COVID-19 Disruptions Disproportionately Affect Female Academics

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The underrepresentation of women in academia is well-established. Prior to the COVID-19 pandemic, women represented only about one third of all full professors in the US and even less in Canada and Europe; published fewer articles and received fewer grants and citations than men; and were less likely to get tenure and get promoted (Catalyst 2020; Hechtman et al. 2018; Holman et al. 2018; Huang et al. 2020). There exists considerable heterogeneity by discipline, with women representing a mere 15 percent of authors in mathematics, physics, and computer science (Huang et al. 2020). Some of these gaps may be explained by differential family responsibilities: academic women bear a disproportionate burden of childcare in the household and suffer a so-called "motherhood penalty" (Ceci et al. 2014; Cheng 2020).

The spread of the COVID-19 pandemic and the subsequent countermeasures such as school closures, are likely to exacerbate these gaps. For example, Squazzoni et al. (2020) find a widening of the gender gap in submissions to Elsevier journals, with the deficit particularly pronounced among women at more advanced stages of their careers. Amano-Patiño et al. (2020) focus on economics working paper series and show that women are being left out of COVID-19-related research, with the largest gender gap among mid-career economists.

What can explain the disproportionate productivity slowdown among female scholars since the onset of the pandemic? Alon et al. (2020) predict that the short-term increase in gender inequality would be due to the disproportionate childcare burden falling upon women amid school and daycare closures. We present new survey evidence on the time use of academic researchers before and after the disruptions due to COVID-19 to test this

hypothesis.[1] Although we find that all respondents with children experienced a decrease in research hours since the onset of the pandemic, female academics with children—especially young children—were significantly more disadvantaged. We find that research as well as self-care (sleep and other activities) were crowded out by a significant increase in time spent on childcare and other housework.

I. The Survey of Academics

We sent a survey via email to approximately 900,000 individuals who had published at least one academic article in the past five years. The distribution window, including two follow-up reminders, was from May 27, 2020 to July 21, 2020, yielding a total of 27,991 responses. Detailed information about the survey is provided in the online appendix.

The main survey question of interest asked the respondents to estimate, both before and after the start of the COVID-19 disruptions, the average number of hours in a given workday they spent on research, all other job-related activities, childcare, commuting to and from work, house work, sleep, and all other activities (which would presumably include hobbies, exercise, entertainment, and other non-work activities). Our main explanatory variables are gender and the number and ages of child dependents, but we also collected information on other life circumstances such as presence of elderly dependents, marital status, and partner employment and time allocation. Respondents also reported the year of their PhD, their research area, academic rank, resources required for research success (such as equipment or access to human subjects), and basic demographics. Finally, we asked about changes to research funding and institutional-level changes to promotion policies since the onset of the pandemic.

III. Data and Pre-COVID Trends

Before we present the main results, we describe our sample and pre-pandemic trends. We focus on respondents with a doctorate degree who self-identified as either male or female and whose time use answers for both before and after the pandemic add up to 24 hours per day. 19,905 respondents satisfied these criteria: 11,901 men and 8,004 women.[2]

Figure 1 shows that on a typical workday prior to COVID-19, female academics spent

[1] To our knowledge, Myers et al. (2020) is the only other study to quantify the short-term effects of increased childcare burdens on female scientists, finding consistent patterns. Our sample is larger and more globally representative, including responses from outside of the US and Europe.

[2] See the online appendix for summary statistics of demographic characteristics. The results are very similar when we use a sample of tenure-track (or equivalent) faculty only (see the online appendix).

about 30 minutes less time on research and 20 minutes more time on other job-related activities, relative to men. Women also spent about 40 more minutes per day on childcare and 10 more minutes on other household activities. Women also reported spending 43 minutes less than men on other non-work activities. Finally, there were no meaningful gender differences in pre-COVID commuting or sleep times.

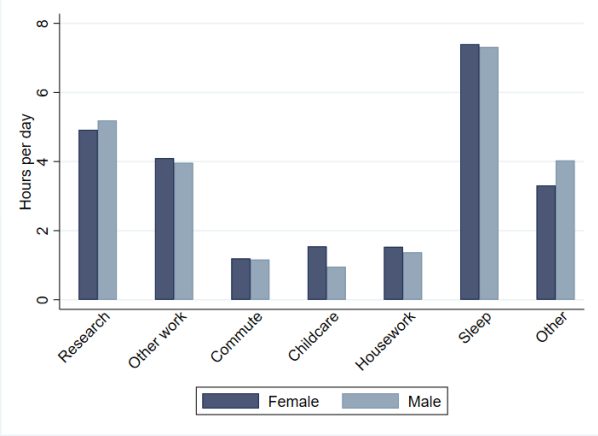

FIGURE 1. MEAN NUMBER OF HOURS SPENT ON EACH ACTIVITY BEFORE COVID-19 BY GENDER

Note: All comparisons by gender are statistically significant at the 1 percent confidence level.

