

COVID-19 Disruptions Disproportionately Affect Female Academics*

Tatyana Deryugina[†]
U Illinois, Urbana-Champaign

Olga Shurchkov[‡]
Wellesley College

Jenna Stearns[§]
UC Davis

January 12, 2021

Abstract

The rapid spread of the COVID-19 pandemic and subsequent countermeasures, such as school closures, the shift to working from home, and social distancing are disrupting economic activity around the world. As with other major economic shocks, there are winners and losers, leading to increased inequality across certain groups. In this project, we investigate the effects of COVID-19 disruptions on the gender gap in academia. We administer a global survey to a broad range of academics across various disciplines to collect nuanced data on the respondents' circumstances, such as a spouse's employment, the number and ages of children, and time use. We find that female academics, particularly those who have children, report a disproportionate reduction in time dedicated to research relative to what comparable men and women without children experience. Both men and women report substantial increases in childcare and housework burdens, but women experienced significantly larger increases than men did.

Key Words: gender differences, COVID-19, academia

JEL Classifications: D10, J16, J4

* We gratefully acknowledge helpful feedback from Kristin Butcher, Marina Chugunova, Pinar Keskin, G. Kartini Shastry, Olga Stoddard, and participants in the Wellesley College Economics Research Seminar, the Max Planck Innovation & Entrepreneurship Seminar, and the session "Gender Disparities: Evidence on Causes and Implications" at the 2021 ASSA meetings. Aria Novianto provided excellent research assistance. Any remaining errors are our own.

[†]University of Illinois, Urbana-Champaign, 4050 Business Instructional Facility, 515 Gregory Drive, Champaign, IL 61820 (e-mail: deryugin@illinois.edu)

[‡]Corresponding author. Wellesley College, 106 Central St., Wellesley, MA, 02481 (email: olga.shurchkov@wellesley.edu)

[§]UC Davis, 1114 SSH, 1 Shields Avenue, Davis, CA 95616 (e-mail: jestearns@ucdavis.edu)

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 an even smaller proportion in Canada and Europe. Moreover, women published fewer articles, received fewer grants and citations, and were less likely to be granted tenure or promoted than men (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 and suffer a so-called “motherhood penalty” (Ceci et al. 2014; Cheng 2020).

The spread of the COVID-19 pandemic and subsequent countermeasures such as school closures are likely to exacerbate these gaps. For example, Squazzoni et al. (2020) find that the gender gap in submissions to Elsevier journals is widening, with the deficit particularly pronounced among women who have reached 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. To test this hypothesis, we analyze new survey evidence pertaining to the use of time by academic researchers before and after the disruptions caused by COVID-19.¹ Although we find that all respondents with children experienced reduced research hours since the onset of the pandemic, female academics with children—especially those with young children—were disadvantaged to a significantly greater extent. We find that research as well as self-care (sleep and other activities) have been crowded out by a significant increase in time spent on childcare and other housework.

¹ To the best of 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 patterns that are consistent with our findings. Our sample is larger and more globally representative, including responses from outside of the US and Europe.

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, ran 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, housework, 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 the presence of elderly dependents, marital status, and partner employment and time allocation. Respondents also reported the years of attaining their PhDs, their research areas, academic ranks, resources required for research success (such as equipment or access to human subjects), and basic demographics. Finally, we asked about changes in research funding and institutional-level changes in promotion policies since the onset of the pandemic.

III. Data and Pre-COVID Trends

Before we present the main results of our survey, we describe our sample and pre-pandemic trends. We focus on respondents with doctoral degrees who self-identified as either male or female and whose time-use answers for add up to 24 hours per day. A total of 19,905 respondents satisfied these criteria: 11,901 men and 8,004 women.²

Figure 1 shows that, on a typical workday prior to the spread of COVID-19, female academics spent about 30 minutes less time on research and 20 minutes more time on other job-related activities than men did. 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 time than men on other non-work activities. Finally, there were no meaningful gender differences in pre-COVID commuting or sleep times.

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

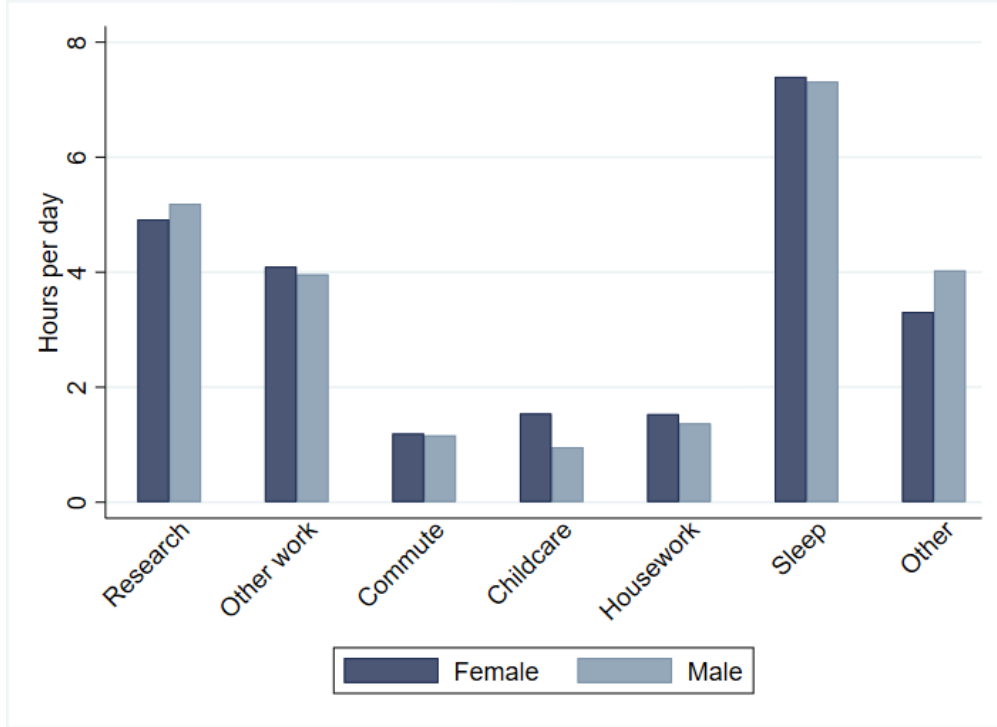


FIGURE 1. MEAN NUMBER OF HOURS SPENT ON EACH ACTIVITY BEFORE COVID-19 BY GENDER
Note: All comparisons by gender are statistically significant at the 1 percent confidence level.

