Remote Work and the Decline in the Big-City Child Penalty

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Abstract. Urban density boosts productivity and economic opportunities, but it increases commuting, housing and childcare costs. In the US, these costs have historically led to the Big-City Child Penalty (BCCP), namely, the lower labor force participation rate of mothers in larger cities than in smaller ones. We uncover a novel fact. Post-2020 the BCCP has suddenly declined in the United States. For college educated mothers this penalty has essentially disappeared, whereas for non-college educated mothers this penalty is weaker but persistent. We present evidence that the sudden and widespread diffusion of remote work can explain this finding.

JEL Codes: J16, J22, R23.

Keywords: Remote work, big-city child penalty, female labor supply.

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1 Introduction

A central tenet in urban economics is that density increases productivity and wages, as agglomeration economies improve resource sharing, ease worker-firm matching, and facilitate learning (Duranton & Puga, 2020; Glaeser, 1999). However, the relationship between density and labor force participation is more nuanced. In addition to generating productivity benefits, dense urban areas also impose substantial congestion, commuting burdens, and high housing and childcare costs (Duranton & Puga, 2020; Leppert, 2024; Moreno Maldonado, 2025). These costs may incentivize specialization within two-adult households, particularly when children are present, and lower the labor supply of women as they concentrate in unpaid care work (Black, Kolesnikova, & Taylor, 2014). Recent research by Moreno Maldonado (2025) shows that, in the United States, the labor force participation of men and women without children is higher in larger cities, while the labor force participation of married women with children is six percentage points lower in large cities than in small cities. She refers to this fact as the *Big-City Child Penalty* (BCCP).

In this paper, we document that the Big-City Child Penalty has suddenly declined in the United States in the aftermath of the COVID-19 pandemic. For college educated mothers, in particular, we show that this penalty has essentially disappeared, whereas for non-college educated mothers this penalty has weakened but persists. We argue that the sudden and widespread diffusion of remote work can explain this finding. There is growing evidence that the post-2020 broad adoption of remote work boosted the labor force participation of mothers (Harrington & Kahn, 2026; Song, 2025; Tito, 2024), and that access to remote work enables affected workers to reconcile paid work with family responsibilities (D'Angelis & Horn, 2026; Goldin, 2022). As workers with lower levels of education tend to be concentrated in inflexible jobs, non-college educated mothers may not have benefited from the in-person to remote shift in the organization of work to the same extent as college educated mothers (Albanesi & Kim, 2021). In line with these hypotheses, using a shift-share instrumental variable strategy, we provide evidence that the post-2020 decline in the BCCP for college educated mothers is explained by the surge in access to remote work following the COVID-19 shock, which boosted the labor force participation of highly educated women with children primarily in large metropolitan areas. For women without a college degree, instead, we find no relationship between the

post-2020 increase in remote work and the BCCP.

This work brings together two strands of research on the economic outcomes of women. The first examines how some characteristics of urban areas such as long commuting times affect the labor supply of women (Black, Kolesnikova, & Taylor, 2014; D'Angelis & Horn, 2026; Farré, Jofre-Monseny, & Torrecillas, 2023; Moreno Maldonado, 2025). Moreno Maldonado (2025) provides evidence that housing costs, childcare prices and long commuting times, are some of the key determinants of the BCCP. Black, Kolesnikova, and Taylor (2014) and Farré, Jofre-Monseny, and Torrecillas (2023) show that in the United States, long commuting times have a negative effect on the labor supply of women, and mostly of mothers, and D'Angelis and Horn (2026) document that differences in access to remote work between college and non-college educated workers explain why long commuting times primarily discourage the labor force participation of mothers with lower levels of education.

The second, described in part above, examines how the rise in remote work has influenced female labor force participation (Harrington & Kahn, 2026; Song, 2025; Tito, 2024). Tito (2024) presents descriptive evidence that prime-age women working in occupations with greater remote-work potential display increased labor force attachment through a lower probability of exiting the labor force. Song (2025) relies on variation across US metropolitan areas in the composition of remote-able jobs to show that labor markets with more remote-able work experienced larger increases in female labor force participation after the COVID-19 pandemic. Harrington and Kahn (2026) rely on pre-2020 variation in access to remote work across college majors to identify the positive impact of remote work on the employment rate of mothers.[1]

We build upon this literature by showing that the effect was especially concentrated among highly educated mothers living in big cities, where labor supply constraints due to long commute times and unaffordable childcare prices are particularly binding. Our findings thus both corroborate existing evidence showing that access to remote work can help reconcile career and family among affected workers (Albanesi, 2023; D'Angelis

[1]There is also a growing body of research examining remote-work in developing countries. Using experiments in India and Bengal, respectively Jalota and Ho (2023) and Ho, Jalota, and Karandikar (2024) find that remote-work availability substantially increases mothers' labor force participation, in some cases as much as doubling existing labor force participation rates.

& Horn, 2026; Goldin, 2022), and suggest that remote work can be instrumental to unlock the economic potential of agglomerated economies, by fostering the labor supply of mothers.

These insights are timely, as anecdotal evidence suggests that corporate leaders are pushing for return-to-office policies and effectively reducing employees' remote work options (Bloom, Barrero, Davis, Meyer, & Mihaylov, 2023; Lahart, 2026; Meyer et al., 2026). Our findings hint that this shift towards more rigid work arrangements may induce a new set-back for the economic outcomes of women with kids, most prominently of those living in large urban areas whose long commutes and high childcare prices exacerbate work-family tradeoffs and discourage female labor supply.

The remainder of the paper proceeds as follows. Section 2 describes the data used in the analysis. Sections 3 and 4 document, respectively, the decline in the BCCP, and the rise of remote work. Section 5 outlines the empirical framework that we use to estimate the relationship between remote work and the decline in the BCCP, and presents the main results. In Section 6 we provide evidence that our results cannot be explained by possibly heterogeneous changes in fertility patterns across metropolitan areas characterized by different exposure to the post-2020 remote-work shock. Section 7 concludes.

2 Data

We use American Community Survey (ACS) data from IPUMS (Ruggles et al., 2025) for the years 2005 to 2024. We construct a sample of women who are household heads or heads' spouses and who are between 18 and 54 years old. For women with children we 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 or active in the military, individuals with missing information on any demographic or geographical variable of interest, and individuals who live in rural areas.

We define time-constant metropolitan statistical areas (MSAs) using the 1990 Census Bureau delineation of metropolitan areas used by Duranton and Turner (2011). We associate individuals in the ACS to 1990 metropolitan areas (MSAs) using their county of residence. We rank metropolitan areas based on their population in 2000, and define the top-20 metropolitan areas based on their population in 2000 as "big cities". Our

samples includes 171 metropolitan areas. We measure remote work access at the MSA-year level through the share of employed men who report to be working from home in the ACS survey. Throughout most of our analyses, we exclude years 2020 and 2021.

