (3) and (4), while mothers of all levels of education are more likely to work remotely compared to women without children, congestion induces an increase in the probability of working from home among college graduate mothers only. The probability that a college graduate working mother works from home rises by 1 percentage-point with a 7-minute (two standard deviations) increase in the MSA-specific commuting time.Increases in congestion do not affect the probability that working mothers without a college degree work from home.

These results are key to interpret the asymmetry in the impact of long commutes on the extensive-margin labor supply of women with different levels of education. As mothers without a college degree have more limited opportunities to access remote-work arrangements, congestion induces some of them to leave the labor force while exerting an upward pressure on the commuting times of labor force participants. Among college graduate mothers, instead, to the extent that those remaining in the labor force are more likely to have access to telework, commuting times decline with congestion, which induces a higher share of them to work from home.[11]

We further corroborate these results by analyzing the time-use patterns of parents who participate in the labor force and report working at least one hour in the day in which they recorded their dairy. We present results for overall time-use in Figure 10 and for travel-specific time-use in Figure 11. While small sample sizes require caution in interpreting results, some facts regarding the time-use of mothers in low-congestion and high-congestion areas are worth highlighting.

[11] The larger effect of congestion on the labor force participation of mothers without a college degree could also be explained by the fact that college graduate women live closer to their workplaces. Evidence in Figure A2, Figure A3 and Figure A4 in the Online Appendix, however, suggest that this may not be the case. Among employed women who do not work from home, college graduates experience longer daily commutes compared to women without a college degree, irrespective of the presence of children.

