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Abstract: Has the COVID-19 pandemic disproportionately affected women relative to men possibly reversing some of the gains made in the labor market? We explore this question using CPS data covering the first several months of the pandemic. We find that the employment-to-population ratio for prime-age women with school-aged children declined substantially relative to comparable men beginning in April 2020 and continuing through subsequent months of the pandemic. The reductions among women with school-age children relative to similar men range from 3.7 to 4.8 percentage points from April to August 2020. Triple difference estimates suggest that 64 to 89 percent of this difference can be attributed to decreased work activity due to their children. With respect to hours of work, women with school-age children suffered major losses relative to men (13-33 percent). Based on triple difference estimates that control for different caregiving responsibilities, 50 to 97 percent of the reduction of hours of work for women with school-age children can be attributed to additional child care responsibilities. In contrast, we find using nonlinear decomposition techniques that women had favorable job and skill characteristics, specifically a greater likelihood to telework, higher education levels and a less-impacted occupational distribution, which all contributed to lessening the negative impacts of COVID-19 for women relative to men. We find some evidence, however, that women were more likely to work in "non-essential" industries contributing to higher relative unemployment in the pandemic.

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I. Introduction

The economic downturn attributable to the social distancing measures and reductions in economic demand due to the emergence and spread of COVID-19 are expected to have different impacts across diverse groups in the labor market. An important and pressing question is whether women have been disproportionately affected by COVID-19 due to child caregiving demands and being concentrated in jobs impacted the most by "nonessential" business closures and remote work flexibility. This paper provides early evidence on the effect of the pandemic recession on labor market outcomes among prime-aged women and men.

The increased integration of women into the U.S. labor market over the past 60 years has mobilized a major economic resource for the nation. Accompanied by technological changes that reduced the necessary time for housework and enabled effective control of fertility along with legal reforms that changed the division of assets following divorce, choices available to women were altered and the shapes of their lives changed through their decisions (Juhn and McCue 2017). Gaps in labor market behavior between men and women narrowed over successive cohorts with progress towards convergence of all measures of labor market activity through direct investment in skills and the choice to delay childbearing and reduce family sizes to also invest in careers (Goldin and Mitchell 2017). Despite this progress disparities in labor market experience associated with childbearing are visible in lifecycle data on women's labor supply and are a driving factor in remaining male-female wage inequality, and difficulty in access to and the affordability of child care is typically identified as an important detriment to labor market participation and advancement for women in the United States (Blau and Kahn 2013, Goldin and Mitchell 2017, Juhn and McCue 2017, Waldfogel 1998).

Further, the lack of flexibility on the part of employers and their customers in having access to employee services at specific times is seen as a driver of gender gaps in work and pay across occupations (Blau and Kahn 2013, Goldin 2014).

Has the unprecedented closure of schools and childcare facilities throughout the country due to the pandemic disrupted the progress women have made in the labor market and exacerbated disparities related to having children? A key concern is the impact of additional childcare responsibilities on the labor market experiences of women due to COVID-19 for single mothers and possible disproportionate responsibilities for married mothers. This paper provides a detailed analysis of the impact of different child care burdens across families on reduced labor market activity of women in the context of the coronavirus pandemic. We focus primarily on different age groups of children because of different child care giving demands both expected and unexpected during school closures during the pandemic. We compare trends in male and female outcomes across child age groups and estimate both difference-in-difference and triple difference models to isolate impacts due to increased child caregiving demands in the first several months of the pandemic.

Although increased caregiving by women may have disproportionately impacted them during the pandemic, the types of jobs held and human capital levels might have also placed women at higher risk of negative labor market outcomes relative to men from COVID-19. Direct levels of skill such as education and potential workplace experience might explain gaps between men and women in any downturn and also differential concentrations in industries and occupations that exhibit different levels of business cycle sensitivity. Of particular interest due to the imposition of social distancing restrictions at the state level which were adopted in

March of 2020 that typically included the physical closure of non-essential businesses is the existing concentration of female relative to male employment in those industries as well as in jobs that cannot be performed remotely or were related to greater exposure to illness. Were women more concentrated in these types of jobs that were hit the hardest by COVID-19 (e.g. services), or were women less concentrated in these jobs partly insulating them from losses (e.g. construction, manufacturing and transportation)? Decomposition methods are used to provide estimates of the relative impacts of essential industries and the ability to work remotely in addition to measures of skill, experience, and labor market structure in contributing to gaps in the pandemic. Findings from these decompositions combined with the DD and DDD models provide comprehensive evidence on whether women were disproportionately impacted by COVID-19 due to differential job types, human capital and child caregiving demands.

Using CPS data for the first few months of the pandemic after the widespread implementation of social distancing restrictions, we find that the employment-to-population ratio fell more for all women ages 25 and 55 than comparable men; however, women without children did not experience changes that were distinguishable from those of men without children. The disproportionate reductions in employment for women occurred among those with school-age children in comparison to men with school-age children. Employment among this group of women dropped substantially relative to men in the first several months of the pandemic (ranging from 3.7 to 4.8 percentage points). Triple difference estimates indicate that that women with school-age children experienced disproportionately large reductions in employment in comparison to women without children suggesting that 64 to 89 percent can be attributed to reductions in work effort due to the presence of their children.

Exploring impacts on hours worked which capture both changes in employment and reductions from full-time to part-time work, we find that hours of work for women were reduced proportionately more than for comparable men with or without children. Women with school-age children suffered especially large losses in hours worked relative to men (13-33 percent). In triple-difference models, women with children ages 6-17 experienced greater percentage reductions in hours than those with no children present, with 50 to 97 percent of the reduction potentially attributable to additional child care responsibilities. In combination, these results for the employment-population ratio and hours of work are consistent with school-aged children unexpectedly arriving at home due to the pandemic presenting an increased home based caregiving demand that was disproportionately met through reduced work activity of women.

In examining job and skill characteristics associated with gaps in unemployment between women and men, interesting patterns are revealed. Nonlinear decompositions indicate that many job and skill characteristics were favorable for women in the pandemic lessening negative impacts. In particular, women are more concentrated in jobs that can be done remotely, in favorable occupations, and have higher education levels than men. Contributing to increasing the gap, however, women were more likely to work in "non-essential" industries than men.

The findings from our paper contribute to a new and rapidly growing literature on early-stage COVID-19 impacts on the labor market of women. One of the first studies focusing on COVID-19 impacts, Alon et al. (2020a) argued that the closures of non-essential businesses and the lack of the ability to telework would likely drive male-female differences in labor market

outcomes. Using data prior to the pandemic, they show that women were less likely to be in these industries. Similarly, they argue that if prior patterns held women would be likely to face hard choices between working when possible or caring for children and that this would additionally be expected to contribute to observed reductions in women's employment due to the pandemic. Making use of CPS data through April 2020, they (Alon et al. 2020b) subsequently develop a calibrated macroeconomic model consistent with these predictions to project patterns for coming years.

Montenovo et al. (2020) also make use of CPS data through April 2020 and examine the impact of COVID-19 on employment of different demographic groups and relate those changes to factors such as distributions of employment, measures of skill and the ability to work remotely. There, they find that traditional factors such as occupational distributions help explain cross-group differences and that ability to work remotely plays a role. They report that employment fell slightly more among women than men and for those in families with large numbers of children. Similarly, Collins et al. (2020) make use of CPS data from February through April 2020 and examine changes in work hours for men and women in married heterosexual couples who remain continuously employed for those months. They find that work hours declined more for women than men particularly for those with young children and that the ability to telework did not eliminate this pattern. Alternatively, Heggenes (2020) focuses on the impact of early school closures on parents with children present under the age of 18 using April through May CPS data from 2019 and 2020. The early closures examined were those occurring prior to all states adopting social distancing provisions in the second half of March 2020. Examining a range of labor market outcomes, the early shutdowns had a concentrated negative

impact for women through "have a job but not be working" but no immediate impact on detachment or unemployment. The mixed findings of these previous studies are likely due to the newness of this literature and rapidly evolving impacts from the pandemic.

Our paper builds on this literature in several important ways. First, we extend these early analyses by looking at a longer time period observing impacts of the coronavirus using CPS micro-data through August 2020. Previous studies are based on the initial months of the pandemic and the labor market experiences of different groups have not all evolved the same beyond the initial impact of the pandemic. For example, the analysis of Couch, Fairlie, and Xu (2020a, 2020b) show that the initial black-white gap in unemployment was not impacted in April 2020 by the arrival of the pandemic but widened in subsequent months as unemployment declined among whites but remained largely stagnant among blacks. Here, we investigate longer term impacts of the pandemic (through August 2020) on female-male labor market outcomes showing that as the reductions in demand and loss of accommodations for children in schools and daycare continue that the disproportionate impact on women has increased. Second, we expand on the types of families considered by looking at both cohabiting and single parents in addition to married heterosexuals. Third, we expand on the range of labor market outcomes considered. In particular, we allow individuals to exit the labor market by focusing primarily on the employment-to-population ratio and unconditional hours worked. Finally, we combine an analysis of not only employment reductions due to increased child care responsibilities but also due to differences in job and skill characteristics providing the first comprehensive study of both influences in the pandemic.