3 Stylized Facts: The Decline in the Big-City Child Penalty

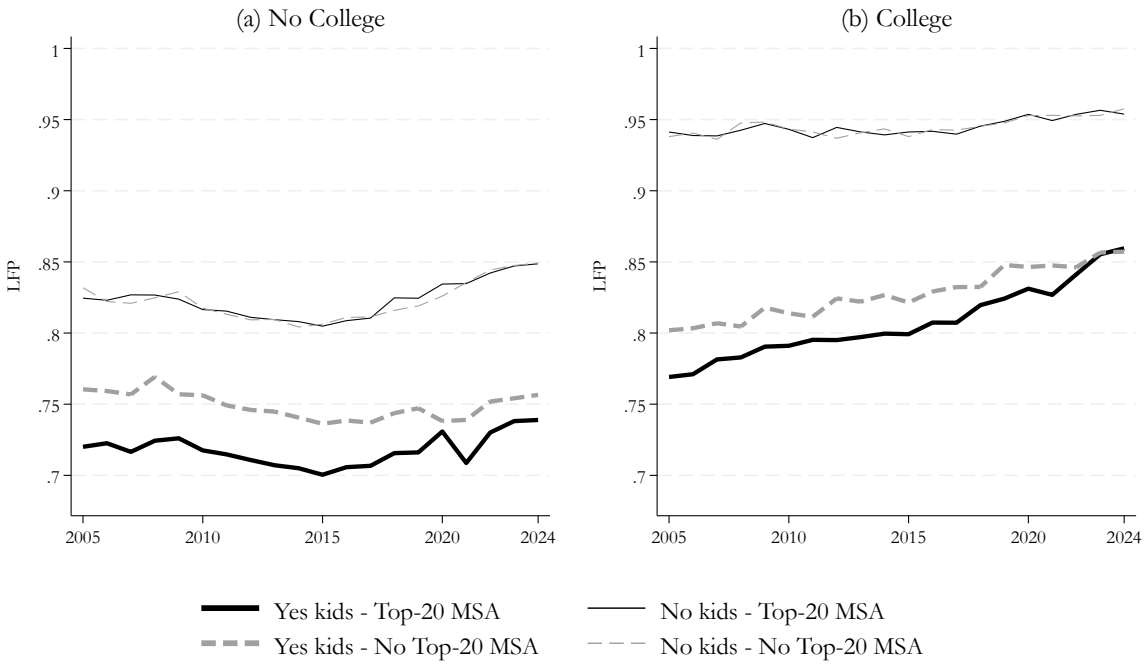
In this section, we document recent changes in the Big-City Child Penalty (BCCP), and establish that the penalty has disappeared for college educated women after 2020. Figure 1 shows trends in the labor force participation (LFP) rate of non-college graduate (Panel a) and college graduate (Panel b) women living in large metropolitan areas (Top-20 MSA, solid lines) and in smaller metropolitan areas (No Top-20 MSA, dashed lines) between 2005 and 2024. The figure shows that the labor force participation rate of college and non-college graduate women with no children (thin lines) is virtually identical across metropolitan areas of different dimension. Between 80 and 85% of non-college graduate women without children participated in the labor force between 2005 and 2024, while the LFP rate of college graduate women with no kids was constant around 95% in the sample period.

Women with children (thick lines), instead, are substantially less likely to participate in the labor force than similarly educated women with no kids. Importantly, in line with previous findings by Moreno Maldonado (2025), Figure 1 shows that women with children in large metropolitan areas were less likely to participate in the labor force than women with children who lived in smaller metropolitan areas until 2020. After 2020, however, the labor force participation gap between mothers living in large cities and mothers living in small cities disappeared among college graduates, as the labor force participation rate of women in the former group suddenly increased. Among women without a college degree, the post-2020 decline in the labor force participation gap between mothers living in Top-20 MSAs and mothers living in smaller metropolitan areas was less pronounced.[2]

The rapid post-2020 increase in the labor force participation rate of college graduate mothers in large metropolitan areas could be driven by changes in women's selection

[2]Figure A1 in the Online Appendix confirms this finding. The figure shows that the negative relationship between MSA size and LFP rate dropped to zero between 2015-19 and 2022-24 for college graduate mothers, while it only slightly declined in magnitude among mothers without a college degree.

Figure 1: Trends in women's LFP by MSA dimension and parenthood



Notes: American Community Survey (ACS), 2005-2024. Sample cleaning described in Section 3. The figure depicts trends in the labor force participation rate of 18-to-54 years old women by MSA dimension and parental status. The sample includes women who are not enrolled in school or college and are not active in the military. Top-20 MSAs are defined based on 2000 MSA populations. Panel (a) shows trends for non-college educated women, Panel (b) shows trends for college educated women.

across cities and, thus, in the socio-economic and demographic composition of cities themselves. Alternatively it could be driven by changes in the fertility decisions of women across cities. To address concerns that the observed decline in the BCCP among college graduate mothers is driven by these factors, we estimate the adjusted BCCP in different years through the difference in the labor force participation gap between mothers and women without children in small and medium metropolitan areas compared to the 20 largest metropolitan areas in the United States, and control for a number of covariates, described in detail below. We estimate the BCCP separately for years 2011-2013, 2014-2016, 2017-2019 and 2022-24. We also estimate it separately for college graduate and non-college graduate women. In particular, we estimate the following model

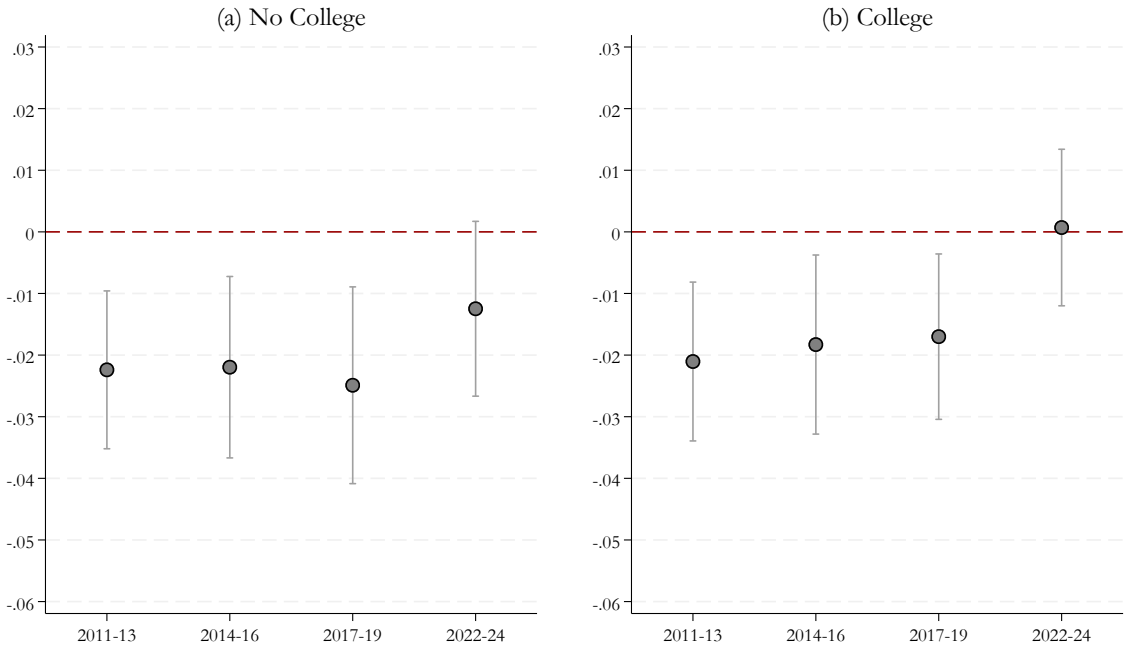
$$\begin{aligned}\mathbf{1}\{\text{In Labor Force}\}_{icst} = \alpha_t + \beta_t \mathbf{1}\{\text{Top-20 MSA}\}_{cs} + \\ + \delta_t \mathbf{1}\{\text{Has Child}\}_{icst} + \gamma_t \mathbf{1}\{\text{Top-20 MSA}\}_c \times \mathbf{1}\{\text{Has Child}\}_{icst} + \\ + x'_{icst}\psi_t + \varphi_s + \lambda_y + u_{icst} \qquad (1)\end{aligned}$$

where the dependent variable is an indicator variable taking value 1 if woman i living in metropolitan area c in state s and the three-year period t participates in the labor force and 0 otherwise. The variable $\mathbf{1}\{\text{Top-20 MSA}\}_{cs}$ indicates whether MSA c is among the Top-20 metropolitan areas in the United States or not, $\mathbf{1}\{\text{Has Child}\}_{icst}$ indicates whether or not woman i has children.

