

Lee, Zeewan; Tan, Poh Lin; Tan-Soo, Jie-Sheng

Working Paper

Unequal Gains from Remote Work during COVID-19 between Spouses: Evidence from Longitudinal Data in Singapore

Suggested Citation: Lee, Zeewan; Tan, Poh Lin; Tan-Soo, Jie-Sheng (2023) : Unequal Gains from Remote Work during COVID-19 between Spouses: Evidence from Longitudinal Data in Singapore, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/270941>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Unequal Gains from Remote Work during COVID-19 between Spouses: Evidence from Longitudinal Data in Singapore

Zeewan Lee¹, Poh Lin Tan², Jie-Sheng Tan-Soo³

Abstract

The rise of remote work arrangements under the COVID-19 pandemic has generated important benefits, enhancing worker productivity by providing flexibility and reducing commuting costs. Would such positive labor market outcomes enjoyed equally between spouses? Using a longitudinal dataset of married women and their spouses before, during and after the lockdown in Singapore, we examine the effect of the pandemic and the availability of remote work on the respondents' salary income, while accounting for the moderating roles of gendered differences in time use (e.g., in childcare) and presence of helpers. We find a significant salary income growth among male remote workers, but not among females. While both male and female remote workers experienced an increase in income if they spent less time on household work, women were less likely to face such smaller household responsibilities than men. This study provides empirical evidence that unequal division of household labor leads to unequal gains from remote work.

Keywords: gender, income, COVID-19, remote work, flexible work, time use

JEL Classification Codes: J16, J24

Funding This project was supported by funding from the Lee Kuan Yew School of Public Policy, National University of Singapore [R-603-000-347-115; A-0003976-00-00; R-603-000-237-133].

1 Corresponding Author. Assistant Professor (Economics & Public Policy) at the Lee Kuan Yew School of Public Policy, National University of Singapore. 469C Bukit Timah Road, NUS, Singapore 259772. Email: zeewan.lee@nus.edu.sg.

2 Assistant Professor at the Lee Kuan Yew School of Public Policy, National University of Singapore. 469C Bukit Timah Road, NUS, Singapore 259772. Email: spptplj@nus.edu.sg.

3 Assistant Professor at the Lee Kuan Yew School of Public Policy, National University of Singapore. 469C Bukit Timah Road, NUS, Singapore 259772. Email: jiesheng.tan@nus.edu.sg.

1. Introduction

The COVID-19 pandemic led to widespread and profound changes to labor markets around the world. As governments enacted unprecedented measures such as lockdowns and restrictions on economic activity to limit the spread of the virus and prevent surges in hospitalizations and mortality rates, industries and businesses faced precipitous declines in demand, while many workers were suddenly required to shift to remote work arrangements. In East Asia and the Pacific, where the virus was first detected, firm sales fell by 38-58% on average in the second quarter of 2020 relative to 2019, forcing businesses to reduce operating capacity, shut temporarily, or go out of business, especially small and medium sized enterprises which had lower access to credit or were slower to adapt e-commerce (de Nicola et al., 2021). Employees, in turn, experienced deteriorating labor market outcomes such as reduced hours, wage cuts, job loss, and logistical challenges of changing work arrangements. While official statistics suggest that economic output in developed countries have shown signs of recovery to pre-pandemic levels, the remote work arrangements continued to stay as a part of the new normal (McCarthy 2021; Saad and Jones, 2021).

The recent surge of Covid19 literature has started showing evidence that the labor market outcomes of women are disproportionately and negatively affected by the pandemic because they, for instance, comprise a larger share of vulnerable employment than male workers do (Adams-Prassl et al., 2020; Alon et al., 2020a; Kikuchi et al., 2021; Papanikolaou and Schmidt, 2022). At the same time, other researchers have argued that, despite the immediate hardships of female workers documented in the empirical literature, women may eventually gain more from more from the rise of remote work induced by the pandemic. Case in point, Alon et al. (2020b)

argue that the rise of remote work and other flexible work arrangements could eventually lead to greater gender equality.

To shed further lights into the literature currently faced with mixed findings, we study the impact of the government-initiated lockdown at the height of the pandemic in the second quarter of 2020 on the salary income of workers given their varying abilities to work remotely. A longitudinal survey data is collected from Singapore, which follows 362 married women over six points in time—beginning two years prior to the pandemic to the end of the first year of the pandemic—and gathers information on the respondents and their spouses. First, we use difference-in-differences estimation strategy which removes noise from endogenous covariates to examine whether workers who adopted remote work enjoyed an income advantage compared to non-remote working peers, and whether this advantage remained even *after* government restrictions were lifted. Next, we test whether there existed *gender differences* in the extent of income advantages induced by the adoption of remote work arrangements, and whether the gender differences persisted over time. Lastly, we explore potential explanations for these gender differences.

Our results show that the salary income increased significantly among remote workers compared to non-remote workers in March-June during the nadir of the economic downturn in Singapore. The results are significant among men, but not among women. Such gender differences persisted across time: When we follow the same groups over time until six months after the lockdown, November 2020, we again find a persistent divergence in income trends only for male workers, with a significant income advantage among those had switched to remote work. The heterogeneity analyses reveal that the remote workers reported significantly income increase than their non-remote counterparts only if they spent less time on childcare or chores.

Yet, women in our sample were less likely to face such smaller household responsibilities than men were.

Our paper contributes to the literature in several manners. First, we add to the growing literature that explores the *long-term* labor market implications of the shift towards remote work—thereby examining, with new data, the nascent optimistic view that the rise of remote work arrangements could relieve gender inequality in labor market outcomes (Alon et al., 2020b). Our study also addresses to a broader, long-standing body of research examining the implications of the ‘increased flexibility of work’ such as blurred boundaries between work and life, increased spatial and temporal autonomy over work, and evolving norms and expectations (Chung and van der Lippe, 2020; Chung and van der Horst, 2018; Kelly et al., 2011; Schieman et al., 2021; van Zoonen et al., 2021).

Our second contribution lies in adding depths to our understanding of the gender differences in gains from remote work, via exploring the mediating effects of (1) differential time-use across mothers and fathers in doing household work (e.g., chores, childcare), and (2) help from domestic helpers and grandparents. Previous studies consistently show that mothers rather than fathers took on a greater share of increased domestic responsibilities during the pandemic (Carlson et al., 2020; Heggeness, 2021; Lyttelton et al., 2020; Sevilla and Smith, 2020; Zang et al., 2021). In this paper, we explicitly link the unequal distribution of household labor to differences in married men’s and women’s income trajectories, using household-level data on both spouses’ time use on household chores and childcare (as reported by female respondents), and household composition and presence of helpers. In providing evidence on varying forms of household resources and responsibilities as mediators to labor market outcomes, this paper seeks

to contribute to our understanding of if and how men and women can benefit from the shift towards more flexible work arrangements.

Lastly, we promote a more diverse set of perspectives of the impact of Covid19 and the adoption of remote work by providing new evidence from Singapore. Our understanding of the labor market impact of Covid19 may be incomplete as it primarily relies on evidence from Western or larger economies—which may not be reflective of non-Western smaller economies affected by the worldwide pandemic given the international heterogeneity in exposure and institutional responses. For instance, the transition to remote work was markedly more stratified by income in China, the U.K. and U.S., compared to Italy, Japan and Korea (Ono and Mori 2021), and there is evidence that the impact of the pandemic on employment was much weaker in Germany than in the U.K. and the U.S., due to a scheme which allowed workers to take more time off (Adams-Prassl et al. 2020). In addition, much of the existing literature on flexible work arrangements has focused on evidence from Australia, the U.K. and U.S., even though institutional and cultural contexts are important determinants of how individuals respond to remote work options, with implications for the gender gap (Chung and van der Lippe 2020).

Singapore, a Southeast Asian city state which was among the first to be hit by the pandemic with cases reported in January 2020, is a useful setting for studying the longer-term labor market impacts of Covid19 for various reasons. The nation-wide lockdown mandate, from 7 April 2020 to 1 June 2020, which forced a large proportion of the workforce categorized as “non-essential” to work from home regardless of personal preferences (Ministry of Health, 2020), was strictly enforced, alleviating issues of self-selection into remote work arrangements. Moreover, the country experienced a relatively smooth economic recovery and transition in- and

out- of the lockdown during 2020,¹ unlike many other economies whose experiences were marked by sporadic virus outbreaks and lockdowns. By the last quarter of 2020, the economy had almost bounced back to pre-pandemic activity levels, which coincided with a steep decline in number of daily confirmed cases to mostly single digits (see **Figure 1**), making it easier to identify the disparate impacts of government restrictions on the income trajectories of remote and non-remote workers.

[Figure 1]

We organize our study as follows. Background Section provides an overview of the international literature on the implications of remote work for gender inequality before and during the pandemic, implications of the adoption of remote work on gender equality, as well as the Singaporean context (i.e., gender norms, division of household labor). Data and Methods Section presents the data, outcome variables, covariates, and descriptive statistics of our sample. Estimation Section explains the empirical strategies. Results Section presents our main findings on differences in the income trajectories of men and women who had shifted to remote work during the height of the pandemic, compared to non-remote workers. This section also presents evidence on outcomes by type of remoteability, the importance of occupational status, gendered differences in time use and the role of household help. Discussion Section evaluates the key implications of our results, and Conclusion summarizes findings and policy recommendations.

¹ Although remote-work continued to be the default arrangement by government mandate, with only 50% of employees allowed to resume working in the office at any one time (Yuen 2021), the trend of working exclusively from home substantially declined to less than 20% of women and less than 10% of men in the last quarter of 2020 (Figure A1 in the Online Appendix).