II. Empirical Framework

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

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

where i indexes individual respondents. The $\Delta TimeUse_i$ variables 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 of a respondent's 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, further decomposes the effects of the pandemic by the number of dependent children who live with a respondent:

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

$Kids_i$ 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 representing the relationship between a 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 of race and ethnicity, an indicator of STEM research area, and an indicator of being located in the European Economic Area. Finally, σ_t represent fixed effects for the date on which a 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 disruptions on female academics by the age of a youngest child by additionally including in Equation (2) a vector of interaction terms that capture the relationship between a respondent's gender and the age of the youngest child in the respondent's household.

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

The pandemic reduced 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 reduction (time spent on other job-related activities decreased by 3 minutes on average). This is consistent with the notion that teaching and service duties are more difficult to cut back on than research, making it more likely that the latter is 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 one hour a day and by 45 minutes a day, respectively. On average, sleep and other activities remained unchanged.

Figure 2 decomposes the overall impact of COVID-19 disruptions by gender, plotting $\hat{\alpha}$ (the estimated effects on males) and $\hat{\alpha} + \hat{\beta}$ (the estimated effects on females) from Equation (1) for each of our time-use outcomes.

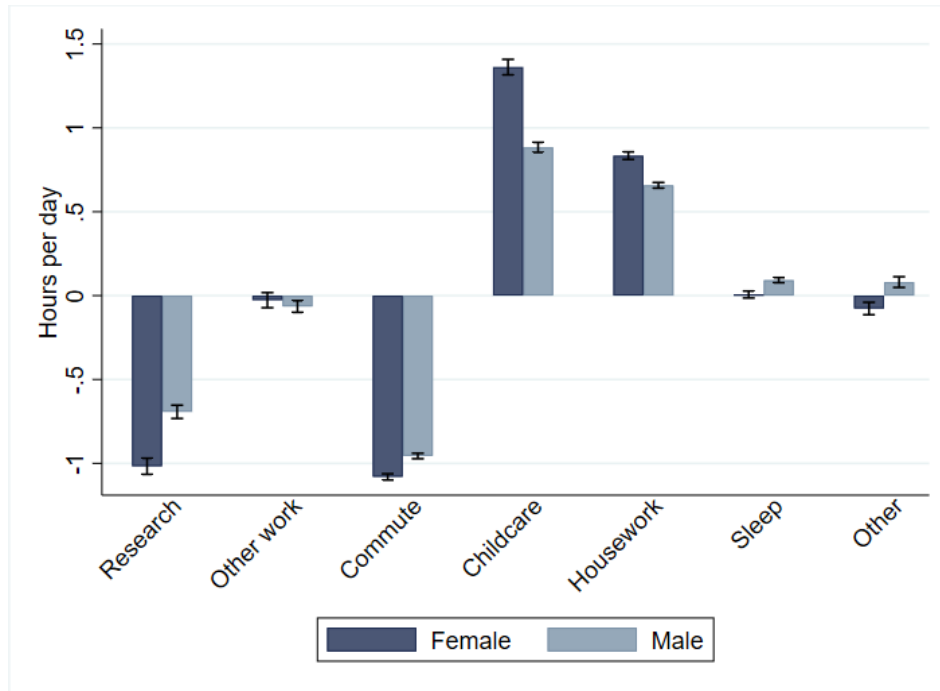


FIGURE 2. CHANGES IN THE NUMBER OF HOURS SPENT ON EACH ACTIVITY BY GENDER

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

The results document a disproportionate decline in research time among female academics relative to research time among male academics. 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 than they did prior to the pandemic, while men are spending slightly more time on such activities. On the other hand, men, but not women, are sleeping more than they did prior to the pandemic, although the magnitudes of these effects are small.

Next, we decompose the gendered effects of the pandemic on research time by the number of children in a household (Equation (2)). On average, childless men report spending 25 fewer minutes on research post-COVID disruptions, and there is no significant difference along this dimension between childless women and childless men (Figure 3).

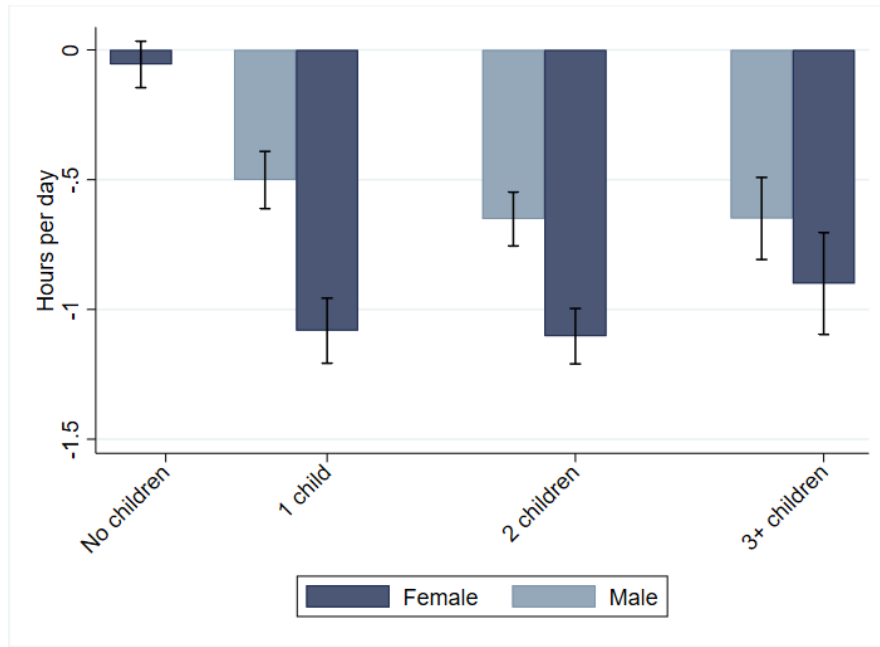


FIGURE 3. CHANGES IN THE NUMBER OF HOURS SPENT ON RESEARCH BY GENDER AND NUMBER OF CHILDREN

Note: Estimates from OLS regressions with interactions for gender and number of children indicators. Controls include PhD-year and date-of-survey-completion fixed effects. Error 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 reduction in research time for both genders, but the effects are doubled for female academics. Overall, women with children lose about an hour of research time per day more than childless men do. Men with children lose 30 minutes of research time more than 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 a 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 reference to the age of the youngest child (controlling for the total number of children), we observe that the most severe disruptions occur in families in which the youngest child is under 7 years of age (Figure 4).