The period-specific BCCP (as defined above) is captured by the parameter γ_t. x_{icst} is a vector of control variables. For each woman, we include age dummies, indicators for race, ethnicity, marital status, number of children, age of the eldest child (if any), non-labor household income (in log terms), and detailed education dummy variables. We also include state (φ_s) and year (λ_y) fixed effects. We estimate the regression via OLS and cluster standard errors at the MSA level.

The estimated γ_t coefficients for different time periods are reported in Figure 2 separately for non-college graduate (Panel a) and college graduate (Panel b) women. For non-college graduate women, the BCCP, the difference in the gap in the LFP rate between mothers and women without children between large and small-medium MSAs, has declined in magnitude in 2022-24 compared to the pre-pandemic period. The change, however, is not statistically significant at conventional levels. Among college graduates, instead, the BCCP has diminished from almost 2 percentage points in the pre-COVID

Figure 2: Changes over time in the Big-City Child Penalty



Notes: ACS, 2005-19 and 2022-24. Sample as in Figure 1. The figure shows estimated γ_t coefficients from regression 1 separately for non-college and for college graduate women in different years. The gray vertical bars indicate 95% confidence intervals.

decade to a precisely estimated zero in 2022-2024. These results confirm that for college educated mothers the BCCP has disappeared post-2020, whereas for non-college educated mothers this penalty has declined but persists.[3]

4 Stylized Facts: The Rise of Remote Work

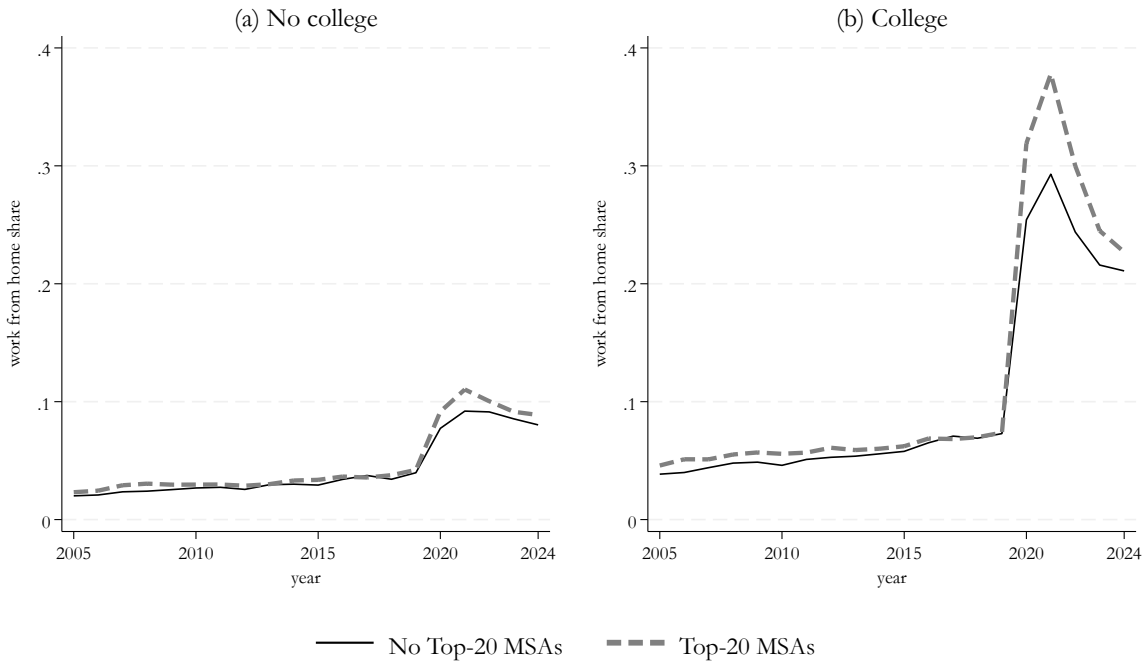
The rise of remote work since 2020 is well documented (Barrero, Bloom, & Davis, 2023; Bick, Blandin, & Mertens, 2023). Consistent with this broader evidence, Figure 3 Panel (i) shows trends between 2005 and 2024 in the share of 18-to-54 years-old employed men who worked from home based on ACS data. Sub-panel (a) plots trends in remote work use among non-college graduate men, while sub-panel (b) shows trends for college graduate men. While the use of remote work was slowly rising before the COVID-19 pandemic among college graduate men, by 2019 less than 9% of college graduate men usually worked remotely in both large and small-medium metropolitan areas. Less than 5% of employed men with no college degree in top-20 and non top-20 metropolitan areas worked remotely by 2019. Reliance on remote work surged in 2020. By 2021 around 10% of employed non-college graduate men worked remotely in both big and small-medium metropolitan areas. Most prominently, the share of college graduate men working remotely rose to 30% in small-medium cities and to almost 40% in the 20 largest US metropolitan areas. Although the share of men working remotely declined after 2021, by 2024 more than 20% of men usually worked remotely in both large and small-medium metropolitan areas.[4]

[3]The evidence that the BCCP has mostly declined among college graduate women after 2020 is even stronger when we restrict the sample to 18-to-44 year-old women to capture the differences by city-size in the labor supply penalties associated with having young children (Figure A2 in the Online Appendix).

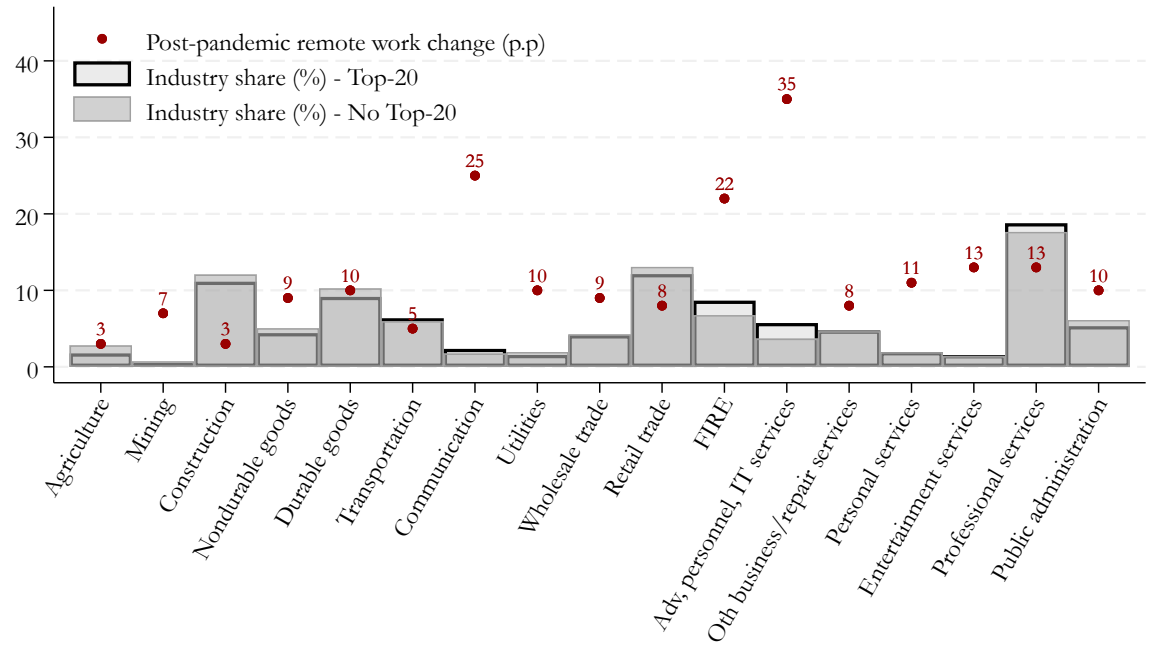
[4]As noted by Buckman, Barrero, Bloom, and Davis (2025) and D'Angelis and Horn (2026), measures of the incidence of work from home based on ACS data may underestimate the extent to which US workers can access remote work. The ACS survey, in fact, records work from home for employed workers who state that they did not commute in the previous week. Therefore, the survey likely captures workers who work fully remotely while possibly under counting workers who can work remotely at least some days per week. Buckman, Barrero, Bloom, and Davis (2025), however, find that measures of remote work access from different surveys depict comparable pictures regarding the diffusion of remote work in the US.