Figure 10: Weekly time use for married mothers and fathers - work hours>0

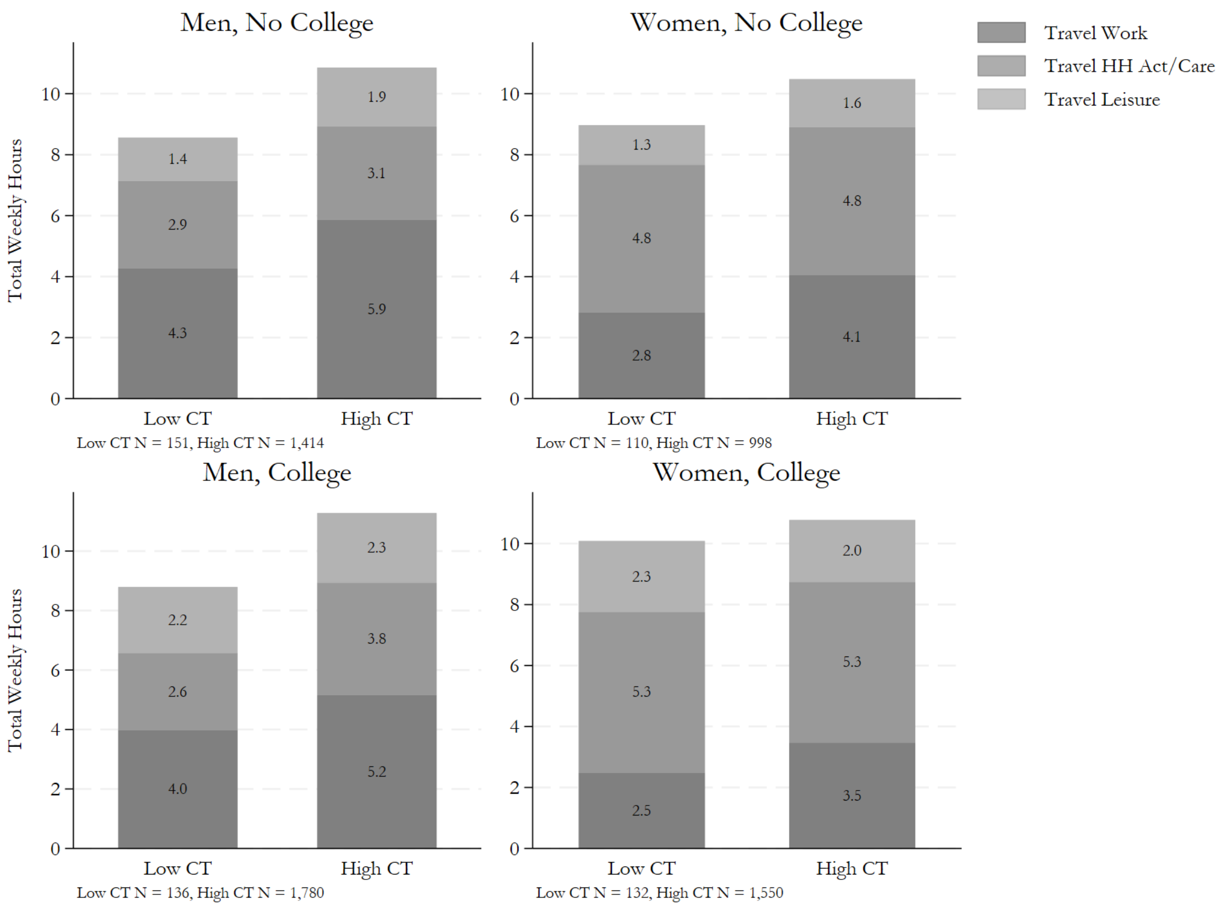



*Notes*: American Time Use Survey 2005-2019. The figure shows weekly hours spent on paid work, household activities and care for others, travel and leisure and self-care for men and women with children, with and without a college degree, for sample of individuals that work more than 0 hours on a given day. Remaining hours are primarily spent sleeping and a small share missing or unknown. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average.

As shown in Figure 10, conditional on participating in the work force, work hours are slightly lower in highly congested areas than in low-congestion areas for mothers with less than college education. Working mothers without a college degree in highly congested areas work on average 20 minutes less per week in high-congestion areas than in low-congestion areas. In contrast working mothers with a college degree work one hour more in high-congestion areas than in low-congestion areas. The slight decline in work hours for non-college educated mothers is offset by a similar increase in household and care activities and, importantly, by a 1.5-hour increase in travel and commuting. Among working college educated mothers, weekly travel time increases by less than one hour between low-congestion and high-congestion metropolitan areas.

Patterns in travel time reported in Figure 11 corroborate the hypothesis that congestion has asymmetric effects on women with different levels of education. While overall weekly travel time increases with congestion for working college educated mothers as well as for working mothers without a college degree, the extent to which commuting time changes with congestion differs by education. Working mothers without a college degree and college graduate working mothers spend a similar amount of weekly time commuting to work in low-congestion areas. In highly congested areas, mothers without a college degree spend approximately 4.1 hours per week commuting, 1.3 hours more than in low-congestion areas. For college graduate mothers, instead, commute time increases between low- and high-congestion areas by about 40 minutes (0.7 hours) per week. This evidence is consistent with the fact that working college graduate mothers in highly congested areas may be more likely than less educated mothers work from home, thus reducing the impact of congestion on their own commutes.

Figure 11: Weekly hours spent traveling for married mothers and fathers - work hours>0




*Notes*: American Time Use Survey 2005-2019. The figure shows weekly hours spent traveling for married men and women with children, with and without a college degree. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average.

# 7 Conclusion

Congestion represents a cost for the US economy. According to the Texas A&M Transportation Institute, the average US commuter lost 54 hours a year in 2019 due to congestion, increasing from 42 hours a year in 2005, costing the US economy approximately $217 billion (Schrank, Albert, Jha, & Eisele, 2024).

In this paper we showed that congestion also represents a barrier to the labor supply of American mothers, and thus overall estimates on the cost of congestion underestimate aggregate costs. Our most conservative estimates suggest that increases in commuting times of around 5 minutes increase the labor force participation gap between mothers and women without children by 1.86 percentage points. Furthermore, we show that congestion is particularly detrimental to the labor force participation of single mothers and, most prominently, of mothers without a college degree. Finally, we show that college graduate mothers, who have more access to telework compared to mothers without a college degree, experience smaller labor force participation declines, and are more likely to switch to remote work due to congestion. These results suggest that the availability of remote work arrangements can attenuate the impact of congestion on mother's labor supply.