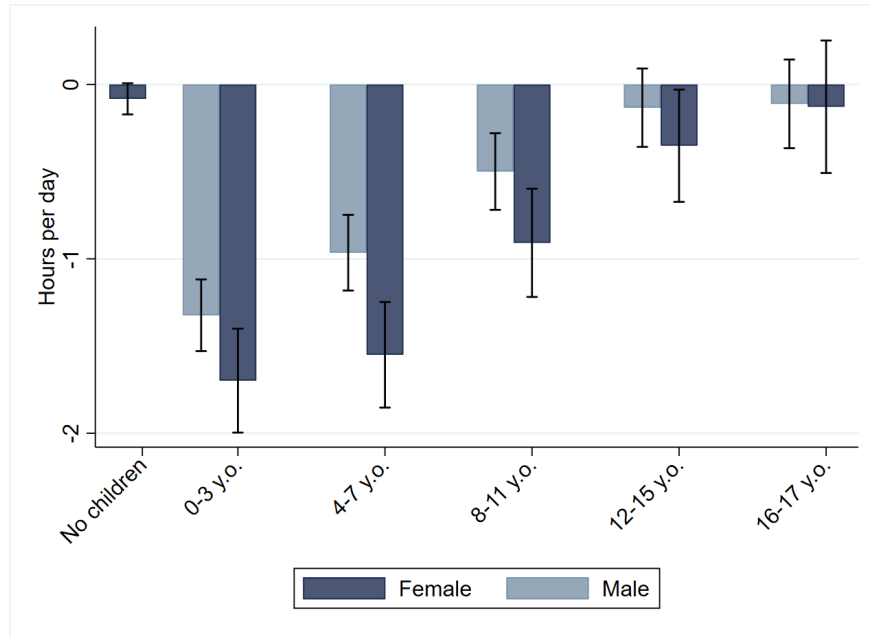


FIGURE 4. CHANGES IN THE NUMBER OF HOURS SPENT ON RESEARCH BY GENDER AND AGE OF YOUNGEST CHILD

Note: Estimates from OLS regressions with interactions for gender and age of youngest child indicators. Controls include PhD-year and date-of-survey-completion fixed effects, number of children indicators and their interactions with gender. Error 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 to decomposing the sample by research field.

V. Discussion

Our time-use survey suggests that the short-term adverse productivity effects of the pandemic fall disproportionately 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 engage simultaneously 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 effects 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 burden 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 academics' overall well-being 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, whereby any faculty member could apply for an extension. Such a universal approach may, however, further exacerbate gender gaps, as has been shown to occur with universal parental leave policies (Antecol, Bedard, and Stearns 2018). Whether more flexible or targeted approaches are feasible or would produce more equitable outcomes remains an open question.

REFERENCES

- Alon, Titan, Doepke, Matthias, Olmstead-Rumsey, and Michele Tertilt. 2020. “The Impact of COVID-19 on Gender Equality” NBER Working Paper No. 26947.
- Amano-Patiño, Noriko, Faraglia, Elisa, Giannitsarou, Chryssi, and Zeina Hasna. 2020. “The Unequal Effects of COVID-19 on Economists’ Research Productivity” Cambridge Working Papers in Economics: 2038.
- Antecol, Heather, Bedard, Kelly, and Jenna Stearns. 2018. “Equal but Inequitable: Who Benefits from Gender-Neutral Tenure Clock Stopping Policies?” *American Economic Review* 108 (9): 2420-41.
- Catalyst. 2020. “Women in Academia” <https://www.catalyst.org/research/women-in-academia/>
- Cheng, Stephanie. 2020. “Careers Versus Children: How Childcare Affects the Academic Tenure-Track Gender Gap,” Working paper.
- Ceci, Stephen J., Donna K. Ginther, Shulamit Kahn, and Wendy M. Williams. 2014. “Women in Academic Science: A Changing Landscape.” *Psychological Science in the Public Interest* 15 (3): 75–141.
- Hechtman, Lisa A., Moore, Nathan P., Schulkey, Claire E., Miklos, Andrew C., Calcagno, Anna Maria, Aragon, Richard, and Judith H. Greenburg. 2018. “NIH Funding Longevity by Gender.” *Proceedings of the National Academy of Sciences* 115 (31): 7943–7948.
- Holman, Luke, Stuart-Fox, Devi, and Cindy E. Hauser. 2018. “The Gender Gap in Science: How Long until Women Are Equally Represented?” *PLOS Biology* 16 (4): e2004956.
- Huang, Junming, Gates, Alexander J., Sinatra, Roberta, and Albert-László Barabási. 2020. “Historical Comparison of Gender Inequality in Scientific Careers Across Countries and Disciplines.” *Proceedings of the National Academy of Sciences* 117 (9): 4609–16.
- Myers, Kyle R., Tham, Wei Yang, Yin, Yian, Cohodes, Nina, Thursby, Jerry G., Thursby, Marie C., Schiffer, Peter, Walsh, Joseph T., Lakhani, Karim R., and Dashun Wang. 2020. “Unequal Effects of the COVID-19 Pandemic on Scientists,” *Nature Human Behavior* 4: 880–3.
- Squazzoni, Flaminio, Bravo, Giangiacomo, Grimaldo, Francisco, Garcia-Costa, Daniel, Farjam, Mike, and Bahar Mehmani. 2020. No Tickets for Women in the COVID-19 Race? A Study on Manuscript Submissions and Reviews in 2347 Elsevier Journals during the Pandemic. Working paper.

SUPPLEMENTARY ONLINE MATERIAL FOR
COVID-19 Disruptions Disproportionately Affect Female Academics

By Tatyana Deryugina, Olga Shurchkov, and Jenna Stearns

Not for publication

Contents

Contents.....	11
A. Recruitment, Consent, and Survey Protocol.....	12
A.1. Email Contents.....	12
A.2. Informed Consent and GDPR Addendum	14
A.3. Survey Instrument	19
B. Survey Data.....	23
B.1. Our Sample	23
B.2. Descriptive Statistics.....	23
C. Additional Analysis	27

A. Recruitment, Consent, and Survey Protocol

The initial invitation to complete our survey was distributed between the dates of May 27 and June 9, 2020, via email to anyone who:

- authored/co-authored a research article in an academic journal published by one of four major academic publishers (Cambridge University Press, Elsevier, Oxford University Press, or Wiley) or in the journals Science, PNAS, or PLOS ONE since 2015
- had a publicly available email address listed on the journal's website. In cases where an email was not listed, we searched for an older contact email associated with the author, going as far back as 2000.
- self-identified as "active researcher with a doctorate degree in an academic appointment at a college, university, government agency, think tank, or other research institution" (screening at consent)

The initial recruitment effort comprised of a total of 916,731 unique email addresses. The first set of reminders were distributed starting June 17th, and the final reminder were distributed starting July 8th. Reminders were not sent to those who already completed the survey or to anyone who unsubscribed or otherwise explicitly requested to be removed from the distribution list.

Potential respondents were first asked if they reside inside the European Economic Area (EEA). Those responding "Yes" were directed to a consent form with a GDPR addendum; the rest were directed to the regular consent form (see below).