II. Context and Background

The diagnosis of the first case of COVID-19 in January 2020 in the United States and the rapid evolution of school closures and business restrictions was a truly unanticipated event. By the end of March 2020 all states had adopted some social distancing measures which typically included closure of non-essential businesses and physical closure of primary and secondary schools as education moved online.

The arrival of COVID-19 and its unusual pattern of economic disruption interact with many decades of progressively increased engagement of women in the labor market. In the past, as family sizes declined and education levels of women increased, competing demands for time at home decreased while the rewards from the labor market increased. Over successive generations of women, this has increased labor force participation and average hours of work at every age until the most recent cohorts (Goldin 2014, Goldin and Mitchell 2017). Nonetheless, over the lifecycle of women within a cohort, reductions in work activity typically occur with the arrival of children. Among contemporary women, these reductions usually occur in the late 20s through the early 30s. Arrival and presence of children is also associated with the male-female wage gap in part due to reduction in formation of specific human capital during intensive periods of child care and possible absence from the labor market (Juhn and McCue 2017). These gaps in employment and pay have been shown to vary across occupations depending on the degree of substitutability of other employees for women who wish to work flexible hours (Goldin 2014).

Accordingly, we focus on the employment-to-population ratio among women as an important indicator of their labor market activity while providing supportive estimates of hours

of work unconditional on work. Hours of work capture additional potential impacts from movement from full-time to part-time work. In ordinary times, families must make child care plans that evolve with the age of the child. Pre-school children require different care than school aged children and those demands typically decline with their age. Labor market interruptions for women most often are associated with child birth. Thus, we focus on differential experiences for women in families with no children, children of different ages and with different numbers of children as day care and school closures would be expected to have different impacts for these groups (Juhn and McCue 2017, Collins et al. 2020).

After examining the impact of COVID-19 on the employment of these different groups of women relative to men, we also estimate triple difference models of the differences in employment across women who face different caregiving demands. In this analysis, women in families with children of different ages and numbers of children are considered.

Nonlinear decomposition methods are then used to explain the contribution of different factors to female-male unemployment gaps during the pandemic. Both personal skills and factors unique to this downturn such as employment in essential industries, the ability to work remotely, and occupational risk of exposure to disease are examined. The contribution of the distribution of employment across occupations and industries to the unemployment gap between women and men is also considered.

III. Data and Measures

The data used in the analysis are drawn from the basic monthly files of the *Current Population Survey* (CPS). The CPS is the primary monthly household survey used to derive

national labor statistics for the United States. The data are collected in a reference week containing the 12th of the month and official tabulations are released by the U.S. Bureau of Labor Statistics on the third subsequent Friday. The survey gathers information on the members of 60,000 households and when weighted the data represents the civilian non-institutional population ages 16 and older of the United States.

As our interest is the impact of the COVID-19 pandemic on labor market activity of men and women, we note that some social distancing measures including local closures of businesses and schools had occurred prior to collection of March CPS data. All states put social distancing measures in place following the collection of March CPS data but prior to the April survey. Thus, we view March as a month partially impacted by the pandemic and April as being the first month where labor market activity was disrupted throughout the country. February was the last month in 2020 prior to the adoption of closures in response to the pandemic.

In the analysis, we make use of the basic monthly public release CPS data files beginning several years prior to the pandemic in 2017 and extending through the most recently released data in August of 2020. We focus most sharply on changes in employment experiences beginning with April 2020 given the timing of the adoption of social distancing restrictions nationally.

We make use of family structure information within the CPS to link prime-aged male and female adult parents to children in their families. By using this linkage along with reported

information on the age of children who are present, we are able to determine the ages of children within families.[1]

Measures Related to COVID-19

To better align the analysis with the context of the pandemic we make use of several measures to highlight the influence of physical closures of non-essential businesses, the ability of people to work remotely, and risk of disease exposure on the job. With respect to measuring whether a person was employed in an essential or non-essential business, we use coding based on Delaware state standards which employ the North American Industry Classification System (NAICS), the same standard used in the CPS survey.[2] This variable is coded at the 4-digit level of classification. Similarly, we make use of a measure developed by Dingel and Neiman (2020) of the ability of a worker to perform work remotely. Their index is based on 15 underlying O*NET (*Occupational Information Network*) questions. Finally, we use a measure of exposure to disease or infection also developed (Baker et al. 2020) from an O*NET question asking ""How often does your current job require you be exposed to diseases or infections?". Those responses are transformed into a Z-score with mean 0 and standard deviation 1.

IV. Descriptive Patterns of Male and Female Employment

[1] We also considered estimates stratified by number of children present rather than the ages of children. The main part of the effects shows up with having one child and not as an increasing function in the number of children. The fixed cost of having one child at home on women's labor supply may be more important than the incremental cost of having additional children at home.

[2] See https://coronavirus.delaware.gov/resources-for-businesses/

Figures 1 and 2 provide descriptive information on the male and female employment-to-population ratios and hours of work since January of 2017. Panel A provides a breakdown for all women and all men, as well as for women with and without children. To focus on both working-age and child rearing adults we include only women and men ages 25-55 throughout. As can be seen in the figures, prior to the adoption of widespread social distancing measures due to the coronavirus in March of 2020, systematic gaps were evident between men and women. With respect to the employment-to-population ratio (Figure 1: Panel A) men averaged about 86 percent employment while women averaged about 73 percent. The employment-to-population ratio among women without children was a bit higher, at about 75 percent and a bit lower (about 70 percent) among women with children. From February to April 2020, the employment-to-population ratio visibly drops across all groups. For men, the reduction was by about 10 percentage points while it was roughly 11 percentage points for each of the three groups of women examined in the graph. The pace of recovery in the subsequent several months, based on the figure, appears to be fairly comparable across the group of all men and those of women; however, these overall patterns may mask heterogeneous impacts if the women were compared directly to men in the same family and job type situation.

Figure 2: Panel A which contains information on average hours of work for the same groups shows a similar pattern. Prior to the widespread implementation of social distancing measures in March 2020, average hours of work were largest for men followed by women without kids, the group of all women, and women with kids. From February to April 2020, average hours of work fell sharply and by similar amounts (6 to 7 hours) across all groups. As the economy began to gradually reopen in the following months, the recovery in average hours

of work appears to have been a bit more rapid for men than the groups of women. It should be noted that these patterns do not hold constant differences across the groups of women and men in terms of skills and other relevant labor market measures that might influence employment and hours of work.

Panel B of Figures 1 and 2 provide more detailed breakdowns among women. In Figure 1: Panel B, women with no kids consistently have the highest employment-to-population ratios followed by those with kids ages 14-17, 6-13, and 0-5. With the arrival of the pandemic, all women experienced a sharp decrease in employment; however, there is clear variation across groups. For women with no kids, the decline in the employment-to-population ratio was by 10 percentage points whereas it was roughly 13 percentage points for women with children ages 14-17. The percentage point reductions for women with children ages 6-13 (11 percentage points) and women ages 0-5 (10 percentage points) were smaller. This descriptive evidence would be consistent with parents who had older, more independent children being placed back in the household increasing demands on their time for caregiving when previously the kids had supervised activities at school. Over subsequent months, from April through August 2020, it appears that the increases in the employment-to-population ratios were similar across groups as some businesses reopened.

Figure 2: Panel B provides the same breakdowns for average hours of work for women with children of different ages. Average hours of work are again consistently ordered over time with women with no kids having the highest average hours followed by those with kids ages 14-17, kids ages 6-13, and kids ages 0-5. From February to April 2020, hours of work fell by similar amounts across all groups (5 to 7 hours). In subsequent months, from April through July of

2020, hours of work appear to be increasing somewhat more rapidly among women without children.

To examine whether women with children in their household are making more of an adjustment to accommodate disruptions due to COVID-19 that have led to their children unexpectedly being at home, we would also like to examine their behavior relative to men in the same family setting. We do this descriptively in Tables 1 and 2 which examine changes in the employment-to-population ratio and average hours of work respectively. We do not report March 2020 because it was only partially affected by COVID-19 (Couch, Fairlie and Xu 2020).

In Table 1, women with and without children are compared to men in the same family circumstance. For example, in Panel A, women ages 25-55 with no children are compared to men in the same age group with no children. In February 2020, the last month before the pandemic had a widespread national impact, the employment-to-population ratio for these men was 81.7 percent and for women 77.1 percent with a male-female gap of 4.6 percentage points. In the initial month where the effects of the pandemic could be clearly measured, April 2020, the employment-to-population ratio fell to 70.7 percent for men and 65.9 percent for women with a male-female gender gap of 4.8 percentage points. The 11-point decline for men with no children and the 11.2 percentage point decline for women with no children were similar in magnitude leaving the initial gender gap largely unchanged. Over subsequent months through August 2020, employment rose more rapidly for men than women widening the male-female gap to 5.7 percentage points.

Women with no children are most similar to men in their labor market participation patterns and the arrival and presence of children often is accompanied for women in the U.S.

by a period of absence from the labor market and increased caregiving demands at home relative to men. Panel B of Table 1 provides a comparison between all men and women ages 25-55 with children. In February 2020, the employment-to-population ratio was 91.3 percent for men and 71.9 percent for women, with a male-female gap of 19.4 percentage points. In April, the employment-to-population ratio fell for both groups but disproportionately for women, widening the male-female gap to 21.8 percentage points, 2.4 percentage points larger than in February, an increase of about 12 percent. In subsequent months, the gap has hovered around this level. It deserves mention that if information from the three prior years had been used in making these comparisons when the male-female gap averaged 21.7 percentage points, the experience of women with children relative to males during the pandemic would not be seen as anomalous on average. Thus, the experience of the pandemic has reversed gains made by working women with children relative to men in terms of their employment over the past several years.