Figure 3: Trends and post-2020 changes in remote work incidence

(i) Trends in the share of men working remotely



(ii) Pre-2020 industry shares and post-2020 change in remote work incidence by industry



Notes: ACS, 2005-24. Panel (i) shows the 2005-to-2024 trends in the share of employed men aged 18-to-54 and not active in the military who work remotely. Sub-panel (a) plots trends for non-college graduate mend and sub-panel (b) for college graduate men. Panel (ii) compares the increase in remote work (dots) between 2015-19 and 2022-24 to the 2015-19 distribution of employed men across industries in Top-20 (outlined bars) and non-Top 20 (gray bars) metropolitan areas.

The post-pandemic surge in remote-work use was not uniform across industries. Figure 3 Panel (ii) compares the post-pandemic surge in remote work (dots) by industry to the pre-pandemic distribution of employed men across industries in Top-20 (outlined bars) and non-Top 20 (gray bars) metropolitan areas. This figure shows that between 2015-19 and 2022-24, the rise in the share of men working remotely was concentrated in a few industries. Specifically, the incidence of remote work rose by 35 percentage points in advertisement, personnel and computer and data services, by 25 percentage points in communication and by 22 percentage points in finance, insurance and real estate. It increased by roughly 8 to 13 percentage points in most other industries. Importantly, the figure shows, the distribution of male workers across industries was similar in small and large metropolitan areas before 2020.

5 Remote Work and the Decline of the BCCP

In this section, we show that the post-2020 rise in access to remote work can explain the disappearance of the Big-City Child Penalty for college graduate women.

5.1 Econometric Model

We study the relationship between the post-2020 surge in remote work and the contemporaneous changes in the education-specific BCCP, by estimating several cross-MSA regression models separately for college and non-college graduate mothers and women without children.

To do so, we construct four balanced panels of 171 MSAs, in which each variable of interest indicates the average characteristics or outcomes of interest of, respectively, college graduate mothers, college graduate women without children, non-college graduate mothers and non-college graduate women without children, in each MSA in 2015-19 and in 2022-24. Separately for each sample, we estimate three different cross-MSA regression models in which the outcome of interest is the MSA-specific change between 2015-19 and 2022-24 in the labor force participation rate of women and the main explanatory variable of interest is a dummy variable indicating whether an MSA is a Top-20 MSA or not. The first model is a simple linear model without control variables (model 2 below), the second model includes region fixed effects and a vector of controls described below

(model 3), and the third model further includes an explanatory variable capturing the observed post-2020 change in the incidence of remote work among employed men in each metropolitan area (model 4).

By comparing the magnitude of the estimated coefficient associated with the Top-20 MSA dummy variable in models (3) and (4), we infer the extent to which the post-2020 increase in access to remote work explains any estimated differences in the post-2020 change in the labor force participation rate of women between big and small cities. Finally, we compare the β-estimates in models (3) and (4) between mothers and women without children in a given education group, to understand the impact of the remote-work shock on the post-2020 changes in the education-specific Big-City Child Penalty.

For each group of women, the three regression models described above take the following forms

$$\Delta \text{LFP}_{cr} = \alpha + \beta \mathbf{1}\{\text{Top-20 MSA}\}_{cr} + u_{cr} \tag{2}$$

$$\Delta \text{LFP}_{cr} = \alpha + \beta \mathbf{1}\{\text{Top-20 MSA}\}_{cr} + x'_{cr}\psi + \phi_r + u_{cr} \tag{3}$$

$$\Delta \text{LFP}_{cr} = \alpha + \beta \mathbf{1}\{\text{Top-20 MSA}\}_{cr} + \delta \Delta \text{RW}_{cr} + x'_{cr}\psi + \phi_r + u_{cr} \tag{4}$$

where the dependent variable is the change in women's labor force participation rate in metropolitan area c in region r between 2015-19 and 2022-24. The dummy variable $\mathbf{1}\{\text{Top-20 MSA}\}_{cr}$ indicates whether the MSA is a big city (as defined above). The main coefficient of interest, β, indicates the post-2020 change in the labor force participation gap between big and small cities among women in a specific group.

In model (4), ΔRW_{cr} indicates the MSA-specific change in the share of prime-age employed men who report to be working remotely between 2015-19 and 2022-24. This variable proxies the intensity of exposure of each MSA to the post-2020 remote-work surge. We also refer to this variable as measuring the post-2020 remote-work shock.

In models (3) and (4), ϕ_r indicates region fixed effects and x_{cr} is a vector of control variables. We control for the 2015-19 characteristics of the group of women included in each regression model in different metropolitan areas. Specifically, we control for the average age, average (log) non-labor household income, as well as share of married, Black and Hispanic women in each metropolitan area in 2015-2019. We also control for the female labor force participation rate and for the distribution of employed women across

industries in each MSA in 2015-2019, and for the 2010-14 to 2015-19 changes in the MSA-specific labor force participation rate of women in each group (pre-trends in the outcome variable). Finally, we control for the 2015-19 to 2020-21 changes in the employment rate among prime age men (proxying the exposure of each MSA to the COVID-19 induced recession), and for the 2015-19 to 2022-24 changes in the share of men employed in different industries (proxying local industry-specific labor demand shocks).

Controlling for the pre-2020 demographic characteristics and labor market outcomes of women in different metropolitan areas addresses concerns that any estimated differential change in the LFP of women between big and small cities is due to unobserved shocks or pre-trends in women's LFP that are correlated with city dimension or with the local exposure to the post-2020 remote-work shock. The inclusion of several variables proxying 2015-19 to 2022-24 changes in the structure of local labor markets, instead, enables us to exclude that the estimated effect of the remote-work shock on women's labor supply strongly reflects the underlying relationship between the remote-work shock and other unobserved local shocks potentially correlated with changes in the labor force participation rate of women.

5.2 Estimation

We estimate models (2) and (3) via OLS and model (4) via both OLS and 2SLS. In the second estimation method, we instrument the MSA-specific remote-work shock defined above, using a shift-share instrument (Z_c) that measures the MSA-specific weighted average of the changes in the national shares of men working remotely between 2015-19 and 2022-24 in the 17 different industries j listed in Figure 3 Panel (ii) (ΔRW_j), with weights equal to the 2015-19 shares of employed prime-age men working in each industry in each metropolitan area (s_{cj}). In particular, the instrument takes the following form

$$Z_c = \sum_j \Delta RW_j \times s_{cj} \tag{5}$$

Estimating the extent to which the rise in remote work explains any post-2020 changes in the BCCP in model (4) through an instrumental variable strategy addresses several concerns regarding the endogeneity of local remote-work shocks. In fact, if the availability

and use of remote work increased faster in certain areas due to a particularly strong increase in women's labor force participation, the resulting reverse-causality bias would lead us to overestimate δ in model (4), thus possibly exacerbating the contribution of the remote-work shock in explaining any post-2020 changes in the education-specific BCCP. Alternatively, if women with strong labor force attachment disproportionately moved to local labor markets with strong growth in remote-work options after 2020, the resulting selection bias would also bias upward the OLS estimate of δ. Conversely, if remote work was adopted faster in areas whose labor markets were disproportionately disrupted by the COVID-19 shock that affected negatively the employment and labor force participation rate, this omitted variable problem would bias the OLS estimate of δ downwards. Finally, even conditional on the dimension of a metropolitan area, post-2020 workers may have adopted the newly available remote-work options faster in areas characterized by long commute times and congestion. These areas are typically characterized by the low labor force participation of women, and especially of mothers (Black, Kolesnikova, & Taylor, 2014; D'Angelis & Horn, 2026; Farré, Jofre-Monseny, & Torrecillas, 2023). If women's LFP would have remained lower in these areas than elsewhere in the absence of the post-2020 remote-work shock, the OLS estimate of δ would also be biased downward.