A.1. Email Contents

EMAIL SUBJECT: How has COVID-19 affected your academic life?

EMAIL TEXT:



We would like to invite you to participate in a survey funded by the University of California, Davis and the University of Illinois, Urbana-Champaign. We know that your time is extremely scarce these days, and this survey should take **less than 10 minutes**. Your participation will help us understand how the COVID-19 pandemic is affecting the lives of academics. This research will help inform future institutional and governmental responses to similar shocks. **Upon completion, you will be entered to win one of 10 prizes valued at \$100 each, in the form of your choice of an Amazon gift card or a donation in your name to one of the charities listed here.**

Your data will be kept strictly confidential. No data that can be used to identify you will be made publicly available.

Please complete the survey by accessing the following link:
XXXXXX

THIS LINK IS UNIQUELY YOURS AND SHOULD NOT BE SHARED.

Thank you in advance for taking this brief survey. Your participation is very important for the success of this study.

Sincerely,
Tatyana Deryugina, Ph.D.
Assistant Professor of Finance
University of Illinois at Urbana-Champaign
deryugin@illinois.edu

Olga Shurchkov, Ph.D.
Associate Professor of Economics
Director, Knapp Social Science Center
Wellesley College
oshurchk@wellesley.edu

Jenna Stearns, Ph.D.
Assistant Professor of Economics
UC Davis
jestearns@ucdavis.edu

You are being contacted because your email is listed publicly as a contact email on at least one research paper recently published in an academic journal. For information about academic research exemptions to GDPR, please click [here](#). If you have further questions about this study, please do not hesitate to reach out to us at deryugin@illinois.edu, oshurchk@wellesley.edu, or jestearns@ucdavis.edu. To opt out of receiving any future communications about this research, please click [here](#).

A.2. *Informed Consent and GDPR Addendum*

[Non-European Economic Area Consent]

KEY INFORMATION

Thank you for your participation in this research study. If you decide to participate in our survey, you will answer a series of questions. We estimate that this survey will take less than 10 minutes to complete.

The purpose of this research is to understand how the COVID-19 pandemic is affecting time use among academic researchers.

Participation in research is completely voluntary. It is your choice whether or not to participate in this research. If you choose to participate, you may change your mind and quit the study at any time. The risks of this research are minimal and you may decline to answer any questions you do not want to answer.

Upon completion, you will be entered to win one of 10 Amazon gift cards of \$100 value. The lottery will be held after the survey closes and winners will be notified by email within 8 weeks of survey competition. If you choose not to participate in the study but want to enter the lottery, you may do so by entering your name and email when prompted.

Your responses will be kept strictly confidential and no data that can be used to identify you will be made publicly available. The email address you provide will never be shared with anyone outside of the research team and will not be used to contact you after you complete the survey except to notify you about prize winnings. However, individuals from our organizations who oversee research may access your data during audits or other monitoring activities. As with all research, there is a change that confidentiality could be compromised; however, we are taking precautions to minimize this risk. To minimize these risks access to response data will be restricted to members of the research team with approved data security protocols in place, and identifiable data will only be stored as approved by our institutions. We may link your responses to external publicly available information including publication records. If identifiers are removed from your identifiable information, the information could be used to answer additional research questions or shared with other investigators without your additional consent.

The researchers for this study are Tatyana Deryugina, Ph.D. (University of Illinois, Urbana-Champaign deryugin@illinois.edu); Olga Shurchkov, Ph.D. (Wellesley College olga.shurchkov@wellesley.edu); and Jenna Stearns, Ph.D. (University of California, Davis jestearns@ucdavis.edu). If you have any questions about this research, feel free to contact the investigators by email.

This research has been reviewed by the Institutional Review Boards of Wellesley College and the University of California at Davis. If you have any questions about your rights as a participant in this study, please contact the University of California Davis, Institutional Review Board at 916-703-9158 or HS-IRBEducation@ucdavis.edu or the Wellesley College Institutional Review Board at 781-283- 3498 or irb@wellesley.edu

You may wish to print this page for your records.

If you would like to be entered into the lottery to win one of 10 \$100 Amazon gift cards, please provide the information below:

Your first and last name: _____

Your work email address: _____

Please choose from the following options:

1) I consent and I am an active researcher with a doctorate degree in an academic appointment at a college, university, government agency, think tank, or other research institution.

[Take to main survey]

2) I am not an active researcher with a doctorate degree in an academic appointment.

[Survey ends:]

Thank you! Your participation in the study is now over.

3) I do not consent.

[Survey ends:]

Thank you!

[For European Economic Area participants: Consent with GDPR Addendum]
KEY INFORMATION

Thank you for your participation in this research study. If you decide to participate in our survey, you will answer a series of questions. We estimate that this survey will take less than 10 minutes to complete.

The purpose of this research is to understand how the COVID-19 pandemic is affecting time use among academic researchers.

Participation in research is completely voluntary. It is your choice whether or not to participate in this research. If you choose to participate, you may change your mind and quit the study at any time. The risks of this research are minimal and you may decline to answer any questions you do not want to answer.

Upon completion, you will be entered to win one of 10 Amazon gift cards of \$100 value. The lottery will be held after the survey closes and winners will be notified by email within 8 weeks of survey competition. If you choose not to participate in the study but want to enter the lottery, you may do so by entering your name and email when prompted.

Your responses will be kept strictly confidential and no data that can be used to identify you will be made publicly available. The email address you provide will never be shared with anyone outside of the research team and will not be used to contact you after you complete the survey except to notify you about prize winnings. However, individuals from our organizations who oversee research may access your data during audits or other monitoring activities. As with all research, there is a change that confidentiality could be compromised; however, we are taking precautions to minimize this risk. To minimize these risks access to response data will be restricted to members of the research team with approved data security protocols in place, and identifiable data will only be stored as approved by our institutions. We may link your responses to external publicly available information including publication records. If identifiers are removed from your identifiable information, the information could be used to answer additional research questions or shared with other investigators without your additional consent.

The researchers for this study are Tatyana Deryugina, Ph.D. (University of Illinois, Urbana-Champaign deryugin@illinois.edu); Olga Shurchkov, Ph.D. (Wellesley College olga.shurchkov@wellesley.edu); and Jenna Stearns, Ph.D. (University of California, Davis jestearns@ucdavis.edu). If you have any questions about this research, feel free to contact the investigators by email.