2. Background

2.1 Consequences of the Shift to Remote Work during the Pandemic

Past literature has provided evidence that remote work arrangements can lead to positive outcomes for both firms and workers. A study by Bloom et al. (2015) using data from a Chinese call center provides evidence that remote work options increase workers' performance and job satisfaction. This finding is supported by qualitative studies conducted in Australia, Belgium and Japan, which show that remote work can enhance worker productivity by providing flexibility, reducing commuting costs, and minimizing interruptions at the workplace (Bosua et al., 2013; Baert et al. 2020; Kazekami 2020).

In the context of COVID-19, access to remote work arrangements was a crucial determinant of workers' labor market outcomes. Globally, the pandemic generated devastating consequences in the labor market, especially for the vulnerable workers earning lower-income, contract-based, or paid by the hour (Adams-Prassl et al., 2020; Kikuchi et al., 2021; Papanikolaou and Schmidt, 2020). In Singapore, studies estimate that around 20% of respondents experienced a job loss or were placed on furlough or unpaid leave around the lockdown period, and that around 40% reported a loss in income (Daly et al., 2021). Job losses as well as physical and mental tolls were especially severe in occupations that could not adopt remote work arrangements and had to maintain physical contacts with their customers (Hammonds et al., 2020; Mongey et al., 2020). In contrast, workers who could work remotely were relatively more immune to detrimental market consequences such as displacement (Sarnosky et al., 2022). One U.K. study evidences that workers in industries and occupations that allowed remote-working reported increases in productivity, whereas the opposite was true for workers in jobs with lower remoteability (Etheridge et al., 2020).

Moreover, some studies suggest that gains from remote work could grow over time—leading to increased productivity and higher life satisfaction—as workers acclimatize to the changes in work arrangements under the Covid-19 era (Etheridge et al., 2020). Other studies support this finding, showing that the impacts of remote work on the post-pandemic economy could result in a 5% boost in labor productivity (Barrero et al., 2021), and lead to a reduction in work-family conflict (Bai et al., 2021). In the case of Singapore, a survey finds that the share of respondents who reported labor productivity increases following the introduction of remote work rose from 15.1% in April 2020 to 22.5% in June 2020, and the share of respondents who were concerned about productivity declines fell from 78% to 40% (EngageRocket, 2020). Another survey from Singapore finds that as of April 2021, 85% of employees and 70% of managers believe that workers were more or equally productive working from home as in the office, suggesting that much of these gains had been consolidated over time (Chew, 2021). Both surveys find that respondents are overwhelmingly in favor of maintaining flexible work arrangements, with 60-70% preferring a hybrid work arrangements. Similarly, around three-quarters of married working women in the survey dataset used for this paper stated that they are strongly or somewhat in favor of permanent work from home arrangements (see **Table A1** in the **Online Appendix**).

The literature above suggests the importance of access to remote work arrangements as a potentially determinant of labour market outcomes. At the same time, we are still in need of empirical evidence on the longer-term labor market outcomes of the rise of remote work, facilitated by the pandemic. This leads to our first hypothesis:

Hypothesis 1: *Workers who were able to shift to remote work during the lockdown period experienced income gains. The gains persisted for those holding jobs with high remoteability.*

2.2 Implications of Remote Work Arrangements for Gender Equality

Against the backdrop of potential gains from remote work, some studies have focused on the implications for gender gaps in labor market outcomes. Generally, women and lower-income workers have been disproportionately affected by the pandemic, partly due to their higher representation in the most ravaged sectors such as the service industries, e.g., travel and hospitality (Kikuchi et al., 2021; Alon et al., 2020a), and partly due to their holding jobs with low remoteability (Bartik et al., 2020; Golden, 2008; Mongey et al., 2020). Women, however, have been seen to face greater job losses even after accounting for differences in job types and remoteability (Adams-Prassl et al., 2020).

One of the driver of the gender gap lies in the underlying disparities in division of household labor (Cunningham, 2005; Lyttelton et al. 2020), which are further exacerbated by the rise of remote work and blurred boundaries between work and household duties in the Covid-19 era (Chung and van der Lippe, 2020). Studies consistently find that mothers rather than fathers bore the brunt of increased domestic work demands during lockdowns even if both were working full-time, with one paper estimating that women spent as much as 40% more time on childcare (Alon et al. 2020b; Carlson et al. 2020; Heggeness 2021; Lyttelton et al. 2020; Sevilla and Smith 2020; Zang et al. 2021). In response to the sudden spike in childcare and household responsibilities due to closure of schools and childcare facilities and loss of access to nannies and other helpers, women were more likely to leave employment or cut work hours, even if their work could be done remotely (Alon et al. 2020b; Calarco et al. 2021; Collins et al. 2020; Heggeness 2021). In particular, because mothers in dual-income families tended to spend more time than fathers on childcare prior to the pandemic, children generally expected and preferred care from their mothers during

lockdowns, resulting in women performing parenting tasks even when fathers or other caregivers were available (Calarco et al. 2021; Chung and van der Lippe, 2020).

Despite the exacerbations in pre-existing gender gaps in the labor market outcomes, Alon et al. (2020b) argue that the rise of remote work and other flexible work arrangements could eventually lead to improve gender equality. The study points to the potential of changing work norms for greater female labor participation and paternal involvement in childcare, equalizing the playing field, consistent with evidence that access to flexible work arrangements helps women stay in employment after childbearing (Chung and van der Horst, 2018). Greater spatial and temporal flexibility over job tasks could also provide women with greater schedule control and improved work-life outcomes by allowing for more role transitions (Kelly et al., 2011; Delanoeije et al., 2019).

The above literature points the potentially divergent labor market experiences of male and female spouses under Covid-19, even after controlling for the extent of their access to remote work arrangements. Moreover, the literature highlights the importance of household resources and responsibilities as mediators in determining whether married men and women will benefit equally from remote work. Without achieving a more equal allocation of household responsibilities, the longer-term prognosis for gender gaps in labor market outcomes may be less positive than argued, particularly given the gendered nature of shifts in time use in reaction to the adoption of remote work arrangements. These observations lead to our next two hypotheses:

Hypothesis 2: *Income gains from the shift to remote work during the lockdown period were lower for women than for men. The gender gap in gains from remote work diminished after the lockdown ended, as childcare facilities and other services became available.*

Hypothesis 3: *Workers who spend less time on household tasks or who have external helpers gain more from switching to remote work. This is especially true for women, who tend to bear primary responsibility for unpaid household work.*

2.3 Singapore Context: Division of Household Responsibilities and Resources

Gender norms in Singapore tend to be socially conservative. Although it is common for married women to hold a full-time job alongside their husbands, they are still expected to be primarily responsible for domestic labor and care work (Jones, 2012), resulting in high levels of physical, mental, and emotional exhaustion (Aryeel, 1993). Moreover, the strong societal emphasis on children's academic achievement has created very stressful conditions for parents, especially for mothers (Jones, 2012). Consequently, mothers spend more time with their children than fathers do on average, with one study estimating that employed and stay-at-home Singaporean mothers spend an average of 3.2 and 5.6 hours respectively with young children on weekdays, whereas fathers spend 1.75 hours regardless of employment status (Yeung, 2020).

Although cultural norms have been slower to shift, the rapid demographic and economic transformation of Singapore have led to changes in household size and composition. In particular, due to rising income and preferences for separate living spaces (Phua and Loh 2008), the prevalence of three-generational households declined from 11.3% to 8.7% of resident households between 2010 and 2017 (Ministry of Social and Family Development 2019). As a result, married women with young children are increasingly not able to rely on elderly parents or in-laws for free childcare assistance. In place of intergenerational exchanges of physical care and help with domestic tasks, hiring a live-in female low-wage domestic worker from a neighboring country such as Indonesia or the Philippines has become an increasingly common practice, with official statistics showing an increase of over 10% from 231,500 to 261,800 between 2015 and 2019 (Ministry of Manpower 2021b). However, at the societal level, the increasing availability of foreign domestic workers has lowered the status of domestic work and social relevance of women's ongoing struggles to achieve work-life balance (Teo, 2016).

During the COVID-19 lockdown from 7 April 2020 to 1 June 2020, only “essential” businesses and services such as supermarkets, delivery services, food suppliers, energy manufacturers and medical centres remained open, and even these services were suspended if any staff member were infected (Ministry of Health, 2020), while other services, including schools and childcare centers, were required to close by law. Residents were permitted to exit the home only to procure essential goods and services or to exercise, which had to be done alone in open spaces, and violations of lockdown guidelines resulted in fines up to \$10,000 (approximately \$7,500 USD) and/or up to six months’ imprisonment. Hence, pre-existing living arrangements were crucial to families’ ability to adjust to remote-working conditions, as households were not allowed to reach out to family members from separate dwellings (Government of Singapore, 2020b), and households who had not hired foreign domestic workers prior to the lockdown faced difficulties doing so during the height of the crisis (Seow, 2020). Households were also not allowed to hire ad-hoc services to help with household tasks apart from essential services such as food delivery. After the lockdown ended in early June, up to two daily visitors from the same family (including grandparents) were permitted, but engagement of non-essential household services was still prohibited (Government of Singapore, 2020a).

3. Data and Methods

3.1 Data

The longitudinal dataset was collected in four main survey waves. The baseline survey was conducted between April and July 2018 (Wave 1). 660 female participants were recruited using street intercept at central public spaces such as metro station exits, walkways of bus interchanges, spaces outside shopping malls and neighborhood town centers, stratified by the five main regions of Singapore: Central, North, Northeast, West and East. Participants met the

following inclusion criteria: currently married; aged 25-34 in 2018; either a Singaporean citizen or married to a Singaporean citizen, and able to read, write and speak in English. Of the 3,038 potential participants who were approached, 657 (21.6%) met the inclusion criteria and were recruited (excluding three participants who were recruited and whose data were subsequently discarded due to failure to meet the age criterion), 558 (18.4%) did not meet the inclusion criteria, and 1,820 (59.9%) declined to participate (1,143 declined prior to introduction and 677 declined after introduction to the study).