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**Supplementary Material**

**Online Appendix**

**to**

# Understanding the Congestion Child Penalty: a Look at Labor Force Participation, Time Use and Work from Home

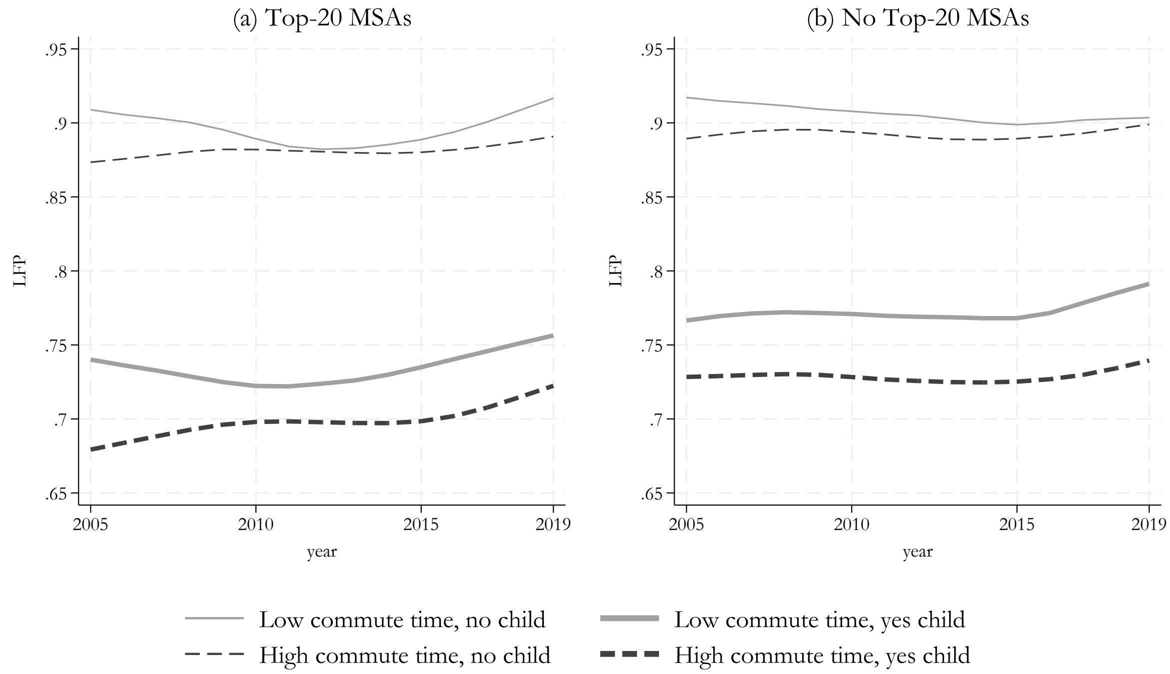
Not for Publication

# A Additional tables and figures

Table A1: Twenty most populated metropolitan areas in 2000

| | State(s) |
|---|---|
| New York-Northern New Jersey-Long Island | NY-NJ-CT-PA |
| Los Angeles-Riverside-Orange County | CA |
| Chicago-Gary-Kenosha | IL-IN-WI |
| Washington-Baltimore | DC-MD-VA-WV |
| San Francisco-Oakland-San Jose | CA |
| Philadelphia-Wilmington-Atlantic City | PA-NJ-DE-MD |
| Boston-Worcester-Lawrence | MA-NH-ME-CT |
| Detroit-Ann Arbor-Flint | MI |
| Dallas-Fort Worth | TX |
| Houston-Galveston-Brazoria | TX |
| Atlanta | GA |
| Miami-Fort Lauderdale | FL |
| Seattle-Tacoma-Bremerton | WA |
| Phoenix-Mesa | AZ |
| Minneapolis-St. Paul | MN-WI |
| Cleveland-Akron | OH |
| San Diego | CA |
| St. Louis | MO-IL |
| Denver-Boulder-Greeley | CO |
| Tampa-St. Petersburg-Clearwater | FL |

Figure A1: Trends in LFP of married women with and without children




*Notes*: American Community Survey 2005-2019. The figures show trends in the labor force participation of married women by parental status. High-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations above the year-specific cross-MSA average. Low-commuting time MSAs include areas whose commuting time is at least 0.5 standard deviations below the year-specific cross-MSA average. Commute times are calculated separately for top-20 and non top-20 MSAs. Trends in labor force participation are smoothed using a Hodrick-Prescott filter with smoothing parameter 6.5. Panel (a) shows trends for the 20 largest metropolitan statistical areas, panel (b) shows trend for small-and-medium-sized metropolitan areas.