The descriptive information for differential experiences of men and women ages 25-55 with children ages 0-5 and 6-13 are similar on average to all women. Relative to February of 2020, April 2020 figures show a widening of the male-female gap in the employment-to-population ratio. However, if data from the prior three years (2017-2019) had been used in evaluating the changes due to the pandemic, the gender gaps observed are not anomalous. Again, the pandemic is seen as unwinding gains made by these groups of women relative to men over the prior several years in the labor market in terms of their employment.

The one group that appears descriptively to have had a much worse experience relative to February 2020 or the prior three years are women ages 25-55 with children ages 14-17 in

comparison to similar men. In February 2020, these women had an employment-to-population ratio of 73.7 percent whereas men's was 90.7 percent with a male-female gap of 17 percentage points. In April, the male-female gap widened to 20.9 percent, or by 23 percent. In May and June, the gap widened further (to 22.9 and 22.7 percent respectively) before contracting somewhat in August (to 20.2 percent). Thus, the increase in the male-female gap has been maintained over subsequent months.

For men and women with children ages 14-17, if data from 2017 through 2019 had been used as the basis of comparison, the male-female gap over that period was 18.5 percentage points. The increase in April 2020 to 20.9 percentage points represents a 13 percent increase. In May and June, when the male female gaps widened to 22.9 and 22.7 percentage points, this represents increases of roughly 23 to 24 percent. The male-female gap narrowed again in August to 20.2 percentage points. Thus, the impact of the COVID-19 pandemic on women with older children has been particularly severe.

A similar pattern is evident in examining hours of work which captures both changes in employment and reductions in hours on the job (reported in Table 2). Considering first men and women ages 25-55 with no children present, in February 2020 men worked an average of 32.9 hours and women 29.3 hours with a male-female gap of 3.6 hours. In April 2020, hours of work for men fell to 25.9 hours and to 22.7 hours for women. The decreases of 7 and 6.6 hours are similar in magnitude but were smaller for these women and slightly narrowed the gap in hours worked to 3.2 hours. However, by August the gap had widened to 4.5 hours as work activity began to resume. The overall widening of the gap in hours from 3.6 to 4.5 hours represents a 25 percent increase. However, if the average gap in hours over the years from

2017 to 2019 (4.7 hours) is used as the basis of comparison, the widening of the gap during the pandemic reverses gains made by these women as the economy experienced a sustained period of growth.

Considering those with children ages 14-17 and using February 2020 as a reference, men in this category worked 38.2 hours on average while women worked 26.9. The male-female gap in February 2020 is 11.3 hours. By April 2020, average hours of men and women fell by similar amounts leaving the male-female gap little changed at 11.1 hours. However, as economic activity began to expand in subsequent months, the male-female gap widened to stand at 12.6 hours in August 2020. This is an increase of 12 percent. If data from 2017 through 2019 had been used as the basis of comparison, the average male-female gap in hours worked in that period was 12.5 hours. Thus, the increase to 12.6 hours in August 2020 would be sufficient to unwind several years of prior gains.

In summary, relative to months just prior to the pandemic, all women with children had larger reductions in employment and hours of work than comparable men. This has resulted in a widening of male-female gaps in labor market outcomes. Descriptively, those decreases in employment and hours of work appear to have erased gains that had been made over the prior several years relative to comparable men when economic growth had been robust and sustained.

V. Methodology

Here, to better gauge the experiences between comparable women and men, and control for pre-COVID trends, we estimate difference-in-difference models. The form of the equation estimated is:

(V.1) $Y_{it} = \alpha + \gamma Female_i + \sum_{m=1}^{6} \pi_m COVID_m + \sum_{m=1}^{6} \delta_m Female_i * COVID_m + \beta' X_{it} + \lambda_t + \theta_t + \tau + Female * \tau + \varepsilon_{it}$

where Y_{it} is one of the two outcomes being examined, (1) the employment-to-population ratio E_{it} or (2) hours of work, $Hours_{it}$. E_{it} is a categorical indicator of whether a person is employed or not. $Hours_{it}$ is the log of weekly working hours including not working (i.e. zero hour) and capped by 60 hours.[3] $Female_i$ is a categorical indicator coded with a value of one for women in the sample. $COVID_m$ is a dummy variable for each post-COVID month beginning with March 2020 through August 2020 (e.g. m=2 for April 2020). The X_{it} are variables measuring personal characteristics for each individual in month t. The sample period includes January 2017 to August 2020 to allow for the inclusion of seasonal (monthly) fixed effects, λ_t, year fixed effects, θ_t, and time trend, τ, (as well as a female specific time trend). March 2020 is included in the sample, but not reported in the tables because of potentially misleading estimates associated with a partially COVID-19 impacted month.[4] ε_{it} is the error term.

We estimate Equation (V.1) for all women and men ages 25-55, and women and men with any young children (ages 0-5) and school-age children (ages 6-17). The separate samples provide evidence on how different groups were impacted after controlling for differences in individual characteristics (e.g. education level, marital status and geographical location) as well

[3] Hours are transformed with inverse hyperbolic sine to approximate logs and include zero hours. The inverse hyperbolic sine transformation is given as: $\sinh^{-1} Hours = \log(Hours + \sqrt{Hours^2 + 1})$

[4] We include a full set of interactions for March. The findings are robust to exclusion of the March 2020 data.

as pre-existing trends in outcomes for women and men. To directly estimate the impact of the presence of children and children of different age groups we estimate triple-difference models.

The triple-difference model of the impact of COVID-19 and the presence of children of different ages in the household on the male-female gap is:

(V.2) $Y_{ijt} = \alpha + \gamma Female_i + \sum_{m=1}^{6} \pi_m COVID_m + \varphi Child_j + \delta_1 Female_i * Child_j + \sum_{m=1}^{6} \delta_{2m} Female_i * COVID_m + \sum_{m=1}^{6} \delta_{3m} COVID_m * Child_j + \sum_{m=1}^{6} \delta_{4m} Female_i * COVID_m * Child_j + \beta' X_{ijt} + \lambda_t + \theta_t + \varepsilon_{ijt}$

where $Child_j$ is a set of dummy variables for the presence of children of different ages (1 for any children ages 0-5, any children ages 6-17, all children ages 0-5, all children ages 6-17, respectively; 0 for no presence of children). Other model specifications are the same as in equation (V.1).

VI. Difference-in-Difference Estimates Relative to Men

Employment-to-Population Ratio

Table 3 Panel A contains estimates for the employment-to-population ratio for the sample of men and women ages 25-55. The first column of estimates shows that for all women in this age group that the pandemic downturn resulted in a widening of the male-female gap in employment in April of 1.12 percentage points. By August, the increased gap in employment due to the pandemic further increased to 1.79 percentage points.

Column (2) contains estimates for women without children relative to men without children. The difference-in-difference estimates indicate that from April through August 2020, the male-female gap in employment was statistically unchanged in comparison to February.

Thus, when controlling for a variety of personal characteristics, the experiences of women without children appears to be comparable to that of men without children. We use this comparison later as the baseline for our triple difference estimates that focus on differential child rearing consequences.

Columns (3) and (5) consider families with young children (ages 0-5). Column (3) measures the presence of young children while allowing for other children to be present. Column (5) considers families with only children ages 0-5. Regardless of the measure used, no significant estimates of the pandemic on the relative employment of men and women are seen from April through August of 2020. Columns (4) and (6) consider families with school-aged children present. Again, Column (4) provides estimates for families with school-aged children where there may be other kids present in the household. Column (6) focuses only on families with children ages 6-17. In both columns, all of the estimated impacts show statistically significant increases in the gap between the employment-to-population ratio of men relative to women in the months from April to August of 2020. In Column (4) the estimates range from 2.1 to 3.4 percentage points whereas in Column (6) they range from 3.7 to 4.8 percentage points. Thus, the reduction in women's employment relative to that of men seems greatest in families with school-aged children, especially those that did not have younger kids present. This is consistent with women in families who had all children engaged with school having to reduce employment in order to meet child care demands associated with children being at home once schools closed or moved to online instruction and the closure of child care centers. Women and men in families with only younger children at home might have been less disrupted by the pandemic because their children were not enrolled in school.

Hours of Work

Table 3 Panel B contains estimates of the change in hours worked among women and men for all individuals (i.e. unconditional on working) making use of a logarithmic specification that allows parameter estimates to be interpreted as percentage changes relative to February 2020. The overall pattern of results are similar to those for the employment-to-population ratio. The estimates contained in Column (1) show that the male-female gap in hours of work had widened by May 2020 by 6.0 percent. The increase in the gap attributable to the pandemic expanded in subsequent months and in August 2020 was 12.3 percent in comparison to February.

Column (2) of Panel B considers the experiences of women without children. The estimates show that statistically significant changes in the male-female gap in hours worked were not estimated until June (7.1 percent) and widened in July (15.0 percent) and August (9.6 percent).