Of the 657 participants recruited in the first wave, 500 consented to be re-contacted for follow-up surveys. 416 (83.2%) completed the first follow-up online survey in May 2020 (Wave 2) in the midst of the lockdown, 399 completed a second follow-up online survey in June 2020 (Wave 3), and 378 (75.6%) completed the last wave in November 2020 (Wave 4), six months after the lockdown. The timeline for each wave of data collection in proximity to major events during the pandemic is provided by **Table 1**.

[Table 1]

The baseline survey in 2018 was conducted face-to-face in English without the presence of third parties, either in nearby public spaces, or alternatively, at the respondents' homes at a time of their convenience. We collected highly detailed information on individual and household characteristics from the female respondent, including both spouses' age and education, wife's ethnicity, date of current marriage, dates of birth of all children, time use on childcare and household chores and household composition. The survey also collected details about both spouses' jobs, including occupational category, income levels and commute time. Potentially sensitive questions about income levels were asked through a computerized self-administered questionnaire to avoid embarrassment and elicit greater honesty. In subsequent online survey

waves, updated data on dates of birth of all children, employment status and income levels were collected. In addition, the online surveys in 2020 asked about both spouses' remote work status (whether working fully from home, mostly from home, half from home and half outside the home, mostly outside the home or fully outside the home).

Due to the unexpected emergence of the pandemic, Waves 3 and 4 included retrospective questions which collected information from periods before and shortly after the lockdown. For instance, income levels in the months of December 2019, March 2020 and May 2020 were retrospectively collected in June 2020 (or in November 2020 if the respondent had not responded in June), while updated occupational status were collected in November 2020. Hence, the longitudinal dataset provides information on each pair of spouses' income levels at six points in time from 2018 to 2020: April-July 2018, December 2019; March 2020; May 2020; June 2020; and November 2020. Each recruited participant received up to SGD 20 (USD 15) for their participation in the 2018 baseline survey, \$25 SGD (USD 19) for their participation in the May-June 2020 online survey, and \$15 SGD (USD 11) for their participation in the November 2020 online survey. The study was approved by the National University of Singapore Institutional Review Board.

The final sample consists of 781 individuals who responded in Wave 1 and at least one survey wave in 2020 and are employed with income data throughout the survey waves, since our research question focuses on the link between the shift to telecommuting and income. Relatively few observations were dropped ($n = 33$ person-waves) when we excluded those who stopped working between Wave 1 and follow-up waves. In addition, we excluded a small number of observations ($n = 15$ person-waves) who were divorced, widowed, or separated. Observations who did not provide valid occupation codes ($n = 66$ person-waves) were included in the

analytical sample by creating a dichotomous indicator for unknown occupation category. Our final sample size is 4,638 observations across all six points in time.

3.2 Key Variables

Outcome variable is monthly salary income. In the survey, this variable was measured in brackets: no income, less than \$1,000, \$1,000-1,999, \$2,000-2,999, \$3,000-3,999, ..., \$9,000-9,999, and \$10,000 or more. To simplify the interpretations of our estimations, we use mid-points of each income bracket except for the last bracket, which is replaced with \$15,000.²

The main independent variables of interest are remote work status, interacted with time periods. In the main analysis, remote work status is coded as a binary variable (1 if working remotely from home, 0 if working at partly outside the home); in additional analyses, remote work status is coded as a vector of dichotomous indicators (whether working fully from home, mostly from home, half from home and half outside the home, mostly outside the home or fully outside the home). Both measures are based on individuals' status during May 2020 and held constant over time, to avoid conflation caused by selection into telecommuting status over time. We group the temporal identifiers into three meaningful time period: pre-COVID-19 outbreak (April-July 2018 and December 2019); the lockdown period and immediately surrounding months (March-June 2020); and the post-lockdown recovery phase (November 2020). The different periods are intended to evaluate both the immediate and longer-term impacts—thereby operationalizing *Hypothesis 1*.

While all survey participants were female workers with children, we use their responses on their spouses to generate distinct observations that constitute the participants' spouses (see **3.1**

² According to the Yearbook of Statistics published by the Department of Statistics, Ministry of Trade and Industry (2019), average monthly household income per household member among resident employed household was SG13,581 in 2018. While data on income deciles of individual earners would be preferable, official data are not publicly available.

Data for details). We use the extended sample to identify the male- and female- subgroups, needed to evaluate the gender differentials and operationalize *Hypothesis 2*.

For covariates, we collect information on time-varying individual and household characteristics, namely number of children and a binary indicator for presence of an infant aged two or below, and dichotomous indicators for occupation.^{3,4} While data for industry were not collected, we note that industry category is generally less predictive than occupation with regard to changes in productivity during the pandemic (Adams-Prassl et al. 2020; Etheridge et al., 2020).

We consider four sets of mediators to explore the heterogeneity of the impact of Covid19 on salary income across remote and non-remote workers: a) occupation type (professional or non-professional, based on job categories), b) time expenditures on childcare and household chores (above or below median levels of time use for each category), c) presence of a potential household helper, and d) spouse's remote work status. Occupation types reflect differences in cognitive and income levels of respondents, which have been linked to divergent productivity changes induced by the shift to remote work (Bartik et al. 2020; Cui et al., 2022).⁵ The other mediators represent household resources and responsibilities needed to operationalize *Hypothesis 3*, which can affect workers' ability to benefit from remote work arrangements. Time use in childcare and household chores are measured as number of minutes per hour based on responses

³ While respondents' ages vary over time, age is not controlled in our estimations due to lack of variation in our sample as well as the collinearity between age and year, which are included to account for time fixed effects.

⁴ The survey provided 29 occupational categories, embedded under 4 larger groupings: Professionals (11 categories), Associate Professionals and technicians (7 categories), Clerical (5 categories), and Service/Sales (6 categories). A 30th category is added for observations who were working and reporting non-zero incomes but did not report their job category. The detailed categorization is provided in Appendix A.

⁵ While evidence from firm-level surveys suggests that productivity loss from remote working may be higher in lower paid industries (Bartik et al. 2020), other scholars have argued that productivity losses from multi-tasking while working from home may be greater for jobs requiring greater cognitive inputs (Cui et al., 2022). Both of these aspects tend to be correlated with occupational type.

to two questions: “How many minutes per day do you/your husband spend on the following? A) household chores like cooking and cleaning (exclude childcare), B) caring for children (can include feeding and bathing or reading to them).” Presence of an external helper is a dichotomous indicator for whether at least one of the following reside in the household: a parent, parent-in-law and hired domestic helper, who could provide informal childcare in place of the unexpected loss of access to formal facilities. Similarly, spouse’s job remote work status indicates whether he/she might be physically available to take on household tasks. All moderating variables are coded as binary (1 if available, 0 if otherwise).

3.3 Summary Statistics

Summary statistics are displayed in **Table 2**. Around 90% of the sample is Chinese. The average ages of male and female observations are around 35 and 32 respectively. The average number of children is 1.4 and around a quarter of households has an infant aged two years or younger. Although women are more likely to have a college degree (69.8% of women vs. 62.9% of men), income is generally higher among men, with men on average earning around S\$5,000 and women on average earning around S\$4,000 per month. When we compare our sample to published nationally representative statistics, we find that the distributions of birth parities are highly comparable (see **Table A2** in the **Online Appendix**), indicating that the sample is somewhat representative of married women in this age range. Our sample statistics for race, income and occupation distributions are not representative, but this is unsurprising as national statistics are not specific to marital status, and in the case of race and occupation, only national statistics based on women of all ages and all marital statuses were available.

[Table 2]

As noted earlier in **Figure 1**, working women were more likely than men to work remotely during the lockdown (55.1% vs. 37.1%). The higher proportion of remote workers among women may reflect the difference in occupational distributions, with similar proportions of men and women in professional or associate professional jobs (around 80%), but a much higher percentage of men in service jobs (16.7% vs. 9.8%), which may require more face-to-face contact, and women in clerical jobs (8.3% vs. 1.8%), which may be easier to perform remotely. Husbands spent much less time than wives on childcare (4.8 and 8.7 minutes per hour respectively) and household chores (2.2 and 3.7 minutes per hour respectively). Around one quarter of observations report living with a foreign domestic worker. In addition, around a third of households live with the wife's parents while less than 15% live with the husband's parents, reflecting the societal perception of domestic responsibilities as women's work and a tendency for married women to prefer additional help with childcare from their own parents. Consistent with the higher proportion of women who worked from home, married men were more likely to have a remotely working spouse during this period (41.5% vs. 31.2%).