This research has been reviewed by the Institutional Review Boards of Wellesley College and the University of California at Davis. If you have any questions about your rights as a participant in this study, please contact the University of California Davis, Institutional Review Board at 916-703-9158 or HS-IRBEducation@ucdavis.edu or the Wellesley College Institutional Review Board at 781-283- 3498 or irb@wellesley.edu

GDPR Addendum

This research will collect data about you that can identify you, referred to as Study Data. The General Data Protection Regulation (“GDPR”) requires researchers to provide this Notice to you when we collect and use Study Data about people who are located in a state that belongs to the European Union or in the European Economic Area. If you reside in these areas during your participation in the Study, your Study Data will be protected by the GDPR in addition to any other laws that might apply.

We will obtain and create Study Data directly from you or from other publicly available sources including publication records and publicly available CVs so we can conduct this research. As we conduct research procedures with your Study Data, new Study Data may be created.

The research team will collect and use the following types of Study data for this research:

- Contact information
- Your racial or ethnic origin
- Information about your job
- Information about your family structure
- Information about your typical time use

This research will keep your Study data for at least 10 years after this research ends. The following categories of individuals may receive Study Data collected or created about you:

- Members of the research team so they properly conduct the research
- Institutional staff will oversee the research to see if it is conducted correctly and to protect your safety and rights
- Representatives of the U.S. Office of Human Research Protections who oversee the research

The research team is based in the United States. The United States does not have the same laws to protect your Study data as States in the EU/EEA. However, the research team is committed to protecting the confidentiality of your Study Data. Additional information about the protections we will use is included in this consent document.

If you reside in the EU or EEA during your participation in the Study, The GDPR gives you rights relating to your Study Data, including the right to:

- Access, correct or withdraw your Study Data; however, the research team may need to keep Study Data as long as it is necessary to achieve the purpose of this research
- Restrict the types of activities the research team can do with your Study Data
- Object to using your Study Data for specific types of activities
- Withdraw your consent to use your Study Data for the purposes outlined in the consent form. Please understand that you may withdraw your consent to use new Study Data but Study Data already collected will continue to be used as outlined in the consent document and in this Notice.

The Regents of the University of California, on behalf of UC Davis, is responsible for the use of your Study Data for this research. The U.C. Davis Privacy Officer is Sharalyn Rasmussen. You can contact Ms. Rasmussen by phone at (916) 734-8808 or by email at smreed@ucdavis.edu if you have:

- Questions about this Notice
- Complaints about the use of your Study Data
- If you want to make a request relating to the rights listed above.

You may also contact the Wellesley College IRB Chair, Dr. Nancy Marshall, at 781-283- 3498 or by email at irb@wellesley.edu

You may wish to print this page for your records.

If you would like to be entered into the lottery to win one of 10 \$100 Amazon gift cards, please provide the information below:

Your first and last name: _____

Your work email address: _____

Please choose from the following options:

1) I consent and I am an active researcher with a doctorate degree in an academic appointment at a college, university, government agency, think tank, or other research institution.

Selecting this option documents that I have freely given my consent to the use of Personal Information as described by the GDPR Addendum.

[Take to main survey]

2) I am not an active researcher with a doctorate degree in an academic appointment.

[Survey ends:]

Thank you! Your participation in the study is now over.

3) I do not consent.

[Survey ends:]

Thank you!

A.3. *Survey Instrument*

MAIN SURVEY: COVID-19 AND TIME USE IN ACADEMIA [Each question appears on a separate screen, unless otherwise specified; fixed order; text in bold red is instructions for survey logic; all questions are optional]

1. Which of the following best describes your academic status?
 - a. Tenure-track faculty, pre-tenure
 - b. Tenure-track faculty, post-tenure
 - c. Junior researcher, not at a college or university
 - d. Senior researcher, not at a college or university
 - e. Non-tenure-track faculty or researcher at a college or university
 - f. Other (Please specify _____)

2. In what year did you complete your highest level of education? [Free response]

3. Which of the following best describes your primary research area?
 - a. Agricultural and animal sciences
 - b. Anthropology
 - c. Archaeology
 - d. Biological sciences
 - e. Business/management/ accounting
 - f. Chemistry
 - g. Computer science
 - h. Communication
 - i. Demography
 - j. Earth and planetary sciences
 - k. Economics/finance
 - l. Education
 - m. Engineering
 - n. Environmental science
 - o. Epidemiology
 - p. Geography
 - q. History
 - r. Languages and literature
 - s. Law
 - t. Materials science
 - u. Mathematics
 - v. Medicine and health
 - w. Music
 - x. Neuroscience
 - y. Pharmacology/toxicology/pharmaceutics
 - z. Philosophy
 - aa. Physics
 - bb. Political science

- cc. Public health
 - dd. Psychology
 - ee. Religious studies
 - ff. Sociology
 - gg. Social work
 - hh. Statistics
 - ii. Visual and performing arts
 - jj. Urban studies
 - kk. Other (please specify)
4. Please tell us who currently resides with you (select all that apply)
- a. I live alone
 - b. Roommate(s)
 - c. Spouse/partner/significant other
 - d. Child dependent(s) [ask Q5]
 - e. Other adult(s)/relative(s) [ask Q6]
5. **[Only ask if selected d on question 4]** Please tell us how many child dependent(s) live in your household.
- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10 or more
6. **[Only ask if selected d on question 4; X is determined by answer to previous question]** Please tell us the current age(s) of the child dependent(s) that live in your household.
- Age (years)
- Dependent 1 _____
- Dependent 2 _____
- ...
- Dependent X _____
7. **[Only ask if selected e on question 4]** Do you help the other adult(s)/relative(s) that live with you with daily self-care tasks (e.g. bathing, dressing, administering medicine)?
- a. Yes
 - b. No

8. Please indicate the importance of the following resources for your research productivity.

	Completely unimportant	Mostly unimportant	Somewhat important	Very important
Research laboratory/ physical research equipment (other than computer)				
Computing or library resources not available through remote access				
Research collaborators (non-student)				
Research assistants/PhD student collaborators/post-docs				
In-person human subjects				
Research field sites				
Other (please specify)				

9. To the best of your ability, please estimate the number of HOURS you spend on the activities below on a given WORKDAY both before and after any disruptions created by COVID-19. (Note that your answers – including the “other” category – must add up to 24 hours)

10.