Columns (3) and (5) of Panel B consider families with young children (ages 0-5). Column (3) allows for the possibility of children of other ages to be present while Column (5) focuses on families that only have children between ages 0-5. In terms of the response of hours of work of women relative to men in the months since April 2020, no statistically significant estimates are found. Columns (4) and (6) consider alternative measures of the presence of children ages 6-17. Column (4) allows for the presence of younger children while Column (6) focuses specifically on families where all kids are ages 6-17. The estimates in Column (4) show a statistically significant reduction in hours of work of women relative to men from May through

August of 2020 ranging from 10 to 24.8 percent. The responses in Column (6) focusing on families where all kids were between ages 6-17 are statistically significant in all months from April to August 2020 and are larger ranging from 12.7 to 33.2 percent. The responses are larger in June, July and August compared to April and May. The estimates for hours of work are consistent with those for the employment-to-population ratio in showing the largest response for women in families who prior to disruption caused by the pandemic had their children safely placed at school during typical weekdays.

VII. Triple-Difference Estimates of Changes Due to Presence of Children

Employment-to-Population Ratio

To further isolate the effects of child caregiving responsibilities on labor market outcomes we estimate triple-difference models that directly compare the gender gap for women and men with children to women and men without children. Table 4 Panel A presents triple difference estimates based on Equation V.2. The third, added difference here is between women and men with children of different age groups and women and men without children. The group in Panel A for whom the presence of children is shown to widen the employment-to-population ratio more than for women with no children is for those in families whose children were all of school ages 6-17. In April, the presence of children ages 6-17 is associated with a widening of the male-female employment gap of 3.3 percentage points. In subsequent months, this widening continues with estimated increases ranging from 2.5 to 4.1 percentage points.

Comparing the triple-difference estimates for the effect of the pandemic on the employment-to-population gap between women and men in families with school-aged children

to the diff-in-diff estimates gives us an estimate of the impact of the influence of the caregiving burdens faced by women in those families relative to women who do not have kids. Dividing the triple difference parameters in Column (5) of Table 4: Panel A by those in Column (6) of Table 3: Panel A suggests that demands associated with having only kids ages 6-17 accounts for 64 to 89 percent of the observed widening in the female-male gap in the employment-to-population ratio.

Hours of Work

Table 4 Panel B similarly contains triple-difference estimates for the portion of the male-female gap in average hours of work that can be attributed to the presence of children of different age groups. Again, the group of women for whom statistically significant estimates are found of the impact of the pandemic associated with having children in the household were for those with children only in the age group from 6-17. The estimates are statistically significant in all months from April through August with the exception of May. Those (significant) parameters indicate that the hours of work for women in those families declined 12.3 to 25.8 percent. Again, dividing the triple-difference parameters (significant months) by comparable estimates from the diff-in-diff models from Table 3 Panel B suggests that childcare responsibilities for these women reduced their employment by 50 to 97 percent of the total reduction.

Married Couples

The primary sample used in the paper considers all adults between ages 25 and 55. One implication is that the tradeoffs being estimated look across all parents and all women and men without children. An alternative approach would be to examine only married individuals to more sharply focus on situations where tradeoffs of family burdens between two adults takes place. Appendix Tables A.1 and A.2 provide estimates comparable to Tables 3 (Diff-in-Diff) and 4 (Triple Difference) reducing the primary sample to those who report being married. Those estimates are qualitatively and quantitatively similar although the reductions in work (employment and hours) for those in families with children only ages 6-17 are larger.

VIII. Explaining the Male-Female Gap in Unemployment Rates

We turn to exploring whether the types of jobs held and skill levels of women placed them at higher or lower risk of negative labor market outcomes relative to men from COVID-19. These factors may have also contributed to impacts of COVID-19 on gender gaps in addition to child caregiving disproportionately impacting women with school-age children. Before turning to an analysis of the contribution of these factors, we note that the CPS only collects information on industry and occupation for those who in the labor force. Thus, we consider factors that may help explain the differences in male and female experiences during the pandemic narrowing the focus to those in the labor force (i.e. employed and unemployed). Information on occupation and industry are not available for those out of the labor force ruling out an analysis of the employment-to-population ratio.

Differential Job and Skill Characteristics and Unemployment Risk

Increases in unemployment driven by the spread of COVID-19 were related in part to the closure of non-essential businesses and demand shifts away from expenditures that required personal interaction such as visits to restaurants and towards those that allowed individuals to remain at home like shopping for groceries. To the extent that women's employment prior to the pandemic was concentrated in areas that were impacted unusually hard by the downturn, they would be expected to be disproportionately impacted.

Table 5 tabulates the proportions of men and women employed in major two-digit industries and occupations in the three years from February 2017 through February 2020 along with the average unemployment rate for each category from April through August 2020. As would be expected due to state closure policies that arrived in March 2020, the unemployment rate since April 2020 has been remarkably high (at 20 percent) among those who worked in non-essential industries. The proportion of women working in non-essential industries was substantially higher than for men (17.1 versus 11.8 percent). Thus, employment in those industries would be expected to increase the male-female gap in the unemployment rate since the onset of the pandemic.

Measured skills in terms of educational attainment are an important correlate of labor market outcomes. As shown in Table 5, men are more likely than women to be a high school dropout (8.8 versus 5.6 percent) or high school graduate (28.1 versus 21.2 percent). Women are more likely to complete higher levels of education than men such as college (28.2 versus 24.7) or post-graduate degrees (17.3 versus 13 percent). These differences in educational attainment would be expected to narrow the unemployment gap between men and women in the pandemic.

Some industries that had relatively high proportions of men employed in them have experienced relatively high unemployment rates. For example, Construction, Manufacturing, and Transportation have relatively high unemployment since April 2020 (10.5, 9.3, and 11.7 percent respectively) but also had much larger proportions of men than women employed in them prior to the pandemic. For example, 13.2 percent of men but only 1.6 percent of women worked in construction in the period from Feb 2017 through Feb 2020. Similarly, 8.1 percent of men and 3.0 percent of women worked in transportation.

Two occupational categories that have experienced lower than average unemployment since the onset of the pandemic have been management (4.8 percent) and professional occupations (6.7 percent). Across these two occupations a notably larger combined proportion of women (48 percent) than men (38 percent) are employed in them. In areas like services, though, which has experienced higher than average unemployment (18.7 percent) more women (19.3 percent) than men (12.8 percent) are employed. Construction, Production, and Transportation occupations have far more men employed in them than women and relatively high unemployment rates (12.9, 12.8 and 15.0 percentage points respectively). Overall, this pattern would suggest relatively less increase in unemployment due to occupational concentration for women than for men and thus contribute to reducing the male-female gap.

Women also tend to be more concentrated in jobs where they can work remotely (46.2 percent) than men (33.1 percent). They are also 2.7 tenths of a standard deviation more likely

to be in jobs that are exposed to disease or illness at work while men are 2.4 tenths of a standard deviation less likely to be in these health risk jobs.[5]

Decomposition of Female-Male Unemployment Gap

While there are general indications of the influence that different groups of risk factors will have on the female-male unemployment gap during the pandemic, we make use of a non-linear multivariate decomposition method for (0,1) outcomes similar to the Oaxaca decomposition (Fairlie 1999, 2005).[6] The method isolates the contribution due to differences in distributions of characteristics multiplied by common slope parameters. Unlike the suggestive impacts reported in descriptive Table 5 it also takes a multivariate approach controlling for potential correlation across explanatory factors. Column (1) of Table 6 reports the unemployment decomposition for the pre-COVID reference month, i.e. February 2020. Women's distribution across occupations and their higher educational attainment were significant explanatory factors in February, which lowered the female-male unemployment gap by about 0.6 and 0.2 percentage point, respectively. Just prior to the pandemic, women had a lower unemployment rate than men.

The decompositions by month starting in April 2020 are shown across the columns (2) to (6) of Table 6. With respect to factors unique to the pandemic, we find some evidence that being in a job where it was more likely to telework explains part of the unemployment gap.[7]

[5] Although we report that higher than median levels of health risk are associated with higher unemployment rates relative to lower than median levels of health risk in Table 5 the relationship follows more of an inverted U shape pattern.
[6] Results of the linear Blinder-Oaxaca decomposition are similar.
[7] After removing the occupation dummies we find that telework variable becomes even stronger. The included major occupation dummies are at the 2 digit level whereas the telework variable is defined at the 4-digit occupation level.

The distribution of workers across industries and in essential industries became a significant explanatory factor in three of the five months in the post-COVID period explaining 0.6 to 1.0 percentage points of the gap. The occupational distribution for women continued to serve to lower the gap between women and men consistently across months by roughly one percentage point. The greater educational attainment of women also served to reduce the female-male unemployment gap in each month by roughly 0.4 to 0.7 percentage points. Gender differences in exposure to health risks do not explain the unemployment gaps. Overall traditional determinants of cross-group differentials such as education, industry and occupation are important in explaining the differentials observed.

IX. Conclusion

The emergence of COVID-19 and its spread in the United States has had a major disruptive impact on the labor market related to the closure of essential businesses and reductions in demand as consumers avoided interpersonal contact in making transactions where possible. The movement of schools to distance learning also meant children who might have been at school, in day care, or at summer camps were now again spending full days at home creating additional child care demands on parental time. Have women been disproportionately affected by COVID-19 due to being concentrated in jobs impacted the most by "nonessential" business closures and remote work flexibility and by increased child caregiving demands?