Table A2: Remote work access - working women by education and occupation

| | (1) All | (2) No child | (3) Yes child |
|---|---|---|---|
| (a) Exec - No coll | 0.065 | 0.053 | 0.070 |
| | (0.001) | (0.002) | (0.001) |
| Col-No Col Diff | 0.023 | 0.010 | 0.033 |
| | (0.001) | (0.002) | (0.002) |
| (b) Prof - No coll | 0.052 | 0.058 | 0.050 |
| | (0.001) | (0.002) | (0.001) |
| Col-No Col Diff | 0.000 | -0.016 | 0.007 |
| | (0.001) | (0.002) | (0.001) |
| (c) Tech - No coll | 0.046 | 0.030 | 0.051 |
| | (0.001) | (0.001) | (0.001) |
| Col-No Col Diff | 0.050 | 0.029 | 0.066 |
| | (0.001) | (0.001) | (0.001) |
| (d) Serv - No coll | 0.047 | 0.025 | 0.054 |
| | (0.001) | (0.001) | (0.001) |
| Col-No Col Diff | 0.027 | 0.003 | 0.046 |
| | (0.002) | (0.002) | (0.002) |
| (e) Prod - No coll | 0.066 | 0.054 | 0.071 |
| | (0.004) | (0.007) | (0.005) |
| Col-No Col Diff | 0.073 | 0.041 | 0.119 |
| | (0.009) | (0.012) | (0.013) |

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. Panel (a) includes women in executive and managerial occupations, panel (b) include professionals, panel (c) includes workers in technical, clerical and sales occupations, panel (d) includes service workers, panel (e) includes production workers and laborers. In each panel, the first line indicates the share of women without a college degree who work from home, the second line indicates the difference in the likelihood of working from home between college gradaute women and women without a college degree. The shares and differences are computed for all women (column 1), women without children (column 2) and women with children (column 3). All statistics are weighted for ACS individual weights.

Table A3: Men's labor force participation and hours - by couple's type

| | (1)<br>LF No Col | (2)<br>LF Col | (3)<br>Hrs No Col | (4)<br>Hrs Col |
|---|---|---|---|---|
| Has child | 0.011** | 0.002* | 0.008* | 0.012** |
| | (0.002) | (0.001) | (0.003) | (0.002) |
| Z(MSA CT) | 0.000 | 0.002+ | 0.003 | 0.010** |
| | (0.002) | (0.001) | (0.005) | (0.003) |
| HC*Z(MSA CT) | 0.000 | -0.001** | 0.002 | -0.008** |
| | (0.001) | (0.001) | (0.002) | (0.002) |
| Obs. | 569707 | 730943 | 544831 | 718759 |
| Adj. R-squared | 0.022 | 0.005 | 0.035 | 0.018 |
| Controls $i$ | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y |
| $MSA$ F.E. | Y | Y | Y | Y |

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2, the regression models are described in Table 1. Standard errors, in parentheses, are clustered at the MSA level. p-Value < 0.1 (+), 0.05 (*), 0.01 (**).

Table A4: Men's labor force participation and hours - by couple's type - IV

| | (1)<br>LF No Col | (2)<br>LF Col | (3)<br>Hrs No Col | (4)<br>Hrs Col |
|---|---|---|---|---|
| Has child | 0.009** | 0.002 | 0.007 | 0.015** |
| | (0.002) | (0.001) | (0.004) | (0.003) |
| Z(MSA CT) | -0.006 | -0.000 | -0.037+ | -0.034+ |
| | (0.007) | (0.004) | (0.021) | (0.019) |
| HC*Z(MSA CT) | 0.002 | -0.001 | 0.003 | -0.010** |
| | (0.002) | (0.001) | (0.004) | (0.003) |
| Obs. | 569707 | 730943 | 544831 | 718759 |
| Adj. R-squared | 0.020 | 0.005 | 0.033 | 0.015 |
| Controls $i$ | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y |
| State F.E. | Y | Y | Y | Y |