4. Estimation

To estimate the income divergence between fully remote workers and workers who worked partly outside the home during and after the COVID-19 lockdown, we use a difference-in-differences (DID) model. One of the key assumptions of the DID framework is parallel pre-trends in the outcome of interest between remote and non-remote workers. We go beyond assessing the graphical evidence and conduct a formal regression-based test to evaluate parallel pre-shock trends (i.e. checking whether the divergences in outcomes appeared only after the onset of the pandemic), following Autor (2003). Among the six time periods for which we have income data, the period immediately preceding the pandemic (December 2019) is used as the

reference period, one period was prior to the pandemic (April-June 2018), and four periods were during the pandemic (March, May, June, and November 2020)

After establishing the parallel trends, in our main estimations testing *Hypothesis 1*, we estimate the following difference-in-differences equation for individual I in wave t ,

$$Income_{its} = \beta_0 + \beta_1(Remote_{is}) + \beta_2(Lockdown_t) + \beta_3(Remote_{is})(Lockdown_t) + \beta_4 X_{it} + I + \delta_t + \gamma_s + \epsilon_{its} \quad (1),$$

where $Income_{its}$ is the salary income for individual i holding job s at wave t , and $Remote_{is}$ is the measure of respondents' extent of remoteability of current jobs. $Lockdown_t$ is a vector of indicators for our temporal variables, indicating the periods before (2018-December 2019), during (March-June 2020), and after (November 2020) the lock-down. To look into differences in income trajectories between remote and non-remote workers during and after the COVID-19 pandemic, the key variables of interest are the coefficient estimates for the interaction terms between job remoteability ($Remote_{is}$) and indicators for time periods ($Lockdown_t$). X_{it} is a vector of time-variant covariates, consisting of sociodemographic characteristics (number of children, and presence of an infant). We add occupation fixed-effects (γ_s), thereby accounting for observed and unobserved time-invariant characteristics and effects of pandemic-induced structural changes in the labor market. We also include wave (δ_t) and individual (λ_i) fixed-effects so that our remaining variation comes from within an individual-state over time. ϵ_{its} is an idiosyncratic error term. Standard errors are clustered at the household level. To explore whether women and men benefitted to the same extent from remote work arrangements, or to test *Hypothesis 2*, we repeat our analysis by gender.

As a sensitivity check, we examine whether there is a monotonic progression in income differences when the group identifier for fully remote workers is recoded as a vector of

dichotomous indicators for the following various degrees of working from home: work fully from home, mostly from home, half from home and half outside the home, mostly outside the home or fully outside the home.

Lastly, we explore the heterogeneity in the DID results by occupation type (professional or non-professional), time use on childcare and household chores (above or below median time spent for each category), presence of at least one form of external helper (parent, parent-in-law, or domestic worker) and spouse's remote work status (remote or not). The potential mediating roles of household responsibilities and resources—suggested by *Hypothesis 3*—are evaluated in the heterogeneity analyses. Coefficients are formally tested for significant differences across moderating variables at the 10% level using seemingly unrelated estimation.

5. Results

5.1 Parallel Pre-Shock Trends Evaluation

Figure 2 shows parallel trends prior to the COVID-19 pandemic, with workers who could switch to remote work during the lockdown earning more on average in 2018-2019. In March 2020, after the pandemic started, there was a noticeable dip in income among non-remote workers but not among remote workers, resulting in divergence of income levels. The divergence continued through the lockdown into November, as both sets of workers saw a rise in income levels.

[Figure 2]

We supplement the graphical evidence with formal regression-based results, shown in **Table 3**. The results confirm that income gaps between remote and non-remote workers were not significantly different in 2018 relative to December 2019, but that a significant divergence in

income by around \$200 was seen in March 2020 and peaked at around \$300 in May-June 2020, statistically significant at the 10% and 5% levels respectively.

[Table 3]

When we repeat the analysis by gender, we find little evidence that gaps in income between remote and non-remote workers were significantly different in 2018 compared to December 2019 for men or women, in support of the parallel trends assumption. The divergence in the salary income of remote and non-remote workers is visible only after the start of the pandemic. Yet, the divergence is significant only for men, peaking at around \$450 in May-June 2020 and remaining large and significant in November 2020. By contrast, the coefficients are smaller and insignificant for women.

5.2 Evaluating the Effects of Remote Work Status on Monthly Income

Table 4 presents the DID estimates between remote and non-remote workers during and after the lockdown, relative to prior to the pandemic. We also include a host of time-varying characteristics and occupation-fixed effects to control for confounding explanations. Column (1) shows a divergence of around \$240 in income levels during the period surrounding the lockdown, significant at the 5% level, which persisted six months after the lockdown. Time fixed effects are in line with macroeconomic data showing a large dip in economic activity during the lockdown before recovering in November 2020 (**Figure 1**). The results support *Hypothesis 1* by showing that workers who shifted to remote work during the lockdown experienced an income advantage compared to peers whose jobs had lower remoteability. Moreover, in line with our postulation in *Hypothesis 1*, the income gains of remote-workers persisted in the longer-term, post-lockdown period.

[Table 4]

When the analysis is repeated by gender, columns (2) and (3) of **Table 4** show the above baseline results are mostly driven by men. Among men, the income divergence between remote and non-remote workers was around \$330 and \$410 during and after the lockdown periods, statistically significant at the 10% and 5% significant levels respectively. This means that male remote workers not only saw a relative income increase during the lockdown period, but the relative increase in earnings persisted even after the lockdown ended. On the other hand, the DID coefficients are much smaller and insignificant for women for both periods, implying that female remote workers' income did not benefit as much from remote work arrangements. These findings partially support *Hypothesis 2*: As expected, women saw lower gains from the shift to remote work than men, but in contrast to the hypothesis, there is *little* evidence of gender convergence immediately after the lockdown.

In a sensitivity check, we consider whether income gains increase monotonically with degree of job remoteability by re-categorizing remote work from a binary variable into a vector that ranges from working fully at home to fully outside the home (five levels in all). Column (1) of **Table 5** shows that, compared to the reference category of “fully outside”, those working fully from home during March-June 2020 had gains by around \$400, significant at the 1% level. For those working mostly from home, the coefficient's magnitude is slightly weaker at around \$340, significant at the 5% level. Overall, we do *not* find a linear progression. Instead, we observe a smaller interaction coefficient for those working half from home and half outside than for those working mostly outside. In November 2020, the coefficient is much larger and significant only for those had worked fully from home during the lockdown.

[Table 5]

When the analysis is repeated by gender, we find more evidence of a monotonic trend for men, with coefficient sizes rising with degree of remoteability, although only the coefficient for those working fully from home is statistically significant at the 5% level during the lockdown period and at the 10% level six months after the lockdown. By contrast, among women, those working mostly outside the home performed better than workers in any other type of work arrangements during the lockdown, significant at the 10% level, which can be largely explained by the higher average number of work hours for workers in this category (see **Table A2, Online Appendix**), followed by those working mostly from home. We find less evidence of longer-term income gaps between by more-remote and less-remote female workers, consistent with the main results which show that gaps tend to be larger and more persistent for men.

5.3 Mediating Roles of Household Responsibilities and Resources

The results so far paint a consistent picture where male workers benefit more from remote work arrangements compared to females. In this section, we further examine reasons for this disparity in outcomes by conducting heterogeneity analyses along the lines of occupation, time use on domestic work, availability of external helpers and spouse's remote work status.

The results are presented in **Table 6**. Columns (1) and (2) of Panel A suggest that only professional job holders benefitted from remote working arrangements during the lockdown and surrounding months, significant at the 10% level, but that this difference weakened six months post-lockdown. Repeating the analysis by gender produces larger coefficients for professional job holders during the lockdown period for both genders, although only the coefficients for women were significantly different across categories (columns (1)-(2) of Panels B and C).

[Table 6]

Next, we consider the role of time use on domestic tasks. Workers who spend below-median levels of time on childcare and household chores (columns 3-6 of Panel A) benefit significantly more from remote work, both during and after the lockdown, in line with *Hypothesis 3*. The corresponding results in Panels B and C confirm that this difference by time use on childcare shows up for both men and women, with larger and more significant coefficients for both men and women who spent below-median amounts of time on childcare. However, only the coefficients for women were significantly different across categories (columns (3)-(4) of Panels B and C). Moreover, differences in coefficients by time spent on housework are statistically different only for women (columns (5)-(6) of Panels B and C), pointing to a larger role of domestic work on gains from income gaps between remote and non-remote working females.

Another crucial difference between male and female workers is the lower proportion of women who fall into time-use categories: only around 35% of observations for female workers fall into the below-median time-use category for childcare (732 out of 2152), whereas around 60% of observations for male workers do so (1475 out of 2486), putting men in a better position to gain from remote work. Moreover, the pandemic accelerated this unequal division of household labor. **Figure 3** shows that prior to the pandemic in 2018, both male and female workers spent more time taking care of children but less time on household chores if they worked remotely. The May 2020 lockdown led to spikes in time allocated to both childcare and chores among all groups, but especially childcare time among mothers working from home, pointing to women's role as default caregivers and home makers (Calarco et al., 2021). By November 2020 time use on domestic work had declined to levels closer to 2018 levels, but the

divergence in childcare time between remote and non-remote working females continued to persist.

[Figure 3]

Lastly, the results in columns (7)-(10) of Panel A show that remote workers who also had a spouse who was working from home saw greater gains from remote work arrangements, with a statistically significant difference both in the lockdown and post-lockdown periods, but that there was much weaker evidence of differences between households with and without household helpers (i.e., parents, in-laws or live-in domestic workers). When we repeat the analysis by gender in Panels B and C, we find that only male remote workers benefit significantly from having their spouse work from home in the post-lockdown period, whereas the interaction coefficients are smaller and insignificant for women. Surprisingly, and contrary to *Hypothesis 3*, the presence of own parents in the household did not significantly enhance female workers' ability to benefit from remote work. One explanation is that women may respond to flexible work arrangements by increasing their domestic work responsibilities, consistent with the much larger increase in childcare time observed among female remote workers relative to all other groups (**Figure 3**).

6. Discussion

Using an individual-level panel dataset consisting of 362 married women collected before and during the pandemic in Singapore, and utilizing a difference-in-differences estimation strategy, this study provides evidence that workers who were able to switch to remote work during the lockdown (i.e., Covid-19 induced government policy) enjoyed an increase in salary income compared to non-remotely working peers. Moreover, this statistically significant income

gains persisted six months later in November 2020. The persistence of the positive income gain is noteworthy, given that Singapore moved away from requiring exclusively remote work to establishing hybrid work arrangements—working in part from home and in part from office—as the new norm in the later half of 2020.