These impacts from the pandemic can first be directly measured in the April 2020 CPS data. Using these data and subsequent months of the CPS, we find that the employment and

hours worked of women declined more than for comparable men during the months following the widespread adoption of social distancing measures (April to August 2020). The largest relative reductions in employment and hours worked were among women with school-age children. Women with school-age children suffered losses in employment ranging from 3.7 to 4.8 percentage points and losses in hours worked ranging from 11 to 33 percent during the pandemic.

Among the group of women who had school-age children, the estimates obtained from the triple difference and diff-in-diff models suggest that 64 to 89 percent of the widening of the gap in the male-female employment-to-population ratio since April 2020 can be attributed to differences due to the presence of the children. For this same group, estimates from the triple difference and diff-in-diff models in combination similarly indicate that 50 to 97 percent of the reduction of their works hours compared to those of men since April 2020 is due to the presence of their children. This group of women was more integrated into the labor market prior to the arrival of the pandemic no doubt because their children were in school enabling them to engage more with work. The evidence indicates that as their children arrived home due to school closures and distance learning that their own work activity declined disproportionately relative to men. This conclusion remains in alternate estimates we provide that focus only on married couples. The relative losses to work activity among women when we focus on married women and men with school-age children further suggests that household labor supply decisions were not favorable to working mothers during the early stages of the pandemic.

In further assessing factors that help explain the differential experiences between men and women, higher educational attainment helps reduce the gap observed between men and women. However, other factors unique to the pandemic also play an important role. For example, the ability to telework is much more concentrated among women and helped reduce the observed gap between women and men's unemployment. However, lower concentrations in essential industries widened the gap between male and female unemployment.

Although we are perhaps only in the early stages of the economic downturn and school shutdowns from COVID-19, we find some evidence that impacts are becoming larger over time. The DD and DDD estimates, for example, show some evidence of larger negative impacts in later months than in earlier months of the pandemic, although we are admittedly underpowered with the CPS to detect these month-to-month changes. Future research should investigate this question as more post-COVID-19 data become available. Over the coming months reductions in demand and loss of accommodations for children in schools and daycare might further exacerbate the disproportionate impact on women with school-age children and continue to erode the progress women have made in the labor market over the past several decades.

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Figure 1(a). Employment to Population Ratio, Women vs. Men, January 2017 to August 2020

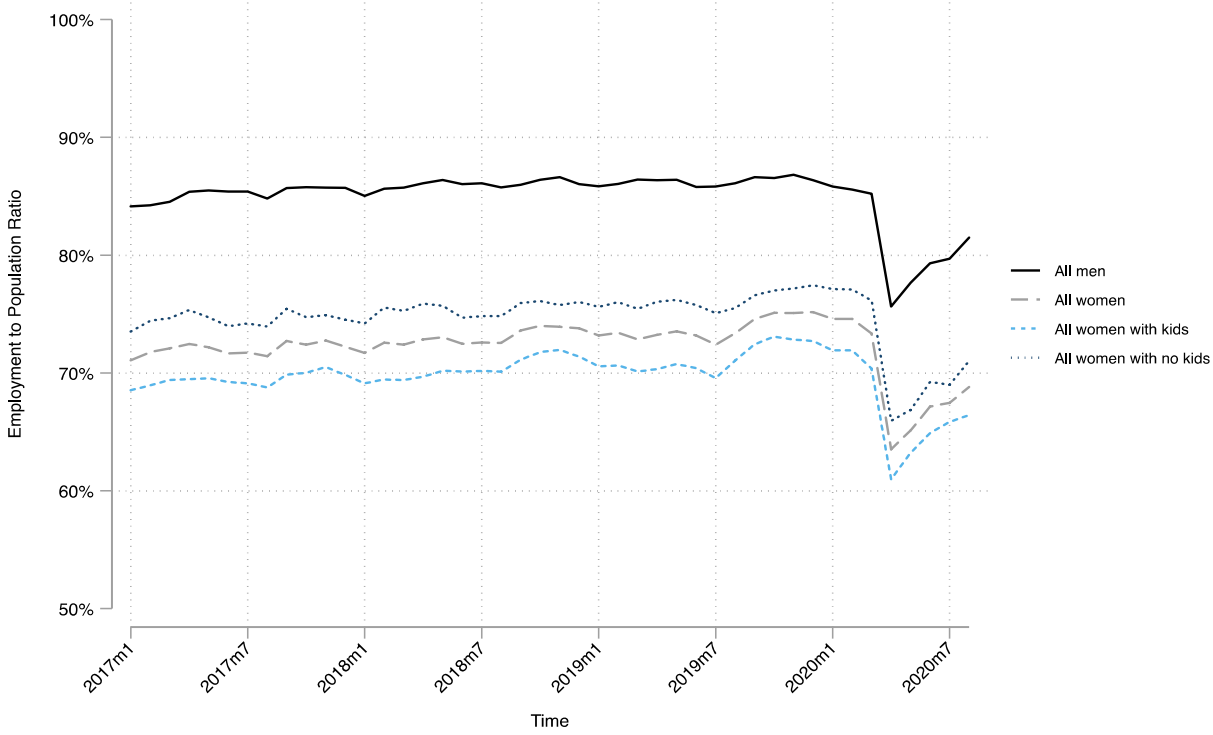

Figure 1(b). Employment to Population Ratio, Women by Children, January 2017 to August 2020