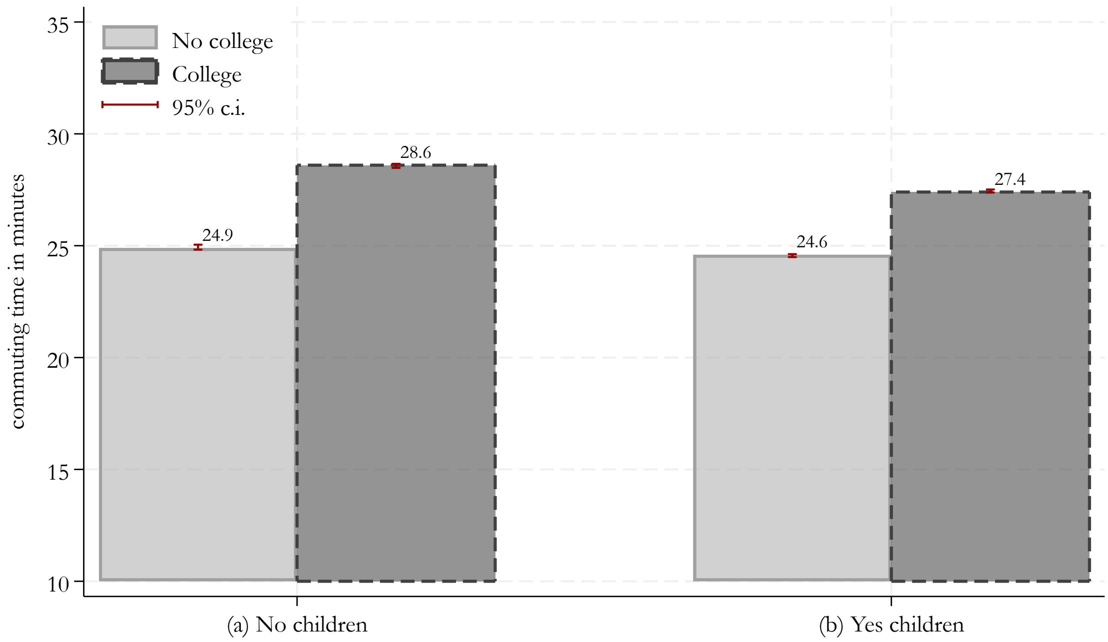
*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2, the regression models are described in Table 1. Standard errors, in parentheses, are clustered at the MSA level. p-Value < 0.1 (+), 0.05 (*), 0.01 (**).

Table A5: Work hours, remote work and congestion: OLS

| | (1)<br>No Col CT | (2)<br>Col CT | (3)<br>No Col WH | (4)<br>Col WH |
|---|---|---|---|---|
| Has child | -0.083** | -0.099** | 0.023** | 0.028** |
| | (0.008) | (0.008) | (0.002) | (0.002) |
| Z(MSA CT) | 0.030** | 0.051** | 0.004* | 0.000 |
| | (0.008) | (0.012) | (0.002) | (0.002) |
| HC*Z(MSA CT) | -0.021* | -0.040** | -0.003* | 0.002 |
| | (0.008) | (0.006) | (0.001) | (0.002) |
| Obs. | 417903 | 424298 | 417903 | 424298 |
| R-squared | 0.062 | 0.070 | 0.024 | 0.035 |
| Controls $i$ | Y | Y | Y | Y |
| Controls $MSA$ | Y | Y | Y | Y |
| Year F.E. | Y | Y | Y | Y |
| MSA F.E. | Y | Y | Y | Y |