	On average prior to any disruptions due to COVID-19	On average since any disruptions due to COVID-19
Research		
All other job-related activities	_____	_____
Commute to/from work		
Child care and schooling		
Housekeeping (cleaning, maintenance, laundry, yardwork, etc.)		
Sleep		
Other		

11. **[Only ask if selected c on question 4 (live with spouse etc.)]** To the best of your ability, please estimate the number of HOURS your spouse/partner/significant other spends on the activities below on a given WORKDAY both before and after any disruptions created by COVID-19. (Note that your answers – including the “other” category – must add up to 24 hours)

	On average prior to any disruptions due to COVID-19	On average since any disruptions due to COVID-19
Work in paid employment	_____	_____
Commute to/from work		

Child care and schooling	_____	_____
Housekeeping (cleaning, maintenance, laundry, yardwork, etc.)	_____	_____
Sleep	_____	_____
Other	_____	_____

12. How has your funding for the following expenses been affected by any disruptions created by COVID-19?

	Significantly increased	Not significantly affected	Significantly reduced	Don't know/N/A
Research assistance/resources				
Teaching assistance/resources				
Administrative assistance/resources				
Other (please specify)				

13. Please tell us how the disruption created by COVID-19 has affected your institution's promotion policy (select all that apply).

- Tenure-track pre-tenure faculty have the option to request to add time to the tenure clock
- Time has been automatically added to the tenure clocks of all tenure-track pre-tenure faculty
- Research expectations have been explicitly changed
- Extensions on deadlines have been granted
- Student evaluations of teaching have been eliminated or are optional for the spring 2020 term
- I do not know/not applicable

[If chose the first option above and report being tenure-track faculty, pre-tenure]

How likely are you to use the option to add time to your tenure clock as a result of the disruptions created by COVID-19?

0 means definitely not,
100 means definitely yes

[SLIDER from 0 to 100]

THE NEXT SET OF QUESTIONS ARE BASIC DEMOGRAPHIC QUESTIONS

1. What is your gender?

- Male Female Other Prefer not to answer

2. What is your age (in years)?

3. Are you of Hispanic, Latino, or Spanish origin?
 YES NO Prefer not to answer
4. Which of the following best describe(s) your race (select all that apply)?
 Asian
 Black or African American
 American Indian or Alaska Native
 Pacific Islander
 White/Caucasian
 Other (please specify) _____
 Prefer not to answer

B. Survey Data

B.1. Our Sample

There were 757,148 currently valid email addresses (82.6% of the total). Out of these, 224,356 emails are recorded as having opened our survey email at least once. This is a lower bound because some mail clients do not allow tracking of openings. 33,585 individuals initiated the survey, and 27,991 consented and completed the survey. The ratio of completed surveys to successfully delivered email invitations implies a response rate of $3.7\% \left(\frac{27,991}{757,148} \right)$.

In all the tables below, the sample consists of all respondents who identified their gender as male or female and whose own time use responses summed up to 24 hours per day (a total of 19,905 observations).

B.2. Descriptive Statistics

Table B1: Summary Statistics of Demographics and Family Circumstances of Survey Respondents by Gender

Variable	Male	Female	t-test p-value
Age (years)	48.8	45.0	<0.001
PhD graduation year	2002	2006	<0.001
% tenure-track or tenured faculty	62.2%	59.0%	<0.001
% in STEM fields	81.4%	65.1%	<0.001
% Hispanic	16.2%	15.5%	0.214
% Asian	14.6%	9.0%	<0.001
% Black	1.4%	1.3%	0.555
% White	74.4%	82.8%	<0.001
% EEA	35.9%	32.6%	<0.001
<i>Family Questions -- Currently live with</i>			
Child(ren)	43.8%	48.4%	<0.001
Spouse or partner	81.2%	75.8%	<0.001
Total respondents	11,901	8,004	

Notes: Other race categories (not reported) included American Indian or Alaska Native; Pacific Islander; Other; Prefer not to answer.

Table B2: Average Responses on the Importance of Resource Requirements for Research Purposes

	Completely unimportant	Mostly unimportant	Somewhat important	Very important	N
Research laboratory/ physical research equipment (other than computer)	35%	16%	16%	34%	19,804
Computing or library resources not available through remote access	25%	33%	22%	20%	19,727
Research collaborators (non-student)	2%	6%	34%	58%	19,826
Research assistants/PhD student collaborators/post-docs	7%	13%	29%	51%	19,807
In-person human subjects	42%	17%	22%	19%	19,602
Research field sites	34%	17%	22%	27%	19,698

Table B3: Incidence of Institutional Policy Changes Post-COVID

Policy Responses	Yes	N
Tenure-track pre-tenure faculty have the option to request to add time to the tenure clock	31%	11,562
Time has been automatically added to the tenure clocks of all tenure-track pre-tenure faculty	16%	11,562
Research expectations have been explicitly changed	23%	14,140
Extensions on deadlines have been granted	44%	14,140
Student evaluations of teaching have been eliminated or are optional for the spring 2020 term	31%	11,562
No policy changes have been made	17%	14,140
Not applicable/Do not know	10%	14,140

Table B4: Average Changes to Resources and Policies by Gender Post-COVID

	Male	Female	t-test p-value	N
<i>Funding was reduced in terms of:</i>				
Research	21%	23%	0.004	19,851
Teaching	16%	14%	0.001	19,772
Administrative	22%	22%	0.829	19,804
Other	20%	26%	<0.001	3,009
<i>For those who have the option to stop the clock:</i>				3,576
Total prob of taking the option	38%	40%	0.319	897
Will definitely take the option	14%	18%	0.072	897

Table B5: Mean Changes in Time Use due to COVID by Gender

Change (After - Before COVID; in minutes)	All Academics				Single Parents			
	Male	Female	Abs Diff	t-test p-value	Male	Female	Abs Diff	t-test p-value
Research	-42	-61	19	<0.0001	-59	-94	35	0.0002
Other job	-4	-2	2	0.1882	-6	-9	3	0.6998
Commute	-57	-65	7	<0.0001	-55	-65	10	0.0101
Child care and schooling	53	82	29	<0.0001	94	148	54	<0.0001
Housekeeping	39	50	11	<0.0001	46	56	10	0.0228
Sleep	6	0	5	<0.0001	-5	-11	6	0.1303
Other	5	-5	9	<0.0001	-15	-24	9	0.1422
Number of Observations	11,901	8,004			384	481		