5.3 Results

The estimation results are reported in Table 1 Panels (a) (college graduate women) and (b) (non-college graduate women). In each panel, columns (1) to (4) show results for women with children, while columns (5) to (8) show results for women without children.

Columns (1) and (5) in each panel show the estimated raw gap between large metropolitan areas and small-medium metropolitan areas in the growth in the labor force participation rate of, respectively, mothers and women without children in an education group, between 2015-19 and 2022-24 (β in model 2). The results in Panel (a) show that the drop in the Big-City Child Penalty observed among college graduate women was driven by the 1.3 percentage-point larger increase in the LFP rate of mothers in large metropolitan areas compared to small and medium metropolitan areas between 2015-19 and 2022-24. Among college graduate women without children, the LFP rate did not change differentially in big cities relative to smaller cities in the sample period.

Including region fixed effects and controls for pre-2020 women's demographic and eco-

nomic characteristics and for changes in local labor market conditions, does not affect the estimated difference in the LFP growth rate between big and small cities (β in model 3) for college graduate mothers (column 2 in Panel a) and women without children (column 6 in Panel a). The conditional post-2020 decline in the BCCP was driven by the fast increase in the LFP rate of college graduate mothers in big metropolitan areas.

Columns (3) and (7) in Panel (a) show the results of estimating regression model (4) via OLS. The results in column (3) show that, conditional on the increase in the share of men working remotely (the remote-work shock), the estimated β coefficient declines in magnitude by around 30% from .014 to .01. This implies that the sudden post-2020 surge in the labor force participation rate of college graduate mothers in large metropolitan areas can be, at least partly, explained by the rise in the share of men working remotely. The estimated coefficient associated with the remote-work shock, in fact, implies that a ceteris paribus 10 percentage-point increase in the share of men working remotely between 2015-19 and 2022-24 in a certain MSA was associated with a 1.64 percentage-point increase in the labor force participation rate of college graduate mothers. The estimated relationship between the remote-work shock and the growth in the labor force participation rate of college graduate women without children (column 7 in Panel a) is also positive, but it is small in magnitude and not statistically significant.

The 2SLS results reported in columns (4) and (8) of Panel (a) corroborate the OLS results. For college graduates, the shift-share instrument estimates suggest that a 10 percentage-point increase in the incidence of remote work in an MSA may have led to a 2.15 percentage-point increase in the LFP rate of mothers and to a not statistically significant 0.53 percentage-point increase in the LFP rate of women with no children. Moreover, the results of the 2SLS estimation show that accounting for the remote-work shock, the post-2020 LFP-growth difference between college graduate mothers living in big and small cities becomes smaller in magnitude and not statistically significant. Panel (a) in Table 1 thus provides evidence that the decline in the BCCP that we document for college educated women can be explained by the increased availability of remote work.

Panel (b) shows the estimated results for women without a college degree. For this group, we find that the Big-City Child Penalty did not neatly decline after 2020, and that the rise in the availability of remote work had little and unclear effects on the labor market outcomes of non-college graduate women.

Table 1: Change in LFP difference between big and small cities, 2015-19 to 2022-24

	Yes kids				No kids			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel a. College								
Big city	0.013**	0.014*	0.010*	0.009	0.002	0.003	0.001	0.001
	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)
Remote work shock			0.164*	0.215*			0.063	0.053
			(0.067)	(0.097)			(0.068)	(0.069)
Obs	171	171	171	171	171	171	171	171
R-squared	0.013	0.289	0.303	0.302	0.000	0.366	0.369	0.369
Panel b. No College								
Big city	0.007	0.004	0.006	0.007	-0.008	-0.012	-0.011	-0.011
	(0.005)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Remote work shock			-0.096	-0.100			-0.010	-0.013
			(0.084)	(0.123)			(0.088)	(0.121)
Obs	171	171	171	171	171	171	171	171
R-squared	0.002	0.439	0.443	0.443	0.004	0.320	0.320	0.320
Region FE		X	X	X		X	X	X
Controls		X	X	X		X	X	X

Notes: ACS, 2015-19 and 2022-24. Sample construction described in Section 5.1. The table reports estimated coefficients β ("Big City") and δ ("Remote work shock") from cross-MSA regression models (2)-(4). The construction of the MSA sample and of the variables used in the models is described in Section 5.2. The sample includes 171 metropolitan statistical areas. Models in columns (1)-(3) and (5)-(7) are estimated via OLS, models in columns (4) and (7) are estimated via 2SLS. Standard errors are clustered at the MSA level. P-values * < 0.05, ** < 0.01, *** < 0.001.

5.4 Robustness

We provide three pieces of evidence supporting the validity of the shift-share instrument, and report results in the Online Appendix. Following Borusyak, Hull, and Jaravel (2025), we aim to show that national changes in the share of men working remotely by industry between 2015-19 and 2022-24 are not related to local shocks affecting the labor force participation of women in specific MSAs, conditional on pre-2020 observable characteristics of women and of their MSA of residence. The use of a shift-share instrument, in fact, could exacerbate endogeneity issues if cross-industry differences in the post-2020 changes in the national share of men working remotely reflect other shocks that affected women's labor force participation in some labor markets.

First, in Figure A3 in the Online Appendix we show that the post-2020 industry-specific changes in the share of men working remotely are mostly similar in magnitude, on average, between big and small cities and, importantly, that the industries with the largest and smallest post-2020 increases in remote work are also similar in Top-20 and in smaller metropolitan areas. This evidence suggests that national industry-specific changes in the incidence of remote work do not reflect labor market transformations specific of few large metropolitan areas.

Second, we estimate model 4 via 2SLS using two alternative instruments, a leave-one-out shift-share instrument that constructs national industry-level changes in the share of employed men working remotely excluding those residing in the MSA of interest, and an alternative instrument that uses MSA-specific industry shares from 2010-2014. Table A1 in the Online Appendix reports the estimated results for college and non-college graduate mothers and women without children. The results broadly confirm and strengthen the 2SLS estimation results in Table 1, especially for college graduate mothers.

Third, to assess whether the instrument reflects pre-existing local trends, we estimate a model analogous to model 4 using 2SLS, and define the dependent variable as the MSA-specific change in women's labor force participation between 2010-14 and 2015-19. The results, reported in Table A2 in the Online Appendix, show no economically or statistically significant relationship between the remote-work exposure predicted by the instrument and pre-2020 LFP trends for either mothers or women without children. Importantly, the results also show that the Big-City Child Penalty was not declining

before 2020 for either college or non-college graduate women.

6 Remote work, fertility and women's LFP

Growing evidence from different countries shows that the possibility to work from home is associated with higher fertility (Davis et al., 2026), especially among women in "greedy" and demanding jobs (Bratsberg & Walther, 2025). If fertility among highly driven women with strong labor force attachment disproportionately rose post-2020 in the United States due to the increased availability of remote work arrangements, the effects of the post-2020 remote-work shock on college graduate mothers' LFP and on the BCCP could be a mechanical outcome of such changes in the composition of mothers.