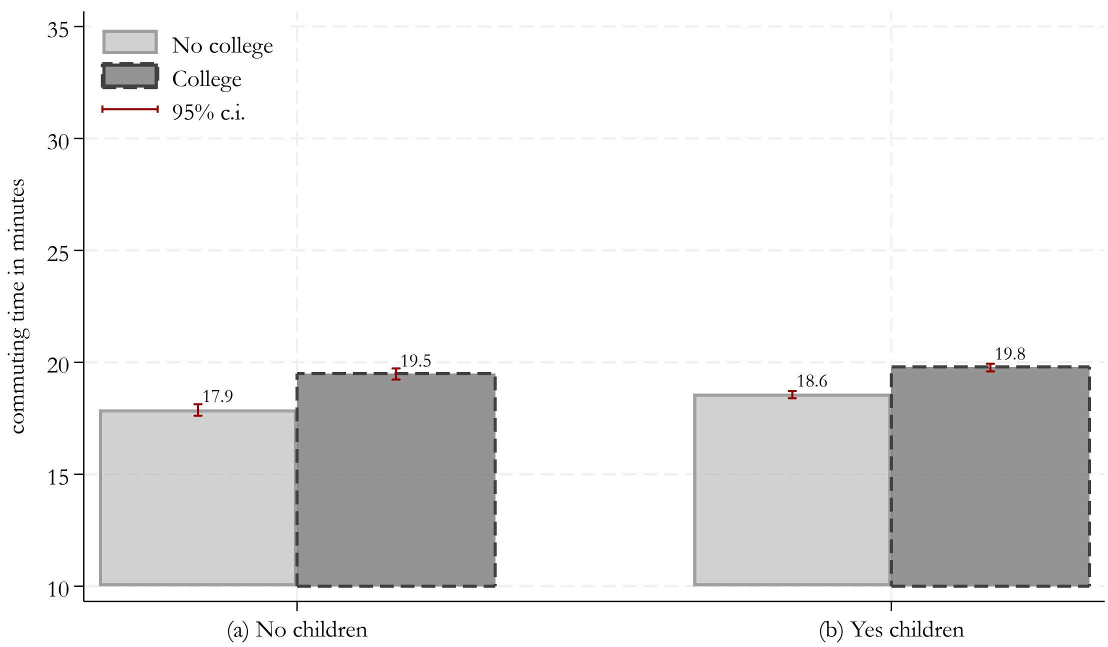
*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. The regressions include all controls listed in Table 2 notes, dummy variables for aggregate occupation and industry groups, workers' wage (in log terms), their partner's work hours, labor force status and commuting time (in log terms). The models are estimated via OLS and standard errors are clustered at the MSA level.. Column (1) shows results for women without a college degree, column (2) shows results for college graduate women. p-Value $< 0.1$ ($^+$), 0.05 ($^*$), 0.01 ($^{**}$).

Figure A2: Average commuting time of employed women not working from home



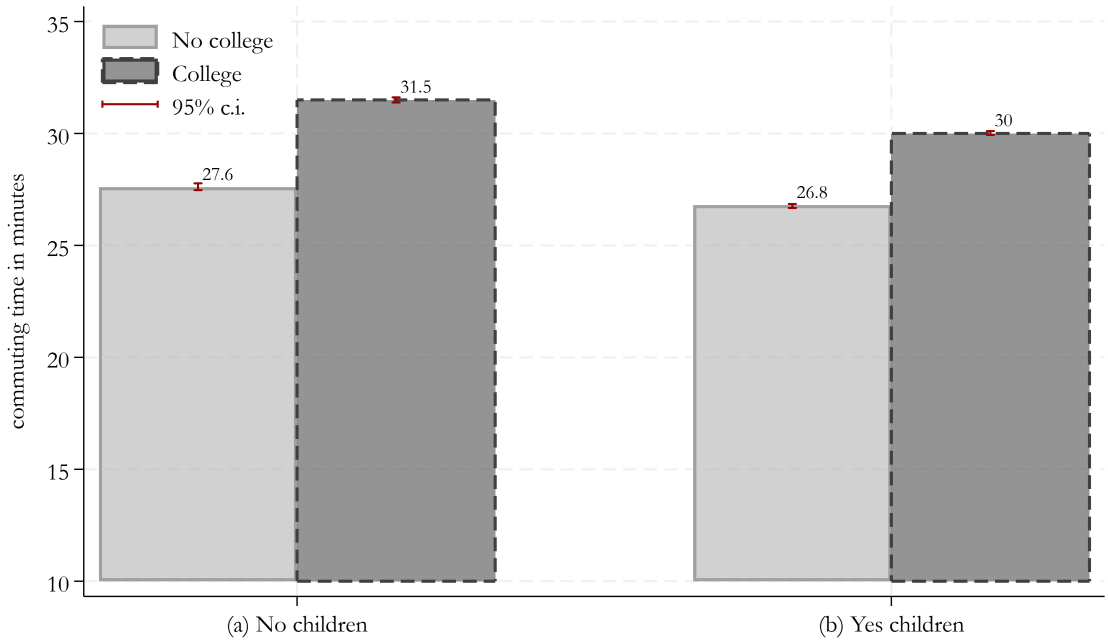

*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. The statistics in the figure are computed using ACS individual weights.

Figure A3: Average commuting time of employed women not working from home: low-congestion areas




*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women who live in low-congestion MSAs in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. Low-congestion MSAs are defined as metropolitan areas whose average year-specific commuting time is at least one-half standard deviation lower than the cross-MSA average. The statistics in the figure are computed using ACS individual weights.