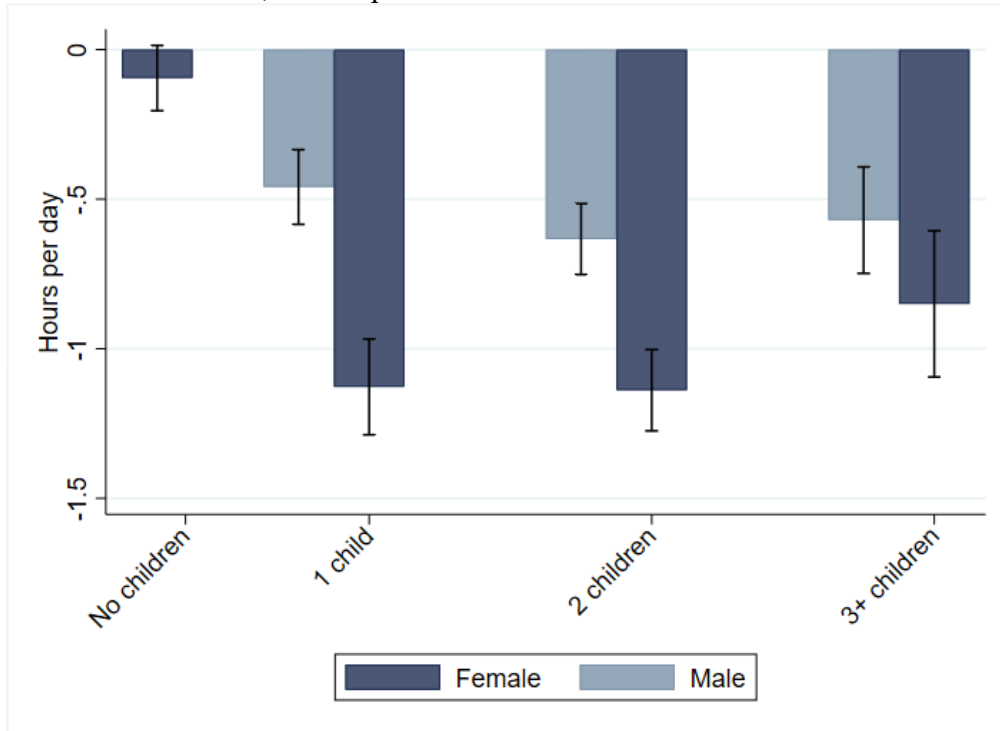
Notes: Single parents are defined as individuals who identified having at least one child dependent present in the household, and who identified not having a spouse or partner present in the household.

C. Additional Analysis

Figures C1 and C2 repeats the number-of-children and age-of-youngest-child analyses for academics whose research is in STEM fields (Agricultural and animal sciences, Biological sciences, Chemistry, Computer Science, Earth and planetary sciences, Economics/finance, Engineering, Environmental science, Epidemiology, Materials science, Mathematics, Medicine and health, Neuroscience, Physics, Statistics).

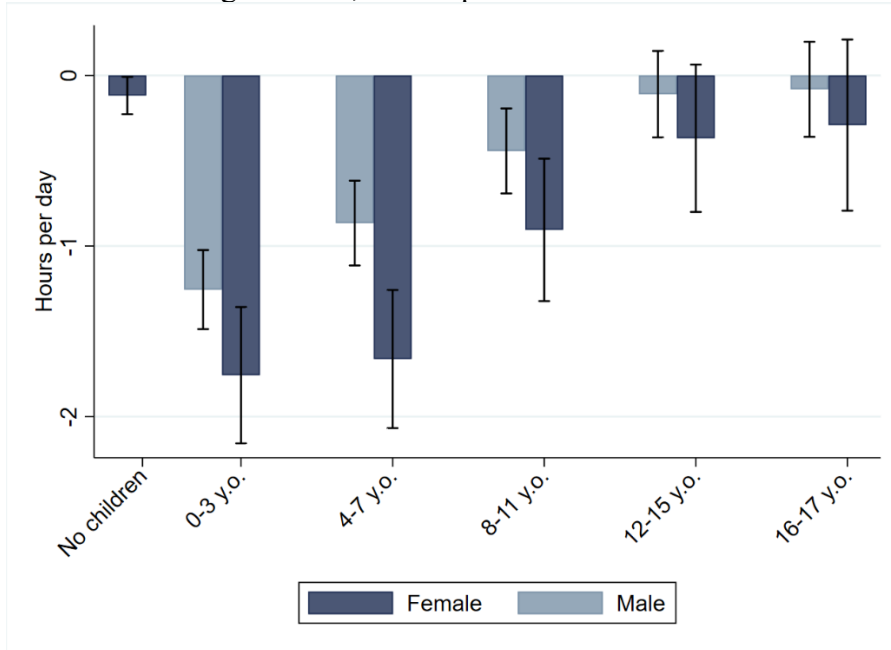
Figure C3 replicates the analysis using developmental age ranges instead of uniform age bins and the full survey sample.

Figure C1: The Change in the Number of Hours Spent on Research by Gender and the Number of Children, for Respondents in STEM Research Fields



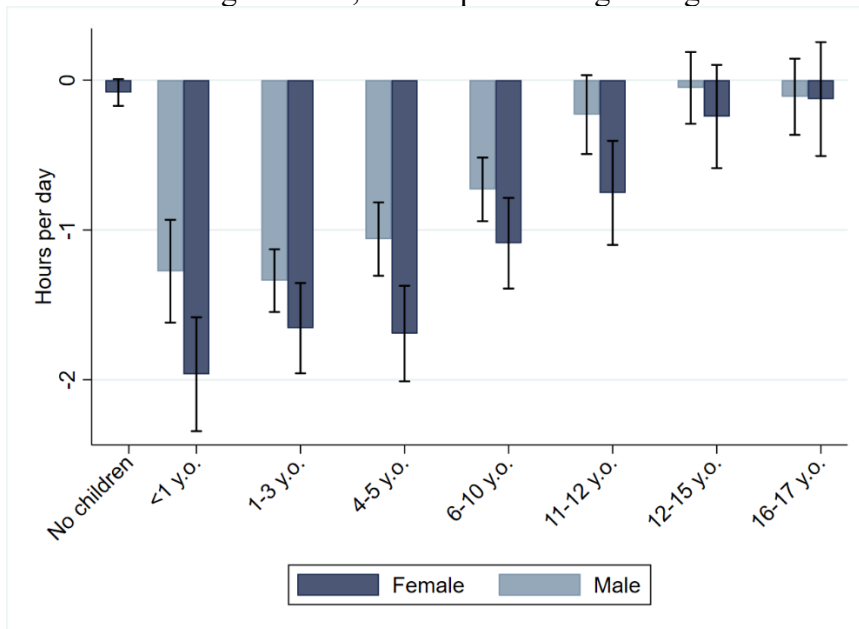
Note: Estimates from OLS regressions with interactions for gender and number of children indicators. Controls include PhD year and date of survey completion FE. Bars represent 95% confidence intervals using robust SE.

Figure C2: The Change in the Number of Hours Spent on Research by Gender and Age of Youngest Child, for Respondents in STEM Research Fields



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 SE.

Figure C3: The Change in the Number of Hours Spent on Research by Gender and Age of Youngest Child, Developmental Age Ranges



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 SE.