Across gender, the income advantage was much larger and statistically significant only for married male workers, with little evidence of improvements in the gender equality over time. In our exploration of the mediating effects of household resources and responsibilities, we found that—regardless of gender—workers gained more from remote work if they devoted below-median amounts of time to domestic tasks. However, married women in our dataset were much less likely to devote below-median time to household responsibilities, in line with the literature showing more substantial shifts in time-use patterns from work to household and childcare duties among women relative to men during the pandemic (Carlson et al., 2020; Lyttelton et al., 2020; Zang et al., 2021). Interestingly, we found that availability of helpers failed to enhance women’s ability to benefit from remote work. However, this outcome is consistent with other findings in the literature where women tend to expand their roles in the domestic sphere when given the opportunity to remote work (Chung and van der Lippe, 2020). When working remotely from home, the presence of a remote-working spouse benefitted men more than women.

This paper provides evidence that in light of gender roles in the society leading to unequal distribution of unpaid household work, the benefits of access to remote work may be less positive for women than previously argued. This study contributes to a growing literature on the unequal economic impacts of the pandemic across gender, by demonstrating that unequal productivity gains between men and women can be at least partially attributed to their unequal divisions of household responsibilities.

This study has several limitations. First, the longitudinal sample is not fully nationally representative, due to non-probabilistic sampling as well as selective attrition over the follow-up survey waves. However, we note that the sample distribution of birth parities is comparable to national statistics for women in this age range. Moreover, although the sample over-represents households with well-educated women based on published statistics from the 2015 General Household Survey conducted by the Singapore Department of Statistics, this subsample is likely to be disproportionately likely to be affected by semi-permanent changes in working arrangements. Second, all data were collected only from female respondents, which may result in reporting biases, particular with regard to men's time use. For example, studies from the United States suggest that wives tend to understate their spouses' contributions while overstating their own (Kamo, 2000; Lee and Waite, 2005). Similarly, a local study found that Singaporean married men tend to underestimate the extent to which primary responsibilities for household tasks fall on married women (Ipsos and United Women Singapore, 2021). Nevertheless, this measurement issue may be ameliorated due to the longitudinal nature of the dataset, which accounts for time-invariant reporting biases, and that shifts towards remote work may have made it easier for individuals to observe spousal contributions, reducing the size and incidence of measurement errors. Finally, the analysis does not include the most recent trends after pandemic-related restrictions were further eased, which can shed light on the longer-terms implications of the shift to remote work. We leave this line of inquiry requiring more data collection to future work.

Despite these limitations, our study provides valuable insight through the use of longitudinal data collected prior to as well as six months after the COVID-19 lockdown, which allows us to demonstrate the causal effect of the rise of remote work in an economy which

experienced a relative smooth recovery six months post-lockdown. Our detailed household-level data on background characteristics, including household composition and presence of helpers, as well as both spouses' time use on household chores and childcare also yields insight into how underlying gendered differences in time use on domestic work may result in differential gains from remote work arrangements for male and female workers. Finally, our paper provides much needed evidence beyond the literature's focus on Western and larger economies, which may not be reflective of non-Western smaller economies affected by the worldwide pandemic.

Several important policy implications are generated from our findings, in the context of the semi-permanency of remote work arrangements in the years to come. To foster more equal benefits of remote work arrangements and to promote a more inclusive economic recovery for workers across gender, policymakers should look beyond simply encouraging or mandating flexible working arrangements. There exists a need to address the gender-inequality in the labor market that is further perpetuated vis-à-vis the adoption of remote work. Without strengthening the public efforts to relieve the gender imbalance in the division of household labor, female employees may not benefit as much as male employees from access to remote work, leading to persistent inequalities in labor market outcomes among dual-earner couples.

To this end, wider recognition that household responsibilities can reduce gains from flexible work arrangements is needed. For instance, workplace initiatives should address persistent negative attitudes and discrimination towards men who seek to take advantage of flexible working arrangements to increase paternal involvement in childcare/household duties. Such societal and cultural norms have the effect of discouraging men from doing so, thereby perpetuating the gendered roles and unequal division of household labor (Ewald et al., 2020). Hence, the discussion of post-pandemic working arrangements should involve not only offering

multiple modes of work (including telecommuting), but also seeking ways to achieve a greater gender-balance in the take-up rates of remote work and to reduce discriminatory attitudes and cultural norms that perpetuate unequal division of household work across gender.