II. Empirical Framework

We use a difference-in-differences approach to estimate the effect of COVID-19 disruptions on how academics allocate their time on a typical workday. Equation (1) captures the change in time use for female relative to male academics:

(1) $\Delta TimeUse_i = \alpha + \beta Female_i + \varepsilon_i$,

where *i* indexes individual respondents.

The variables $\Delta TimeUse_i$ represent the difference in hours spent on a given activity pre- and post-COVID-19 (a negative value signifies a drop in hours since the pandemic). $Female_i$ is an indicator for the respondent being female. Our hypothesis is that the coefficient, β, is negative for research, sleep, and other activities, and positive for childcare and other housework.

Equation (2), our main specification, decomposes the effects of the pandemic further by the number of dependent children who live with the respondent:

(2) $\Delta TimeUse_i = \alpha + \beta_1 Female_i + Kids_i'\beta_2 + [Female \times Kids]'_i\,\beta_{12} + X_i'\gamma + \sigma_t + \varepsilon_i$.

$Kids_i$ is a vector of indicators for the number of child dependents in the care of respondent *i* with possible values of 0, 1, 2, and 3 or more, while $Female \times Kids_i$ is a vector of interaction terms between the respondent's gender and the number of children in her family. The vector X_i is a set of respondent characteristics that includes year of PhD fixed effects. In our robustness checks, we expand X_i to include other controls, such as indicators for race and ethnicity, an indicator for STEM

research area, and an indicator for being located in the European Economic Area. Finally, σ_t are fixed effects for the date on which the respondent completed the survey. Our hypothesis is that the coefficients β_2 and β_{12} will both be negative for research time use, indicating a negative productivity shock on respondents with children that is more pronounced for women. We also estimate heterogeneous effects of COVID-19 on female academics by age of youngest child by additionally including a vector of interaction terms between the respondent's gender and the age of the youngest child in the household in Equation (2).

IV. Results: The Effect of COVID-19 on the Gender Differences in Time Use

The pandemic decreased daily work hours by about one hour per day relative to the pre-pandemic 9.1-hour average, with time spent on research driving the vast majority of the decrease (time spent on other job-related activities decreased by 3 minutes on average). This is consistent with teaching and service duties being more difficult to cut back on than research, making the latter more likely to be pushed aside when overall work time becomes more limited. Time spent commuting fell by an hour, while time spent on childcare and housework increased by an hour and 45 minutes a day, respectively. On average, sleep and other activities remained unchanged.

Figure 2 decomposes the overall impact by gender, plotting $\hat{\alpha}$ (the estimated effect on males) and $\hat{\alpha} + \hat{\beta}$ (the estimated effect on females) from Equation (1) for each of our time use outcomes. The results document a disproportionate decline in research time among female faculty relative to male faculty. There are no differential effects by gender on other job-related activities. The larger drop in research time among women is mirrored by a disproportionate increase in time spent on childcare and other housework. We also find that women are spending slightly less time on other non-work activities relative to the pre-pandemic levels, while men are spending slightly more. On the other hand, men, but not women, are sleeping more than prior to the pandemic, although the magnitudes of these effects are small.

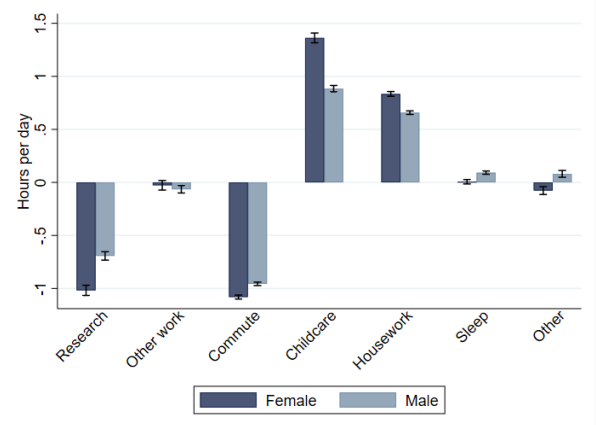

FIGURE 2. THE CHANGE IN THE NUMBER OF HOURS SPENT ON EACH ACTIVITY BY GENDER

Note: Bars represent 95% confidence intervals using robust standard errors.

Next, we decompose the gendered effects of the pandemic on research time by the number of children in the household (Equation (2)). On average, childless men report spending 43 fewer minutes on research post-COVID disruptions, and there is no significant difference on this dimension between childless women and childless men (Figure 3).