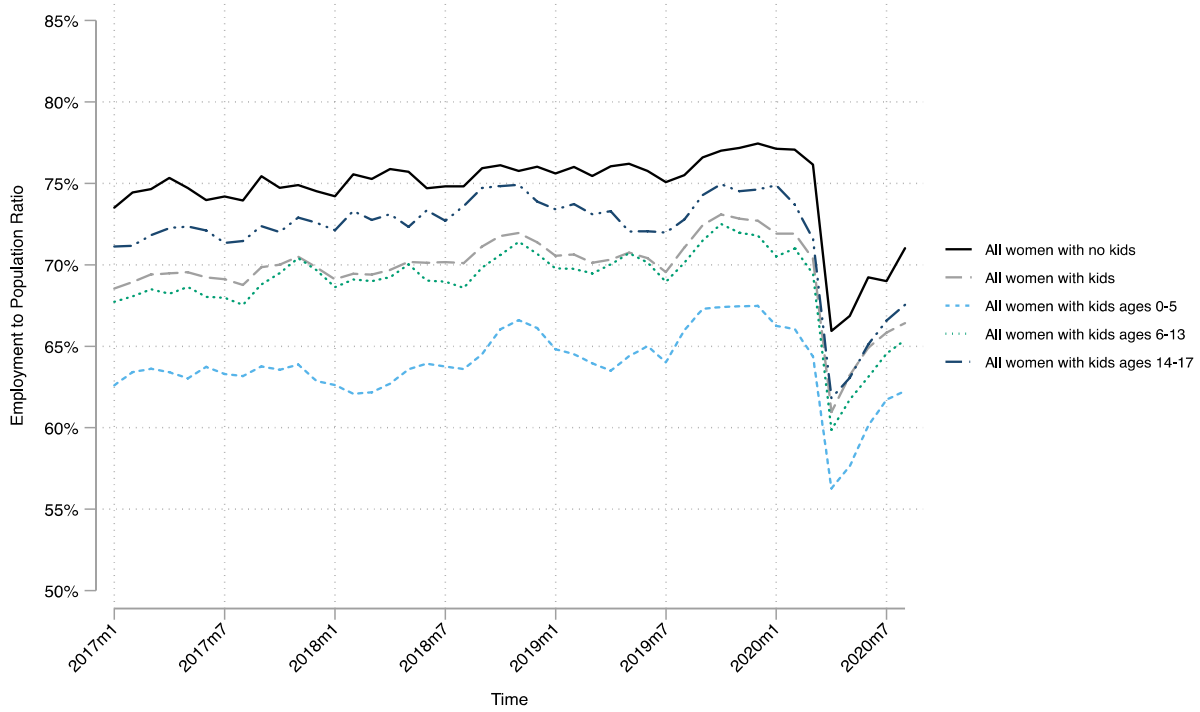

Figure 2(a). Average Hours of Work, Women vs. Men, January 2017 to August 2020

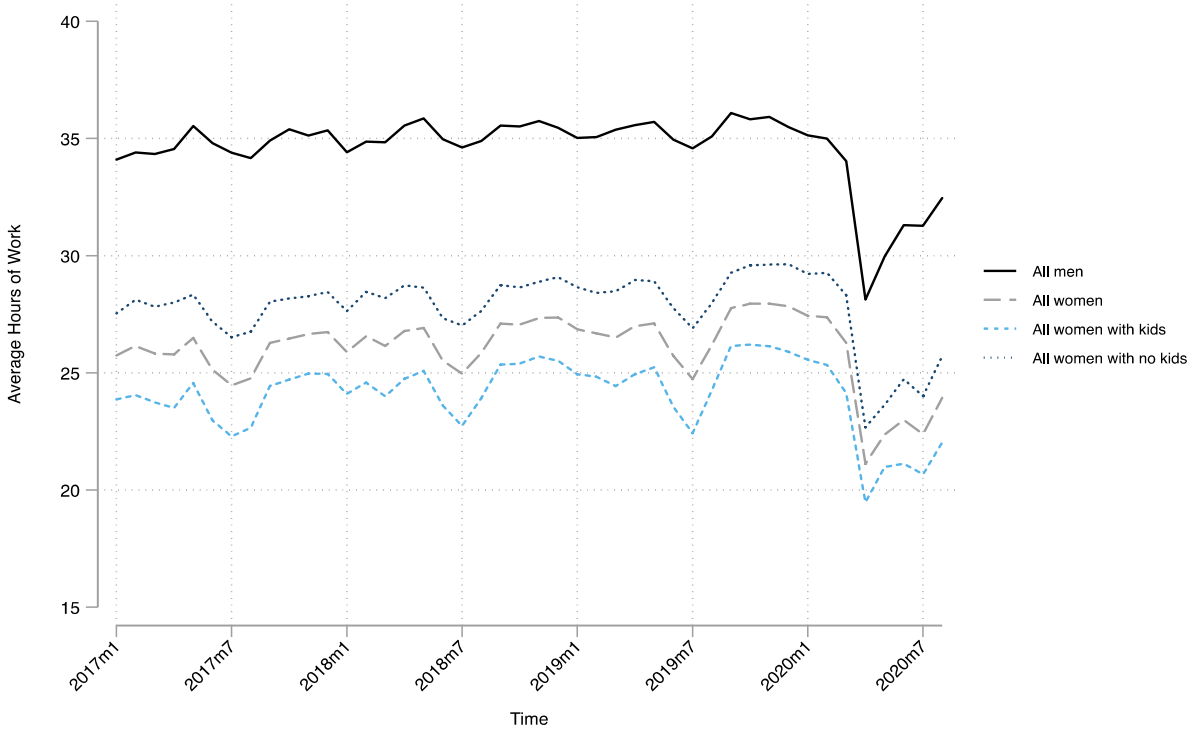

Figure 2(b). Average Hours of Work, Women by Children, January 2017 to August 2020

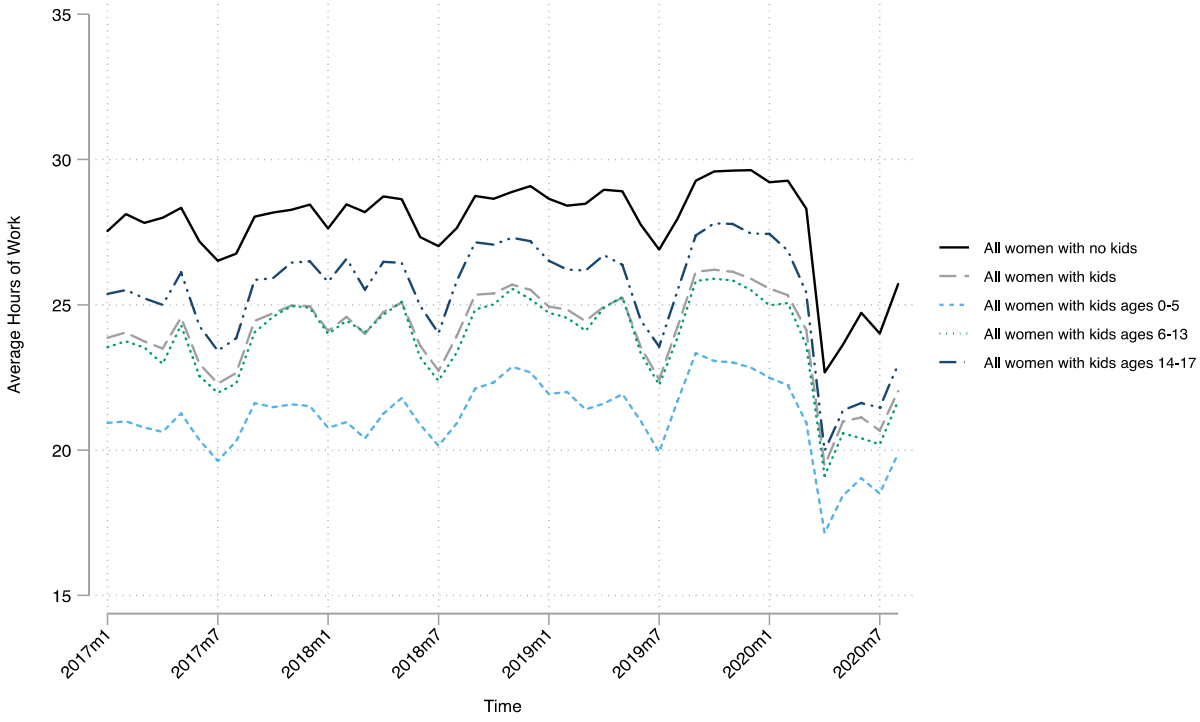

Table 1. Employment to Population Ratio

	Male	Female	Male-female Gap	Total
Panel A. With no children				
Jan 2017 - Dec 2019	81.6%	75.4%	6.2%	78.7%
February 2020	81.7%	77.1%	4.6%	79.5%
April 2020 (COVID)	70.7%	65.9%	4.8%	68.5%
May 2020 (COVID)	72.5%	66.9%	5.6%	69.8%
June 2020 (COVID)	74.1%	69.2%	4.9%	71.8%
July 2020 (COVID)	74.6%	69.0%	5.6%	72.0%
August 2020 (COVID)	76.7%	71.0%	5.7%	74.0%
Panel B. With children				
Jan 2017 - Dec 2019	92.0%	70.3%	21.7%	80.0%
February 2020	91.3%	71.9%	19.4%	80.6%
April 2020 (COVID)	82.8%	61.0%	21.8%	70.8%
May 2020 (COVID)	85.4%	63.2%	22.2%	73.2%
June 2020 (COVID)	87.1%	64.9%	22.2%	74.8%
July 2020 (COVID)	87.2%	65.8%	21.4%	75.4%
August 2020 (COVID)	88.4%	66.4%	22.0%	76.3%
Panel C. With any 0-5 years children				
Jan 2017 - Dec 2019	92.7%	64.3%	28.4%	77.6%
February 2020	92.1%	66.1%	26.0%	78.1%
April 2020 (COVID)	82.7%	56.3%	26.4%	68.6%
May 2020 (COVID)	84.9%	57.6%	27.3%	70.6%
June 2020 (COVID)	86.4%	60.1%	26.3%	72.6%
July 2020 (COVID)	86.5%	61.7%	24.8%	73.4%
August 2020 (COVID)	88.4%	62.3%	26.1%	74.7%
Panel D. With any 6-13 years children				
Jan 2017 - Dec 2019	92.1%	69.6%	22.5%	79.5%
February 2020	91.3%	71.0%	20.3%	80.0%
April 2020 (COVID)	82.5%	59.9%	22.6%	70.0%
May 2020 (COVID)	85.7%	61.7%	24.0%	72.5%
June 2020 (COVID)	86.8%	63.1%	23.7%	73.7%
July 2020 (COVID)	87.4%	64.6%	22.8%	74.7%
August 2020 (COVID)	88.5%	65.4%	23.1%	75.7%
Panel E. With any 14-17 years children				
Jan 2017 - Dec 2019	91.4%	72.9%	18.5%	80.9%
February 2020	90.7%	73.7%	17.0%	81.1%
April 2020 (COVID)	82.7%	61.8%	20.9%	70.9%
May 2020 (COVID)	86.0%	63.1%	22.9%	73.0%
June 2020 (COVID)	87.8%	65.1%	22.7%	74.9%
July 2020 (COVID)	87.4%	66.6%	20.8%	75.5%
August 2020 (COVID)	87.7%	67.5%	20.2%	76.3%

Note: The sample consists of all people ages 25 to 55 years. All calculations use CPS sample weights.