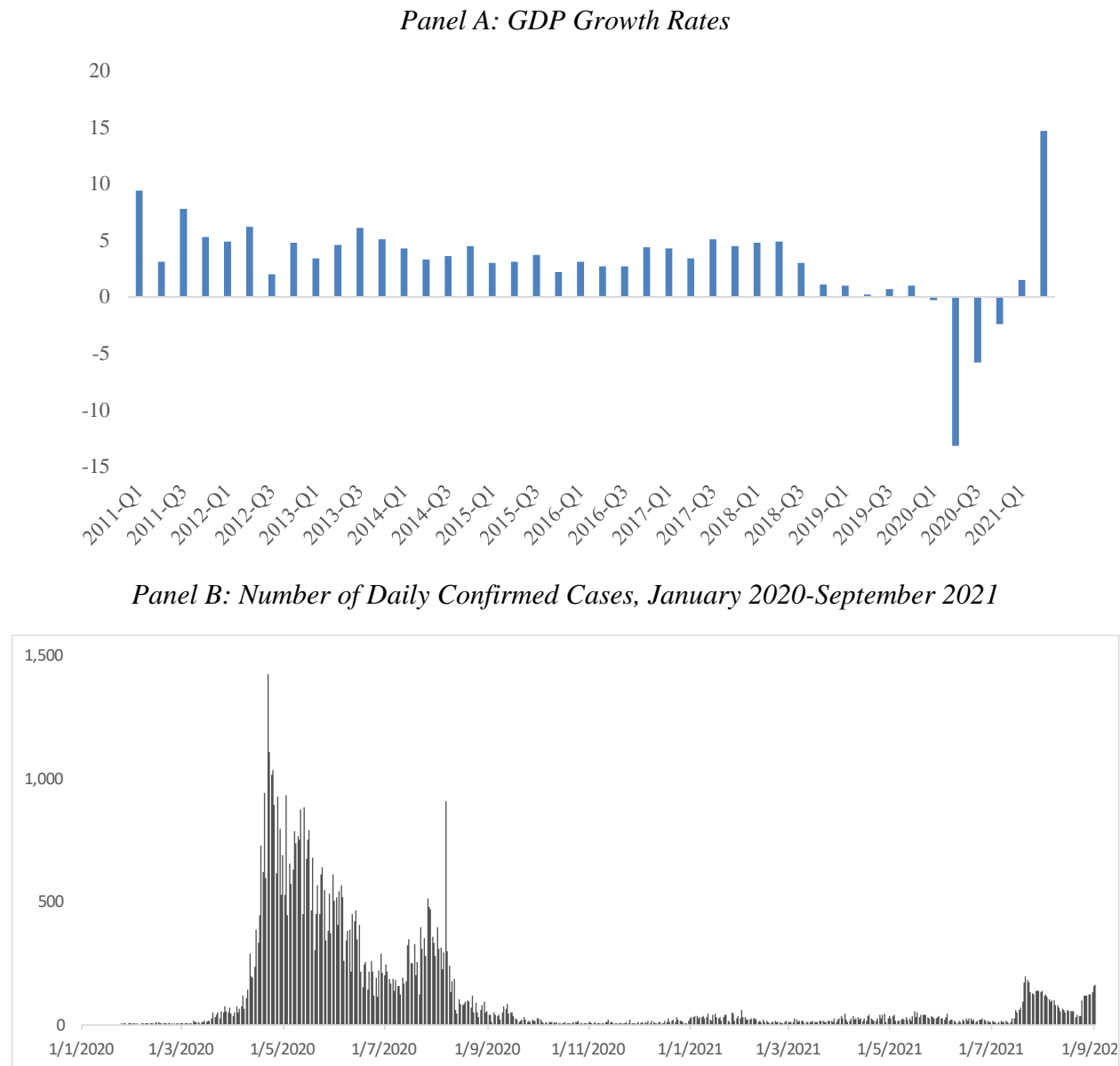
References

- Adams-Prassl, A., Boneva, T., Golin, M., & Rauh, C. (2020). Inequality in the impact of the coronavirus shock: Evidence from real time surveys. *Journal of Public Economics*, 189, 104245.
- Alon T, Doepke M, Tertilt M, and Olmstead-Rumsey J (2020a) This time it's different: The role of women's employment in a pandemic recession. *NBER Working Paper 27660*.
- (2020b) The Impact of COVID-19 on Gender Equality. *Covid Economics: Vetted and Real-Time Papers*. Issue 4:62–85.
- Aryeel S (1993) Dual-earner couples in Singapore: An examination of work and nonwork sources of their experienced burnout. *Human Relations* 46(12): 1441-1468.
- Autor DH (2003) Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing. *Journal of Labor Economics* 21(1): 1-42.
- Baert S, Lippens L, Moens E, Weytjens J, and Sterkens P (2020) The COVID-19 crisis and telework: A research survey on experiences, expectations and hopes. *IZA Discussion Paper No. 13229*.
- Bai, B., Gopalan, N., Beutell, N. et al. (2021) Impact of absolute and relative commute time on work–family conflict: work schedule control, child care hours, and life satisfaction. *Journal of Family and Economic Issues* 42, 586–600.
- Barrero JM, Bloom N, and Davis SJ. (2021) Why working from home will stick. *Becker Friedman Institute Working Paper No. 2020-174*.
- Bartik AW, Cullen ZB, Glaeser EL, Luca M, and Stanton CT (2020) What jobs are being done at home during the COVID-19 crisis? Evidence from firm-level surveys. *NBER Working Paper No. 27422*.
- Bloom N, Liang J, Roberts J, and Ying ZJ (2015) Does working from home work? Evidence from a Chinese experiment. *The Quarterly Journal of Economics* 130(1): 165-218.
- Bosua R, Gloet M, Kurnia S, Mendoza A, and Yong J (2012) Telework, productivity and wellbeing: An Australian perspective. *Telecommunications Journal of Australia* 63(1): 11.1-11.12.
- Calarco, J. M., Meanwell, E., Anderson, E. M., & Knopf, A. (2021). By default: The origins of gendered inequalities in pandemic parenting. *Working Paper-SocArXiv Preprint*, June, 29.
- Chew HM (2021, 17 April) In focus: Thinking out of the cubicle – What lies ahead for hybrid working? *ChannelNewsAsia*. Available at: <https://www.channelnewsasia.com/news/singapore/office-home-future-hybrid-work-flexible-wfh-in-focus-14627258>.
- Chung H., and Van der Horst M. (2018). Women's employment patterns after childbirth and the perceived access to and use of flexitime and teleworking. *Human Relations* 71(1): 47–72.
- Chung H, and Van der Lippe T (2020). Flexible working, work–life balance, and gender equality: Introduction. *Social Indicators Research* 151(2): 365-381.

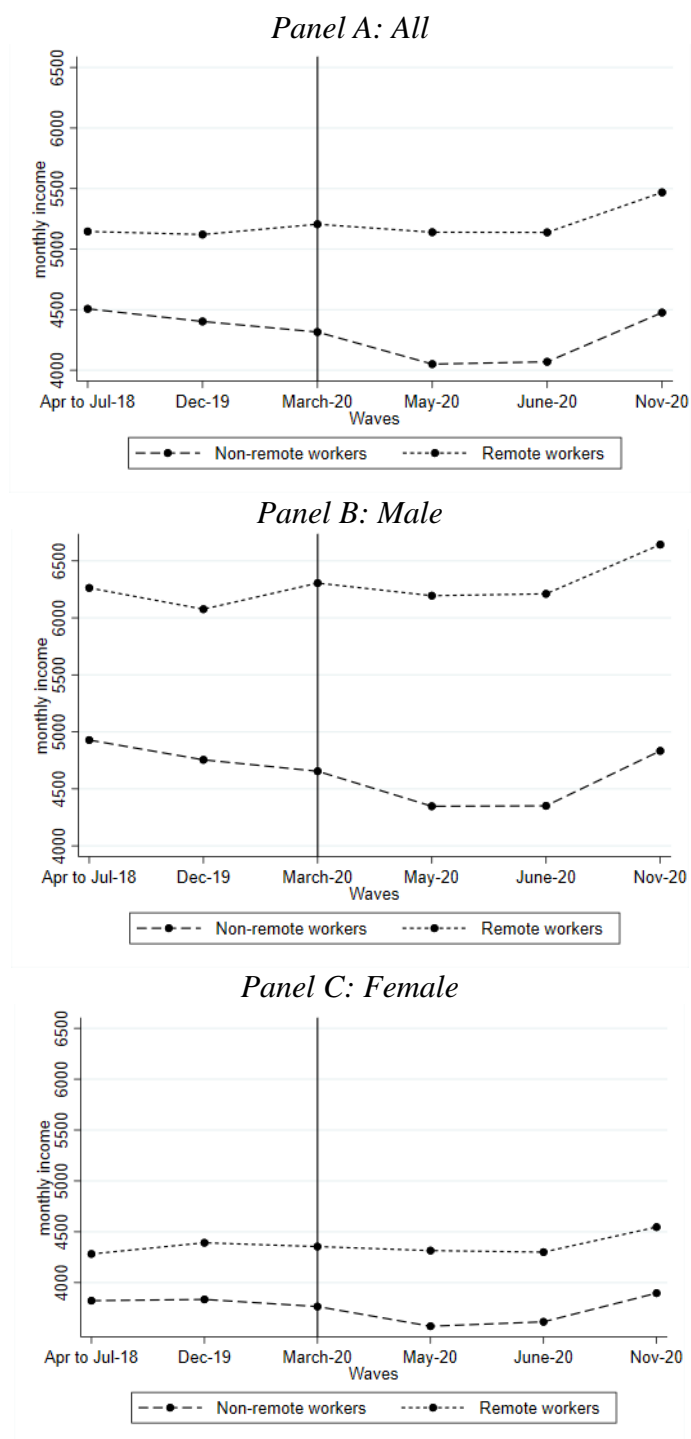
- Collins C, Landivar LC, Ruppanner L, and Scarborough WJ (2021) COVID-19 and the gender gap in work hours. *Gender, Work & Organization* 28(S1): 549-560.
- Cui, R., Ding, H., & Zhu, F. (2022). Gender inequality in research productivity during the COVID-19 pandemic. *Manufacturing & Service Operations Management*, 24(2), 707-726.
- Daly, P., Brassard, C., McCaughey, J., Ng, R., Kathiravelu, L., & Horton, B. (2021). The social and economic impacts of COVID-19 mitigation measures on citizens and permanent residents during the circuit breaker period in Singapore. *NTS Insight No. IN21-02*.
- Delanoeije J., Verbruggen M., and Germeys L. (2019). Boundary role transitions: A day-to-day approach to explain the effects of home-based telework on work-to-home conflict and home-to-work conflict. *Human Relations* 72(12): 1843–1868.
- Department of Statistics, Ministry of Trade and Industry. (2019). ‘Year of Statistics Singapore 2019.’ ISSN 2591-7919.
- De Nicola F, Mattoo A, Timmis J and Tran TT (2021). Productivity in the Time of COVID-19: Evidence from East Asia and Pacific. *World Bank Malaysia Hub Research & Policy Briefs* No. 46.
- EngageRocket (2020) “The Resilience of the Singapore Workforce.” 2020 Research Report. Available at: <https://www.engagerocket.co/the-resilience-of-singapore-workforce-in-2020>.
- Etheridg B, Wang Y, and Tang L (2020) Worker productivity during lockdown and working from home: Evidence from self-reports. *Centre for Economic Policy Research* Issue 52: 118-174.
- Ewald A, Gilbertand E, Huppatz K (2020) Fathering and flexible working arrangements: A systematic interdisciplinary review. *Journal of Family Theory & Review* 12(1): 27-40.
- Golden, L. (2008). Limited Access: Disparities in Flexible Work Schedules and Work-at-home. *Journal of Family and Economic Issues*, 29(1), 86–109. <https://doi.org/10.1007/s10834-007-9090-7>.
- Government of Singapore (2020a) Ending Circuit Breaker: Phased Approach to Resuming Activities Safely. Available at <https://www.gov.sg/article/ending-circuit-breaker-phased-approach-to-resuming-activities-safely>.
- (2020b) What You Can and Cannot Do During the Circuit Breaker Period.” Available at <https://www.gov.sg/article/what-you-can-and-cannot-do-during-the-circuit-breaker-period>.
- Hammonds C, Kerrissey J, and Tomaskovic-Devey D (2020) *Stressed, unsafe, and insecure: Essential workers need a new, new deal*. Amherst, MA, USA: University of Massachusetts Amherst Labor Center.
- Heggeness M (2021) Telework Did Not Save Us: Motherhood, Work, and a Once in a Century Pandemic. *Federal Reserve Bank of Minneapolis Opportunity & Inclusive Growth Institute Working Paper* No. 52.

- Ipsos and United Women Singapore (2021) Singapore Women are Doing More Unpaid Domestic and Care Work than the Men Think They Are. Press Release. Available at <https://www.ipsos.com/en-sg/singapore-women-are-doing-more-unpaid-domestic-care-work-men-think-they-are>.
- Jones GW (2012) Population policy in a prosperous city-state: Dilemmas for Singapore. *Population and Development Review* 38(2): 311-336.
- Kamo Y (2000). “He said, she said”: Assessing discrepancies in husbands' and wives' reports on the division of household labor. *Social Science Research* 29(4): 459-476.
- Kazekami S (2020) Mechanisms to improve labor productivity by performing telework. *Telecommunications Policy* 44(2): 101868.
- Kelly EL, Moenand P, Tranby E (2011) Changing workplaces to reduce work-family conflict: Schedule control in a white-collar organization. *American Sociological Review* 76(2): 265-290.
- Kikuchi S, Kitao S, and Mikoshiba M (2021) Who suffers from the COVID-19 shocks? Labor market heterogeneity and welfare consequences in Japan. *Journal of the Japanese and International Economies* 59:101117.
- Lee YS, Waite LJ (2005) Husbands’ and wives’ time spent on housework: A comparison of measures. *Journal of Marriage and Family* 67(2): 328-336.
- Lyttelton T, Zang E, and Musick K (2020) Gender differences in telecommuting and implications for inequality at home and work. *SSRN Working Paper*.
- McCarthy N (2021) COVID-19: how many remote workers are there in different parts of Europe? *World Economic Forum*. Available at <https://www.weforum.org/agenda/2021/05/europeans-work-from-home-remote-covid-coronavirus-pandemic-europe-eu/>.
- Ministry of Health (2020) Circuit Breaker to Minimize Further Spread of COVID-19. Available at <https://www.moh.gov.sg/news-highlights/details/circuit-breaker-to-minimise-further-spread-of-covid-19>.
- Ministry of Manpower (2021a) Labour Force In Singapore 2021. Report. Available at <https://stats.mom.gov.sg/Pages/Labour-Force-In-Singapore-2021.aspx>.
- (2021b) Foreign Workforce Numbers. Available at <https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers>.
- Ministry of Social and Family Development (2019) Families and Households in Singapore, 2000-2017. Statistics Series Paper No. 1/2019.
- Mongey S, Pilossoph L, and Weinberg A (2021) Which workers bear the burden of social distancing?. *NBER Working Paper* No. 27085.
- Ono H and Mori T (2021) COVID-19 and telework: An international comparison. *Journal of Quantitative Description: Digital Media*, 1.
- Papanikolaou, D., & Schmidt, L. D. (2022). Working remotely and the supply-side impact of Covid-19. *The Review of Asset Pricing Studies*, 12(1), 53-111.