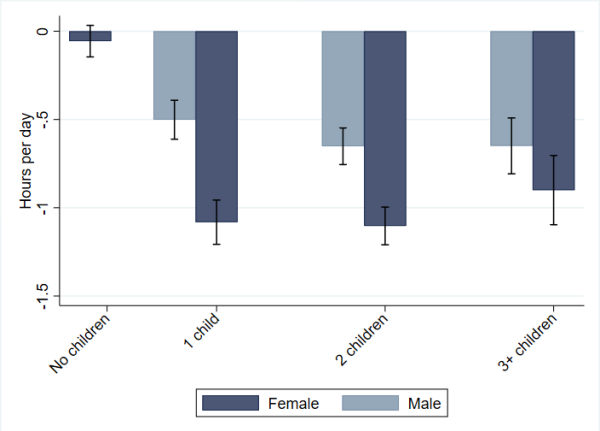

FIGURE 3. THE CHANGE IN THE NUMBER OF HOURS SPENT ON RESEARCH BY GENDER AND NUMBER OF CHILDREN

Note: Estimates from OLS regressions with interactions for gender and number of children indicators. Controls include PhD year and date of survey completion FE. Bars represent 95% confidence intervals using robust standard errors.

Figure 3 further demonstrates that having a child is correlated with a significantly larger post-pandemic decrease in research time for both genders, but the effect is doubled for female academics. Overall, women with children lose about an hour of research time per day relative to childless men. Men with children lose 30 minutes of research time relative to men with no children. Importantly, the widening of the male-female research time gap is driven by the presence of at least one child in the family: we do not observe any significant additional declines in research time as the number of children increases, regardless of gender.

When we look at the effects of the pandemic by the age of the youngest child (controlling for the total number of children), we observe that the most severe disruptions occur in families with the youngest child under 7 years of age (Figure 4).

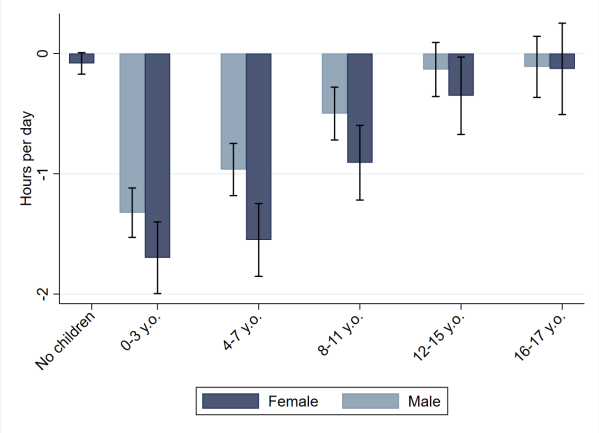

FIGURE 4. THE CHANGE IN THE NUMBER OF HOURS SPENT ON RESEARCH BY GENDER AND AGE OF YOUNGEST CHILD

Note: Estimates from OLS regressions with interactions for gender and age of youngest child indicators. Controls include PhD year and date of survey completion FE, # children indicators and their interactions with gender. Bars represent 95% confidence intervals using robust standard errors.

In the online appendix, we show that the largest relative drop in research time occurs for women with children under 1 year of age (nearly 2 hours per day). We also confirm that the results are robust to the inclusion of other controls, and when we decompose the sample by research field.

V. Discussion

Our time-use survey suggests that the short-term adverse productivity effects of the pandemic disproportionately fall on female academics with children. The widest gender gaps emerged for those with young children.

It is likely that our results underestimate lost research time among academics with children. First, we suspect that the most overburdened individuals would be less likely to respond to our survey, which means that they may be underrepresented in our data. Second, parents supervising children at home may simultaneously engage in childcare and research activities, making them less productive in both.

It is also important to recognize that a decrease in the time faculty spend on research does not necessarily translate into a proportionate decline in productivity. Researchers may have sought to increase work efficiency to counteract the time limitations created by the pandemic. In future work, we plan to connect publication records of respondents (including working papers) to their survey responses to assess the effect on research output.

It is also worth noting that neither time use nor productivity impacts allow us to evaluate the detrimental effects of the pandemic on overall welfare. Even if female researchers do not end up with fewer publications because they manage to make up for lost time by working more intensely or by successfully navigating the double-duty of childcare and research, the outcome may not be welfare-neutral because the researchers may experience adverse mental health effects as a result. Assessing the differential effects of the pandemic on overall well-being of academics is an important direction for future research.

In light of the disruptions caused by the pandemic, many colleges and universities responded by either automatically extending tenure clocks and reappointment decisions by one year or by instituting a no-questions-asked policy, where any faculty member could apply for an extension. However, such a universal approach may further exacerbate gender gaps, as has been shown to happen with universal parental leave policies (Antecol, Bedard, and Stearns 2018). More flexible or targeted approaches would potentially produce more equitable outcomes. In the longer term, institutions may need to reevaluate faculty benefits, going beyond parental leave and focusing on supporting broader access to childcare.

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