Table 2. Average Weekly Hours of Work on All Jobs

	Male	Female	Male-female Gap	Total
Panel A. With no children				
Jan 2017 - Dec 2019	32.9	28.2	4.7	30.7
February 2020	32.9	29.3	3.6	31.2
April 2020 (COVID)	25.9	22.7	3.2	24.4
May 2020 (COVID)	27.6	23.6	4.0	25.7
June 2020 (COVID)	28.9	24.7	4.2	26.9
July 2020 (COVID)	29.0	24.0	5.0	26.6
August 2020 (COVID)	30.2	25.7	4.5	28.1
Panel B. With children				
Jan 2017 - Dec 2019	38.3	24.5	13.8	30.7
February 2020	38.1	25.3	12.8	31.1
April 2020 (COVID)	31.4	19.5	11.9	24.8
May 2020 (COVID)	33.6	21.0	12.6	26.6
June 2020 (COVID)	35.0	21.1	13.9	27.3
July 2020 (COVID)	34.6	20.7	13.9	26.9
August 2020 (COVID)	35.7	22.0	13.7	28.2
Panel C. With any 0-5 years children				
Jan 2017 - Dec 2019	38.3	21.4	16.9	29.4
February 2020	38.2	22.2	16.0	29.6
April 2020 (COVID)	31.4	17.2	14.2	23.8
May 2020 (COVID)	33.2	18.4	14.8	25.4
June 2020 (COVID)	34.7	19.0	15.7	26.4
July 2020 (COVID)	34.4	18.5	15.9	26.0
August 2020 (COVID)	35.6	19.9	15.7	27.4
Panel D. With any 6-13 years children				
Jan 2017 - Dec 2019	38.4	24.2	14.2	30.5
February 2020	38.2	25.1	13.1	30.9
April 2020 (COVID)	31.3	19.1	12.2	24.6
May 2020 (COVID)	33.7	20.6	13.1	26.4
June 2020 (COVID)	35.0	20.4	14.6	26.9
July 2020 (COVID)	34.8	20.2	14.6	26.7
August 2020 (COVID)	35.6	21.7	13.9	27.9
Panel E. With any 14-17 years children				
Jan 2017 - Dec 2019	38.4	25.9	12.5	31.3
February 2020	38.2	26.9	11.3	31.8
April 2020 (COVID)	31.1	20.0	11.1	24.8
May 2020 (COVID)	33.8	21.4	12.4	26.7
June 2020 (COVID)	35.0	21.6	13.4	27.4
July 2020 (COVID)	34.8	21.5	13.3	27.2
August 2020 (COVID)	35.5	22.9	12.6	28.4

Note: The sample consists of all people ages 25 to 55 years. Average weekly working hours on all jobs are top-coded to 60 hours and include zero hours for those not working. All calculations use CPS sample weights.

Table 3. Difference-in-Difference Estimates Relative to Men

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	All	No kid	Any 0-5 kid	Any 6-17 kid	Only 0-5 kid	Only 6-17 kid
Panel A. Employment to population ratio						
April * Female	-0.0112*	-0.0038	-0.0018	-0.0213**	-0.0202	-0.0374***
	(0.0060)	(0.0083)	(0.0133)	(0.0096)	(0.0183)	(0.0110)
May * Female	-0.0164***	-0.0133	-0.0121	-0.0332***	0.0013	-0.0394***
	(0.0061)	(0.0084)	(0.0134)	(0.0095)	(0.0184)	(0.0109)
June * Female	-0.0128**	-0.0059	-0.0018	-0.0341***	0.0038	-0.0480***
	(0.0061)	(0.0084)	(0.0135)	(0.0096)	(0.0182)	(0.0109)
July * Female	-0.0140**	-0.0127	0.0099	-0.0278***	0.0110	-0.0442***
	(0.0061)	(0.0084)	(0.0134)	(0.0094)	(0.0186)	(0.0107)
August * Female	-0.0179***	-0.0128	-0.0025	-0.0281***	-0.0183	-0.0465***
	(0.0058)	(0.0081)	(0.0129)	(0.0092)	(0.0180)	(0.0105)
Panel B. Hours of work						
April * Female	-0.0205	-0.0011	0.0576	-0.0386	-0.0516	-0.1266**
	(0.0273)	(0.0375)	(0.0598)	(0.0440)	(0.0834)	(0.0509)
May * Female	-0.0597**	-0.0586	0.002	-0.1007**	-0.0137	-0.1612***
	(0.0273)	(0.0375)	(0.0602)	(0.0436)	(0.0837)	(0.0501)
June * Female	-0.1224***	-0.0711*	-0.0423	-0.2476***	-0.0130	-0.3318***
	(0.0277)	(0.0380)	(0.0613)	(0.0441)	(0.0844)	(0.0505)
July * Female	-0.1716***	-0.1504***	-0.0699	-0.2253***	-0.0965	-0.3079***
	(0.0278)	(0.0382)	(0.0616)	(0.0440)	(0.0867)	(0.0507)
August * Female	-0.1228***	-0.0958***	-0.0186	-0.1687***	-0.0992	-0.2709***
	-0.0267	-0.0366	-0.059	(0.0424)	(0.0831)	(0.0489)
Personal	Yes	Yes	Yes	Yes	Yes	Yes
Seasonality	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size	2,057,218	1,130,935	394,156	728,860	197,423	532,127

Notes: The sample consists of all people ages 25 to 55. The dependent variable is the Employment to Population ratio in Panel A and is log weekly working hours on all jobs in Panel B (including zero hours for those not working and top-coded to 60 hours). Log hours are transformed with inverse hyperbolic sine to approximate logs and include zero hours. The sample period covers January 2017 to August 2020. The reference period is February 2020. All specifications include full interaction terms and a constant term. All specifications also control for years of potential work experience and its square, education level, and marital status. All specifications are estimated using CPS sample weights and robust standard errors. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01

Table 4. Triple-Difference Estimates of Changes Due to Presence of Children

Sample:	(1) Any kid + no kid	(2) Any 0-5 kid + no kid	(3) Any 6-17 kid + no kid	(4) Only 0-5 kid + no kid	(5) Only 6-17 kid + no kid
Panel A. Employment to population ratio					
April * Female * Child	-0.0178	0.0008	-0.0175	-0.0167	-0.0331**
	(0.0119)	(0.0157)	(0.0127)	(0.0201)	(0.0138)
May * Female * Child	-0.0129	-0.0006	-0.0199	0.0131	-0.0254*
	(0.0119)	(0.0158)	(0.0127)	(0.0202)	(0.0137)
June * Female * Child	-0.0205*	0.0025	-0.0283**	0.0086	-0.0413***
	(0.0119)	(0.0159)	(0.0128)	(0.0201)	(0.0138)
July * Female * Child	-0.0070	0.0209	-0.0155	0.0222	-0.0308**
	(0.0119)	(0.0158)	(0.0126)	(0.0204)	(0.0136)
August * Female * Child	-0.0134	0.0093	-0.0154	-0.0064	-0.0329**
	(0.0114)	(0.0151)	(0.0122)	(0.0197)	(0.0132)
Panel B. Hours of work					
April * Female * Child	-0.0448	0.0526	-0.0380	-0.0523	-0.1233*
	(0.0540)	(0.0705)	(0.0577)	(0.0913)	(0.0631)
May * Female * Child	-0.0272	0.0504	-0.0429	0.0364	-0.0995
	(0.0539)	(0.0709)	(0.0575)	(0.0917)	(0.0625)
June * Female * Child	-0.1302**	0.0185	-0.1781***	0.0516	-0.2575***
	(0.0545)	(0.0720)	(0.0582)	(0.0926)	(0.0632)
July * Female * Child	-0.0510	0.0693	-0.0783	0.0454	-0.1546**
	(0.0548)	(0.0725)	(0.0583)	(0.0948)	(0.0635)
August * Female * Child	-0.0610	0.0706	-0.0748	-0.0069	-0.1719***
	(0.0525)	(0.0693)	(0.0559)	(0.0906)	(0.0611)
Personal	Yes	Yes	Yes	Yes	Yes
Seasonality	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Sample Size	2,057,218	1,525,091	1,859,795	1,328,358	1,663,062

Notes: The sample consists of all people ages 25 to 55. The dependent variable is the Employment to Population ratio in Panel A and is log weekly working hours on all jobs in Panel B (including zero hours for those not working and top-coded to 60 hours). Log hours are transformed with inverse hyperbolic sine to approximate logs and include zero hours. The sample period covers January 2017 to August 2020. The reference period is February 2020. All specifications include full interaction terms of the triple interaction and a constant term. The child indicator equals to 1 for the presence of children of different ages and equals to 0 for no presence of children. All specifications also control for years of potential work experience and its square, education level, and marital status. All specifications are estimated using CPS sample weights and robust standard errors. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01

Table 5. Risk Factors for Unemployment from COVID-19

	Risk Factor (Feb. 2017 – Feb. 2020)			April 2020 to August 2020
	Men	Women	Total	National Unemployment Rate
Essential				
Nonessential industry	11.8%	17.1%	14.2%	20.0%
Essential industry	88.3%	82.9%	85.8%	8.6%
Education				
High school dropout	8.8%	5.6%	7.3%	17.0%
High school grad	28.1%	21.2%	24.9%	13.3%
Some college	25.5%	27.8%	26.6%	11.5%
College grad	24.7%	28.2%	26.3%	7.9%
Graduate school	13.0%	17.3%	15.0%	4.8%
Region				
Northeast	17.1%	17.7%	17.3%	12.0%
Midwest	20.7%	21.3%	21.0%	9.6%
South	37.3%	37.5%	37.4%	8.8%
West	25.0%	23.6%	24.3%	11.2%
Experience				
Potential experience (years)	20.4	20.0	20.2	
Less than median				10.4%
More than median				9.7%
Major industry				
Agriculture, forestry, fishing, and hunting	1.8%	0.8%	1.3%	5.2%
Mining	0.9%	0.2%	0.5%	11.6%
Construction	13.2%	1.6%	7.8%	10.5%
Manufacturing	13.7%	6.6%	10.4%	9.3%
Wholesale and retail trade	12.2%	11.0%	11.7%	10.4%
Transportation and utilities	8.1%	3.0%	5.7%	11.7%
Information	2.3%	1.6%	2.0%	9.2%
Financial activities	6.3%	8.0%	7.1%	4.7%
Professional and business services	14.3%	11.7%	13.1%	7.5%
Educational and health services	10.7%	37.3%	23.2%	7.9%
Leisure and hospitality	7.2%	8.2%	7.7%	29.6%
Other services	4.1%	5.3%	4.7%	14.7%
Public administration	5.2%	4.7%	5.0%	3.0%
Major occupation				
Management, business, and financial occupations	17.9%	17.2%	17.6%	4.8%
Professional and related occupations	20.1%	30.8%	25.1%	6.7%
Service occupations	12.8%	19.3%	15.9%	18.7%
Sales and related occupations	8.8%	9.1%	8.9%	10.9%
Office and administrative support occupations	5.7%	16.5%	10.8%	9.2%
Farming, fishing, and forestry occupations	1.0%	0.4%	0.7%	9.9%
Construction and extraction occupations	10.7%	0.4%	5.9%	12.9%
Installation, maintenance, and repair occupations	5.9%	0.3%	3.3%	9.3%
Production occupations	7.5%	3.4%	5.6%	12.8%
Transportation and material moving occupations	9.4%	2.5%	6.2%	15.0%
Telework				
Share of jobs that can be done at home	33.1%	46.2%	39.2%	
Less than median				12.6%
More than median				7.5%
Health risk				
Exposed to health risk index (Z-score)	-0.24	0.27	0.00	
Less than median				8.5%
More than median				11.8%

Notes: Calculated by author using CPS microdata based on February 2017 to February 2020. Sample includes all individuals ages 25 to 55 in the labor force. The last column shows the April to August national unemployment rate in 2020.