- Sarnosky, K., Benden, M., Sansom, G., Cizmas, L., & Regan, A. K. (2022) Impact of workplace displacement during a natural disaster on computer performance metrics: A 2-year interrupted time series analysis. *Work*, 71(2):465-470.
- Schieman S, Badawy P, Milkie M, and Bierman A (2021) Work-life conflict during the COVID-19 pandemic. *Socius*, 7, 2378023120982856.
- Seow J, The C (2020, April 18) Coronavirus: New Portal Aims to Address Domestic Helper Shortage. *Straits Times*. Available at <https://www.straitstimes.com/singapore/manpower/new-portal-aims-to-address-domestic-helper-shortage>.
- Sevilla A, Smith S (2020) Baby steps: The gender division of childcare during the COVID-19 pandemic. *Oxford Review of Economic Policy* 36(Supplement_1): S169-S186.
- Teo Y (2016) Not everyone has ‘maids’: class differentials in the elusive quest for work-life balance. *Gender, Place & Culture* 23(8): 1164-1178.
- Van Zoonen W, Sivunen A, Blomqvist K, Olsson T, Ropponen A, Henttonen K, and Vartiainen M (2021) Understanding stressor–strain relationships during the COVID-19 pandemic: the role of social support, adjustment to remote work, and work–life conflict. *Journal of Management & Organization* 27(6): 1038-1059.
- Yeung, W. J. J. (2020). Singapore Longitudinal Early Development Study Research Updates Issue 3. *SG LEADS Research Briefs*, vol.3. Centre for Family and Population Research, National University of Singapore.
- Yuen S (2021, March 24) Up to 75% of staff can return to office from April 5; working from home no longer default mode. *Straits Times*. Available at <https://www.straitstimes.com/singapore/up-to-75-of-staff-can-return-to-office-from-april-5-working-from-home-no-longer-default>.
- Zang, E., Tan, P. L., Lyttelton, T., & Guo, A. (2021). Gendered time use patterns during the COVID-19 lockdown: Evidence from longitudinal data in Singapore. *SSRN Working Paper*.

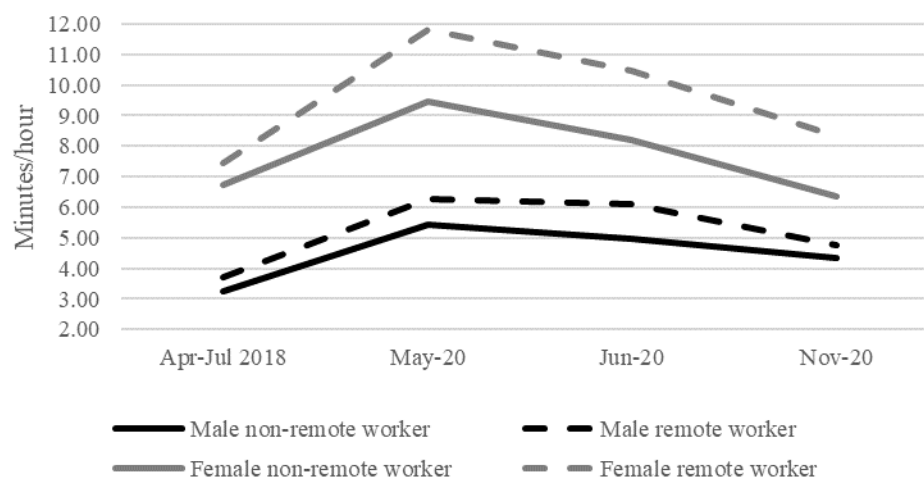
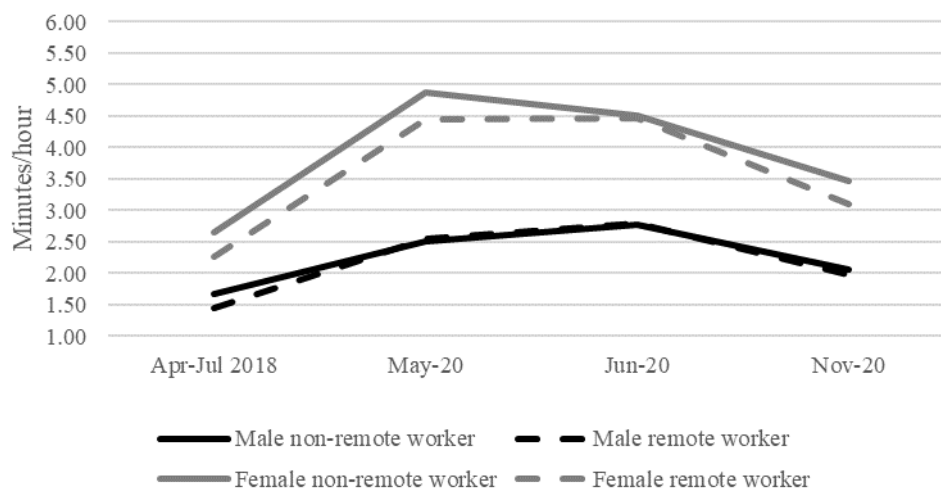
Figure 1. GDP Growth Rates and Number of Confirmed Cases in Singapore, 2020-2021

Sources: Data on GDP growth retrieved from Government of Singapore at <https://data.gov.sg/dataset?q=gdp>. Data on confirmed cases retrieved from WHO Coronavirus Disease (COVID-19) Dashboard at <https://covid19.who.int/WHO-COVID-19-global-data.csv>.

Figure 2. Monthly Income Trends Before and During the Pandemic

Notes: “Remote workers” refer to those working fully from home in May 2020 during the COVID-19 lockdown, and “non-remote workers” refer to all those who worked outside the home at least part of the time.

Source: Authors' calculations using the survey data

Figure 3. Time Use on Childcare and Household Chores, 2018-2020*Panel A: Childcare**Panel B: Chores*

Notes: “Remote workers” refer to those working fully from home in May 2020 during the COVID-19 lockdown, and “non-remote workers” refer to all those who worked outside the home at least part of the time.

Source: Authors' calculations using the survey data

Table 1. Key Dates of the COVID-19 Pandemic and Survey Data Collection

	April-July 2018	January 2020	April 2020	May 2020	June 2020	November 2020
Pandemic timeline	Pre-crisis	Singapore confirms first infection case on January 23	Circuit breaker begins on 7 April	Circuit breaker (ongoing)	Circuit breaker ends on June 1; Phases I/II commence	Phase II with relaxed movement restrictions
Data collection timeline	In-person survey			Online survey	Current and retrospective income data collected for December 2019 and March, May and June 2020	Online survey

Table 2. Descriptive Statistics

	Total		Male		Female	
	Mean	SD	Mean	SD	Mean	SD
<i>Background variables</i>						
Age	33.76	3.69	35.07	3.99	32.25	2.57
Female (%)	46.44	49.88	0.00	0.00	100.00	0.00
Race (%)						
Chinese	91.61	27.73	90.98	28.66	92.33	26.61
Indian	1.88	13.57	1.61	12.59	2.18	14.62
Malay	5.24	22.29	5.04	21.87	5.48	22.77
College educated (%)	66.08	47.35	62.89	48.32	69.75	45.95
Number of children	1.41	0.97	1.42	0.97	1.39	0.97
Presence of infant below age 2 (%)	26.89	44.34	27.32	44.57	26.39	44.09
<i>Dependent variables</i>						
Monthly income (SGD)	4712.05	2850.08	5251.81	3227.45	4088.52	2179.78
<i>Independent variable</i>						
Working remotely (only from home) during lockdown (%)	45.47	49.80	37.11	48.32	55.11	49.75
<i>Moderating variables</i>						
Occupation (%)						
Professional	69.49	46.05	70.55	45.59	68.26	46.56
Associate professional	10.03	30.05	8.82	28.37	11.43	31.83
Clerical	4.79	21.36	1.77	13.20	8.27	27.55
Service	13.49	34.16	16.68	37.29	9.80	29.74
Other or unknown	2.20	14.67	2.18	14.59	2.23	14.77
Time use on childcare (min/h)	6.58	9.38	4.76	7.14	8.69	11.06
Time use on chores (min/h)	2.91	4.25	2.23	3.51	3.70	4.86
Spouse's time use on childcare (min/h)	7.57	10.64	10.03	12.27	4.71	7.39
Spouse's time use on chores (min/h)	3.20	4.53	3.99	5.05	2.29	3.65
Presence of domestic helper (%)	23.89	42.65	23.63	42.49	24.18	42.83
Coresidence with parents (%)	21.63	41.18	12.27	32.82	32.47	46.84
Coresidence with parents-in-laws (%)	23.18	42.20	31.87	46.61	13.10	33.75
Spouse teleworking (%)	36.69	48.20	41.46	49.27	31.18	46.33
No. of individual-wave observations	4638		2486		2152	
No. of individuals	781		419		362	

Table 3. Parallel Income Pre-Trends

	(1) All	(2) Male	(2) Female
TREATED x TIME PERIODS			
Remote x Apr-Jul 2018	-108.351 (88.446)	-29.672 (147.981)	-131.239 (100.575)
Remote x Mar 2020	209.035* (117.417)	337.589* (197.901)	90.903 (117.518)
Remote x May 2020	314.002** (130.972)	439.390** (209.985)	162.141 (142.506)
Remote x June 2020	293.710** (130.185)	451.807** (210.157)	103.702 (145.804)
Remote x Nov 2020	247.215* (146.192)	436.093* (234.229)	92.135 (165.986)
TIME PERIODS			
Apr-Jul 2018	-200.267*** (49.574)	-224.644*** (68.104)	-161.548** (62.976)
May 2020	-369.412*** (68.857)	-436.835*** (89.760)	-260.959*** (92.003)
June 2020	-350.544*** (67.602)	-433.018*** (90.709)	-217.749** (91.550)
Nov 2020	25.844 (73.637)	14.513 (97.030)	43.498 (105.289)
Individual FE	Yes	Yes	Yes
Dependent Var Mean	4712.053	5251.810	4088.522
N	4638	2486	2152

Notes: Remote is a dichotomous variable for whether the respondent worked fully from home in May 2020 during the COVID-19 lockdown. The reference time period is Dec 2019, prior to the COVID-19 pandemic. Standard errors, shown in the parentheses, are clustered at the household level.