In this section we present evidence to address the concerns that our results regarding the effect of the post-2020 remote-work shock on college graduate mothers' LFP and on the Big-City Child Penalty among college graduate women may be due to the effect of the remote-work shock on the selection of highly educated women into motherhood. To do so, we study whether fertility changed heterogeneously between 2015-19 and 2022-24 in metropolitan areas of different dimensions or characterized by remote-work shocks of different intensity.

Table 2 shows the results of the estimation of the relationship between cross-MSA changes in fertility, measured as the share of women with at least one child and, respectively, the city dimension (measured by the big-city dummy) and the remote-work shock. Panel (a) shows results for college graduate mothers, Panel (b) shows results for women without a college degree. For college graduate women, the results highlight that any post-2020 changes in the share of mothers in different MSAs were not significantly related to city dimension (columns 1, 3, 5 and 6) or to changes in the share of men working remotely (columns 2, 4, 5 and 6). These results hold irrespective of whether the control variables used in regression (4) are included (columns 3 to 6) or not (columns 1 and 2), whether the big-city dummy and the remote-work shock variable are both included in the regression (columns 5 and 6) or not (columns 1 to 4), and whether the regression model is estimated via OLS (columns 1 to 5) or using the shift-share instrumental variable strategy explained above (column 6). For non-college graduate women, fertility changed homogeneously across MSAs of different dimensions between 2015-19 and 2022-24. The remote-work shock, instead, is associated with a decrease in fertility. According to the

estimates in columns (4) to (5) in Panel (b), a MSA where the share of men working remotely rose by 10 percentage-points is predicted to have experienced a 2.5 percentage-point decline in the share of 18-to-54 year-old non-college graduate women with at least one kid. The relationship, however, becomes not statistically significant when estimated via 2SLS (column 6).

These results are reassuring that our main findings, namely, the role of remote-work in attenuating the BCCP among college graduate mothers after 2020, should not be strongly affected by changes in fertility. Yet, as fertility may have changed among non-college graduate women together with changes in the availability of remote-work, we further investigate the relationship between the remote-work shock and the demographic composition of mothers with different levels of education.

To do so, we use simple cross-MSA regression models to estimate the relationship between the 2015-19 to 2022-24 changes in the average characteristics of mothers in different MSAs and, respectively, the MSA dimension (captured by the big-city dummy variable) and the post-2020 remote-work shock (measured as the standardized MSA-specific change in the share of employed men working remotely). The results of this exercise are reported in Online Appendix Table A3, and show that most observable characteristics of mothers changed homogeneously between 2015-19 and 2022-24 across MSAs of different dimensions and characterized by remote-work shocks of different intensity. This latter result is particularly relevant, as it suggests that the post-2020 change in the share of men working remotely was not strongly related to changes in the observable characteristics of mothers that could somehow drive the relationship between the post-2020 remote-work shock and the decline in the BCCP among college graduate women.

Table 2: Remote work and changes in the share of women with kids

	(1)	(2)	(3)	(4)	(5)	(6)
Panel a. College						
Big city	0.007		0.011		0.016	0.020
	(0.017)		(0.015)		(0.015)	(0.014)
Remote work shock		-0.133		-0.070	-0.120	-0.227
		(0.088)		(0.121)	(0.113)	(0.137)
Obs	171	171	171	171	171	171
R-squared	0.002	0.016	0.235	0.232	0.240	0.236
Panel b. No College						
Big city	-0.007		-0.012		-0.002	-0.005
	(0.006)		(0.009)		(0.010)	(0.009)
Remote work shock		-0.090		-0.256*	-0.251*	-0.160
		(0.085)		(0.110)	(0.122)	(0.122)
Obs	171	171	171	171	171	171
R-squared	0.002	0.008	0.346	0.374	0.374	0.370
Region FE			X	X	X	X
Controls			X	X	X	X

Notes: ACS, 2015-19 and 2022-24. Sample as in Table 1. The table shows the estimated coefficients β ("Big city") and δ ("Remote work shock") from a version of models (2)-(4) where the outcome variable is the MSA-specific change in the share of women with at least one child between 2015-19 and 2022-24. Panel (a) includes results for college educated women and Panel (b) show results for non-college educated women. Columns (1) and (2) present results with no controls. Columns (3) and (4) present results with controls. Column (5) presents results with controls and the both big city indicator and the remote-work shock, Column (6) uses the shift-share instrumental variable approach described above. P-values * < 0.05, ** < 0.01, *** < 0.001.

7 Conclusion

Urban density increases productivity and wages, and fosters economic opportunities, but large metropolitan areas are also characterized by strong commuting burdens and high housing and childcare costs (Duranton & Puga, 2020; Moreno Maldonado, 2025). Long commutes and the lack of affordable childcare services have been shown to discourage the labor supply of mothers, and are among the major determinants of the particularly low labor force participation rate of mothers in big American cities (the Big-City Child Penalty) (Araujo, McBride, & Sandler, 2025; Black, Kolesnikova, & Taylor, 2014; D'Angelis & Horn, 2026; Farré, Jofre-Monseny, & Torrecillas, 2023; Moreno Maldonado, 2025).

In this paper, we present a new fact: the Big-City Child Penalty has suddenly declined in the United States in the aftermath of the COVID-19 pandemic. We show that the penalty has disappeared among college educated women, driven by the sudden post-2020 increase in the labor force participation rate of highly educated mothers in large metropolitan areas. Among non-college educated women, instead, the post-2020 decline in the BCCP was smaller and less clear.

We present evidence that the rapid rise of remote work can explain this fact. We show that, between 2015-19 and 2022-24, the labor supply of college graduate mothers living in large metropolitan areas did not grow significantly faster than the labor supply of similarly educated mothers living in smaller cities, once we control for each metropolitan area exposure to the post-2020 remote-work shock in a 2SLS framework. These findings are not driven by any post-2020 heterogeneity in fertility patterns related to metropolitan area dimension or local exposure to the remote-work shock, or to changes in highly educated women's selection into motherhood.

Our work contributes to a recent strand of literature showing that the post-2020 increase in remote work determined a contemporaneous increase in the LFP rate and labor force attachment of women and, most prominently, of mothers (Albanesi, 2023; Harrington & Kahn, 2026; Song, 2025; Tito, 2024). We show that the effect was especially concentrated among highly educated mothers living in big cities, where the labor supply constraints due to long commute times and unaffordable childcare prices are particularly binding. Our findings thus corroborate existing evidence showing that access to remote

work can help reconcile career and family among affected workers (D'Angelis & Horn, 2026; Goldin, 2022). Furthermore, our findings also suggest that access to remote work can be instrumental to unlock the economic potential of agglomerated economies, by fostering the labor supply of mothers.

These findings naturally lead to further considerations. First, despite the recent push among corporate leaders to return to office, 69% of US workers still have access to some form of hybrid work (Bloom, Barrero, Davis, Meyer, & Mihaylov, 2023; Meyer et al., 2026). Anecdotal evidence, however, suggests that several companies are making in-office requirements more stringent and allowing few days per week of remote work, with limited flexibility in how workers can allocate it (Lahart, 2026). It is worthwhile for future research to investigate whether these changes in the management and organization of work will lead to a new set-back in the economic outcomes of mothers.

Second, while workers appreciate the flexibility that remote work entails, it can increase social isolation and contribute to deteriorate workers' mental health (Cullen, Pakzad-Hurson, & Perez-Truglia, 2025; Emanuel, Harrington, & Pallais, 2026). Future research should investigate whether and how remote work practices can be implemented so that the benefits of increased labor force participation by mothers, particularly in large urban areas, outpace the possibly detrimental effects of remote work itself on workers' well-being.