Table 6. Nonlinear Decompositions of Unemployment

	(1)	(2)	(3)	(4)	(5)	(6)
	February	April	May	June	July	August
Female Unemployment Rate	2.98	13.53	12.09	10.38	9.97	8.06
Male Unemployment Rate	3.75	11.99	10.43	9.18	8.61	7.17
Female – Male Gap	-0.76	1.54	1.66	1.2	1.36	0.9
Essential/Major Industry	-0.15	1.03***	0.91***	0.36	0.59**	0.16
	(0.16)	(0.33)	(0.31)	(0.29)	(0.28)	(0.25)
Major Occupation	-0.57***	-1.11***	-1.03***	-0.74**	-0.96***	-0.69**
	(0.18)	(0.36)	(0.35)	(0.31)	(0.31)	(0.27)
Education	-0.24***	-0.68***	-0.67***	-0.46***	-0.44***	-0.47***
	(0.05)	(0.10)	(0.10)	(0.09)	(0.10)	(0.09)
State	0.01	0.04	-0.04	-0.02	0.00	-0.03
	(0.02)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)
Potential Experience	0.04*	0.05**	0.09***	0.13***	0.10***	0.12***
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Telework	-0.07	-0.41***	-0.35***	-0.32**	0.12	-0.06
	(0.06)	(0.14)	(0.13)	(0.12)	(0.12)	(0.11)
Health Risk (Z-score)	0.06	-0.29*	-0.19	-0.03	-0.10	-0.07
	(0.08)	(0.17)	(0.17)	(0.15)	(0.14)	(0.14)
Sample Size	37,926	31,038	30,074	28,755	29,382	30,957

Notes: All nonlinear decomposition specifications use pooled coefficient estimates from the full sample of male and female. Sampling weights are used in all specifications. Standard errors are reported in parentheses below contribution estimates.

Appendix

Table A.1. Difference-in-Difference Estimates Relative to Men, Married Sample

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	All	No kid	Any 0-5 kid	Any 6-17 kid	Only 0-5 kid	Only 6-17 kid
Panel A. Employment to population ratio						
April * Female	-0.0145*	-0.0139	0.0007	-0.0146	-0.0110	-0.0262**
	(0.0074)	(0.0122)	(0.0143)	(0.0106)	(0.0196)	(0.0122)
May * Female	-0.0155**	-0.0048	-0.0076	-0.0350***	0.0149	-0.0387***
	(0.0074)	(0.0122)	(0.0143)	(0.0105)	(0.0198)	(0.0121)
June * Female	-0.0092	0.0057	0.0122	-0.0328***	0.0258	-0.0471***
	(0.0075)	(0.0123)	(0.0144)	(0.0106)	(0.0196)	(0.0121)
July * Female	-0.0131*	-0.0085	0.0188	-0.0267**	0.0240	-0.0443***
	(0.0074)	(0.0122)	(0.0144)	(0.0105)	(0.0199)	(0.0121)
August * Female	-0.0120*	0.0033	0.0127	-0.0248**	-0.0108	-0.0507***
	(0.0071)	(0.0117)	(0.0138)	(0.0102)	(0.0192)	(0.0118)
Panel B. Hours of work						
April * Female	-0.0333	-0.0453	0.0672	-0.0155	-0.0305	-0.0931*
	(0.0340)	(0.0561)	(0.0644)	(0.0483)	(0.0895)	(0.0561)
May * Female	-0.0341	-0.0103	0.0470	-0.0983**	0.0844	-0.1493***
	(0.0338)	(0.0554)	(0.0647)	(0.0480)	(0.0905)	(0.0556)
June * Female	-0.1213***	-0.0556	0.0045	-0.2359***	0.0710	-0.3141***
	(0.0343)	(0.0564)	(0.0658)	(0.0484)	(0.0912)	(0.0558)
July * Female	-0.1652***	-0.1248**	-0.0546	-0.2209***	-0.0755	-0.3040***
	(0.0344)	(0.0564)	(0.0663)	(0.0487)	(0.0934)	(0.0567)
August * Female	-0.0921***	-0.0263	0.0481	-0.1502***	-0.0768	-0.2887***
	(0.0330)	(0.0542)	(0.0636)	(0.0468)	(0.0892)	(0.0544)
Personal	Yes	Yes	Yes	Yes	Yes	Yes
Seasonality	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size	1,205,244	470,510	320,817	576,254	158,480	413,917

Notes: The sample consists of all married people ages 25 to 55. The dependent variable is the Employment to Population ratio in Panel A and is log weekly working hours on all jobs in Panel B (including zero hours for those not working and top-coded to 60 hours). Log hours are transformed with inverse hyperbolic sine to approximate logs and include zero hours. The sample period covers January 2017 to August 2020. The reference period is February 2020. All specifications include full interaction terms and a constant term. All specifications also control for years of potential work experience and its square, education level, and marital status. All specifications are estimated using CPS sample weights and robust standard errors. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01

Table A.2. Triple-Difference Estimates of Changes Due to Presence of Children, Married Sample

Sample:	(1) Any kid + no kid	(2) Any 0-5 kid + no kid	(3) Any 6-17 kid + no kid	(4) Only 0-5 kid + no kid	(5) Only 6-17 kid + no kid
Panel A. Employment to population ratio					
April * Female * Child	-0.0004	0.0149	-0.0012	0.0044	-0.0126
	(0.0153)	(0.0188)	(0.0161)	(0.0231)	(0.0172)
May * Female * Child	-0.0199	-0.0023	-0.0309*	0.0212	-0.0343**
	(0.0153)	(0.0188)	(0.0161)	(0.0233)	(0.0171)
June * Female * Child	-0.0265*	0.0071	-0.0398**	0.0219	-0.0536***
	(0.0154)	(0.0189)	(0.0162)	(0.0231)	(0.0172)
July * Female * Child	-0.0086	0.0274	-0.0202	0.0340	-0.0371**
	(0.0153)	(0.0188)	(0.0161)	(0.0233)	(0.0171)
August * Female * Child	-0.0266*	0.0095	-0.0299*	-0.0121	-0.0553***
	(0.0147)	(0.0180)	(0.0155)	(0.0224)	(0.0166)
Panel B. Hours of work					
April * Female * Child	0.0234	0.1142	0.0275	0.0224	-0.0491
	(0.0704)	(0.0855)	(0.0740)	(0.1058)	(0.0793)
May * Female * Child	-0.0513	0.0601	-0.0916	0.1041	-0.1408*
	(0.0698)	(0.0852)	(0.0733)	(0.1062)	(0.0784)
June * Female * Child	-0.1173*	0.0628	-0.1861**	0.1376	-0.2618***
	(0.0708)	(0.0867)	(0.0743)	(0.1074)	(0.0793)
July * Female * Child	-0.0717	0.0712	-0.1050	0.0608	-0.1844**
	(0.0711)	(0.0870)	(0.0745)	(0.1092)	(0.0799)
August * Female * Child	-0.1145*	0.0768	-0.1323*	-0.0350	-0.2686***
	(0.0681)	(0.0834)	(0.0715)	(0.1040)	(0.0766)
Personal	Yes	Yes	Yes	Yes	Yes
Seasonality	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Sample Size	1,205,244	791,327	1,046,764	628,990	884,427

Notes: The sample consists of all married people ages 25 to 55. The dependent variable is the Employment to Population ratio in Panel A and is log weekly working hours on all jobs in Panel B (including zero hours for those not working and top-coded to 60 hours). Log hours are transformed with inverse hyperbolic sine to approximate logs and include zero hours. The sample period covers January 2017 to August 2020. The reference period is February 2020. All specifications include full interaction terms of the triple interaction and a constant term. The child indicator equals to 1 for the presence of children of different ages and equals to 0 for no presence of children. All specifications also control for years of potential work experience and its square, education level, and marital status. All specifications are estimated using CPS sample weights and robust standard errors. Standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01