Figure A4: Average commuting time of employed women not working from home: high-congestion areas




*Notes*: American Community Survey 2005-2019. Sample selection of couples is described in Section 2. The samples are restricted to working women who live in low-congestion MSAs in heterosexual cohabiting couples for whom information about work-from-home arrangements is available. Low-congestion MSAs are defined as metropolitan areas whose average year-specific commuting time is at least one-half standard deviation higher than the cross-MSA average. The statistics in the figure are computed using ACS individual weights.

# B Model Proofs

**Proposition 1** Under the assumptions of the model in Section 4, a ceteris paribus increase in commuting time $\tau$ increases workers reservation wages $w^r$ thus causing a decline in labor force participation.

A worker's reservation wage is $w^r = \phi\tau^\gamma$. Hence, $\frac{\partial w^r}{\partial \tau} = \gamma\phi\tau^{\gamma-1} > 0$.

**Proposition 2** Under the assumptions of the model in Section 4, a ceteris paribus increase in commuting time $\tau$ has a stronger negative effect on the labor force participation of workers with higher marginal utility cost of working $\phi$.

$\frac{\partial w^r}{\partial \tau} = \gamma\phi\tau^{\gamma-1} > 0$. Hence, $\frac{\partial^2 w^r}{\partial \tau \partial \phi} = \gamma\tau^{\gamma-1} > 0$

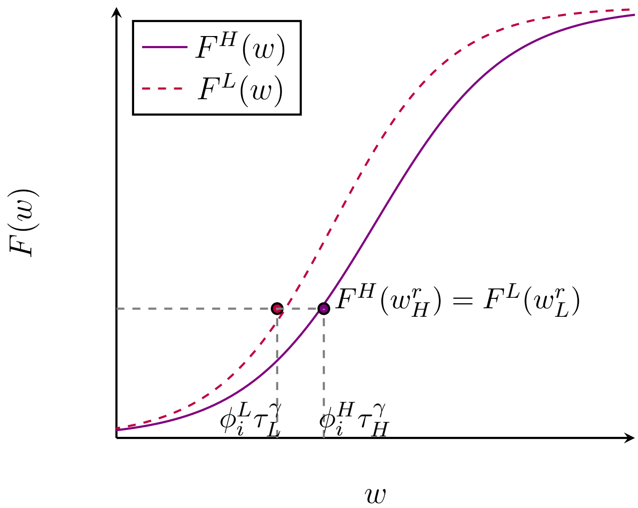
**Proposition 3** Under the assumptions of the model in Section 4, keeping constant the characteristics of labor demand and of workers across metropolitan areas, the labor force participation of workers is equal across areas characterized by different commuting times if workers with low marginal utility cost of working select in metropolitan areas with high commuting times ($\tau_H$).

The share of workers participating in the labor force in a metropolitan area is the share of workers who are offered a wage $w$ higher than their reservation wage, that is $P^J(w > w_J^r)$, where $J = H$ in high-commuting-time areas and $J = L$ in low-commuting-time areas.

$$\begin{aligned} P^H(w > w_H^r) &= P^L(w > w_L^r) \\ 1 - F^H(w_H^r) &= 1 - F^L(w_L^r) \\ F^H(w_H^r) &= F^L(w_L^r) \\ w_H^r &= w_L^r \\ \phi_i^H &= \left(\frac{\tau_L}{\tau_H}\right)^\gamma \phi_i^L < \phi_i^L \end{aligned} \tag{5}$$

**Proposition 4** Under the assumptions of the model in Section 4, it is possible that $\phi_i^H < \phi_i^H$ even if the distribution of wages in high-commuting-time areas first order stochastically dominates (FOSD) the distribution of wages in low-commuting-time areas as illustrated in figure A5.

Figure A5: Labor force participation, wage distribution and reservation wages in high and low congestion areas assuming heterogeneity in labor demand.



$$
\begin{aligned}
P^H(w > w_H^r) &= P^L(w > w_L^r) \\
1 - F^H(w_H^r) &= 1 - F^L(w_L^r) \\
F^H(w_H^r) &= F^L(w_L^r) \\
F^L(w_H^r) &> F^L(w_L^r) \text{ assuming } F^H \text{ FOSD } F^L \\
w_H^r &> w_L^r \\
\phi_i^H &> \left(\frac{\tau_L}{\tau_H}\right)^\gamma \phi_i^L < \phi_i^L \qquad (6)
\end{aligned}
$$

This inequality does not exclude that $\phi^H < \phi^L$.