Finally, and crucially, we show that the labor supply of mothers with no college education was virtually unaffected by the post-2020 remote-work shock either in big metropolitan areas or in smaller cities. This finding is unsurprising given non-college educated women's over-representation in service occupations that usually involve in-person activities (Albanesi & Kim, 2021). Understanding which (if any) changes in the organization of work or in the functioning of urban areas could encourage the labor force participation of non-college educated mothers in big cities is beyond the scope of this paper. Yet, we see this as a critical policy-relevant question for future research.

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Supplementary Material

Online Appendix

to

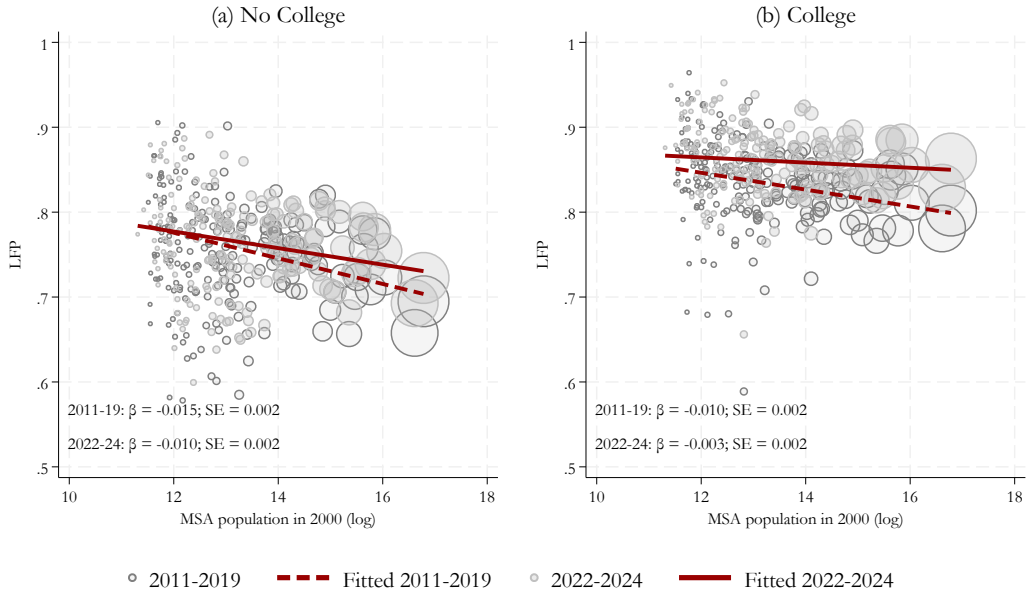
Remote Work and the Decline in the Big-City Child Penalty