Tables C1 and C2 estimate the effects of gender and presence of children in the family on all time use variables (in hours per day), controlling for a rich set of demographic characteristics. Note that the main adverse effects on research time use for women with children are robust to the inclusion of controls. We also note that respondents in the EEA are less likely to have lost research time relative to non-EEA respondents, and are less likely to see increases in time spent on childcare and other household duties post-COVID. On the other hand, STEM researchers are more negatively impacted by the pandemic than non-STEM researchers, seeing larger decreases in research time.

Table C1: The Change in the Number of Hours Spent on Research, Other Job-Related Activities, and Commuting by Gender and Number of Children, Controlling for Researcher Characteristics

Variable	ΔResearch Time		ΔOther Job		ΔCommuting	
	(1)	(2)	(3)	(4)	(5)	(6)
1 child	-0.538*** (0.0573)	-0.524*** (0.0575)	-0.338*** (0.0508)	-0.318*** (0.0510)	-0.0364 (0.0234)	-0.0402* (0.0234)
2 children	-0.628*** (0.0536)	-0.629*** (0.0540)	-0.377*** (0.0479)	-0.366*** (0.0478)	-0.0459** (0.0222)	-0.0499** (0.0222)
3+ children	-0.626*** (0.0823)	-0.630*** (0.0826)	-0.373*** (0.0755)	-0.352*** (0.0753)	-0.0776** (0.0378)	-0.0819** (0.0379)
Fem; 0 children	-0.0559 (0.0456)	-0.104** (0.0465)	0.202*** (0.0416)	0.216*** (0.0422)	-0.120*** (0.0182)	-0.119*** (0.0184)
Fem; 1 child	-0.485*** (0.0724)	-0.552*** (0.0731)	0.0332 (0.0655)	0.0265 (0.0661)	-0.113*** (0.0292)	-0.104*** (0.0295)
Fem; 2 children	-0.503*** (0.0608)	-0.557*** (0.0613)	-0.0647 (0.0589)	-0.0500 (0.0589)	-0.113*** (0.0253)	-0.107*** (0.0254)
Fem; 3+ children	-0.318** (0.124)	-0.385*** (0.124)	-0.152 (0.116)	-0.155 (0.115)	-0.143*** (0.0533)	-0.131** (0.0533)
STEM		-0.283*** (0.0345)		0.0597* (0.0329)		0.0655*** (0.0146)
EEA		0.229*** (0.0330)		0.300*** (0.0298)		-0.126*** (0.0140)
Age		0.0120*** (0.00315)		0.00561** (0.00260)		0.00108 (0.00114)
Asian		-0.199 (0.171)		0.0783 (0.140)		0.0571 (0.0563)
Black		-0.0623 (0.224)		-0.228 (0.192)		0.0138 (0.0802)
White		-0.0620 (0.173)		0.267* (0.142)		0.00937 (0.0576)
Hispanic		-0.174*** (0.0481)		0.165*** (0.0427)		-0.0846*** (0.0184)
Dep. Var. Mean	-0.824	-0.825	-0.0502	-0.0533	-1.006	-1.007
R2	0.0521	0.0605	0.0324	0.0427	0.0151	0.0236
N	19862	19593	19862	19593	19862	19593

Note: Estimates from OLS regressions with interactions for gender and number of children indicators. Other controls include PhD year and date of survey completion FE. Significance levels: * p<0.10; **p<0.05; ***p<0.01

Table C2: The Change in the Number of Hours Spent on Childcare, Housework, Sleep, and Other Non-Work Activities by Gender and Number of Children, Controlling for Researcher Characteristics

Variable	ΔChildcare		ΔHousework		ΔSleep		ΔOther Non-Work	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 child	1.403*** (0.0417)	1.384*** (0.0416)	0.0959*** (0.0243)	0.0918*** (0.0239)	-0.191*** (0.0217)	-0.195*** (0.0218)	-0.395*** (0.0429)	-0.399*** (0.0431)
2 children	1.699*** (0.0422)	1.669*** (0.0421)	0.105*** (0.0236)	0.131*** (0.0233)	-0.215*** (0.0210)	-0.216*** (0.0211)	-0.537*** (0.0416)	-0.539*** (0.0418)
3+ children	1.594*** (0.0768)	1.557*** (0.0761)	0.123*** (0.0361)	0.157*** (0.0358)	-0.194*** (0.0373)	-0.204*** (0.0374)	-0.447*** (0.0695)	-0.446*** (0.0699)
Fem; 0 children	-0.137*** (0.0162)	-0.152*** (0.0172)	0.175*** (0.0206)	0.208*** (0.0205)	-0.0220 (0.0182)	-0.0211 (0.0184)	-0.0436 (0.0378)	-0.0269 (0.0384)
Fem; 1 child	0.841*** (0.0691)	0.829*** (0.0692)	0.146*** (0.0325)	0.184*** (0.0323)	-0.154*** (0.0299)	-0.146*** (0.0300)	-0.268*** (0.0512)	-0.238*** (0.0518)
Fem; 2 children	0.773*** (0.0624)	0.752*** (0.0624)	0.201*** (0.0302)	0.236*** (0.0298)	-0.138*** (0.0278)	-0.135*** (0.0282)	-0.155*** (0.0444)	-0.139*** (0.0448)
Fem; 3+ children	0.784*** (0.128)	0.793*** (0.128)	0.162*** (0.0623)	0.190*** (0.0623)	-0.106* (0.0578)	-0.0985* (0.0577)	-0.227** (0.0923)	-0.222** (0.0926)
STEM		-0.00253 (0.0262)		0.0633*** (0.0160)		0.0156 (0.0148)		0.0815*** (0.0281)
EEA		-0.0733*** (0.0231)		-0.115*** (0.0141)		-0.0624*** (0.0132)		-0.152*** (0.0260)
Age		-0.0209*** (0.00386)		0.00265 (0.00174)		-0.00035 (0.00107)		-0.00004 (0.00227)
Asian		0.0535 (0.119)		0.0883 (0.0734)		-0.164** (0.0688)		0.0867 (0.122)
Black		0.215 (0.145)		0.133 (0.0969)		0.157 (0.101)		-0.229 (0.158)
White		0.251** (0.119)		-0.120 (0.0749)		-0.225*** (0.0698)		-0.119 (0.125)
Hispanic		0.0138 (0.0305)		0.418*** (0.0220)		-0.0573*** (0.0192)		-0.281*** (0.0364)
Dep. Var. Mean	1.077	1.082	0.728	0.729	0.0580	0.0570	0.0176	0.0182
R2	0.377	0.383	0.0186	0.0592	0.0338	0.0394	0.0452	0.0532
N	19862	19593	19862	19593	19862	19593	19862	19593

Note: Estimates from OLS regressions with interactions for gender and number of children indicators. Other controls include PhD year and date of survey completion FE. Significance levels: * p<0.10; **p<0.05; ***p<0.01