Table 4. Difference-in-Differences Effects of Remote Work Status on Monthly Income

	(1) All	(2) Male	(2) Female
(reference = Pre-Lockdown)			
Remote x Lockdown	239.812** (121.381)	333.899* (188.542)	100.504 (125.655)
Remote x Post- lockdown	262.797** (133.414)	407.932** (202.351)	108.258 (153.316)
Lockdown	-280.464*** (91.865)	-194.796* (110.781)	-178.111* (106.029)
Post-lockdown	86.280 (84.694)	84.212 (119.772)	98.040 (100.659)
Individual FE	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Dependent Var Mean	4712.053	5251.810	4088.522
N	4638	2486	2152

Notes: Remote is a dichotomous variable for whether the respondent worked fully from home in May 2020 during the COVID-19 lockdown. The reference time period is 'pre-lockdown', between April-July 2018 and December 2019, prior to the COVID-19 pandemic. 'Lockdown' refers to the lockdown period of 7 April-1 June 2020 and surrounding months of March and June 2020, while 'Post-lockdown' refers to November 2020, approximately six months after the end of the lockdown. Standard errors, shown in the parentheses, are clustered at the household level.

*p<0.1 **p<0.05 ***p<0.01

Table 5. Difference-in-Differences Effects of Remoteability Type on Monthly Income

	(1) All	(2) Male	(3) Female
(reference = Pre-Lockdown)			
Mostly outside x Lockdown	212.198 (202.569)	65.041 (276.522)	383.678* (206.076)
Half from home x Lockdown	89.455 (164.543)	203.844 (229.514)	6.545 (196.426)
Mostly from home x Lockdown	343.841** (167.399)	329.547 (223.195)	313.143 (208.692)
Fully from home x Lockdown	400.243*** (149.654)	492.525** (212.316)	238.939 (169.351)
Mostly outside x Post-lockdown	-64.122 (176.455)	-263.774 (260.854)	171.773 (226.384)
Half from home x Post-lockdown	19.261 (162.774)	-31.005 (225.254)	140.293 (211.422)
Mostly from home x Post-lockdown	64.709 (184.318)	63.162 (282.335)	1.764 (221.238)
Fully from home x Post-lockdown	295.274** (145.694)	409.039* (217.647)	152.356 (164.962)
Lockdown	-379.833*** (132.224)	-331.951* (172.418)	-170.116 (149.786)
Post-lockdown	119.292 (118.439)	162.126 (159.054)	90.521 (142.372)
Individual FE	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Dependent Var Mean	4712.053	5251.810	4088.522
N	4638	2486	2152

Notes: The reference time period is 'pre-lockdown', between April-July 2018 and December 2019, prior to the COVID-19 pandemic. 'Lockdown' refers to the lockdown period of 7 April-1 June 2020 and surrounding months of March and June 2020, while 'Post-lockdown' refers to November 2020, approximately six months after the end of the lockdown. Standard errors, shown in the parentheses, are clustered at the household level. *p<0.1 **p<0.05 ***p<0.01

Table 6. Heterogeneous Effects of Remote Work Status on Monthly Income

	(1) Professional	(2) Non- profession al	(3) Childcare time use > median	(4) Childcare time use < median	(5) Chores time use > median	(6) Chores time use < median	(7) External helper available	(8) External helper not available	(9) Spouse remote working	(10) Spouse not remote working
<i>Panel A: All</i>										
Remote x Lockdown	403.882*** † (137.803)	-116.483 (258.076)	-42.394 † (192.908)	606.537*** (185.015)	-89.509 † (178.677)	460.433** (189.578)	282.811* (152.742)	299.476 (200.425)	459.129** † (201.368)	41.298 (132.628)
Remote x Post- lockdown	271.523* (139.364)	341.303 (282.278)	-11.267 † (205.865)	593.517*** (209.815)	-29.519 (203.266)	418.259** (208.338)	376.037** (163.251)	204.453 (232.676)	665.172** † (293.504)	-28.901 (153.172)
N	3224	1414	2431	2207	2338	2300	2710	1928	1702	2936
<i>Panel B: Male</i>										
Remote x Lockdown	481.302** (210.116)	-146.157 (472.284)	175.116 (338.676)	673.081** (271.153)	312.930 (308.462)	382.633 (253.966)	560.431** (252.114)	372.382 (296.822)	421.560 (273.720)	7.404 (256.184)
Remote x Post- lockdown	404.341* (223.377)	609.836 (551.580)	165.333 (327.572)	726.614** (331.821)	378.806 (371.911)	347.048 (286.861)	644.035** (260.963)	427.315 (328.026)	1036.830*** † (372.305)	-154.314 (311.555)
N	1755	731	1011	1475	965	1521	1417	1069	1031	1455
<i>Panel C: Female</i>										
Remote x Lockdown	268.563 † (164.870)	-374.608 (260.359)	-84.012 † (196.249)	496.383** (199.544)	-268.745 † (198.374)	350.668 (275.853)	-91.803 (176.108)	-9.224 (258.039)	256.427 (294.308)	-1.236 (137.074)
Remote x Post- lockdown	111.258 (175.457)	66.379 (301.389)	54.809 (243.441)	263.890 (219.450)	-150.211 (231.612)	390.613 (273.141)	72.730 (208.007)	-274.884 (331.255)	-101.464 (459.660)	96.747 (153.584)
N	1469	683	1420	732	1373	779	1293	859	671	1481

Notes: The reference time period is ‘pre-lockdown’, between April-July 2018 and December 2019, prior to the COVID-19 pandemic. ‘Lockdown’ refers to the lockdown period of 7 April-1 June 2020 and surrounding months of March and June 2020, while ‘Post-lockdown’ refers to November 2020, approximately six months after the end of the lockdown. All regressions control for individual- and time-fixed effects and control variables. Standard errors, shown in the parentheses, are clustered at the household level.

* p<0.1 ** p<0.05 *** p<0.01 † difference across moderating variable statistically significant at the 10% level

Online Appendix

Unequal Gains from Remote Work during COVID-19 between Spouses: Evidence from Longitudinal Data in Singapore

Occupational Categories in the Survey

Professionals		Clerical Support Workers	
1	Legislator, Senior Official and Chief Executives	19	Clerical Supervisor
2	Administrative and Commercial Manager	20	General and Keyboard Clerk
3	Production and Specialised Services Manager	21	Customer Services Officers and Clerk
4	Hospitality, Retail and related Services Manager	22	Numerical and Material-Recording Clerk
5	Science and Engineering Professional	23	Others PLEASE SPECIFY
6	Health Professional	Service and Sales Workers	
7	Teaching and Training Professional	24	Personal Service Worker
8	Business and Administration Professional	25	Sales Worker
9	Information and Communications Technology Professional	26	Personal Care Worker
10	Legal, Social and Cultural Professionals	27	Protective Services Worker
11	Others PLEASE SPECIFY	28	Customer Service Worker
Associate Professionals And Technicians		29	Others PLEASE SPECIFY
12	Physical and Engineering Science associate professionals	30	Occupation unknown/ Other
13	Health Associate Professional		
14	Business and Administration Associate Professional		
15	Legal, Social, Cultural and related Associate Professional		
16	Information and Communications Technician		
17	Teaching Associate Professional		
18	Others PLEASE SPECIFY		

Table A1. Remote Work Preferences Among Female Respondents in November 2020

Preferences	Count	%
Strongly favoring	110	37.16
Somewhat favoring	110	37.16
No preference	37	12.50
Somewhat not favoring	26	8.78
Strongly not favoring	13	4.39
N	296	

Notes: Respondents are asked: “Given a choice, would you be in favor of a permanent work-from-home arrangement?”

Table A2. Average Working Hours by Month and Remoteability Type

	July 2018		May 2020		Nov 2020	
	Male	Female	Male	Female	Male	Female
All	49.69	42.45	38.47	36.11	44.48	39.91
Fully outside	49.69	42.81	46.88	38.45	49.01	42.59
Mostly outside	48.18	41.58	42.06	43.58	43.82	46.61
Half from home and half outside	46.30	42.91	31.80	34.76	42.59	38.59
Mostly from home	44.52	43.27	36.24	38.19	44.57	47.33
Fully from home	45.34	42.14	36.32	34.78	42.62	37.31
N	419	362	416	359	412	355