Not for Publication

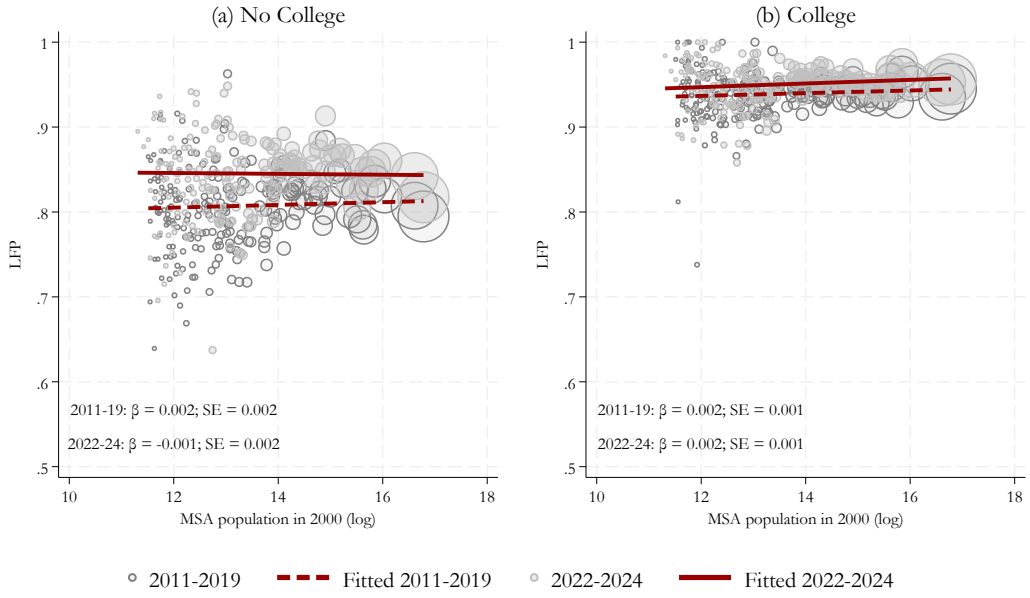
A Additional Tables and Figures

Figure A1: Cross-MSA correlation between population and women's LFP

(a) Women with kids

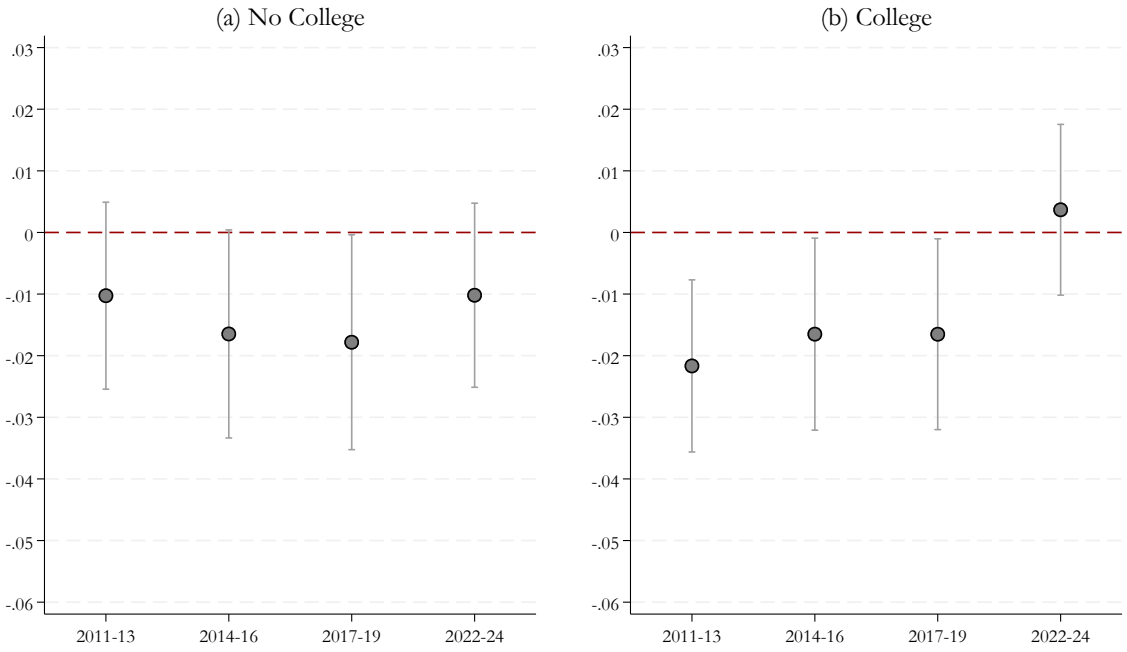


(b) Women with no kids



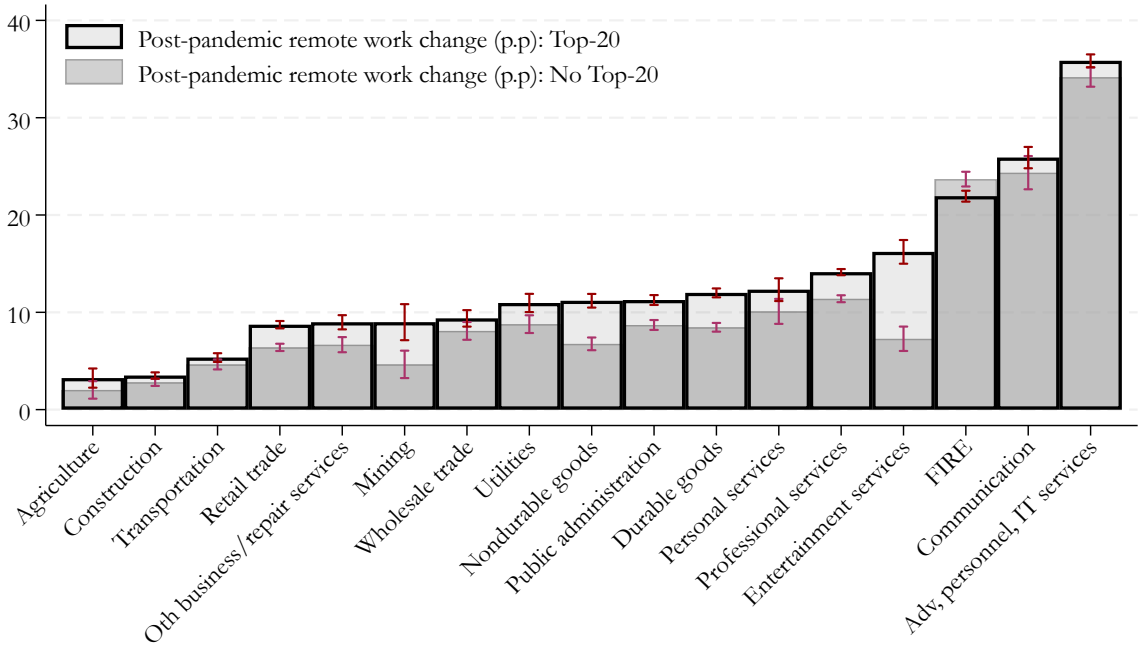
Notes: ACS, 2011-19 and 2022-24. The figure plots the MSA population measured in 2000 (in logs) and women's labor force participation rate across metropolitan areas in 2011 to 2019 (darker circles) and in 2022 to 2024 (lighter circles) respectively. The dashed line shows the estimated linear relationship between population and LFP for 2011 to 2019 and the solid line shows the estimated linear relationship between population and LFP for 2022 to 2024. The estimated coefficients and standard errors are reported in the figure.

Figure A2: Changes over time in the Big-City Child Penalty – 18-44 years old



Notes: ACS, 2005-19 and 2022-24. Sample as in Figure 1, excluding 45-54 year-old women. The figure shows estimated γ_t coefficients from regression (1) separately for non-college and for college graduate women in different years. The gray vertical bars indicate 95% confidence intervals.

Figure A3: Change in remote-work by industry and by city dimension



Notes: ACS, 2015-19 and 2022-24. Sample as in Figure 3. The figure presents the change in the share of men working remotely between 2015-19 and 2022-24 by industry in Top-20 (outlined bars) and non-Top 20 (gray bars) metropolitan areas. Capped error bars show 95% confidence intervals.

Table A1: Alternative instruments

	a. College				b. No College			
	Yes kids		No kids		Yes kids		No kids	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Big city	0.008	0.011	0.000	-0.001	0.007	0.002	-0.011	-0.015
	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.008)	(0.009)
RW shock	0.227*	0.128	0.076	0.110	-0.118	0.036	-0.014	0.071
	(0.101)	(0.150)	(0.068)	(0.080)	(0.135)	(0.147)	(0.121)	(0.140)
First-st. coef.	3.402	3.151	3.832	3.449	3.737	3.444	3.967	3.672
First-st. s.e.	0.390	0.444	0.349	0.401	0.372	0.372	0.370	0.375
K-P F	75.95	50.43	120.39	73.96	100.78	85.80	114.66	95.64
R-squared	0.301	0.303	0.369	0.367	0.442	0.436	0.320	0.317
Obs	171	171	171	171	171	171	171	171

Notes: ACS, 2015-19 and 2022-24. Sample as in Table 1. The table estimated coefficients β ("Big city") and δ ("RW shock") from model 4. The model is estimated via 2SLS using two alternative instruments. Columns (1), (3), (5) and (7) show results using leave-one-out shift-share instrument that constructs national industry-level changes in the share of employed men working remotely excluding those residing in the MSA of interest. In columns (2), (4), (6) and (8), the shift-share instrument uses MSA-specific industry shares from 2010-2014, with results in even-numbered columns. First-stage coefficients, standard errors and Kleibergen Paap F-statistic are also shown. P-values * $<$ 0.05, ** $<$ 0.01, *** $<$ 0.001.

Table A2: Remote-work shock and pre-trends in women's LFP

	a. College		b. No College	
	(1) Y	(2) N	(3) Y	(4) N
Big city	0.004	0.001	0.001	0.011
	(0.006)	(0.004)	(0.009)	(0.008)
Remote work shock	-0.065	0.028	-0.114	0.037
	(0.106)	(0.094)	(0.160)	(0.114)
First-stage coef.	3.511	3.904	3.867	4.069
First-stage SE	0.396	0.383	0.377	0.383
Kleibergen-Paap F-stat.	78.571	103.833	105.203	112.851
R-squared	0.221	0.167	0.184	0.251
Obs	171	171	171	171

Notes: ACS, 2015-19 and 2022-24. Sample as in Table 1. The table shows the coefficients β ("Big city") and δ ("Remote work shock") estimated via 2SLS in a regression analogous to model (4). The dependent variable is the MSA-specific change in the LFP of different groups of women between 2010-14 and 2015-19. The control variables correspond to those included in Table 1 models (3)-(5) and (6)-(8), but exclude the 2010-14 to 2015-19 pre-trends. Columns (1) and (3) show results for women with children, columns (2) and (4) show results for women without children. P-values * $<$ 0.05, ** $<$ 0.01, *** $<$ 0.001.

Table A3: Remote work and changes in mothers' observable characteristics

	a. College		**b. No college**	
	Top 20 MSA	Change WFH	Top 20 MSA	Change WFH
Δ Age eldest child	0.133	0.051	-0.063	-0.008
	(0.119)	(0.042)	(0.046)	(0.036)
Δ Has newborn	-0.004	-0.002	0.001	-0.003
	(0.005)	(0.002)	(0.003)	(0.002)
Δ Age	0.154	0.118*	-0.087	0.026
	(0.109)	(0.045)	(0.074)	(0.058)
Δ Married	-0.000	0.004	0.010	0.005
	(0.006)	(0.003)	(0.012)	(0.004)
Δ Black	0.001	0.002	-0.005	0.001
	(0.006)	(0.002)	(0.013)	(0.003)
Δ Hispanic	-0.007	-0.007*	-0.011	0.001
	(0.005)	(0.003)	(0.012)	(0.003)
Δ Log hh income	0.032	0.031	0.115	0.045
	(0.042)	(0.037)	(0.085)	(0.036)
Observations	171	171	171	171

Notes: ACS, 2015-19 and 2022-24. Sample as in Table 1 columns (1)-(4). The table shows the estimated coefficients of cross-MSA regression models describing the relationship between the 2015-19 to 2022-24 change in the average characteristics of mothers in different MSAs and, respectively, the MSA dimension (captured by the big-city dummy variable defined above) and the post-2020 remote-work shock (measured as the MSA-specific change in the share of employed men working remotely). The remote-work explanatory variable is standardized. All regressions are estimated separately for college graduate mothers (first two columns) and non-college graduate mothers (last two columns). P-values * < 0.05, ** < 0.01, *** < 0.001.